

APPENDIX 4F

DIEBACK ASSESSMENT

Phytophthora Dieback Assessment Report

Yalyalup

Method of assessment	Comprehensive / Linear assessment
Dates of field work	2nd October and 1 st November 2019
Interpretation	BARK Environmental
Map Expiry	Figure 1 expires - November 2020
Map Validity for disturbance activities	<p>The <i>Phytophthora</i> Dieback Occurrence Map (Figure 1) is valid for 12 months (November 2020). It can be rechecked annually for up to 3 years (November 2022), before any further soil disturbance activities occur.</p> <p>After November 2022, a comprehensive <i>Phytophthora</i> assessment should be undertaken to ensure accurate mapping of disease.</p>
Report Version	1.2019

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Figure 1. *Phytophthora* Dieback Occurrence: Yalyalup

1 INTRODUCTION

1.1 Background

A *Phytophthora* Dieback Assessment is required as part of the environmental approvals process for a number of Lots and an access road known as Yalyalup, for proposed mineral sands mining by Doral Mineral Sands Pty Ltd. The study area is located approximately 10km south west from Busselton town centre and is 925 ha in total size.

Phytophthora Dieback is a devastating plant disease caused by a soil-borne water mould that threatens biodiversity in the south west region where up to 40% of the known native plant species are susceptible (DWG, 2015). The pathogen is now a widespread problem in south west Australia

Phytophthora spread is particularly accelerated by physically moving infested soil and plant material across landscapes, particularly under warm, moist conditions. It also spreads autonomously through infected root to root contact and in water. Therefore, human activities that can transport *Phytophthora* infected material present the most significant risk to vectoring the disease such as on uncleaned vehicles, tools and footwear, when clearing vegetation and uncontrolled vehicle movements.

Mitigating the spread and impact of *Phytophthora* Dieback in natural areas is difficult. Raising awareness of the issue among stakeholders and mapping its spatial distribution are the first steps to developing an effective Dieback Management Plan. This report describes the results with recommendations from undertaking a *Phytophthora* Dieback Occurrence Assessment over the site known as Yalyalup over 2 separate days. It includes a *Phytophthora* Dieback Occurrence Map (Figure 1) with Dieback Management Recommendations.

1.1 Site description and historical disturbance

Yalyalup site comprises a number of adjoining Lots over a total 925 ha. This study area is traversed by Princefield Road to the north, McGibbon Track in the east, Yalyalup Road in the south and a section of Wonnerup South Road forms the western boundary.

Rainfall records between 1997 – 2019 show the annual average rainfall at the proximate Busselton Aero weather station is 684.8mm (Bureau of Meteorology, 2019). This confirms that the study area falls within the vulnerable zone where *Phytophthora* disease can develop and impact upon susceptible native vegetation.

The subject area has largely been cleared of native vegetation. Pasture grass and stock grazing has also occurred. Overall, the area is highly fragmented, with degraded to completely degraded remnant vegetation previously mapped as Abba and Southern River complexes, extend along some sections of the road reserves as 1-3 tree wide areas with little to no understorey remaining. Some scattered paddock trees remain over pasture grass and weeds and shelterbelt tree plantings with a range of non-local species are present. A recent fire has occurred along the western section of Princefield Road side and in this area the understorey is not intact. Princefield Road, Yalyalup Road and Wonnerup South Road are sealed roads but McGibbon Track is not sealed and is subject to seasonal inundation along parts. Overall, this area has been subjected to a range of significant agricultural and other human disturbances for decades.

Seasonal streams flow south to north in the western part of the area towards the Sabina River. The landform is gently undulating on the Swan Coastal Plain. Soil in the streamline areas is fertile and there are no, to limited, plant species susceptible to *Phytophthora* present. The fragmented extents of this vegetation community were excluded from interpretation, along with cleared agricultural land.

2 METHODS

2.1 Interpretation

Field interpretation was based on methodology used by the DEPARTMENT OF Biodiversity Conservation and Attractions described in “Forest and Ecosystem Management Division 2015, *Phytophthora* Dieback Interpreter's manual for lands managed by the department, DPaW, Perth, Western Australia.”

2.2 Demarcation

Infested areas have been demarcated using 25 mm fluoro pink tape tied to trees at chest height with the knots facing towards the infestation. Excluded and Uninterpretable areas are typically demarcated using 25 mm striped black/pink tape tied to trees with the knots facing towards the respective category. When vegetated, fenced or road boundaries adjoin extensive “Excluded” areas, taping at this site was not applied as the boundaries are easily observed in the field, on aerial imagery, and can be confirmed on site with captured GPS data.

