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Phytophthora Dieback Occurrence Survey

Mount Hallowell Reserve 46618 – Shire of Denmark

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Phytophthora Dieback Occurrence Survey

Mount Hallowell Reserve 46618 - Shire of Denmark

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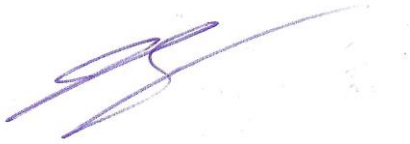
Written and submitted by



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EXECUTIVE SUMMARY

The Great Southern Centre for Outdoor Recreation Excellence (GSCORE) is currently undertaking planning associated with development of a proposed trail network across the Mount Hallowell Reserve, in the Shire of Denmark. To assist the planning process, GSCORE require understanding of environmental factors within the reserve including the occurrence of Phytophthora Dieback.

The survey was performed using the Broad Area survey method which involves assessment of linear disease occurrence along accessible tracks and other linear infrastructure, with an extrapolation of disease occurrence using topography, high-risk disease vectors and other influences. It should be noted that extrapolated areas were not subject to ground coverage.

The vegetation occurring within the reserve can be described as upland granite communities surrounded by a tall forest of Karri transitioning into a mixed Karri/Jarrah/Marri forest over a mixed mid storey of *Agonis flexuosa* (Peppermint) and *Banksia grandis*. Disease expression across the survey area is very limited due to a general absence of disease indicator species within the Karri forest vegetation type which occurs across the majority of the survey area. In the vegetation surrounding the residential areas there is a higher density of susceptible species and visible disease expression through deaths of *B. grandis, X. platyphylla*, and *P. umbrosa*.

In accordance with DBCA, 2015 guidelines, disease occurrence mapping associated with Broad Area surveys is limited to vegetation where visual expression and positive samples are available to confirm disease presence.

All vegetation immediately adjoining existing residential areas has been classified as infested, with the infested area's extending upslope covering areas with visible disease expression and/or historic positive sample recoveries. A second area of infested vegetation is situated along the Bibbulmun track to the west of the current assessment area. This vegetation is largely uninterpretable however limited disease expression was sampled during a previous survey performed in 2014, and provided two positive recoveries of *Phytophthora cinnamomi*.

All remaining vegetation within the current assessment area is unclassified, as required by the DBCA Broad Area survey methodology (DBCA 2015). It is however anticipated that Phytophthora Dieback is likely to occur along the Bibbulmun track section between the two infested areas. The vegetation to the north of the Bibbulmun track is also considered likely to contain Phytophthora Dieback as this area is situated downslope of the Bibbulmun track and there is active disease expression in interpretable areas just beyond the current assessment area boundary. The areas where Phytophthora Dieback is considered likely to occur have been classified as unprotectable.

Prior to proposed soil disturbance activities, a comprehensive transect survey will be required. The comprehensive transect survey is likely to accurately map the active disease edge where it occurs in interpretable vegetation. All currently unclassified vegetation is likely to be classified as uninterpretable following detailed assessment.

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1 INTRODUCTION

1.1 Background

The Great Southern Centre for Outdoor Recreation Excellence (GSCORE) is currently undertaking planning associated with development of a proposed trail network across Reserve 46618, known as the Mount Hallowell Reserve, in the Shire of Denmark. To assist the planning process, GSCORE require understanding of environmental factors within the reserve including the occurrence of Phytophthora Dieback. The proposed trails area is associated with an area in the south east of the reserve that was previously assessed as either infested or uninterpretable. This report presents the findings of a Broad Area Dieback Occurrence survey performed by Great Southern Bio Logic within the proposed trail network area of the Mount Hallowell Reserve, which is presented in Figure 1.

Phytophthora Dieback is an introduced soil borne plant pathogen that affects up to 40% of native plant species within Western Australia. Most commonly the disease is caused by the species *Phytophthora cinnamomi,* however, other species such as *P. multivora* can also have significant impact under specific environmental conditions. Phytophthora Dieback is commonly introduced to an area through infested soils carried as basic raw materials or on vehicles, plant and machinery. In favourable conditions the pathogen can result in the collapse of entire vegetation communities. Once introduced to an area, Phytophthora Dieback will spread through further human vectoring and also via water movement and root to root contact, resulting in extensive infestations which may cause significant impact to native vegetation communities. There is currently no practical method of eradication of the pathogen.

