Main Roads Western Australia

Perth Children's Hospital Foundation Kid's Bridge

Phytophthora Dieback occurrence assessment – Version Rev 0

GLEVAN CONSULTING

Client	Main Roads Western Australia
Report name	Perth Children's Hospital Foundation Kid's Bridge

This report has been prepared in accordance with the scope of work agreed between Main Roads and Glevan Consulting and contains results and recommendations specific to the agreement. Results and recommendations in this report should not be referenced for other projects without the written consent of Glevan Consulting.

Procedures and guidelines stipulated in various manuals, particularly Phytophthora Dieback Interpreters Manual for lands managed by the Department (DBCA), are applied as the base methodology used by Glevan Consulting in the delivery of the services and products required by this scope of work. These guidelines, along with overarching peer review and quality standards ensure that all results are presented to the highest standard.

Glevan Consulting has assessed areas based on existing evidence presented at the time of assessment. The Phytophthora pathogen may exist in the soil as incipient disease. Methods have been devised and utilised that compensate for this phenomenon; however, very new centres of infestation, that do not present any visible evidence, may remain undetected during the assessment.

Executive Summary

Glevan Consulting conducted an assessment of the development envelope associated with the proposed Perth Childrens Hospital Foundation Kids Bridge project for the presence of Phytophthora Dieback. The development envelope is located on the western side of Kings Park and comprises a total of 8.5 ha in area.

No Phytophthora Dieback infestations were observed during the assessment and the entire interpretable area (7.6 ha) was found to be uninfested. An area comprising 0.9 ha was excluded from the assessment due to being degraded or void of vegetation (as per DPAW 2015).

A desktop assessment of previous *Phytophthora* spp. recoveries for the area indicates that *Phytophthora* spp. has not been recovered in or near the development envelope. The species *P. multivora* was recovered approximately 300m from the development envelope in 2014. The development envelope and the infested site are separated by a considerable distance and sealed roads and as such there is low risk associated with this infested site.

A single soil and tissue sample was taken during the assessment, which tested negative for the presence of *Phytophthora cinnamomi*. Only one sample was collected as no other deceased, reliable indicator plants were present.

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1 Introduction

Glevan Consulting was commissioned by Woodman Environmental Consulting on behalf of Main Roads W.A to conduct an assessment of the development envelope associated with the proposed Kings Park Link Bridge project for the presence of Phytophthora Dieback. The development envelope is located on the western side of Kings Park and Botanic Garden and incorporates a section of Winthrop Avenue (Figure 1). The development envelope comprises a total of 8.5 ha in area. The assessment is required to determine the Dieback status of the vegetation within development envelope prior to the commencement of construction activities.

Perth Children's Hospital Foundation Kid's Bridge - Simon Robinson (Author)

Figure 1 - Assessment area location

Perth Children's Hospital Foundation Kid's Bridge - Simon Robinson (Author)

2 Background

Thousands of Australian native plant species are susceptible to Phytophthora dieback—a destructive disease caused by the pathogen *Phytophthora cinnamomi* and other Phytophthora species. This disease is a major threat to Australia's biodiversity, placing important plant species at risk of death, local extirpation or even extinction. Its dramatic impact on plant communities can also result in major declines in some insect, bird and animal species due to the loss of shelter, nesting sites and food sources. Phytophthora dieback can cause permanent damage to ecosystems. Once an area is infested with the pathogen, eradication is usually impossible. Awareness that human activity can easily spread the pathogen will help prevent an increase in the extent of this disease (Commonwealth of Australia, 2018)

Phytophthora spp. are a group of microscopic water moulds that belongs to the class Oomycetes. Oomycetes organisms are filamentous and absorptive and reproduce both sexually and asexually. *Phytophthora* spp. are considered parasitic. The species behave largely as a necrotrophic pathogen causing damage to the host plant's root tissues because of infection and invasion. (Department of Parks and Wildlife, 2015) The pathogen infects a host when it enters at a cellular level and damages the cell structure.

Phytophthora Dieback is the result of interaction between three physical components forming a 'disease triangle': the pathogen (*Phytophthora* spp.), the environment and the host. All three components are needed for the disease to develop over time. The relationship between the presence of *Phytophthora* spp. and the development of Phytophthora Dieback disease is variable and based on the susceptibility of native plant species and the different environmental characteristics, landform types and rainfall zones across bioregions.

Armillaria Rot Disease (ARD) is a pathogen frequently encountered during Phytophthora Dieback assessments. It is caused by an indigenous fungus which is endemic to the south-west of Western Australia, occasionally presenting symptoms consistent with Phytophthora Dieback presence. The impact of the fungus on the vegetation may range from single dead plants to complete devastation of understorey and overstorey species.

3 Materials and methods

3.1 The assessment area

As per DPAW (2015) areas within the development envelope will be excluded from assessment if the vegetation is suffering from significant disturbance. This disturbance (Table 1) is based on Vegetation Condition Scales (Keighery, 1994). The remaining area, including the area outside of the development envelope if necessary, will be categorised post-assessment into Phytophthora Dieback occurrence categories (Table 2, Map 1).