2.3 Soil and tissue sampling

Soil and tissue samples associated with dead or dying plants were collected per FEM 2015 methodology to confirm the presence or absence of *Phytophthora spp.* Sample locations are tagged in the field and point data is then recorded with GPS receivers before despatching samples to a laboratory for testing. Sample results are only used as supporting evidence.

2.4 Mapping

Field observations, boundaries, waypoints and survey data were recorded on hand-held GPS and downloaded into a Geographic Information System (GIS) to produce *Phytophthora Occurrence Maps*.

2.5 Vegetation Condition Rating

Site vegetation was rated using the scale described below.

Table 1. Vegetation Condition Rating Scale (Keighery, 1996).

Rating	Description
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback , logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

3 RESULTS

3.1 Assessment category distribution

Two assessment categories have been applied within the Yalyallup study area as follows:

- **Infested** – Defined as areas where disease symptoms are consistent with the presence of *Phytophthora* spp.
There is 1 area mapped and demarcated as infested where a sample #2 returned a positive result for *Phytophthora cinnamomi*.
- **Excluded** – Defined as areas of high disturbance unlikely to recover to enable interpretation.
This category was applied to all remaining Yalyalup areas, fragmented remnant vegetation, isolated paddock trees, planted trees and Degraded/Completely Degraded vegetation/land.

Table 2: Dieback Assessment Categories, Yalyalup

Category	Area (ha)
Infested	0.3
Uninfested	0
Excluded	924.7
Total Area	925

3.2 Disease expression

Phytophthora disease expression is average within the assessed area. Although a range of scattered susceptible plants occur such as Banksias, Lucopogons and Xanthorrhoea, there is insufficient mid and understorey plant abundance to enable interpretation. At this site the most obvious indicator plant for *Phytophthora* presence is *Xanthorrhoea preissii*, however they also appeared to be impacted by mechanical damage, insects and possible waterlogging, fire damage, likely Pythiums and water-logging when growing adjacent to constructed drainage lines. This has left a number of isolated and widely scattered plant deaths in the area of which the most recent were sampled attempting to detect *Phytophthora* as the agent of their death.

3.3 Disease impact and distribution

As much of the remnant vegetation has been cleared and exposed to long term threatening processes, the disease impact at this site cannot be quantified. The adverse effects from previous human disturbance activities such as clearing, planting trees, track development, grading roads and timber harvesting have all contributed to this. The abundance of *Phytophthora* indicator plants is extremely low and does not enable interpretation, other than to detect the occasional suspicious plant death possibly attributable to *Phytophthora*.

It is highly unlikely that any previous biosecurity-hygiene was applied for any soil disturbance activities in this locality such as during road construction which may have introduced infested gravel. With so few indicator plants present it is currently impossible to ascertain the precise occurrence and distribution of *Phytophthora* disease in such areas.

3.4 Sample results

Three soil and plant tissue samples were collected in an attempt to detect *Phytophthora* and the laboratory results are given in Table 3. *Phytophthora cinnamomi* was only detected in Sample 2. Given the paucity of susceptible vegetation to sample, the sampling strategy applied was to target the most recent indicator plant deaths and these only occurred at points within some of the roadside vegetation. At this site the only suitable plants to sample were *Xanthorrhoea preissii* (grass trees) and evidence of other contributing factors to their deaths was observed including fire damage, possible water-logging and mechanical damage.

Table 3. Sample Results Summary

Sample Name (date)	Plant Sampled	Lat/Long (GDA 94, Z50)	Result (POSITIVE, NEGATIVE)
S1 - Yalyalup	<i>Xanthorrhoea preissii</i>	E 0359145 N 6270734	NEGATIVE
S2 - Yalyalup	<i>Xanthorrhoea preissii</i>	E 0357673 N 6271732	POSITIVE <i>(Phytophthora cinnamomi)</i>
S3 - Yalyalup	<i>Xanthorrhoea preissii</i>	E 0358812 N 6271779	NEGATIVE

3.5 Vegetation Condition

Industry accepted Dieback assessment methodology and Keighery 1996 Vegetation Condition Scale Ratings were considered. Degraded areas and Completely Degraded areas are extensive at this highly disturbed site. In the authors opinion, given the severe fragmentation of the native vegetation remaining in small and linear shapes, with large exposed edges, it is not likely to improve over time without significant intervention should any be retained. The McGibbon Track is an unsealed open track and seasonally inundated in parts which could easily vector *Phytophthora* - if it is present. Should any vulnerable plant community be conserved within any of the subject area, it is suggested that revegetation should use *Phytophthora* resistant plant species to maximise its success.

