DIEBACK HYGIENE EVALUATION

USER GUIDELINES

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

R. Armstrong August 1993

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DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Form CLM 80B

To:

Your Ref:
Our Ref: fb:am:127
Enquiries: Mr Batini
Phone: 334 0368

Subject: **DIEBACK HYGIENE EVALUATION - USER GUIDELINES**

The king is dead, long live the king! No doubt you've heard this saying.

After 12 years, (1982-1993), the 7 Way Test is dead, now replaced by the dieback hygiene evaluation.

These user guidelines include contributions particularly from Roger Armstrong, Alex Moylett, John Asher and Gavin Butcher.

They are provided for your use. Hopefully they will be of assistance.

No doubt you will find some errors or ways to improve this guideline.

Please advise the Branch so we may be able to incorporate your ideas. We intend to revise the document at least annually.

Frank Batini

F Batini
MANAGER
ENVIRONMENTAL PROTECTION BRANCH

30 August 1993

CONTENTS

APPENDIX 1. - OPERATIONAL HYGIENE STANDARDS

A Conservation and Scientific.

B Catchment Protection.

C Water and Timber Production.

D Landscape, Recreation, Visual Resource Management.

APENDIX 2. - HAZARD RATINGS

1 Northern Jarrah Forest.

2 Southern Jarrah Forest.

3 Sunklands.

4 South Coast.

5 Northern Sandplain.

6 Wheatbelt.

7 Swan Coastal Plain.

APPENDIX 3. - GLOSSARY OF TERMS

APPENDIX 4. - HYGIENE EVALUATION FORM CLM781

1. INTRODUCTION

In the past the 7-Way Test was the tool used to evaluate an operation and the risk it posed of spreading dieback disease. This tool has been replaced with the "Hygiene Evaluation". The guidelines for its use are set out in this document.

Policy Statement No. 3 "Dieback Disease", 1991 states "the Department will evaluate the following factors before any operation proceeds which is likely to introduce, spread or intensify the impact of *Phytophthora* species on land entrusted to CALM.

1. ACTIVITY:	Whether the proposed activity needs to take place.
2. HAZARD:	The vegetation/landform type. The land uses for which the area is being managed.
3. RISK:	The risk of introducing, spreading or intensifying the disease.
4. CONSEQUENCE:	The consequences of infection on landuse and ecological values.
5. HYGIENE:	What hygiene is required to minimise the consequences.
6. EVALUATION:	The judgement of the manager regarding the adequacy of hygiene tactics to minimise the consequences to a level that is acceptable.

This appraisal is the HYGIENE EVALUATION. This disease management tool is used to determine appropriate operational hygiene after balancing the risk of disease introduction and spread against the consequences of hygiene failure.

The objective of the Hygiene Evaluation is to determine the level of hygiene which is appropriate for a particular activity. The tool evaluates the relative merits of alternative strategies. The evaluation is not the sole criteria for deciding whether a particular activity should occur. It is, however, one of the most important criteria.

C.A.L.M. has responsibility for disease management on all the land categories it manages. Although *P. cinnamomi* has been the main concern in the past, there are also other *Phytophthora* species causing the death of vegetation. The Hygiene Evaluation is equally relevant to prescribing hygiene measures for the management of these fungi.

These guidelines should be used in conjunction with the Dieback Disease Hygiene Manual and 'Timber Harvesting in Western Australia' where appropriate.

2. ASSESSING THE RISK OF INTRODUCTION AND SPREAD OF DIEBACK DISEASE

One of the fundamental questions which must be addressed in determining any hygiene strategy is:
"What is the risk of this operation introducing or spreading dieback disease?"

This question can be approached by considering three factors:

i) THE RISK OF INTRODUCING OR SPREADING DIEBACK DUE TO THE NATURE OF THE PROPOSED OPERATION.

Is the type of operation likely to move infected material around (soil, roots, water). For example are tracked or rubber tyred machines to be used; is earthmoving likely; will the operation be in muddy or sticky soils?

Highest Risk	Lowest Risk
Movement from dieback to dieback free	Movement within the same hygiene category
Operation over large area	Operation over small area
Complex operation	Simple operation
Much machinery	Little machinery
Much movement of soils	Little movement of soils
Untrained personnel	Well trained personnel
Inexperienced personnel	Experienced personnel
Without hygiene	With strict hygiene

ii) THE RISK OF INTRODUCING OR SPREADING DIEBACK DUE TO THE NATURE OF THE SITE.

Are soil conditions such that soil is likely to stick to machinery and be moved around (moist and sticky).

Highest Risk	Lowest Risk
Wet conditions	Dry conditions
Sticky soils	Non-sticking soils
Low lying site	Elevated site
Dieback known nearby	Dieback not known nearby
Uninterpretable	Interpretable

iii) THE RISK OF THE PATHOGEN SURVIVING

Are soil conditions such that the fungus will survive if delivered to a new site (moist).

Highest Risk	Lowest Risk
Moist soil Propagule buried Adjacent to or within host	Dry soil Propagule exposed Host absent

3. ASSESSING THE DIEBACK DISEASE HAZARD

Dieback disease hazard is a term which describes the final impact of the disease on a site if the disease were introduced. The final impact of dieback disease on a site depends on:

* The susceptibility and abundance of plant species present.
* The fertility, chemical and physical properties of the soils.
* The lateral and vertical drainage characteristics of the site.
* Topography, and
* Climate.

Assessing hazard allows the project manager to gauge the consequences of a hygiene breakdown on the land use values of the site. The magnitude of the consequence combined with a judgement on the level of risk associated with the operation allows the project manager to determine the level of resources that need to be committed to hygiene tactics.

Assessment of hazard is an imprecise science. It involves using vegetation associations, landform classifications and soil types as indices of the potential impact of dieback disease. It requires extensive knowledge of plant associations, disease biology and aetiology and experience of disease impacts on various sites. This task is most confidently performed by an expert.

Hazard ratings have been prepared from field observations of disease impact on the vegetation over many years and associated with various environmental factors such as vegetation associations and soil types. These Hazard Ratings are set out in Appendix 2. Hazard ratings cover a range of climate, and locations and are our best available predictions of the end expression of dieback disease at present. Research is on-going and improvements to these predictions will eventuate as our knowledge of the disease and it's interaction with the environment increases. Environmental Protection Branch would be pleased to hear of any marked difference between hazard ratings given and current disease impact observed in the field.