Table 1 - Keighery Vegetation Condition Scale

Scale		Vegetation condition
1	Pristine	Pristine or nearly so; no obvious signs of disturbance.
2	Excellent	Vegetation structure intact; disturbance affecting individual species and weeds are non-aggressive species.
3	Very good	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.
4	Good	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.
5	Degraded	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.
6	Completely degraded	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.

Table 2 - Phytophthora Dieback assessment for vegetation condition

Vegetation Condition	Phytophthora occurrence category
Naturally vegetated areas. Keighery disturbance rating of 3 or less Phytophthora occurrence categorisation is possible	Infested - Determined to have plant disease symptoms consistent with the presence of *Phytophthora cinnamomi*.
	Uninfested - Determined to be free of plant disease symptoms that indicate the presence of *P. cinnamomi*
	Uninterpretable - Undisturbed areas where susceptible plants are absent, or too few to make a determination of the presence or absence of *P. cinnamomi*.
	Not yet resolved.
Vegetation structure temporarily altered.	Temporarily Uninterpretable - Areas of disturbance where natural vegetation is likely to recover.
Vegetation structure severely altered. Keighery disturbance rating 4 or greater. Phytophthora occurrence assessment is not possible	Excluded.

3.2 The assessment method

All Phytophthora Dieback detection, diagnosis and mapping will be performed to standards and procedures defined in FEM047 Chapter 6 (DPAW 2015). These procedures are grounded on the presence in the vegetation of Indicator Species, and the observance of deaths in these plants. An indicator species is a plant species that is reliably susceptible to *Phytophthora cinnamomi*. Indicator species deaths (ISDs) alone do not necessarily indicate disease presence and it is necessary to consider all environmental and ecological factors that may be present. These other factors (as listed in FEM047) include:

- Chronology of deaths;
- Pattern of deaths;
- Topographical position;
- Vectoring – causal agencies, and;
- Biomass and biological diversity reduction.

Other causes of plant deaths need to be considered when determining the presence of Phytophthora Dieback, including (from FEM047):

- *Armillaria luteobubalina*;
- various cankers;
- insects;
- drought, wind scorch and frost;
- salinity and waterlogging;
- fire and lightning;
- senescence and competition;
- physical damage, and;
- herbicides and chemical spills.

The assessment type will be either a comprehensive assessment using transects (demarcating all obvious infested areas and then systematically assessing remaining areas using transects) or a linear assessment (when a proposed activity is linear in nature, such as along a utility easement or road) using standards defined by Chapter 8, FEM047. Prior to assessment, all information relevant to the project will be assembled to assist the interpretation process (as defined in Chapter 7, FEM047). This information may include previous assessments of the area, history of burning and possible other disturbances.

3.3   Other *Phytophthora* species

Phytophthora spp. other than *P. cinnamomi* are identified using DNA analysis by the Centre for Phytophthora Science and Management (CPSM) at Murdoch University, following the identification of the presence of a *Phytophthora* spp. in baiting analysis performed by Vegetation Health Service (VHS) at the Department of Biodiversity, Conservation and Attractions (DBCA). *P. cinnamomi* is easily identifiable under a microscope and therefore DNA analysis is not required.

3.4   Collection of evidence of Phytophthora Dieback

During the assessment process, the collection of evidence to support the field diagnosis were recorded using a tablet running the ESRI Collector application (GPS accuracy +/- 5m). Waypoints were recorded at locations to show evidence of:

- where field diagnosis is certain or almost certain of Phytophthora Dieback infestation;
- healthy indicator species where field diagnosis is almost certain of the site being uninfested;
- sites with too few or devoid of indicator species, thus supporting uninterpretable classification, or
- areas of disturbance, which are temporarily uninterpretable or excluded from assessment.

Additional waypoints recorded include:

- points located at soil and tissue sample sites with *Phytophthora cinnamomi* result;
- points located at sites known to be infested by Phytophthora species other than *Phytophthora cinnamomi*;
- points located where field diagnosis is certain or almost certain of Armillaria;
- points requiring soil and tissue sampling;
- points located where samples have been taken, results pending;
- points located at ISDs, and
- points that need to be revisited for further examination.

3.5   Soil and Tissue Samples

Any soil and tissue samples taken during the assessment will be to standards and prescriptions defined in Chapter 11 of FEM047. All samples are analysed in the Vegetation Health Services (DBCA) laboratory using best-practice techniques.

Taking a soil and tissue sample from dead and dying plants is an integral part of assessment – although in some cases sampling is not essential. Sample results provide evidence to support field diagnostic decisions. The following table (Table 3) shows the need for sampling to assist the disease diagnosis process (Department of Parks and Wildlife, 2015).