Two previous assessments of the reserve have been undertaken. The first was performed by Green Skills in 2008 and the second performed by Great Southern Bio Logic in 2014. As disease occurrence data has a limited period of currency due to disease movement, the data from previous assessments is longer considered valid and a full reassessment is required.

1.2 Objectives

The objectives of the Phytophthora Dieback survey were to:

- determine the presence/absence of the disease within selected areas of remnant native vegetation within the Mount Hallowell Reserve; and
- apply protectable area criteria to assessed vegetation to determine the distribution of vegetation that may be protectable and require a detailed assessment should ground disturbing works be programmed for that area.

1.3 Scope of Works

In order to achieve the project objectives, the following scope of works was undertaken:

- completion of a detailed desktop assessment of the Mount Hallowell Reserve involving an analysis of known infestations, topography, geology, land use and access;
- completion of a Broad Area survey across the proposed trails network area within the Reserve;
- collection of field data using a hand help GPS unit. Field data includes disease evidence points, sample locations if required and survey effort track files;

- completion of a soil and tissue sampling program to verify field interpretation decisions. All samples to be transported to the Department of Biodiversity, Conservation and Attractions (DBCA) Vegetation Health Service (VHS) in Perth for analysis; and
- development of a disease occurrence report inclusive of disease occurrence figures and associated spatial data.

1.4 Site Characteristics

1.4.1 Mount Hallowell Reserve

Mount Hallowell is the largest reserve vested under the Shire of Denmark. It is approximately 532 ha in area and situated approximately 5 km south west from the town of Denmark. There are several access points to the reserve including via Harrington Break, Heather Road, the Sheila Hill Memorial Trail off Ocean Beach Road, Iluka Avenue and the Monkey Rock car park off Lights Road.

The reserve is adjoined on all sides by private property consisting of agricultural land to the north and west, residential developments to the south and east and a quarry on the southern boundary to the west. There is a maintained fire break either on or near the reserve boundary along the northern and western edges.

The Bibbulmun Track runs through the reserve from an entry point in the south west and exits the reserve across the eastern boundary. The section of the Bibbulmun track within the reserve is locally known as the Sheila Hill Memorial Trail. This section extends to the peak of Mount Hallowell and traverses the main ridge line within the reserve. There are also several small walk-tracks and routes surrounding the adjoining residential areas.

The Mount Hallowell reserve is characterised by a series of steep granite peaks ranging from approximately 20 mAHD to approximately 291 mAHD. To the north, the reserve runs into a broad, open creek line. The vegetation is broadly defined as a tall forest largely dominated by *Eucalyptus diversicolor* (Karri) which transitions into low open heath to the north. The vegetation within the Mount Hallowell Reserve was surveyed and described by the Denmark Environment Centre in 2004 as a part of the initial reserve survey (Denmark Environment Centre, 2004). The vegetation units defined in that report have been used to assist the development of disease hygiene categories.

1.4.2 Climate

The Bureau of Meteorology (BoM) broadly classifies the climate across the south west region of Western Australia as warm summers with cold winters. The BoM maintains a network of weather stations across Australia to record weather data, with the nearest station to the project area being Denmark. The long-term average annual rainfall data from Denmark shows that the annual average rainfall is 1085.2 mm/yr (BoM 2021).

This is an important figure as the accepted distribution of *Phytophthora* is generally restricted by the 400 mm isohyet with distribution in the 400-600 mm/yr zone further restricted to sites with high summer rainfall averages or associated with water gaining sites. Based on the BoM climate classification and rainfall data the Mount Hallowell Reserve experiences suitable climatic conditions for *Phytophthora* to have a significant impact.

2 METHOD

In accordance with the agreed project scope of works, the field survey was undertaken using the Broad Area Survey method. The broad area survey method is consistent with the DBCA guideline, *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (DBCA, 2015). The information produced using the broad area assessment method only provides planning level disease occurrence information.

The field survey was completed on 6 January 2021. A summary of key survey activities is provided below.

2.1 Desktop Interpretation

The Mount Hallowell Reserve was subject to an initial desktop assessment involving a review of the previous assessment reports, the Vegetation Health Service (VHS) historic *Phytophthora* sample database and examination of available aerial imagery to assess:

- the extent of assessable remnant native vegetation occurring within the Mount Hallowell Reserve;
- the known occurrence of Phytophthora Dieback within or influential to the Mount Hallowell Reserve;
- the occurrence of site specific or influencing high risk vectors including but not limited to roads, creek lines and gravel pits; and
- evidence of existing disease signatures such as areas of obvious vegetation decline.