Dieback hazard relates to the innate site characteristics which directly influence the development and expression of disease and is an indication of what the final impact will be on that site when the disease has reached its climax and can do no more damage. Dieback hazard, as used here, does not give an indication of ecological hazard. That is, the consequences on a biological community as a result of the loss of one or more plant or animal species due to dieback. For example, the loss of one species of banksia from an area could severely affect nectar dependant animals such as pygmy possums and bird species. Similarly hazard does not quantify productivity loss in terms of growth increment, flower

or pollen production etc which are significant in the commercial use of natural resources.

There are several indices of hazard that can be used (appendix 2.) eg., Shearers Hazard Rating in the Northern jarrah forest, Havels vegetation mapping of the Northern jarrah forest, Strelein's vegetation mapping of the Southern jarrah forest, Landform (System 6) mapping of the Northern and Central Forest Regions, McCutcheons soil types in the Sunklands, Beard's vegetation maps, Churchwood and McArthur landform classifications etc. The coverage where each system can be applied varies. The most applicable system for each operation must be determined locally.

Dieback Hazard Tables

Appendix 2. lists dieback disease hazard ratings that have been tabulated for use with the Hygiene Evaluation. They represent the best available information at the time of compilation of this document. The Senior Regional Interpreter or Environmental Protection Branch should be consulted if the tabulated ratings are to be challenged in compiling a Hygiene Evaluation.

Hazard Rating

The definitions below are those used over all CALM estate. They may not be entirely suitable for use in some situations. They will, however, give a guide to the manager compiling a Hygiene Evaluation.

Low	Few species are susceptible. Environment factors are such that only a few individuals would be killed, with the dominant vegetation being largely undisturbed.
Moderate	Many species are susceptible, including some of the dominant species. Environmental factors are likely to lead to many plant deaths including a proportion of the overstorey.
High	Most dominant and many other species are susceptible. Environmental conditions will lead to the death of many individual plants, including a significant proportion of the overstorey.

The definition for hazard rating published in 'Timber Harvesting in WA' is slightly different and should only be used in forest situations.

Low	Few susceptible plant species present. If the pathogen were introduced symptoms would be evident as a few scattered deaths in the scrub layer.
Moderate	Some susceptible plant species present. If the pathogen were introduced most susceptible understorey plant species and less than 10 percent of the overstorey species would die. Overstorey deaths would be scattered not clumped.
High	Many susceptible plant species present. If the disease were introduced most susceptible understorey plants and more than 10 percent of the overstorey species would die

4. CONSEQUENCES ON LAND USE

CALM lands are managed on a multiple use concept where possible. Priority uses and zones may be allocated as necessary. Hygiene planning should consider all possible land uses pertaining to an area and select the most relevant disease control strategy to protect these uses.

The consequences of disease on land uses may vary according to the hazard rating of the site being examined (see Appendix 1.). Always err on the conservative side. e.g. low hazard & few susceptible species may indicate a low level of consequence if the area became infected, but the vegetation may support a very delicate ecosystem of dependant species which has great ecological significance.

In general the following effects apply:

Conservation
Any disease in conservation areas will have a serious effect on the land use. Effects may include destruction of native plants, removal or degradation of fauna habitat and degraded aesthetic values.

Production
Timber. Disease in timber production areas may kill or impair growth of productive species. It may also effect the method and cost of harvesting operations.

Water. Water production in diseased areas may in fact be enhanced due to increased runoff. If vegetative cover is markedly reduced water quality may decrease due to increased sedimentation and salination.

Catchment Protection
It is important that a deep rooted tree component be retained so as to control salinity - especially in areas of low rainfall and high salinity risk. Degradation of vegetative cover may also lead to turbidity and siltation problems.

Recreation
Effects on recreation may be aesthetic, restriction or control of access, or negative effects on specialist interests such as wildflower hobbyists.

Scientific
Results of research studies and trials may be affected significantly by the introduction of the disease.

Landscape
The effects of disease on landscape can be serious on both environmental and visual resources.

5. PLANNING OPERATIONAL HYGIENE

There is a logical process involved in determining whether dieback disease is an issue associated with any particular operation. If it is, then practical strategies and tactics can be developed to achieve dieback disease control.

When determining a hygiene strategy for any operation the planner should never depend on one tactic only. Several integrated and mutually supportive tactics should be built into the operation to ensure successful hygiene.

The following factors should be considered when planning an operation to determine the relative importance of dieback disease and its management.

(a) What kind of operation is planned? Do any parts of the operation involve the possible transfer of infected soil, plant material or water.

(b) Are there areas of susceptible vegetation that could be placed at risk by the operation?

(c) Are the land use values on site or adjacent to the operation likely to be effected by dieback disease?. Conservation or production values such as habitat, water quality, wildflower growing, timber production etc are examples of vulnerable land uses.

(d) Is dieback already present?

(e) Is dieback disease so widespread that any attempts at control within the project are likely to be futile? If the answer is yes, then no further consideration within the project is required. Preventing the spread to other sites will need to be considered.

(f) If dieback disease is not present, or present but not widespread, what is the risk of introducing or spreading dieback disease?

(g) What resources are currently available to implement disease management? If resources are limiting and the potential for disease impact is high it may be appropriate to defer the operation until sufficient resources are available.

(h) Is the state of knowledge about dieback disease on the site such that the project should be deferred until more information is available?

(i) Is there some other factor present on the site or on adjacent land which precludes any effective management solely for this operation.

The appropriate level of hygiene can only be achieved by good planning well in advance of the operation. This involves scheduling of the planning process with respect to other operations that may affect, or be affected by, the operation being planned. For example the lead time associated with gathering data can be up to 5 to 7 years where prescribed burning patterns need to be altered. Generally the lead time is much less, but should be sufficient to ensure there is time for dieback mapping, vegetation typing and gathering of other relevant data.

5.1 When and Where is a Hygiene Evaluation Required.

Figure 1 indicates the known geographic range of Phytophthora species in W.A.. Operations within that zone must be exposed to a Hygiene Evaluation. This includes all tenures of land managed by CALM.

Separate Hygiene Evaluations should be compiled for an operation with phases which are likely to require distinctive hygiene prescriptions. Eg., logging operations should have separate evaluations for roading and coupe management.

5.2 Who Should Compile the Hygiene Evaluation.

The person responsible for supervising the proposed operation should prepare the Hygiene Evaluation.

5.3 Who Approves the Hygiene Evaluation.

Authorities to approve Hygiene Evaluations are indicated in table 2. Each of these officers is required to make an evaluation of the proposal or any changes to the original proposal.

