LOWLANDS DIEBACK ASSESSMENT

October 2006

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Introduction

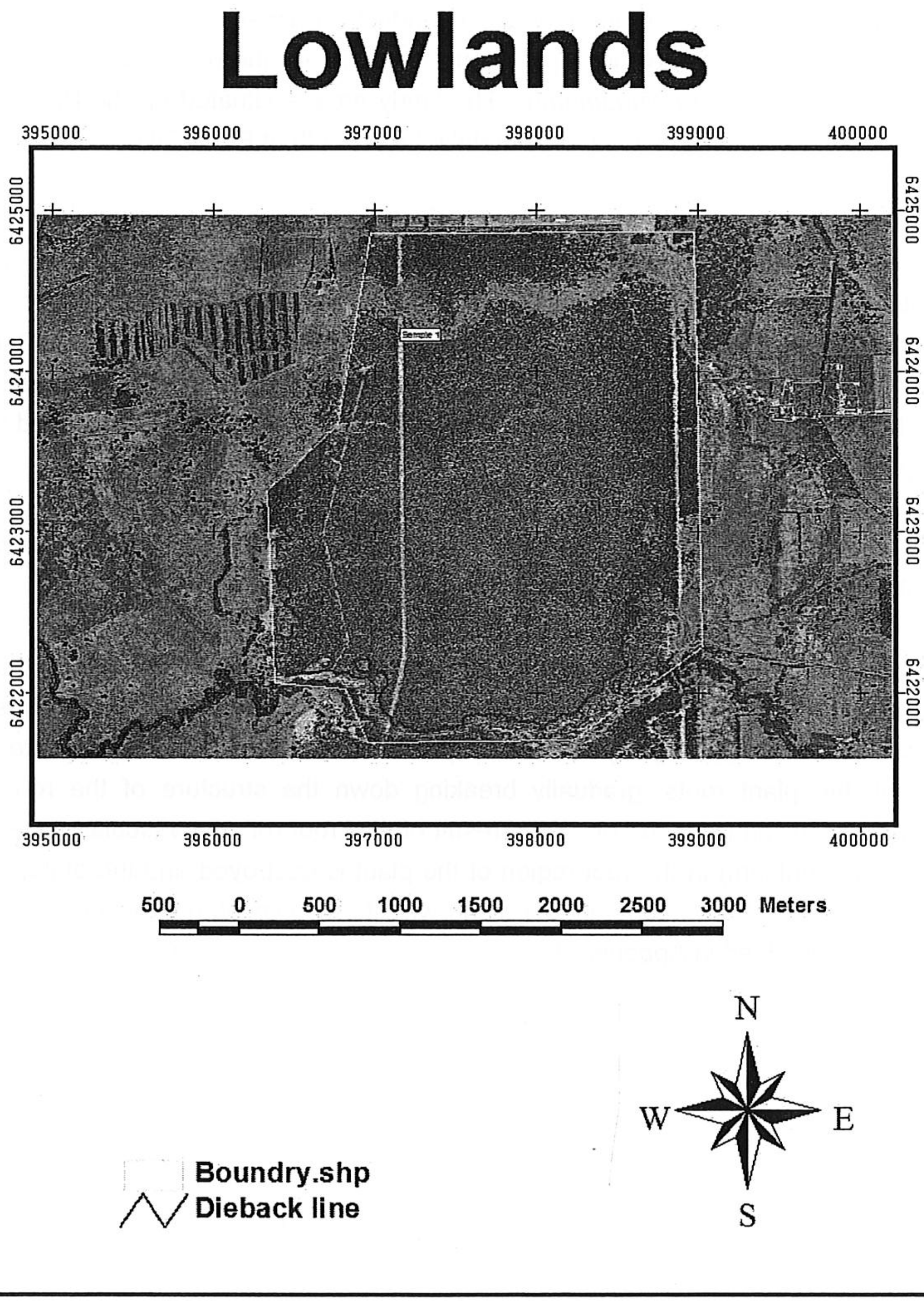
Glevan Consulting was commissioned to conduct an assessment of an area of Banksia woodland comprising approximately 707 ha, for the presence of 'Jarrah Dieback' (*Phytophthora cinnamomi*). The study area is situated on the Pinjarra Plain within the Alluvial plain, approximately 35km south of Perth City.