2.2 Broad Area Survey

The Broad Area survey method involves assessment of linear disease occurrence along accessible tracks and other linear infrastructure, with an extrapolation of disease occurrence using topography, high-risk disease vectors and other influences. It should be noted that extrapolated areas were not subject to intensive ground coverage.

The survey was undertaken by a DBCA registered disease interpreter and included visual diagnosis of the disease within areas of assessable remnant vegetation within the assessment area. Visual diagnosis includes identification of susceptible species deaths occurring in patterns consistent with disease spread, such as radiating from an identified vector. Plant deaths associated with *Phytophthora* are complete rather than partial, and rapid. There should also be a chronologic pattern of deaths with the oldest deaths close to the disease vector and most recent deaths further from the vector, forming a disease front.

This method may only be used for non-operational mapping to identify obvious infested sites. It is usually carried out in very large areas where a comprehensive assessment would be prohibitively expensive and there are no impending soil disturbance activities anticipated within 12 months. The resulting data is generally used for broadscale planning and targeting of areas for comprehensive assessment, if required.

2.3 Sampling Program

Visual diagnosis may be supported by laboratory assessment of soil and tissue samples. As defined in *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (DBCA 2015), soil and tissue samples are to be collected from representative individual disease indicator species deaths located across the site. Sample results may then be used to inform the likely cause of death of other disease indicator species exhibiting similar symptoms in similar vegetation units across the assessment area.

Sampling for Phytophthora Dieback involves the collection of soil and tissue material from fresh deaths of plants considered to be reliable indicator species of *Phytophthora* expression and representative of plant deaths across the assessment area. Where suspicious deaths were identified, soil and root tissue material were collected into heavy duty plastic bags and forwarded to the DBCA Vegetation Health Service (VHS) laboratory for analysis.

All sampling undertaken was performed in accordance with the methods described in the *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (DBCA, 2015)**.**

3 ASSESSMENT CRITERIA

DBCA (2015) guidelines identify six potential disease hygiene categories based on presence/absence of the disease, or the unknown disease status of an area. An area can have an unknown disease status if the vegetation at the site is not susceptible to the disease or it cannot be assessed because of disturbance, e.g. fire. As a result, even if the pathogen is present, there may be no interpretable signs.

Only areas with suitable remnant native vegetation can be assessed. Areas that have been cleared or significantly altered are excluded from survey. In some cases, small, excluded areas may be afforded a hygiene category if they are small enough to be influenced by adjacent surveyed vegetation or situated such that topographical influences can be used to determine disease presence or absence.

The six possible disease categories are listed and described below:

1. **Infested –** Areas a registered interpreter determines to have plant disease symptoms consistent with the presence of *Phytophthora cinnamomi*.
2. **Uninfested –** Areas determined by a registered interpreter to be free of plant disease symptoms that indicate the presence of *P. cinnamomi*.
3. **Uninterpretable –** Natural, undisturbed areas where susceptible plants are absent, or are too few to make a determination of the presence or absence of *P. cinnamomi*.
4. **Temporarily uninterpretable –** Areas where disease presence or absence cannot be determined due to a level and type of site disturbance that will recover within the short to medium term, e.g. fire, rehabilitation.
5. **Not yet resolved –** *Phytophthora* occurrence diagnosis cannot be made because of inconsistent or incomplete evidence (including sample results). The category is only to be used in low interpretability zones (400 mm to 600 mm rainfall range).
6. **Disease risk roads (DRR) –** Interpreters will use the DRR category to show the disease status is unknown because of suspected or apparent recent use under unknown hygiene conditions.

Following the determination of disease categories, protectable areas are identified to determine areas that are likely to remain free from the disease with the application of appropriate disease hygiene as required.