5.4 Who Gets a Copy?

Districts must keep an up-to-date register of all Hygiene Evaluations **with endorsements as they occur.** A copy of each evaluation should be sent to the appropriate approving officer who shall return the evaluation once approved or disapproved together with any alterations or endorsements made. Correspondence that adds to the detail or changes the evaluation in any way should become a permanent attachment to the original and working copies of the evaluation.

5.5 Leadtimes

The following factors should be used as a guide to determine the planning horizon required for an operation.

(a) Prescribed Burning.

To be interpreted for dieback the vegetation should be undisturbed for a period prior to photography or survey to allow full expression of symptoms. 3 years is generally accepted as the minimum required in the jarrah forest, 6 to 7 years may be required in heath/mallee heath associations.
If an operation is imminent burning may only occur:

- after interpretation and permanent demarcation **AND,**
- with Regional Manager approval, **OR**
- subsequent to the operation.

(b) Dieback Photography.

Programmes for photography are submitted each September. Photography takes place each autumn, and even high priority areas may take more than 6 months to interpret. This equates to a lead time of 12-18 months for summer/autumn operations and 2 years for winter/spring operations. Heath association do not require full cloud coverage so lead times are a little more flexible.

(c) Upgrading Existing Maps.

Where hygiene maps already exist they may continue to be used subject to verification. The Senior Regional Interpreter should be contacted where accuracy ratings or verifications are required. In cases where maps are classified as inaccurate or of doubtful accuracy, upgrading or re-mapping will be required. Lead times depend upon available personnel and the area involved.

Ground stripping maps should be used with the utmost caution. These maps will require field checking every time they are used.

(d) Ground Survey.

Primarily dependent on the availability of trained staff and the area involved. A minimum lead time of 3 months is suggested to allow samples to be processed.

(e) Carry out the Hygiene Evaluation and Prepare the Hygiene Prescription.

Carry out the Hygiene Evaluation as close as possible to the operation. Ensure enough time is allowed for approvals and that the most recent/accurate information is used.

5.6 Review of Standards.

Environmental Protection Branch will conduct regular monitoring and training with each Region/District.

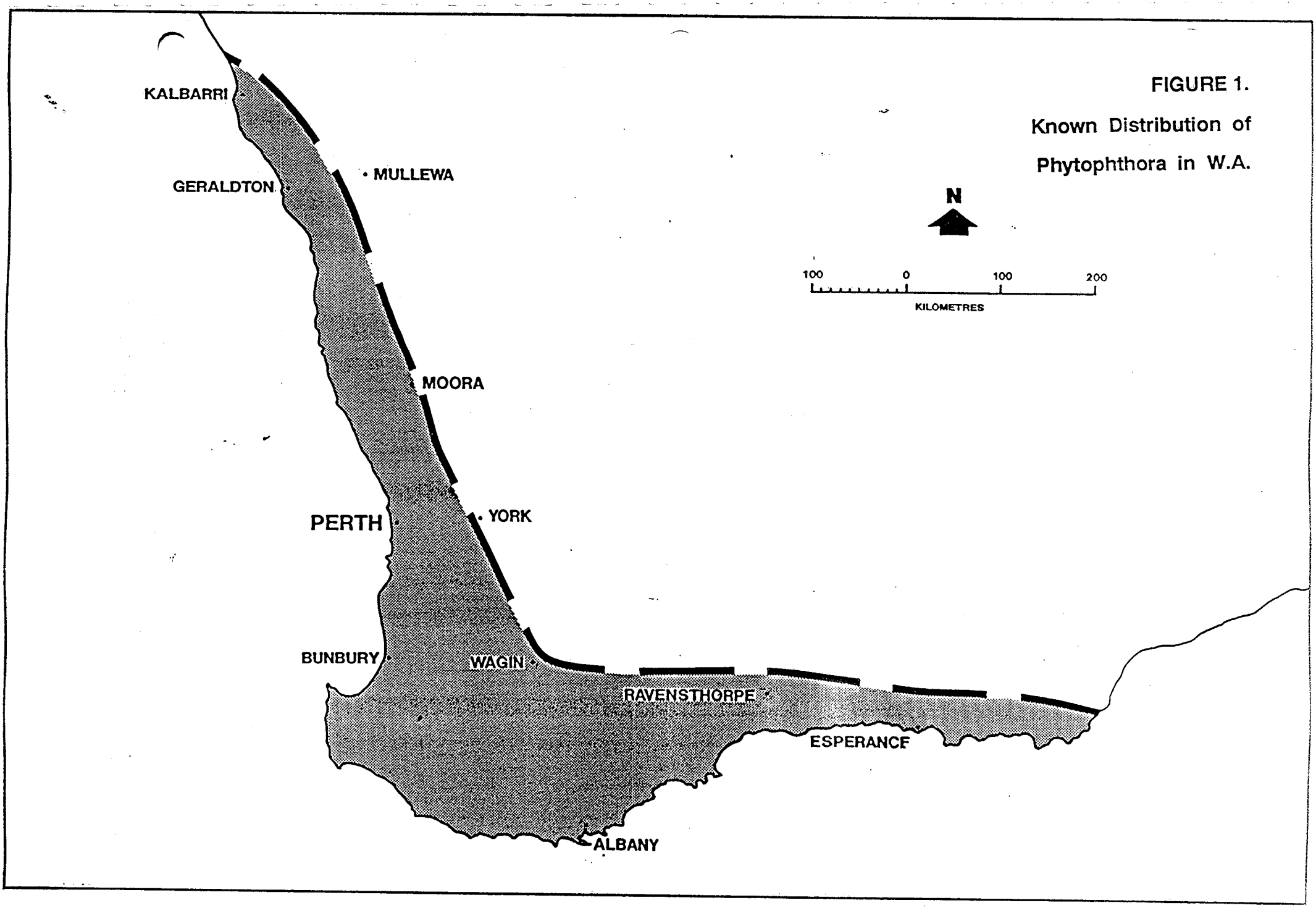

FIGURE 1.

Known Distribution of Phytophthora in W.A.

6. COMPILING A HYGIENE EVALUATION.

All Hygiene Evaluations should be accompanied by maps and diagrams showing:

- latest dieback information (hygiene plans - include other diseases if relevant, eg., Armillaria).
- contours and drainage lines.
- access routes existing and proposed.
- landform or vegetation types.
- hazard ratings.
- location of the operation and special hygiene features such as clean down points.
- illustrations of the phasing techniques to be utilised.

6.1 PART 1. - ACTIVITY

Evaluation Numbering.