The assessment for the presence of the disease caused by *Phytophthora cinnamomi* (Dieback) within the remnant Banksia woodland vegetation at Lowlands was conducted between the 31st of August 2006 and the 19th of October 2006. Three infections were identified, demarcated and recorded. One of the three identified infections had been located during a previous assessment. The boundary of this infection has not altered significantly from when identified in the previous assessment.

One sample was taken within the study area. This sample returned a negative result.

Phytophthora cinnamomi is an introduced soil-borne pathogen (water mould) that causes the death of a vast and diverse range of plant species in South West Western Australia through a disease known as 'Dieback'. The disease enters through the plant roots, gradually breaking down the structure of the roots, ultimately causing roots to 'rot'. As a result of this 'root rot', the vascular system (xylem and phloem) in the root region of the plant is destroyed and the ability to transport water and nutrients is lost along with it. Additional information on the Disease is provided in Appendix 1.

Map 1 *P. Cinnamomi* Occurrence



Methods

Boundary Demarcation

The method of assessment was to target areas within the Lowlands property that appeared to be at the greatest risk of being affected by the Dieback disease. These areas were determined by an analysis of the aerial photograph, identifying sites that appeared to have a reduced biomass. These sites were then ground-truthed to determine if the disease was present at the site. Any found disease boundaries were then demarcated through an interpretation of the visual evidence available within the study area. Interpreters from Glevan Consulting used the presence of susceptible plant deaths as an initial point of reference. These susceptible species are known as 'indicator species' and they can vary considerably from area to area. Some species, although considered indicators of *P. cinnamomi*, may actually be much less reliable than others.

Those species generally considered to most reliably indicate the presence of *P. cinnamomi* in the Alluvial plain were used to delineate the disease boundaries within the study area. These species included (but were not limited to) *Banksia attenuata, Banksia ilicifolia, Banksia menziesii, Xanthorrhoea gracilis, Xanthorrhoea preissii, Stirlingia latifolia, Patersonia occidentalis, Petrophile linearis and Hibbertia subvaginata.*

In addition to indicator species deaths, Interpreters sought evidence of an identifiable age range amongst the deaths. This is used to help confirm the presence of *P. cinnamomi* as a distinct pattern will often form, whereby the older deaths are closer to the original point of infection, and the most recent or 'fresh' deaths will be located nearer the disease edge.

Where the existing disease boundaries were deemed to no longer be appropriate, they were adjusted accordingly. The boundary was denoted with 'Day Glow Orange' flagging tape. The 'flagging' consists of a single band tied (where possible) around the main stem of an appropriate tree at approximately 10m intervals along the boundary, with all knots facing the infection. The beginning and end points of the infection boundaries were marked with a double band of flagging tape. The taped boundaries were positioned approximately 20m outside the identified infection 'edge', to provide the required buffer zone.

Boundary Mapping

Subsequent to demarcation, the boundaries were again walked and recorded via GPS. The information was then transferred to a desktop computer and used to produce the relevant maps.

Sampling

Any sampling required was conducted using the following procedure:

- All digging implements used were thoroughly sterilised prior to use with methylated spirits. The implements were then allowed to dry so that the integrity of the sample was not compromised.
- The area around the base of the plant/s to be sampled was cleared of vegetative matter to aid the digging process.
- The plant was dug to a satisfactory depth so that the tissue with the highest moisture content was obtained.
- Sections of the roots and stem base from all sides of the plant were taken and placed in a plastic bag. If any lesion was noticed on the tissue, it was also placed in the bag. A few handfuls of sand from various depths were also deposited in the plastic bag.
- The sample bags were irrigated with distilled water to try and simulate the optimum conditions for the *Phytophthora* to survive.
- Details, such as the date, sample number and interpreters were written on an aluminium tag, which was left at the site. The tag was demarcated with a strip of day-glow orange flagging tape.
- All digging implements used were again sterilised after each sample was taken to ensure that infected soil was not transported to the next sample site.