4 CONCLUSION

The Yalyalup study area has been subjected to soil disturbance activities for a very long time. The remaining native vegetation is extremely fragmented and extensively degraded so large areas were excluded from Dieback interpretation. *Phytophthora cinnamomi* was detected through observations and sampling at one point along Princefield Road. It has been demarcated with fluoro-pink flagging tape tied to trees either side with a buffer. As the disease was positively detected at this point, best practice management would avoid disturbing this point or apply hygiene when exiting it during clearing and earthworks.

Purely in terms of Dieback management, there are no areas of remnant vegetation remaining at the Yalyalup site that warrant the "Protectable" status for *Phytophthora* management. They are simply too small, exposed to edge effects and either too degraded or in a landscape position that is unlikely to sustain a disease free status in the longer term.

Figure 1 shows the spatial results from this *Phytophthora* assessment. It is valid for 1 year and can be rechecked in the field annually for up to 3 years prior to undertaking soil disturbance activities. After 3 years (2022) a comprehensive *Phytophthora* assessment is typically required to inform current Dieback Management Plans.

Overall, *Phytophthora* Dieback management at this site should be kept simple.

Standard *Phytophthora* management tactics are recommended below to assist with developing a Dieback Management Plan.

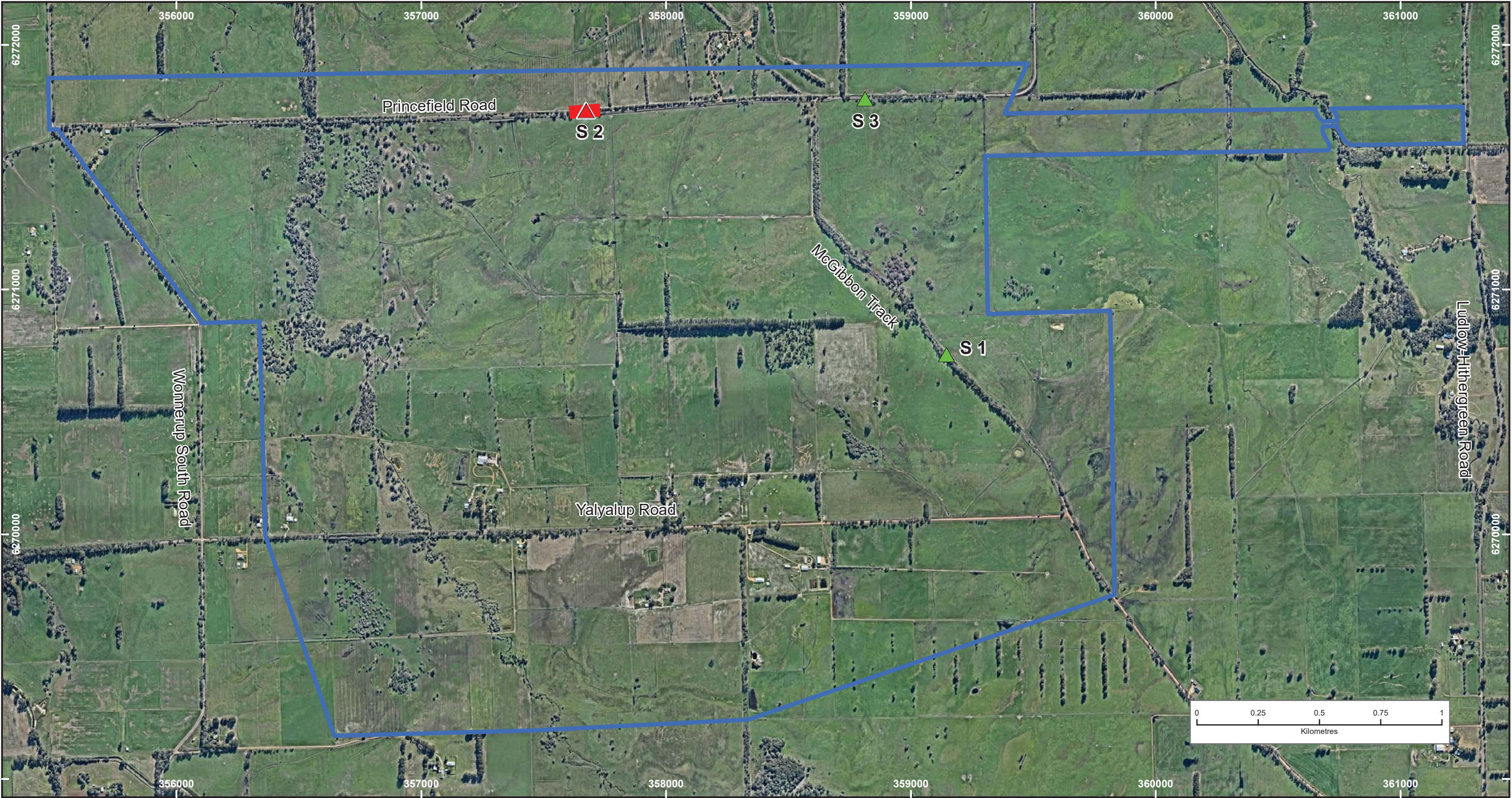
5 RECOMMENDATIONS

Dieback Management within the Yalyalup assessment area should aim to not spread the known *Phytophthora* disease outside of the operational footprint into any vulnerable vegetation retained/planted onsite or into offsite areas.


1. **Train the workforce** – about *Phytophthora* Dieback, its impact and management. Green Card training is recommended.
2. **Inform personnel** – within contracts and site inductions that they are entering a site where *Phytophthora* Dieback has been detected at one point and that precautions need to be taken around that and when exiting the site - it minimise the risk of spreading the disease off-site.