Each evaluation should be individually identified by the first letter of the District, the number of the evaluation and the year of compilation. ie., the 15th evaluation compiled in Albany in 1988 would be numbered "A 15/88". Evaluations submitted by a body outside of CALM (eg., mining or timber industry) should be incorporated into the District numbering system prior to approval of the evaluation.

The "valid to:" date of the evaluation is the date at which the evaluation will have to be reviewed because the information on which it is based has become unreliable.

Proposed Activity:

Describe briefly (one sentence) the type of activity and the name of the area in which it is to occur. Record the name of the officer compiling the Evaluation.

Type and Extent of the Activity:

Describe briefly the type of operation proposed. Describe each component part of the operation. Show the extent of the activity in quantitative terms, ie., areas, distances etc.

Alternative Strategies Considered:

Other activities, strategies and locations which may achieve the purpose of the activity (including the "do nothing" option) should be considered and listed. Reasons for rejection should also be noted.

If relevant, include reasons why it is inappropriate for the entire operation to be undertaken in dry soil conditions.

6.2 PART 2. & 3. RISK AND HAZARD

The Risk/Hazard Summary table is a quantitative summary of hygiene categories and hazard classes which are placed at risk by the various parts of an operation. It enables approving officers to see at a glance what areas are at risk and what the impacts on landuses may be if hygiene fails.

TO COMPLETE THE TABLE:

- Identify the activity and extent (distance, area etc) of each part of the operation and complete a summary for each activity. For example, road construction could be one part, logging (fall, snig, load) or car-park clearing may be other parts. This part can address several activities and the individual pages should be identified by filling in the "page__of__" at the top of each page.

- State the hygiene category and area of each affected by the operation.

- For each hygiene category state the area put at risk. The area put at risk is that area which may be infected. The area includes the area directly affected by the operation and the area downslope of that operation.

- State the vegetation type or landform of the areas put at risk (from maps supplied or field surveys).

- From the appropriate list in Appendix 2. state the hazard rating applied to the vegetation type or landform.

- Determine the area of each of these hazard ratings.

- From Appendix 1. under the appropriate land use nominate the soil conditions required for that part of the operation.

The hazard class, the land uses and the estimated area (ha's) put at risk must be considered so that the appropriate hygiene constraints can be applied. The hazard class, land use and area (ha's) put at risk is the measure of the consequence of infection if hygiene fails.

6.3 PART 4. - CONSEQUENCE OF DISEASE INTRODUCTION

It is essential to indicate all values which may be put at risk on the proposal. Refer to the appropriate Regional management plans for land tenure and purpose classification.

Indicate the designated purpose and also consider important secondary uses and other values. Show the area of land having each of the landuse values. Determine the area of each landuse that is rated as LOW, MODERATE or HIGH hazard.

Record the consequence of infection on each of these values. These judgements require an understanding of the disease and its likely impact on landuse and ecological values of the area.

Where there are important secondary values, the hygiene prescription should also ensure protection of those values. These values should be recorded in the space at the bottom of the form headed "other".

The level of hygiene implemented reflects the sensitivity of the land use values to damage by disease.

6.4 PART 5. - HYGIENE PRESCRIPTION

Useful hygiene tactics are illustrated in the CALM Dieback Disease Hygiene Manual. This document should be referred to when considering the selection of appropriate hygiene tactics

Fill out the hygiene prescription using the criteria from Appendix 1. relevant to the land use values. Show all information on an accompanying map.

Dieback Maps Available.

Specify the most up to date information available covering the area of the operation.

(i) Level 1. Disease Maps:

Maps produced from the interpretation of 230mm photography is recognised as the most accurate method of determining disease distribution. This source of hygiene information should be used in preference to all others when it is available.

(ii) Level 2. Disease Maps:

The ground stripping method is considered to be slightly less desirable than 230mm maps. Ground stripping is limited by the spacing between the lines used to assess disease distribution. The further apart the lines, the less reliable the information.

(iii) Level 3. Disease Maps:

The most unreliable method is the broadscale survey that only assesses creeks and roads or broadscale areas by studying them through binoculars. This information is not suitable for the production of detailed hygiene prescriptions and should not be used.

Map Quality.

All methods are restricted by the recency of the information. Disease distribution information that is greater than one year old should be checked in the field before the operation begins and information older than one year should be used with caution as the disease can extend its distribution downslope significantly during this time. The Senior Regional Interpreter should be consulted if a doubt exists about the reliability of the disease distribution information.

An enquiry to the Senior Regional Interpreter should be made to determine the level of confidence to be placed on any map older than 3 years.

Date Prepared/Varified.

Record the date of preparation and verification of the hygiene information being used. This is the date at which the information was correct and reliable in the field, not the date of map compilation.

Information Valid to:

The older hygiene information gets the more unreliable it becomes. The author of the hygiene information being used (preferably the Regional Interpreter) should determine a date in the future that indicates when the hygiene information will no longer be reliable and will need re-checking before use.

Demarcation Categories.

Specify all categories to be demarcated prior to the operation starting. Table 1. sets out the hygiene categories requiring demarcation during a logging operation and is a suitable guide for other operations.

TABLE 1.

Hygiene Demarcation Categories

ADJOINING HYGIENE CATEGORY	LPR	U/I	SUS	HPR	NEQ	D/B
SDF	**yes** SM or old maps **No** NSM or new maps	**yes** (all ops)	**yes** (all ops)	**yes** (all ops)	**yes** (all ops)	**yes** (all ops)
LOW POTENTIAL RISK		**yes** (LPR not below U/I **No** LPR below U/I	**yes** (all ops)	**yes** (all ops)	**yes** (SM or old maps) **No** (NSM LPR below NEQ or new maps	**yes** (all ops)
UNINTERP-RETABLE			**yes** (all ops)	**yes** (all ops)	**yes** (all ops)	**yes** (all ops)
SUSPECT				**yes** (all ops)	**yes** (all ops)	**yes** (all ops)
HIGH POTENTIAL RISK					**yes** (all ops)	**yes** (SM) **No** (NSM)
NOT EFFECTIVELY QUARANTINED						**yes** (all ops)

SM = Soil Movement **NSM** = No Soil Movement

Soil Conditions.

The likelihood of inoculum surviving when deposited onto a dry soil surface is much lower than if it is deposited onto a moist soil surface. Bearing this in mind and the ease with which moist soil can be moved by adhering to machinery,

specify the soil conditions under which the operation should take place and whether soil movement is to be permitted or not.