Laboratory procedure

The samples taken were sent to the Vegetation Health Service Branch Laboratory in Kensington. Samples were analysed using the laboratory procedure described in *Phytophthora cinnamomi* and the disease caused by it

Volume II Interpreter Guidelines for Detection, Diagnosis and Mapping (2001). The method is known as 'baiting' and is performed as follows:

- On arrival each sample is assigned an individual barcode on the sample sheet to ensure identification of the samples.
- Soil is shaken in the bag and then placed into two containers that have the same barcode as the sample sheet. The aluminium tag goes in one of these containers.
- The containers are placed in temperature controlled room at 25° C. Distilled water is added to the containers and the sample is stirred with a sterile implement.
- Cotyledons of *Eucalyptus sieberi* (an east coast species) are floated on the water as bait for the *Phytophthora* zoospores. The cotyledons of the seedlings are purple underneath.
- The cotyledons are left for 10 days. If the cotyledons lose the purple colour by day 5 they are presumed to be infected. Infected cotyledons are placed into antibiotic agar in a Petri dish. This is known as plating and will determine whether the sample is infected with *P. cinnamomi* or another *Phytophthora* spp. Phytophthora cinnamomi can be quickly identified whilst other spp. will take considerably longer to identify.
- On day 10 the rest of the cotyledons are plated even if they show no signs o infection.
- Plated baits are left for a maximum of 3 days and if there is no fungal growth in the agar, it is discarded and the sample is recorded as negative.
- *Samples containing Phytophthora cinnamomi* (positive samples) are identified directly on the plate by the presence of hyphal swellings, as other *Phytophthora* spp. do not have such swellings.

Results

Three infections were located during the assessment (map1). One of these infections had been identified in previous surveys. The boundaries of these infections have not altered significantly from those delineated in previous assessments. Two new infections were identified as a result of field observations.

The original demarcation (from the previous assessment) was still partially visible over the majority of the dieback lines. From this old demarcation, it was easy to observe if the infections had increased significantly. Generally it would be expected that the infections would have grown by approximately eight metres (as an average), and it was found that little excessive spread was observed across the site.

Sample Results

One sample was taken during the Assessment at the location indicated (Map 1).

Table 1. Species Sample List and Analysis Results.

Sample	Species	Other Species Deaths	Vector(1)	Pattern(2)	Other Possible causes of Death	Expected Result	Actual Result
1	*Banksia attenuata*	*None*	None	Slight	Drought	Negative	Negative

(1) A vector is considered any possible method of introduction into the site, being track, road, firebreak, walk trail, construction, watercourse, etc.

(2) If the pathogen was present at the site, it would be expected that the deaths displaying the symptoms would have an associated pattern, being the oldest deaths toward the origin of the infection, the fresh deaths near the edge of the active disease.

Discussion and Recommendations

Three separate infections of the dieback disease caused by *P. cinnamomi* were identified and demarcated within the study area. One of the infections was associated with an access track, which had been sealed with gravel in the past, this being the probable source of the infestation. The other two sites were associated with a possible dampland extending out from grazed open paddock. Such dampland areas are subject to seasonal waterlogging, providing ideal conditions for the survival and sporulation of the pathogen. Spread of the disease is generally faster within high moisture sites, where the disease is transported by water and does not rely on root to root contact to be transmitted.

The spread of the disease within the study area appears to be slow, and as a result, the boundaries demarcated during this assessment were very close to those identified in earlier assessments. The spread is particularly slow in the areas not associated with seasonal inundation. Both survival and spread of the *P. cinnamomi* pathogen is reduced in dry sandy soils such as those found throughout much of the study area.

An area exhibiting significant levels of disturbance and poor plant vigour was observed adjacent to most open grazing areas. There were a significant number of plant deaths, including two or three indicator species. However the characteristic pattern normally associated with the disease was not strongly expressed at the site and deaths appeared to be older and were lacking an age range. The sample was taken to back the decision to call these areas "green" or not infected *with P. cinnamomi.* Possible explanations for this disturbance could be the impact of increased grazing pressure from both livestock and an increased kangaroo population, or there is also a chance that it was affected by drought.

The study area is under dieback management and subject to minimal disturbance and traffic activity. The non-autonomous spread of the disease should therefore be restricted to water drainage and root to root contact. The rate of spread by root-to-root contact is typically slow, approximately one metre per year under ideal conditions.

The most important consideration for such movements is that vehicles and equipment be cleaned in an appropriate manner if they are entering an uninfected area from an infected area. Refer to Appendix 2 and 3 for general management and hygiene recommendations associated with the movement of vehicles and equipment to and from dieback infected areas.

No new infections were identified during the 'stripping' process, with the majority of the vegetation appearing to be in good health.