Protectable areas are defined in the *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (2015) as areas that:

- have greater than 600 mm of annual rainfall or are water gaining sites in the 400-600 mm rainfall zone;
- are determined to be free from *Phytophthora cinnamomi* by a DBCA registered disease interpreter. Uninterpretable areas may be classified as protectable;
- comprehensive transect survey areas that are positioned in the landscape and are of sufficient size that they will not be engulfed by *Phytophthora* via autonomous spread. Such an area is defined as being greater than 4 ha with a minimum axis greater than 100 m, and not down slope of an infested area;
- linear assessment areas longer than 100 m after the application of appropriate disease category buffers;

- have controllable human vectors; or
- include high conservation and/or socio-economic values.

4 RESULTS AND DISCUSSION

The Mount Hallowell Reserve assessment area, disease occurrence and positive historic sample locations are shown in Figure 1. Due to the coverage of the previous sampling program (GSBL2014) and current disease expression, it was considered that additional sampling was not required for the current survey.

4.1 Desktop

4.1.1 Previous interpretation data

The previous broad area assessment (GSBL 2014) identified Phytophthora Dieback occurrences across the northern and eastern regions of the reserve. It shows infested vegetation extending along the entire northern boundary, then spreading south around the residential areas associated with Harrington Break, Heather Road and Iluka Avenue. The extent of the mapped disease occurrence was extrapolated using topography and protectable area criteria. The remaining areas were classified as either uninterpretable or uninfested based on the absence of high-risk disease vectors and the 2004 Green Skills vegetation mapping, which was used to distinguish the uninterpretable category from uninfested.

The 2014 assessment was conducted prior to the formal definition of the Broad Area Survey method that is now defined in the *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (DBCA 2015). The method now defined in the manual does not allow for mapping of uninterpretable or uninfested areas as they cannot be conclusively confirmed without operational standard field assessment.

4.1.2 Historic positive *Phytophthora* sample recoveries

A review of the VHS positive sample recovery database shows ten positive sample recoveries including those within the reserve from the 2014 assessment and several just outside the reserve boundary to the north and east of the reserve. The samples include confirmed *Phytophthora cinnamomi* and one *P. multivora* occurrence.

Because of the distance from Mount Hallowell Reserve and location being within a separate hydrological catchment, the samples located to the north of Mount Hallowell are not considered to be influential on the reserve. As shown on Figure 1 there are even positive sample recoveries from within the current assessment area, including one positive result for *P. multivora*.

4.1.3 Assessable remnant native vegetation

As defined in the assessment criteria presented in Section 3, only areas with suitable remnant native vegetation can be assessed. Areas that have been cleared or significantly altered are excluded from assessment (i.e. those classed as degraded or completely degraded under the Keighery (1994) condition scale). Excluded areas are limited to the fire hazard reduction buffer surrounding residential areas in the south east. This area is parkland cleared, which removes all susceptible species and represents an area of uncontrolled access.

4.2 Broad Area Survey

4.2.1 Vegetation

The vegetation occurring within the reserve is detailed in the 2004 Denmark Environment Centre survey and report which was used to inform the assessment of interpretability across vegetation types. However,

for the purposes of interpretation the vegetation can be described as upland granite communities surrounded by a tall forest of Karri transitioning into a mixed Karri/Jarrah/Marri forest over a mixed mid storey of *Agonis flexuosa* (Peppermint) and *Banksia grandis*.

Disease indicator species used to determine disease presence within the upland granite areas included:

- *Andersonia caerulea;*
- *Leucopogon revolutus;*
- *Xanthorrhoea platyphylla*.

Disease indicator species used to determine disease presence within the Karri dominated forest included:

- *B. grandis;*
- *L. verticillatus;*
- *Patersonia umbrosa;*
- *Petrophile diversifolia;*
- *L. revolutus;*
- *X. platyphylla.*

4.2.2 Disease Expression

Disease expression across the survey area is very limited. This is due to a general absence of disease indicator species within the Karri forest vegetation type which occurs across the majority of the survey area. In the vegetation surrounding the residential areas there is a higher density of susceptible species and visible disease expression through deaths of *B. grandis, X. platyphylla*, and *P. umbrosa*. The observed deaths range in age with the oldest deaths situated closest to cleared residential areas, being the assumed disease vector. While fresh deaths were very limited, occasional fresh *B. grandis* deaths were noted upslope of the cleared residential area.

4.2.3 Disease Occurrence and Hygiene categories

As shown on Figure 1, the eastern edge of the survey area has been classified as infested. This classification is based on the presence of positive *Phytophthora* sample recoveries, occasional fresh indicator species deaths and historic disease expression. The disease occurrence extends westwards, to historic positive *P. multivora* presence along the Bibbulmun Track. Based on the continued influence of residential land providing a disease vector and two positive sample recoveries, disease presence was confirmed in the area.

In accordance with DBCA, 2015 guidelines, disease occurrence mapping associated with Broad Area surveys is limited to vegetation where visual expression and positive samples are available to confirm disease presence. Vegetation that is uninterpretable or considered likely to be uninfested are not classified due to limited survey effort. For this reason there is no mapped classification of the vegetation immediately west of historic positive *P. multivora* as the vegetation there is uninterpretable. However, as shown on Figure 1, there is a second infested area further west where there are another two historic positive sample recoveries. GSBL (2014) showed this area as infested due to the influence of the Bibbulmun Track which links the two infested areas and provides a disease vector. Due to the revised survey method and assessment criteria (DBCA 2015) this classification is no longer considered appropriate because of the paucity of disease indicators (only infested areas may be mapped), however, the area remains classified as unprotectable due to the likelihood of disease being present but undetectable.

4.2.4 Soil and Tissue Samples

No soil and tissue samples were collected in 2021 due to the presence of nine historic positive sample recoveries occurring within the reserve, seven of which occur in the current survey area. The historic positive sample recoveries are shown on Figure 1.

4.3 Protectability Assessment

The protectability criteria presented in Section 3 was applied to the reserve using the results of the Broad Area survey. Justification for the application of the protectable area classification includes:

- the reserve is situated in the Shire of Denmark which receives an annual average rainfall of1085.2 mm/yr (BoM 2019). This meets protectable area criteria in relation to rainfall.
- no vegetation has been classified as being uninfested by *Phytophthora cinnamomi* by a DBCA registered disease interpreter, however, significant areas of vegetation with limited numbers of susceptible species do occur upslope of infested areas and high-risk disease vectors. It is considered likely that a detailed survey would identify uninterpretable vegetation that would be considered protectable
- human vectors influencing the reserve include the public access roads, fuel reduction buffers and walking trails including the Bibbulmun Track. Of these, only the Bibbulmun Track represents a significant threat to potentially protectable vegetation within the reserve and hygiene measures including boot cleaning stations and signage are located at each end of the protectable section of the track.

Following the application of the protectability criteria it is considered that protectable vegetation occurs west and south of the infested vegetation shown on Figure 1. This conclusion is based on:

- the vegetation lying upslope from known infested areas; and
- the presence of occasional, healthy disease indicator species, occasionally in clumps, occurring within the protectable vegetation.

The small section of the Bibbulmun Track previously classified as infested (GSBL 2014) is now mapped as uninterpretable due to the absence of disease indicator species and associated disease expression but has been classified as unprotectable due to the presence of confirmed infestations at either end. It is considered likely that infested soil has been transported through this area by track walkers.

4.4 Limitation of results

The Broad Area survey method provides planning level information only. The extrapolated disease occurrence as shown on Figure 1 includes confirmed occurrences of Phytophthora Dieback but does not accurately represent the location of disease edges. Instead, the mapped occurrence of Phytophthora Dieback is limited to the extent of visual disease expression collected through limited ground coverage.

Phytophthora Dieback is a soil borne plant pathogen that spreads autonomously via root to root transmission, independently through the soil and with the movement of water. The disease is also widely spread by human activities involving the movement of infested soil and plant material. As a result, the edge of a disease infestation is considered to be an actively spreading disease front, and all uninfested

areas of vegetation that are associated with human vectors such as tracks and access ways are considered to be at risk of future infestation unless appropriate management is applied.

5 REFERENCES

Bureau of Meteorology (BoM) (2021): http://www.bom.gov.au/climate/data/

Denmark Environment Centre (2004): *Mount Hallowell Survey, Vegetation Structure and Composition (Map 4),* Unpublished report

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Keighery, B.J. (1994), *Bushland plant survey. A guide to plant community survey for the community*. Wildflower Society of WA (Inc.), Nedlands, Western Australia.

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Figures

Phytophthora Dieback Occurrence Survey – Mount Hallowell Reserve

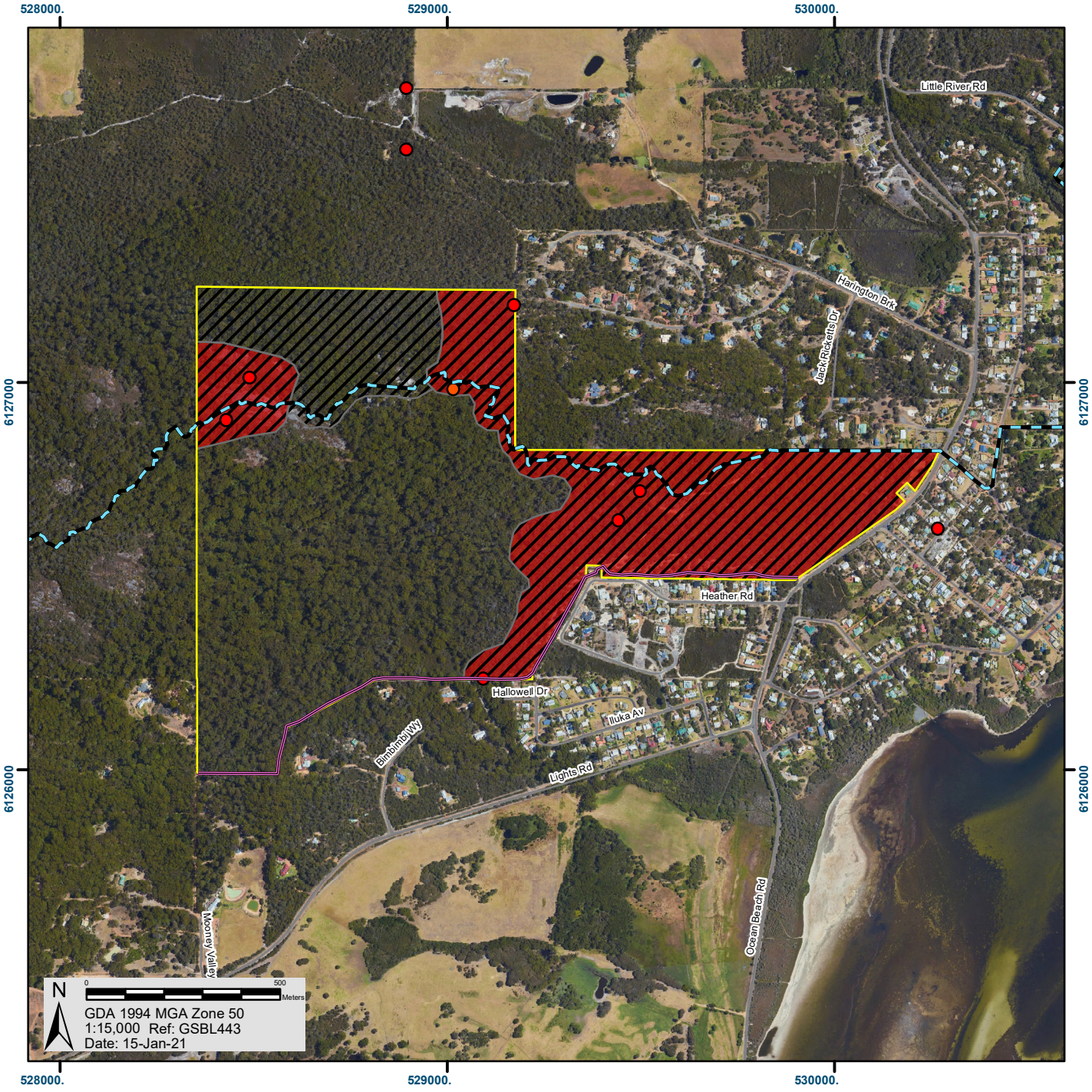

Figure 1 - Broad Area Survey - Phytophthora Dieback Occurrence showing Historic Sample Locations and Protectable Areas - Mount Hallowell, Denmark

Dieback Status

- Infested
- Unprotectable
- Historic P. cinnamomi (to June 2019)
- Historic P. multivora (to June 2019)
- Bibbulmun Track (Shiela Hill Memorial Trail)
- Fire Access Track
- Survey Area

Phytophthora Dieback Occurrence Survey - Mount Hallowell Reserve 46618 - Shire of Denmark prepared for the Great Southern Centre for Outdoor Recreation Excellence, January 2021

GREAT SOUTHERN BIO LOGIC

Phytophthora Dieback occurrence as at January 2021. Recheck required from January 2022.