Using information from Appendix 1. determine the areas available under soil movement and no soil movement conditions. Determine areas (ha) for each and show on hygiene plan attached to test.

Access Routes.

Show proposed moist and dry soil access routes on the hygiene plan. Describe road names and distances for dry and moist soil access.

Operational Segregation.

The only instance where sub-catchment segregation does not apply is when the entire operation occurs wholly within an infected area.

Specify whether the components of the operation will be separated in time or space or both. Specify the methods to be used to implement phasing. The chosen techniques are to be supported by diagrams attached to the test.

Vehicle Cleanliness.

All vehicles, plant and machinery (or other potential carrier) must be free of soil and plant material when crossing hygiene or subcatchment boundaries. Specify when, where and how machines must be cleaned down eg., on entry, on exit, between hygiene categories, at designated washdown points etc, cleandown points are to be shown on a supporting plan.

Supervision.

Nominate the level, intensity and personnel (by name) involved in supervision. Include supervising contractor personnel.

Working Arrangement Documents.

List all documents and the applicable section relevant to dieback hygiene for the operation being undertaken eg., job prescription for roading Stokes Inlet National Park, Dieback Hygiene Manual Section 3, Timber Harvesting in W.A. Section 5.1, Contract documents etc.

Disease Risk Area Permit Required.

If the operation is within a D.R.A. a permit is required. If the operation is outside D.R.A. but special conditions on access are applied these should be noted on the Hygiene Evaluation eg., self quarantining areas should not have public access improved as a result of the operation if this can be avoided.

Monitoring Arrangements.

Specify any monitoring arrangements. Specify who, when, where and how any monitoring is going to be done. Departmental Policy recommends that representative samples of all operations be monitored for hygiene effectiveness. Arrangements for regular monitoring should be made via the Region to Environmental Protection Branch.

6.5 PART 6. - EVALUATION

This section is to be filled out by the person responsible for approving the evaluation as per Administrative Instruction No. 46 September 1990 (see below). It should incorporate a broadscale assessment of consequences on land uses as well as being a check of the proposed activity and hygiene standards.

HYGIENE EVALUATIONS - AUTHORITY TO APPROVE

Area Involved	Approving Officer	Remarks
State Forest outside Disease Risk Area.	District Manager	Separate file to be kept at District office for perusal by R/L Env. Prot.and/or Env. Prot. Branch
State Forest Disease Risk Area	Regional Manager (Recommendation by R/L Env Prot)	Separate file to be within kept at Regional office for perusal by Env Prot Branch staff or Policy Review Group.
Parks & Reserves or any area where timber production is not a priority land use. Existing Programs New programs	 District Mannager Regional Manager	Kept on same Regional file as above

A Policy decision may still be required for certain Hygiene evaluations for operations without precedent or having unusual circumstances. Examples would be where other agencies are concerned, where several Districts or Regions are involved such as SEC line maintenance project, large scale mineral exploration proposals, or projects considered to pose severe hygiene risks. Such proposals will still be referred by the Regional Manager to Environmental Protection Branch. Approval will either be given by the Manager, Environmental Protection Branch or, where appropriate, referred to the appropriate Director.

District Managers should encourage staff to consider the Hygiene Evaluation as a check-list for all operations involving a hygiene risk. This does not mean that a written Hygiene Evaluation is necessary in every case where established hygiene guidelines and prescriptions are available for routine operations. However, the guidelines and working drafts should be used as a training medium and be filed for future evaluation.

The approving officer must specify the date at which the Hygiene Evaluation will be unreliable and require review. If the Hygiene Evaluation requires an extension, the hygiene information used will require re-checking and be satisfactory to the approving officer. Regional Leaders (Environmental Protection) and Environmental Protection Branch staff will be available to provide guidance, training and as a point of referral in the first instance.

APPENDIX 1. OPERATIONAL HYGIENE STANDARDS

(A) Land Use: Conservation + Scientific.
(National Parks, Nature Reserves, Conservation Parks, and Wildlife Reserves)

OPERATION	DIEBACK HAZARD		
	LOW	MODERATE	HIGH
D/B loc'n and mapping	Level 1. mapping preferred for all operations. Maps of doubtful or poor accuracy require field checking & upgrading, or remapping before use. Level 2. mapping for linear operations, if less than 6 months before operation commences. Ground surveys must allow 100% coverage of area with supervision of survey responsibility of dieback disease interpreter.		
Demar-cation	All hygiene categories, as per table 1.		
Access	High quality, low profile roading generally preferred for moist soil access.		No moist soil access except on high quality low profile roads.
Soil Conditions	No movement of soil and only if recent mapping available.		Dry soil conditions only.
Oper'nal Phasing & Segreg'n	Split-phase for moist soil ops otherwise physical separation. Segregate sub catchments.		Physical separation. Segregate sub catchments.
Vehicle Clean-liness	To be free of soil when crossing hygiene categories & sub catchment boundaries.		
Con-sequence on land use	Moderate		High

(B) Land Use: Catchment Protection.

OPERATION	DIEBACK HAZARD		
	LOW	MODERATE	HIGH
D/B Loc'n & mapping	Level 2. mapping for linear operations, if less than 6 months before operations. Level 1. mapping for all other operations. Maps of doubtful or poor accuracy to be field checked & upgraded or remapped prior to use.		
Demar-cation	All hygiene categores, as per table 1.		
Access	High quality, low profile roads generally preferred for moist soil access.	No moist soil access except on high quality, low profile roading. Preferred alignment in lower dieback hazard.	
Soil Cond'ns	No movement of soil		Dry soil only.
Oper'nal Phasing & Segreg'n	Split phase ops in moist soil, otherwise physical separation. Sub catchment segregation.		Physical separation, sub catchment segregation.
Vehicle Clean-liness	To be free of soil when crossing hygiene categories and sub catchment boundaries.		
Con-sequence on land use	Low	Moderate	High

(C) Land Use: Water and Timber Production.

OPERATION	DIEBACK HAZARD		
	LOW	MODERATE	HIGH
D/B Loc'n & Mapping	Level 2. mapping for linear operations less than 12 months prior to operations. Level 1. mapping preferred for all other operations. Maps of doubtful or poor accuracy require field checking & upgrading or remapping prior to use.		
Demar-cation	All hygiene categores, as per table 1.		
Access	High quality, low profile access preferred for moist soil access.	No moist soil access except on high quality, low profile roads.	
Soil Cond'ns	No restriction	No movement of soil.	Dry soil only.
Oper'nal Phasing & Segreg'n	1. Split phase logging in moist soil conditions, otherwise physical separation. 2. Sub-catchment segregation.		Physical separation sub catchment segregation.
Vehicle Clean-liness	To be free of soil when crossing dieback categories and sub catchment boundaries.		
Con-sequence on land use	Low	Moderate	High

(D) Land use: Landscape, Recreation, Visual Resource Management.