One sample was taken during the assessment. This sample was taken in an uninfected area. The negative result of Sample 1 has no bearing on the final results of the survey with the boundaries not changing to reflect the sample result. The sample was taken in an area that appears to have suffered past disturbance with the vegetation appearing to be in poor condition.

Appendix 1 – *Phytophthora cinnamomi* (Dieback)

Phytophthora cinnamomi is an introduced soil-borne pathogen (water mould) that kills a diverse range of plant species in South West Western Australia. Jarrah Dieback, the name given to the disease associated with *P. cinnamomi*, is actually something of a misnomer. The Jarrah *(Eucalyptus marginata) is susceptible to P. cinnamomi*, but it also demonstrates a degree of resistance to the pathogen (that most susceptible species appear to lack), and hence it is often observed to gradually 'die back'. Most susceptible species however, do not gradually dieback, but rather experience a 'sudden death' in which the entire plant dies at once.

P. cinnamomi is thought to have been introduced to Western Australia shortly after European colonization and has since produced a complex mosaic of infected and uninfected areas throughout the southwest of the State. The spread of the pathogen accelerated after World War II with the use of heavy machinery being used for road building and logging activities and unknowingly spreading infected soil.

The life cycle of *P. cinnamomi* depends on moist conditions that favour the survival, sporulation and dispersal of the spores. The pathogen is not capable of photosynthesis and must extract food from living plant tissue. It does this via a mass of microscopic threadlike mycelium that forms the body of the organism that grows through host tissue. The mycelia continue to grow within the host tissue when the ambient moisture content is above 80%. The mycelia may be transported in soil and host tissue and then deposited where it may infect new hosts. During favourable (warm, moist) conditions, the mycelium, are capable of producing the millions of tiny spores that reproduce the pathogen. There are two spore types that are produced.

Zoospores

Zoospores are very small spores that can actively swim very short distances towards new hosts and initiate new infections. They are short-lived and fragile but produced in large numbers, and are the mode for the spread of the disease from one plant to the next. Zoospores can also be carried along in moving water over large distances. As they move through the soil zoospores lodge on plant roots, infect them, and in susceptible plants produce mycelia. The mycelium grows, feeding on the host, rotting the roots and cutting off the plant's water supply. The mycelium may grow from plant to plant via root-to-root contact points and/or root grafts.

Chlamydospore

Chlamydospores are larger spores that are tough and long-lived (within dead plants and the soil). They are produced under unfavourable conditions and are the resistant resting phase of the pathogen. They may be transported in soil or roots and then germinate to cause a new infection when they encounter favourable conditions. The chlamydospores produce mycelium and zoospores.

When conditions are warm and moist, microscopic spore sacks called sporangia and thick walled chlamydospores are produced vegetatively from mycelia strands that form the body of the pathogen in the soil or host tissue. The sporangia release motile zoospores in free water to infect host roots. Following infection, the pathogen invades root bark and forms lesions that may extend in to the plants stem collar. In susceptible species, the infection of roots and collar will result in the death of the host.

Mycelia of different mating types may grow together inducing the production of thick walled sexual spores called oospores. The two recognised mating types are known as either A1 or A2, and only one of these mating types (A1) is known to occur in WA. As a result, the pathogen cannot reproduce sexually in WA and relies on vegetative reproduction for survival and dispersal.

P. cinnamomi has a very wide host range, with at least 1000 species from taxonomically diverse families reported as hosts, almost half of which have been recorded from research in Australia. Indigenous species most affected belong to four families:

- Proteaceae
- Epacridaceae
- Papilionaceae/Fabaceae
- Myrtaceae

It has been estimated that approximately 1500 to 2000 species of the estimated 8000 species of vascular plants in the South West of WA may be susceptible to the degree that successful infections result in the death of the host. It is important to note however that not all genera within a family or all species within a genus are necessarily susceptible. Some species of *Eucalyptus,* for example, are highly resistant (including Karri, Marri, Wandoo and Tuart) while some, such as Jarrah, are affected but have the ability to resist the invasion of the pathogen under certain conditions (Tissue moisture content < 80%).

The survival of any *Phytophthora* species is dependant upon the presence of a combination of the pathogen, host and suitable environmental conditions. The optimum temperature for the growth of the organism is between 15°C and 30°C while the optimum temperature for sporulation is considered to be 25°C to 30°C. Any temperatures less than 0°C and greater than 35°C are unfavourable to the survival of the spores and mycelium of *P. cinnamomi.*

Infertile soils are more compatible to *P. cinnamomi* where there is a good movement of water and little biomass with few antagonistic microflora. The soil texture allows for the easy lateral movement of the motile zoospores and the easy development of mycelium. Native vegetation that has adapted to the infertile soils through a large surface area of root matter is at greater risk of infestation.