3. **Maintain the fluoro-pink tape demarcating the known Dieback point** – to ensure there are no quarantine breaches.
4. **Clean-on-exit** – to reduce the risk of spreading any *Phytophthora* outside of the Yalyalup envelope, establish a Clean-on-Exit point where operators can ensure their machinery, vehicles and equipment/boots exit clean free of clods of dirt, mud and organic material, including weed material.
5. **Insitu use of cleared vegetation/topsoil is recommended for the Princefield Road Dieback infested area, or avoid disturbing it.**
6. **Rehabilitation** – if planting, use *Phytophthora* resistant plant species sourced from accredited nurseries to increase success of revegetation.
7. **Signage** – ensure Dieback signage is installed at any Clean-Down points.

6 REFERENCES


- Department of Conservation and Land Management (2001) *Phytophthora cinnamomi* and disease caused by it. Volume I Management Guidelines
- DPaW (2015) Forest and Ecosystem Management Division 2015. *Phytophthora* Dieback Interpreter's manual for lands managed by the department, DPaW, Perth, WA.
- DWG (no date). Management of *Phytophthora* Dieback in Extractive Industries.
- DWG (2000). Managing *Phytophthora* Dieback – Guidelines for Local Government.
- Havel, J.J. (1975) Site Vegetation Mapping in the Northern Jarrah Forest (Darling Range). 2. Location and Mapping of Site-Vegetation Types.
- Keighery, B. J. 1994. Bushland Plant Survey: A guide to plant community survey for the community. Wildflower Society of WA Inc.




Legend

 Assessment Area

Sample Locations

 Negative

 Positive (*P. cinnamoni*)

Dieback Occurrence

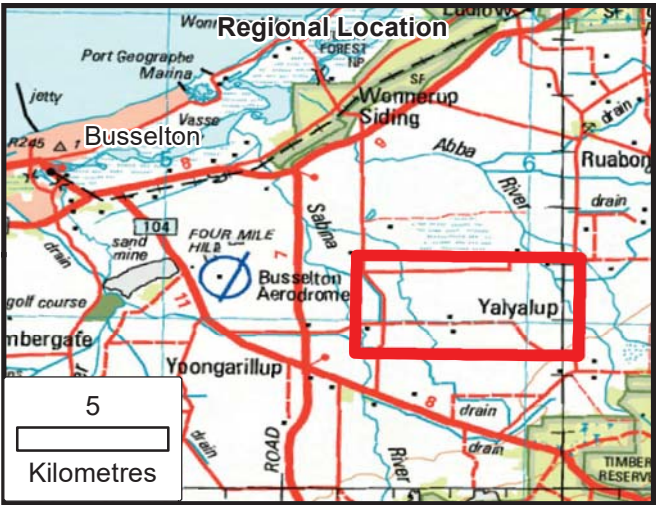
 Infested

 Excluded

Area Statement

Occurrence Category	Area (ha)
Infested	0.30
Uninfested	0.00
Excluded	924.70
Total area	925.00

Interpretation Completed: November 2019
Map Expiry: November 2020



Phytophthora Dieback Occurrence
Yalyalup



Datum: GDA 94
Projection: MGA Zone 50

Scale: 1:15,000 @A3

Date: 08/11/2019

Drawn: G Harewood

Checked: B Rikli

Figure 1