OPERATION	DIEBACK HAZARD		
	LOW	MODERATE	HIGH
D/B loc'n & mapping	Level 2. mapping for site development and linear operations. Level 3. mapping for broadside landscape design.		
Demar-cation	All hygiene categories as per table 1.		
Access	High quality, low profile roads to service recreation sites. Walk trails to be hard surfaced, well drained & preferably low in the profile with clean down points at hygiene category boundaries.		
Soil Cond-itions	soil movement if recent mapping	no soil movement. Dry soil conditions only	
Oper'nal Phasing & Segreg'n	split phase for moist soil movement op's otherwise phys-ical separation. Segregate sub-catchments.	physical separation. Segregate sub-catchments	
Vehicle clean-liness	To be free of soil when crossing hygiene categories & subcatchment boundaries.		
Con-sequence	Low	High	

APPENDIX 2. HAZARD RATINGS

1. Northern Jarrah Forest

Havel Vegetation types

Vegetation Type	Dieback Hazard
A	Low
B	High
D	High
E	High
W	Moderate
C	Low-High due to variability of banksia communities.
F	Moderate - High
J	Moderate - High
H	Low-Moderate
P	High
Z	Low-Moderate
S	Moderate-High - Wide range seek better info. - apply NJF hazard rating system.
T	Low-Moderate
U	Low
R	Moderate - High (vulnerable communities on the margins of rock outcrops)
Q	Low
M	Low
L	Low
Y	Low
O	Low-High - wide range seek better info - apply NJF hazard rating system.

Landform Types - System 6 - Churchwood & McArthur:

Yarragil	Low (swamp) - High (Fringes)
Dwp/High rainfall/Well drained	Moderate-High
Dwp/High rainfall/Concreted Laterite	High
Dwp/Low rainfall/Yalanbee	Low
Helena/Murray	Low
Monadnocks	Low (High localised)
Williams/Michibin	Low
Pindalup/Goonapin/Coolakin	Low-Moderate
Collie/Cardiff/Muja	High

2. Southern Jarrah Forest.

Landform (Churchwood & McArthur)	Vegetation Type (Strelein)	Hazard
Hester	P, R	High
Hester	S	Low - High
Dwellingup	P, S	High
Ellis	P	High
Mungardup	A, B	High
Caldyanup	F, B, J	High
Trent	P	High
Bevan	K	Low
Crowea sand	P	Moderate - High
Crowea yellow	S, T	Low
Crowea laterite	P	Moderate - High
Crowea brown	T, S	Low
Collis yellow	P	High
Collis yellow	I, S, T	Low
Collis shallow	N	High
Major valleys	T, K	Low
Mattaband yellow (lateritic duricrust)	P	High
Mattaband shallow &	Mtd - P	High
duplex	Mtd - T, K	Low
Keystone yellow (shallow soils)	S, P	High
Keystone brown	P	High
Keystone brown	K	Low
Stream	Various	Low - High

3. **Sunklands.**

McCutcheon Soil Types

Soil Type	Brief Description	Hazard
1	Lateritic sand	Moderate - High*
2	Sand over laterite 50cm	Moderate - High*
3	Yellow-Brown sand 50cm	Low - Moderate*
4	Light-Greyish Brown sand 50cm	Low - Moderate*
5	Yellow-Brown Sandy loam	High
7	Alluvial soils	Moderate - High

* some areas exhibit high impact where an impeding layer is present.

Landform - Churchwood & McArthur

Landform	Hazard
Balingup	Low - Moderate
Hester	Moderate - High
Ellis (Grimwade)	High
Dwellingup	Moderate - High
Wilga	Moderate - High
Catterick	Low - Moderate
Yarragil	Moderate - High
Goonaping	Moderate - High
Bassendean	Low - High
Yoongarillup	Low
Kingia	High
Preston	Low - Moderate
Pindalup	Low - Moderate
Coolakin	Low
Michibin	Low
Jarrahwood	Low - High
Cartis	Low - High
Mungardup	High
Mungrove	High
Rosa	Low
Chapman	Low - Moderate *
Keenan	Moderate *
Kaloorup	High
Scott	High

4. **South Coast.**
Beard vegetation associations

Community Types	Hazard
Forest:	
Karri	Low
Jarrah/Marri	Moderate-High
Low Forest (<10m):	
Jarrah	Moderate
Bullich	Low
River yate	Low
Riverine/Lacustrine Low Forest:	
Paperbark (fresh)	Low
Paperbark (salt)	Low
Banksia seminuda	High
Sclerophyll Woodland: (Eucalypt component referred to only)	
E. newbey	Low
E. platypus	Low
E. wandoo	Low
E. loxophleba	Low
E. occidentalis	Low
Allocasuarina huegeliana	Low
All other sclerphyll woodlands including E. salmonophloia, E. rudis, E. oleosa, E. flocktoniae, E. annulata, E. transcontinentalis E. longicornis	Low
Low Woodlands (<5m):	
Jarrah; Jarrah/Sheoak	Moderate-High
E. staeri	Moderate-High
Agonis flexuosa	Low
E. decipiens	Low
Shrublands:	
Ravensthorpe Range Thicket	High
Barren Ranges Thicket	High
Stirling Ranges Thicket	High
Banksia shrublands/heath (incl. B. speciosa, B. media)	High
Agonis flexuosa/E. angulosa	Low
Broomebush Thicket	
i) Allocasuarina campestris, Thrytomene, Melaleuca	Low-Moderate
ii) Allocasuarina/Melaleuca/ Acacia	Low
iii) Allocasuarina/Melaleuca/ Calothamnus	Low

Mallee/Marlock: usually 1 layer duplex soils:	
E. stoatei	Moderate
E. annulata	Low
E. conglobata	Low
Other communities dominated by E. nutans, E. gardneri, E. anglosa, E. dicipiens, E. cornuta or E. lehmanni	Low
Scrub/heath (2 layers)	
Mixed Proteaceae/Myrtaceae	Moderate - High
Agonis flexuosa	Low
Melaleuca Communities on Clay:	
M. thyoides/M. parviflora	Low
Mallee:	
Jarrah	Moderate
E. tetragona	Moderate-High
Mixed	Moderate-High
E. incrassata	Moderate
Heath:	
Myrtaceae/Proteaceae	Moderate-High
Coastal heath (Scaevola/Olearia)	Moderate
Casuarina heath (A. campestris)	Moderate
Heath with scattered Nuytsia floribunda	High
Reed Swamps	Low
Halophytic communities	Low
Low scrub on granite	Low-High
Moss swards	Low
Mosaics of Mallee - Heath/Woodland	High