Clay and laterite are significant components of some soil types of the southwest and may act as impeding layers and cause subsurface ponding, which can facilitate the production of spores. These soils tend to drain laterally, further spreading the zoospores. The moisture content of the soil must be at a level that provides for aerobic environmental conditions. Saturated soils may become anaerobic and will not contain the oxygen levels required for the production of sporangia.

In some areas that are environmentally suited to the establishment, survival and reproduction of the pathogen, the spread of *Phytophthora* infections has reached epidemic proportions. These areas are generally in areas receiving more than 800mm of rainfall annually. In areas receiving between 600-800mm, the occurrence of *P. cinnamomi* is less extensive and confined to water-gaining sites in the landscape.

Appendix 2 – Disease Management

The management of *P. cinnamomi* can be described in four parts, PATHOGEN, PROCESSES, PEOPLE and PERFORMANCE.

Pathogen

To determine if the disease caused by *P. cinnamomi* is present at a site, an initial visual assessment is made of the site, particularly where there are deaths observed in plant species that are susceptible to the disease. By these visual indications, the site can be interpreted to determine if the deaths form a recognised pattern of movement of the disease. In the sites infested with Dieback, the deaths are generally fresher on the extremities of the infestation. This age range of deaths shows the rate and direction of the spread.

The effect of *P. cinnamomi* upon the health of plant communities, and upon individual species within them, varies greatly. This variability exists due to various environmental factors and significant differences between native plant species in terms of their response to the presence of *P. cinnamomi*. In many places, it destroys the structure of many native communities, reduces their floristic diversity, decimates their primary productivity and destroys the habitat upon which much of the native fauna is dependant, particularly its value as protection against feral predators. Conversely, in other areas, where conditions do not favour its success, the pathogen causes only minimal damage.

The assessment for the presence or absence of *Phytophthora* sp. at all sites within a study area determined with consideration of the following:

- The presence of *Phytophthora* can only be deduced from the death of susceptible plants.
- A single death may be caused by *Phytophthora*. A more confident assessment may be made if more dead plants are seen and/or if the plants are of a differing species. A note is also made of any progression in the deaths (a range in the age of deaths) or the evidence of vehicle tracks nearby (or other potential vectors).

- The presence of *Phytophthora* can sometimes be determined by laboratory analysis. A negative result indicates only that the *Phytophthora* was not recovered from the sample supplied and does not indicate that *Phytophthora* is not present at the sample site. Site analysis should always be conducted with through a combination of both laboratory results and field based interpretation.
- It is difficult to detect the presence of *Phytophthora* in areas that have been recently burnt or where there are too few indicator species present.
- Areas that have had recent disturbance may harbour cryptic infections. The time taken for any new infection to express as a disease may vary from six months to many years depending on environmental conditions.
- Many other agents may be responsible for a plant death, eg drought, frost, other pathogens, insects and mechanical activity.

Processes

Detailed processes should be enacted to manage the impact and non-autonomous spread of the disease caused by *Phytophthora.* Each specific operation may have a distinct set of procedures, however there are some overarching processes, such as:

- Ensuring that the active disease edge has been recently mapped and demarcated in the field.
- Strategic placement of vehicle and / or pedestrian clean-down points.
- Controlling unauthorised access.

People

Everybody plays a role in ensuring that the spread and subsequent impact of the disease is minimised. All personnel involved with land management activities should be informed as to the risks associated with their activities and the potential for spreading the disease caused by *Phytophthora.* Factors to consider are:

- Do all personnel understand and comply with hygiene procedures? Is training required?
- Are all contractor vehicles clean prior to their entry to the site?

Performance

Adhering to the identified procedures is the simplest and most effective strategy in minimising the spread of the disease. Any strategy employed should also offer indicators to measure the success of the procedures. These performance measures could include:

- The number of new diseased areas.
- Known breaches of hygiene regulations.
- The increased size of the diseased areas caused by external influences.

Appendix 3 – Disease Hygiene

Risk reduction

Any area currently infested with *Phytophthora cinnamomi* needs to be treated with extreme caution. Each infested site has a high risk of vectored spread, which will require that hygiene measures be implemented to reduce the risk of non-autonomous spread.