Table 3 - Determination of requirement for sampling

Observable factors indicating likelihood of *Phytophthora cinnamomi* presence				
ISD type	Multiple	Cluster	Scattered	Isolated
Species	Some or most indicator species	Any indicator plant	Any indicator plant	Any indicator plant
Pattern development	Obvious			Not obvious
Chronology	Obvious			Not obvious
Topographic situation	Gully/flat	Lower to mid slope	Mid slope to upper slope	Ridge
Causal agent	Obvious			Not obvious
Requirement for soil and tissue sample	Low	High	High	Low

Samples may also be taken for the following strategic reasons:

- Supporting infested field diagnosis;
- Incipient, subtle or cryptic disease in apparent uninfested sites, or
- Altering mapped infested area boundaries.

4 Results

4.1 Phytophthora Dieback Occurrence

No Phytophthora Dieback infestations were observed during the assessment and the entire interpretable area (7.6 ha) was found to be uninfested (Table 4). It is not known whether a Phytophthora Dieback assessment has been previously conducted within the development envelope, however a desktop assessment of previous *Phytophthora* spp. recoveries for the area indicates that *Phytophthora* spp. has not been recovered in or near the development envelope. The species *P. multivora* was recovered approximately 300m from the development envelope in 2014. The development envelope and the infested site are separated by a considerable distance and sealed roads and as such there is low risk associated with this site.

An area comprising 0.9 ha was excluded from the assessment due to being degraded or void of vegetation. The excluded area was associated with roads (Winthrop Avenue), footpaths and median strips.

Table 4 - Area Summary

Category	Area (ha)	% of total area
Infested (with *Phytophthora)*	0.0	
Uninfested	7.6	89
Excluded	0.9	11
TOTAL AREA	8.5	

4.2 Disease symptoms and expression

No evidence of disease presence was observed during the assessment.

4.3 Other *Phytophthora* species

No other *Phytophthora* spp. were identified during the assessment. The pathogen *P. multivora* was recorded in 2014 at a site on the western side of Winthrop Avenue, approximately 300m north of the development envelope.

4.4   Ecosystem health

In general, the vegetation was observed to be in good health. There were occasional, scattered *Xanthorrhoea. preissii* deaths observed, one of which was sampled. A negative sample result was recorded at the site, supporting the view that the deaths are not related to Phytophthora Dieback.

4.5   Armillaria luteobubalina

No infestations associated with ARD were observed during the assessment.

4.6   Sample results

A single soil and tissue sample was taken during the assessment, which tested negative for the presence of *Phytophthora* spp*.* The location and results are presented in Section 7 (Appendices). Only one sample was taken as there was no other field evidence indicating the presence of Phytophthora Dieback.

5 Discussion

The presence of the calcareous soils associated with the Spearwood Dune system throughout most of the development envelope means that there is a very low likelihood of *Phytophthora cinnamomi* being present. The pH of such soils is hostile to the pathogen and its ability to manifest as visible disease symptoms is known to be significantly reduced.

The soils present within the study area are however not hostile to some other Phytophthora spp., such as *P. multivora* and *P. arenaria*. These species typically cause decline similar to that of *P. cinnamomi* but with reduced levels of impact. They are also detected through the same sampling / laboratory process used to detect *P. cinnamomi*. Therefore, if these pathogens were present, they would also be detected using the assessment methods employed for the detection of *P. cinnamomi*.

There is a distinct and abrupt change between the remnant uninfested vegetation and the excluded areas, and as such, no demarcation of the boundary between the two categories was required.

6 Bibliography

Commonwealth of Australia. (2018). *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi.*

Department of Parks and Wildlife. (2015). *FEM047 Phytophthora Dieback Interpreter's Manual for lands managed by the department.* Unpublished.

Keighery, B. (1994). *Bushland Plant Survey: a Guide to Plant Community Survey for the Community.* Wildflower Society of WA (Inc.).

7 Appendices

7.1 Sample summary

Sample	Plant Sampled	Easting	Northing	Result
1	*Xanthorrhoea preissii*	388348	6462833	Negative

7.2 Mapping Metadata

DATASET DESCRIPTION	
Title	PCHF_Kid's_Bridge_Shapefiles
Data Created	19-11-2019
Date Last Updated	20-11-2019
Abstract	Phytophthora Dieback Occurrence and sample location shapefiles for PCHF Kids Bridge project.
Purpose	Dieback category boundary mapping
Document Number	19-0839
Contact Organisation	Glevan Consulting
Contact Name	Simon Robinson
Contact Position	Phytophthora Dieback Interpreter
Contact Phone	0427 113 336
Contact Email	simon.robinson@glevan.com.au
Lineage	All field data recorded using ESRI Collector on a GPS enabled tablet.
Datum / Coordinate System	GDA94 Zone 50
Geographic Description	Western edge of Kings Park, opposite Perth Children's Hospital.
Restrictions	None

7.3 Shapefile spatial data

Spatial data is contained in the attached file named PCHF_Kid's_Bridge_Shapefiles.zip

Map 1
Phytophthora Dieback Occurrence

PCHF Kid's Bridge

Main Roads W.A

Study Area

Occurrence

Uninfested

Excluded

Samples

Negative

P_multivora (2014)

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Author: Simon Robinson	Datum: GDA94 Zone 50
Date: 03-03-2020	Mapping expiry: 24-10-2020

50   0   50   100   150 m