South Coast - Landforms (Churchwood & McArthur)

Torndirrup:	Hazard
Gg - podsols on slopes of granite outcrops with dense heath, many proteaceae. Thickets of Mallee in gullies.	High
Mp Mf - podsols over calcareous sands. Woodlands of Agonis, Banksias and Eucalypts.	Moderate *
Mc Mp Mf - calcareous soils, limestone outcrop, low coastal heath, agonis.	Low *
Two Peoples Bay:	
Gg - As for Torndirrup.	High
Mp Mf as above. Some Mf podsols on interdune plain with Banksia.	High *
Mc Mp on limestone substrate as for Torndirrup.	Low *
OW - Thicket, heath, reeds.	Low
S6-S7 podsols and duplex soils	High
DC sands and laterites - JM woodland	High
West Cape Howe:	
Mp Ms strong calcareous influence.	Low *
Ks - dieback present on podsols teatree heath and J. woodlands.	High
William Bay:	
M series - mostly calcareous origin.	Low *
Some Mf podsols within range	Moderate
Millbrook:	
Dc sands and laterites, JM forest.	High
R yellow duplex soils, JM forest.	Moderate
S7 podsols and duplex soils.	High
Bakers Junction:	
DC sands and laterites. JM forest.	High
S6-S7 see above.	High
Many Peaks:	
TK - mostly cleared, some evidence on road verges, duplex JM heaths.	High
Yate in depressions.	Low
Podsols and Banksia woodland.	High
DC see above.	High
Gs - sands and podsols Hakea sp.	High
S7 - broad valley, low J. scrub.	High
BAg - granite outcrops.	Moderate-High on fringes *

North Sister: (Lake Pleasant View)	
Bo - Yate melaleuca swamps.	Low
Podsols J, B, scrub.	Moderate-High on fringes
South Sister:	
BAf - duplex soils JM sheoak.	High

(* Requires further resolution - use with caution).

5. Northern Sand Plain.

Bassendean sands	High
Quindalup dunes	Low
Banovich Uplands	High
Peron Slopes	High
Gairdner dissected uplands	High
Bitter pool rises	High
Peron slopes	High
Lesueur dissected uplands	High

	VEGETATION TYPE [1]	LANDFORM [2]					HAZARD
		PS	LDU	GDU	BU	BPR	
A	Sand Heath	A	A	M	A	-	High
B	Lateritic Heath	A	A	M	A	-	High
C	Sandstone Heath	-	M	I	-	-	High
D	Gravel Heath	-	M	M	M	M	High
E	*Ecdeiocolea* Heath	-	-	M*	-	M	High
F	*Hakea erinacea*	-	-	I*	-	I*	High
G	*Melaleuca platycalyx* Heath	-	-	I*	-	I*	High
H	*Petrophile seminuda* Heath	-	-	I*	M*	I*	High
I	*Gastrolobium spinosum* Scrub	-	-	-	-	-	Moderate
J	*Calothamnus quadrifidus* Heath	-	-	I*	M*	I*	High
K	*Eucalyptus wandoo* Woodland	-	-	I	M	-	Low
L	Clayey drainage lines	-	M	I	M	M	High
M	Sandy drainage lines	-	M	-	M	-	High
X	*Allocasuarina campestris* Heath	-	-	M	-	-	High

1 After Martinick and Associates (1988)
2 After Beard (1976, 1979)

Landform codes

PS	Peron Slopes
LDU	Lesueur Dissected Uplands
GDU	Gairdner Dissected Uplands
BU	Banovich Uplands
BPR	Bitter Pool Rises

Abundance codes

A Abundant
I Important
M Minor
* mainly as a complex

6. **Wheatbelt.**

Not yet available.

7. **Swan coastal Plain**

Quindalup dune	Low
Spearwood dune	Low-High (in swales)
Bassendean Dunes	High
Gavin Sands	Moderate-High

APPENDIX 3

GLOSSARY OF TERMS

cleandown:

The removal of all potentially infected material from an object. This can be achieved by using a high pressure water jet (washdown), compressed air (blowdown) or a brush (brushdown).

consequence:
The effects of disease on the potential of a site to sustain the designated land uses or ecological processes pertaining to that site.

dieback:

Progressive deterioration of tree crowns from the top down due to death of leading twigs and branches. In Western Australia often associated with infection by *Phytophthora cinnamomi*, but can also be caused by other pathogens that infect roots (eg., *Armillaria luteobubalina*) and cause cankers on branches (eg., *Botryosphaeria ribis*).

disease:

A harmful alteration of the normal physiological and biochemical development of a plant.

disease risk area:

Any area of public land which in the opinion of the Executive Director may become infected with a forest disease and has been gazetted by the Governor as such on the recommendation of the Minister.

dry soil:

Soil which will not adhere in clumps to the wheels of a vehicle. (grains of sand are OK)

ecosystem:

A functional system which includes the organisms of natural community together with their environment.

front barrier:

A physical barrier to the movement of machinery placed at the front of a log landing, directly behind the soil disturbance caused by roading. Its purpose is to minimise the risk of infected soil being moved from the road onto the landing. A log of 40cm minimum diameter is required.

fungus:

One of the lower forms of plant life that lack chlorophyll and being incapable of manufacturing its own food, derives energy from dead or living plant or animal tissue.

ground stripping:

The systematic interpretation (inspection, sampling, decision, mapping) on foot of an area of forest for the presents of disease symptoms.

hazard:

The intrinsic characteristics of a site which determine the activity of the fungus and the degree of disease intensification, if the fungus is introduced.

hazard plan:

A plan showing the spatial arrangement of hazard categories derived from landform, soils and vegetation information.

host:

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

host range:

The various kinds of plants that may be affected by a pathogen.

high quality roads:

Hard surfaced well drained quick drying roads.

hygiene:

Actions that decrease the risk of the pathogen being introduced, spread, intensified or surviving.

hygiene plan:

A plan showing the spatial arrangement of diseased vegetation, disease free vegetation, vegetation of unknown disease status and areas put at risk of infection by natural spread.