These risk reduction tactics may include:

- Restrict access to the sites to summer (dry soil) only.
- Plan as few access points as possible, which minimises the number of interfaces between infested and uninfested areas.
- Plan for, construct, manage, supervise and audit high quality clean-down points.
- Utilise enforcement patrols.

The following table should be adopted for the cleaning of machinery when transporting vehicles from the selected category (column) to the selected hygiene category (row):

Moving from ↓ to →	Infested	Uninterpretable	Uninfested
Infested		**Clean on entry**	**Clean on entry**
Uninterpretable			**Clean on entry**
Uninfested			

Clean-down specifications

Clean-down points must be constructed to the following standards:

- The clean-down point must provide a physical separation between the object being cleaned and the effluent being produced;

- The point must provide a physical separation from the object being cleaned and infested soil and plants; and
- The point must provide easy and safe access for both the placement of the object to be cleaned and the operator conducting the clean down.

When placing the clean-down point in the field, the following considerations must be taken into account:

- The site must allow the effluent to fall directly onto infested soil or in a construction able to capture the effluent for the later transportation and disposal;
- Any cleaned objects must be allowed to enter the uninfested area without coming into contact with infested materials; and
- The clean down must be situated to allow a turn-around point for vehicles that cannot satisfy the hygiene guidelines.

Note that an object is considered to be clean if it is free of soil and plant tissue and slurry consisting of soil and water. Moreover, a clean-down point is not necessarily a wash-down point. In dry-soil conditions for example, it would be necessary to 'brush down' vehicles rather than wash down, to ensure that mud was not created at the site.

Accepted best practices

The following best management practices have been adapted from Department of Conservation and Land Management publication *Phytophthora cinnamomi* and the disease caused by it Volume 1 Management Guidelines (2001). With the exception of some minor additions, the management practices are duplicated in full, and some irrelevant sections, have been deleted.

Managing drainage from infested areas

Water draining from roads that are likely to be infested and drainage from known infested areas should be directed away from uninfested 'protectable' areas or taken to the lowest possible point in the landscape before being directed into areas on native vegetation.

Entry Points into Uninfested 'Protectable' Areas

Where possible only one entry point should be provided into each uninfested 'protectable' area. Effective management of entry points will minimise the spread of *Phytophthora cinnamomi* and will be characterised by the presence of the following:

- Signage;
- An inspection and/or clean down point and cleaning equipment;
- A gate; and
- A safe place for large vehicles and equipment to turnaround and exit the area if they are found on inspection to be unclean or cannot be effectively cleaned in the field.

Timing is critical when implementing managed entry points. Where new roads are to be constructed within uninfested areas, the entry point should be installed (where practicable) on the same day that the clearing of the road alignment commences.

Preventing Cross Contamination during Works within Uninfested Areas

Vehicles, machinery, equipment and footwear can enter uninfested areas when they are clean and be used to carry out a range of activities over time within that area without the need for further cleaning provided they do not come into contact with infested soil. Cross contamination can be prevented by:

- The use of barrier systems that ensure that the clean equipment within the uninfested area does not come into direct physical contact with infested soil or unclean equipment operating outside the uninfested area;
- The use of demarcation and barrier systems to ensure that vehicles and equipment do not cross inadvertently into infested areas;
- Ensuring that drainage, soil and plant material from the infested areas does not enter the uninfested areas; and
- Limiting entry to periods when the soil is not moist enough to be picked up and moved by vehicles and equipment.

Uninfested Basic Raw Materials

Accredited personnel are required to assess and certify that basic raw material (BRM) borrow pits are free of the pathogen. Borrow pits can only be certified as being free of the pathogen under the following circumstances:

- For a new pit that is to be located in undisturbed areas where sufficient indicator plants are available for an assessment to be made or;
- For an existing pit that has records confirming that it was originally free of the pathogen, and for which sufficient evidence exists that an effective system of hygiene has been maintained to ensure that the pit has remained free of the pathogen.

Existing pits without a known history that can be effectively placed in quarantine and kept free of all living and dead plant material of all species for a period of three years may then have their status reviewed. *Phytophthora cinnamomi* requires plant tissue from which to derive its energy (food source) to survive in the long term. A three year quarantine period, during which no new plant tissue (living or dead), mycelia, chlamydospores or zoospores are introduced into to pit either autonomous spread or human vectoring, in most cases will allow sufficient time for any previously introduced mycelium, chlamydospores and zoospores to desiccate and die.

Where BRM is being extracted from deep pits, such as mines and quarries, where there is no obvious source of inoculum (e.g. mixing of top-soil and plant material, sub-surface water flow from adjacent infested areas likely to be carrying zoospores or unhygienic entry of vehicle, machine or equipment into the area), this material may also be certified as free of the pathogen.

New road construction into 'protectable' areas

Hygiene management is a critical element in long-term protection of an area. Where the construction of new roads is to occur through 'protectable' areas, hygiene management is essential. Where possible, the first 50 metres of the new alignment should be left un-cleared until the remainder of the clearing has been completed. Light vehicle and machine tender vehicle access to the new alignment can be provided with appropriate attention to the hygiene requirements, provision of clean-down facilities and signage. The retained section should be maintained relatively undisturbed for as long as is practicable.

Often it will be necessary for the bull-dozer that clears the alignment to open up the retained section prior to the commencement of the road formation and gravelling works e.g. to allow logs in pushed trees to be cut and removed. The bulldozer should work from inside the 'protectable' area towards the boundary of the infested area.

At the time of opening up the retained section, relevant signage pertaining to *Phytophthora cinnamomi* and the associated management considerations must be implemented. Moreover, portable traffic control barriers must placed across the road at the demarcated boundary of the 'protectable' area. Where gravelling operations are to be delayed over substantial periods (e.g. winter), consideration should be given to temporarily blocking the new alignment with several substantial logs.

During road construction works, the graders should work from inside the 'protectable' area up to the demarcated boundary, and work in infested areas last. To ensure vehicles are clean on entry, gravelling activities should (where possible), work from the 'protectable' area into the infested area, especially where the gravel pit is within the 'protectable' area. The installation of permanent gates and relevant signage must coincide with the completion of the surface gravelling activities and the removal of the temporary signs and barriers.

Water binding

Water binding should be kept to a level where run-off into does not occur. The early installation of correctly designed table drains will ensure that un-seasonal rainfall does not flush material from the road building operation across large areas of adjoining land.

Appendix 4 – Glossary of Terms

Hazard	A source of potential harm or a situation with the potential to cause loss.
Disease	A combination of a pathogen, host and correct environmental conditions, which results in disease symptoms or death of a host.
Host	The plant which is invaded by a pathogen and from which the pathogen derives its energy
Infested areas	Areas that accredited personnel have determined have plant disease symptoms consistent with the presence of the pathogen *P. cinnamomi*.
Pathogen	Any organism or factor causing disease within a host.
Protectable area	Areas, including areas of high conservation and/or socio-economic value (E.g. a small uninfested area which contain a known population of a susceptible species of threatened flora) within the vulnerable zone that: • Are situated in zones receiving > 600 mm per annum rainfall or are water gaining sites (E.g. granite outcrops, impeded drainage or engineering works which aggregate rainfall) in the 400-600 mm per annum rainfall zone • Do not have a calcareous soil (e.g. not a Quindalup dune system) • Have been determined to be free of the pathogen *P. cinnamomi* by a qualified Disease Interpreter (all susceptible indicator plant species are healthy, no plant disease symptoms normally attributed to *P. cinnamomi* are evident)

• Are positioned in the landscape and are of sufficient size. (E.g. > 4 ha with axis > 100m) such that a qualified Interpreter judges that the pathogen will not autonomously engulf them in the short term (a period of a few decades)

• Consists of areas where human vectors are controllable (E.g. not an open road, private property)

Susceptible Influenced or harmed by *P. cinnamomi.*

Uninfested areas Areas that an accredited person has determined to be free of plant disease symptoms that indicate the presence of the pathogen *P. cinnamomi.*

Uninterpretable areas Areas situated in areas receiving > 600+ mm per annum rainfall or are water gaining sites (eg. granite outcrops, impeded drainage or engineering works which aggregate rainfall) in the 400-600mm per annum rainfall zone where indicator plants are absent or too few to determine the presence or absence of disease caused by *P. cinnamomi.* (CALM – *Phytophthora cinnamomi* and the disease caused by it)

References

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Lowlands Conservation Zone – East Block North of Serpentine River *P. cinnamomi* active edge