impact:

The effect of disease on plant health.

infection:

The process of establishing a pathogenic relationship with a host.

low profile road:

A road constructed low in the landscape so as to minimize the area put at risk of infection downslope from the road.

mini-catchments:

An area within a larger catchment which is self contained in terms of surface water runoff.

moist soil:

Any soil which contains enough moisture to adhere in clumps to machinery

pathogen:

Any organism or factor causing disease.

pathogenicity:

The process of being able to cause disease.

phytophthora:

(*phyton*, a plant; *phthora*, destruction) Many species in this genus are destructive parasites of economic plants. Hyphae typically branch at right angles and are often constricted at the base. Some species (eg., *P.cinnamomi*) frequently produce hyphal swellings. Hyphae asexually produce oval shaped sporangia which germinate directly by a hypha or indirectly by segmentation of the protoplasm into zoospores. Following release, the motile ovoid diflagellate zoospores swarm for some time, come to rest, encyst and germinate. Sexual reproduction is by means of fertilization of an oogonium by an antheridium borne on the same or different hyphae and formation of an oospore.

plant community:

Aggregation of plants characterized by a distinctive combination of two or more ecologically related species.

quarantine:

Restriction of entry of vehicles into designated areas of forest.

rear barrier:

A physical barrier to the movement of machinery placed at the rear of a log landing. All logs from the fallers block are delivered to the landing by being lifted or pushed over this barrier. A log of 40cm minimum diameter is required. Its purpose is to minimise the risk of infected material being moved from the landing onto the fallers block.

Resistant:

Not susceptible to disease; the inherent capacity of a plant to restrict the entry or subsequent activity of a pathogen when the plant is exposed to inoculum under environmental conditions suitable for infection.

Risk:

The probability of an operation introducing, spreading or intensifying dieback disease, or allowing the pathogen to survive at a site.

soil movement:

The movement of moist soil sticking to the wheels or tracks of vehicles.

split phasing:

The separation of component tasks of an operation in time and/or space, so as to minimise opportunities for disease spread.

survival:

The ability of individuals of a population to withstand adverse conditions.

susceptibility:

The capacity of a plant to become infected by a pathogen or to be affected by a disease.

symptoms:

Usually a visible reaction of a plant to a pathogen or abiotic agent.

topography:

The general configuration of the land surface including its relief.

Sub Catchments:

see mini-catchments

Susceptible:

(Plant) Able to become infected by Phytophthora sp. and show disease symptoms.

CLM781
PART 1
ACTIVITY

DISEASE HYGIENE EVALUATION AND PRESCRIPTION

DISTRICT:_____ **EVALUATION No:**_____ **VALID TO:**_____

THE PROPOSED ACTIVITY: (PURPOSE AND LOCATION)

TEST COMPILED BY:_____

TYPE AND EXTENT OF THE ACTIVITY: (AREAS/DISTANCES/INTENSITY - ATTACH MAPS):

ALTERNATIVE STATEGIES CONSIDERED:
(LIST THOSE CONSIDERED AND REASONS FOR REJECTION)

RISK/HAZARD SUMMARY

ACTIVITY:_____ EXTENT:_____

RISK			HAZARD			
HYGIENE CATEGORY	EXTENT ha/km	AREA PUT AT RISK	VEGETATION LANDFORM	HAZARD RATING	AREA ha/km	SOIL CON
TOTAL AT RISK:						

CONSEQUENCE OF DISEASE INTRODUCTION

TENURE:_____

MANAGEMENT PURPOSE / ZONE:_____

LANDUSE VALUE	ha	HAZARD	ha	CONSEQUENCES
CONSERVATION -ECOLOGICAL -CULTURAL		LOW MODERATE HIGH LOW MODERATE HIGH		
PRODUCTION -TIMBER -WATER		LOW MODERATE HIGH LOW MODERATE HIGH		
PROTECTION -CATCHMENT -SALT		LOW MODERATE HIGH LOW MODERATE HIGH		
RECREATION		LOW MODERATE HIGH		
SCIENTIFIC -RESEARCH -EDUCATION		LOW MODERATE HIGH LOW MODERATE HIGH		
LANDSCAPE & VISUAL RESOURCE		LOW MODERATE HIGH		
OTHER -SPECIFY		LOW MODERATE HIGH LOW MODERATE HIGH LOW MODERATE HIGH		

HYGIENE PRESCRIPTION

DIEBACK MAPS

LEVEL 1. 230mm _____ 70mm _____

LEVEL 2. Ground survey _____ Spacing _____

LEVEL 3. Broardscale _____

Not Availiable _____

MAP QUALITY : Accurate _____ Doubtful _____ Inaccurate _____

DATE FIELD VERIFIED: _____

INFORMATION VALID TO: _____

DEMARCATION CATEGORIES (Yes/No)

_____ Secure Dieback Free

_____ Uninterpretable

_____ High Potential Risk

_____ Dieback

_____ Low Potential Risk

_____ NEQ

_____ Suspect

_____ Not Availiable

SOIL CONDITIONS

_____ NO SOIL MOVEMENT

_____ WITH SOIL MOVEMENT

ACCESS ROUTE (show on plan)

MOIST

DRY

OPERATIONAL SEGREGATION

Sub-catchment segregation

Split Phase in Time

Physical Separation

Not Applicable

DETAILED METHOD

VEHICLE CLEANLINESS

SUPERVISION

WORKING ARRANGEMENT DOCUMENTS

_____ MANAGEMENT PLAN

_____ INTERIM GUIDELINES

_____ DIEBACK HYGIENE MANUAL

_____ JOB PRESCRIPTION

_____ TIMBER HARVESTING IN WA

_____ OTHER (SPECIFY)

DRA PERMIT REQUIRED YES NO

PERMIT NO _____ EXPIRY DATE _____

MONITORING ARRANGEMENT:

EVALUATION

APPROVALS AND RECOMMENDATIONS:	Signature and Date
DISTRICT MANAGER	
REGIONAL MANAGER	
DIV MANAGER OPERATIONS	
MANAGER ENVIRONMENTAL PROTECTION	
DIRECTOR NATIONAL PARKS	
DIRECTOR NATURE CONSERVATION	

ALTERATIONS AND ENDORSEMENTS:	Signature and Date
EVALUATION VALID TO:	

EXTENDED TO:_____(field verification date + 12 months)

FOLLOWING RECHECK OF HYGIENE INFORMATION BY INTERPRETERS.

COMMENTS: