Talison Lithium Pty Ltd

GC-23-1530 - Saltwater Gully Phytophthora Dieback Occurrence Report

Phytophthora Dieback Occurrence Assessment – Version 0.1

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Client	*Talison Lithium Pty Ltd*
Report name	*GC-23-1530 - Saltwater Gully Phytophthora Dieback Occurrence Report*

This report has been prepared in accordance with the scope of work agreed between Talison Lithium Pty Ltd 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.

Executive Summary

Glevan Consulting was commissioned by Talison Lithium Pty Ltd to conduct an assessment of the Saltwater Gully project area for the presence of Phytophthora Dieback. The project area was comprised of 146.6 hectares (ha), of which 47.4 hectares was assessed, with 99.2 ha being Excluded due to being degraded or devoid of vegetation. The assessment was conducted in March 2023.

A total of 31.5 ha of Infested vegetation was observed within the project area. Disease presence within the area corresponded with the presence of rehabilitation from historical mining activities. An additional 15.9 ha of vegetation was mapped as Uninterpretable due to containing an insufficient coverage of reliable indicator species.

All of the water gaining sites throughout the assessed area are either Infested or Uninterpretable, and likely to be Infested with Phytophthora Dieback. Uninterpretable and Excluded areas contained within the project area have been categorised as Unprotectable due to life-stock grazing, historic rehabilitation, the presence of an adjoining waterbody and general levels of disturbance.

A total of four soil and tissue samples were taken during the assessment, all of which tested positive for the presence of *Phytophthora cinnamomi*.

The Phytophthora Dieback occurrence categories mapped during this assessment are valid for 12 months and will expire in March 2024.

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1 Introduction

Talison Lithium Pty Ltd commissioned Glevan Consulting to conduct a Phytophthora Dieback assessment of the Saltwater Gully project area located in Greenbushes, Western Australia. The project area incorporates State Forest, land owned by Talison Lithium Pty Ltd, and private property. This assessment was required to determine the disease status of the vegetation for the development of a water holding area to be used by Talison Lithium Pty Ltd as part of their mining operations. The project area comprises of a total of 146.6 hectares (ha) (Figure 1).

The assessment was conducted by Danica Delaporte and Shannon Hewitt of Glevan Consulting in March 2023. The Phytophthora Dieback occurrence categories mapped during this assessment are valid for 12 months and will expire March 2024.

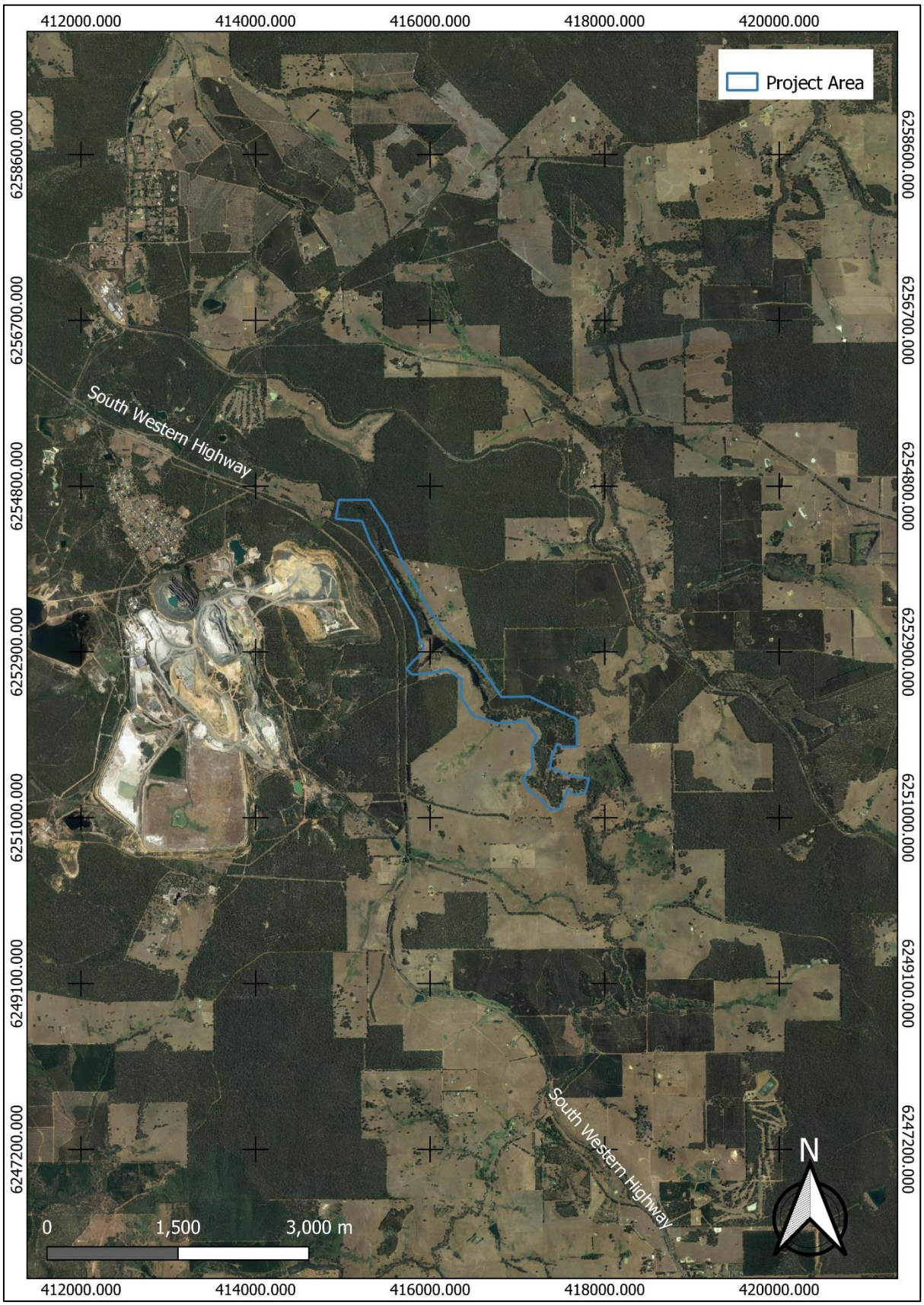


Figure 1 – Assessment Area Location.

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 is a microscopic water mould that belongs to the class Oomycetes. Oomycetes organisms are filamentous and absorptive and reproduce both sexually and asexually. *Phytophthoras* are considered parasitic. It behaves 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 species*), the environment and the host. All three components are needed for the disease to develop over time.

The relationship between the presence of *Phytophthora* and the development of Phytophthora Dieback disease is variable based on the susceptibility of native plant species and the different environmental characteristics, landform types and rainfall zones across bioregions.

3 Materials and Methods

Procedures and guidelines stipulated in the current DBCA manual, "Phytophthora Dieback Interpreters Manual for lands managed by the Department", are applied as the base methodology used by Glevan Consulting in delivering the services and products required by this scope of work. These guidelines and 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. For example, the Phytophthora pathogen may live in the soil as an 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.

The Assessment Area

As per current Department of Biodiversity, Conservation and Attractions (DBCA) guidance (Department of Parks and Wildlife, 2015), areas within the development envelope were excluded from assessment as the vegetation is suffering from significant disturbance. This disturbance (Table 1) is based on Vegetation Condition Scales (Keighery, 1994). The remaining area was categorised post-assessment into Phytophthora Dieback occurrence categories (Table 2).

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*.
	Uninterpretable - Undisturbed areas where susceptible plants are absent, or too few to make a determination of the presence or absence of *Phytophthora cinnamomi.*
Vegetation structure severely altered. Keighery disturbance rating 4 or greater. Phytophthora occurrence assessment is not possible.	Excluded - Areas devoid of vegetation are excluded from the assessment area.

The Assessment Method

All Phytophthora Dieback detection, diagnosis and mapping were performed to standards and procedures defined in the Interpreter's Manual. 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 was necessary to consider all environmental and ecological factors that were present, including:

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

Other causes of plant deaths were considered when determining the presence of Phytophthora Dieback, including:

- Drought, wind scorch and frost,
- Salinity and waterlogging,
- Fire and lightning,
- Senescence and competition,
- Physical damage, and
- Herbicides and chemical spills.

The assessment type was both a comprehensive assessment using transects (demarcating all infested areas and then systematically assessing remaining areas using transects) and a linear assessment (when a proposed activity is linear, such as along a utility easement or road). Prior to assessment, all information relevant to the project was assembled to assist the interpretation process. This information included previous assessments of the area, publicly available sample data and the burning history.

Collection of Evidence of Phytophthora Dieback

During the assessment process, the collection of evidence to support the field diagnosis was recorded using a tablet running the ESRI Field Maps application. 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 that were recorded included:

- Points requiring soil and tissue sampling,
- Points located where samples have been taken, and
- Points located at ISDs.

Soil and Tissue Samples

Soil and tissue samples taken during the assessment were taken to standards and prescriptions defined in Chapter 11 of FEM047. All samples were analysed in the Vegetation Health Service 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.

Criteria for Identifying Protectable Areas

The Dieback Interpreters Guidelines (Department of Parks and Wildlife, 2015) define 'Protectable Areas' as those that:

- Have been determined to be free of the pathogen *Phytophthora* spp. by a registered Dieback Interpreter (all susceptible indicator plant species are healthy and no plant disease symptoms normally attributed to Phytophthora Dieback are evident),
- Consists of areas where human vectors are controllable (e.g., not an open road, private property), and
- Are positioned in the landscape and are of sufficient size (e.g., > 4 ha with axis >100 m) such that a qualified Interpreter judges that the pathogen will not autonomously engulf them in the short term (a period of a few decades), or
- Includes areas of high conservation and/or socio-economic value (for example, a small Uninfested area with a known population of a susceptible species of Threatened flora).

4 Results

4.1 Disease Distribution

Phytophthora Dieback was observed throughout the northern portion of the Saltwater Gully project area (Figure 2). Disease presence appears to be associated with historic rehabilitation within the site. All of the water gaining sites throughout the assessed area are either Infested or Uninterpretable, and likely to be Infested with Phytophthora Dieback.

4.2 Disease Symptoms and Expression

Disease expression ranged from subtle expression with minimal indicator species deaths (ISD's), to obvious expression with multiple ISD's. Expression throughout most of the project area was obvious, with the main indicator species observed within the project area were *Xanthorrhoea gracilis*, *Xanthorrhoea preissii* and *Banksia grandis*.

4.3 Allocation of Categories

The Phytophthora Dieback occurrence categories for the Saltwater Gully project area are shown in Table 4.

Table 4 – Saltwater Gully Area Summary.

Phytophthora Dieback Occurrence Category	**Protectable Vegetation (Hectares)**	**Unprotectable Vegetation (Hectares)**
Infested	0	31.46
Uninterpretable	0	15.90
Assessed Area Total		**47.36**
Excluded Area	0	99.22
Project Area Total		**146.58**

4.4 Excluded Areas

Excluded areas are not assessed for the presence of Phytophthora Dieback due to the level of disturbance of the vegetation, based on the Keighery Vegetation Condition Scale (Table 1).

Excluded areas represented 99.2 ha (67.7 %) of the project area due to being degraded or devoid of vegetation (Figure 2). Excluded areas comprised of private properties utilised for life-stock grazing.

4.5 Uninterpretable

Two sections of Uninterpretable vegetation were observed during the assessment, which corresponds with forestry plantations. The Uninterpretable areas were located in the western section of the project area (Figure 2). Due to factors such the presence of nearby infestations, presence of an adjoining waterbody and general levels of disturbance present, the Uninterpretable areas have been classified as Unprotectable.

4.6 Sample Results

A total of four soil and tissue samples were taken during the course of the assessment (Figure 2), all of which returned results positive for *Phytophthora cinnamomi*. A break down of the soil and tissue samples taken during the Saltwater Gully assessment is located in Table 5.

5 Discussion

The northern section of the Saltwater Gully project area was observed to be Infested with *Phytophthora cinnamomi*. The Infested status of the vegetation was confirmed through soil and tissue sampling. The infestation appears to be associated with historic rehabilitation within the area.

All of the water gaining sites throughout the assessed area are either Infested or Uninterpretable, and likely to be Infested with Phytophthora Dieback.

Two areas of Uninterpretable vegetation were identified that corresponded with forestry plantations. Due to the historic rehabilitation overlapping in parts with the plantations, the presence of an adjoining waterbody and general levels of disturbance, the Uninterpretable vegetation has been categorised as Unprotectable.

6 Recommendations

Soil and plant material should not be transported from the Infested or Uninterpretable sections of the project area for use at any Protectable area.

Vehicles and machinery should be clean upon entry into any Protectable areas.

Soil movement within each category is permissible, but should not occur across category boundaries, except where the source is Uninfested. Soil movement from Uninterpretable into an Infested category is also permissible.

Vehicles and machinery should be clean upon entry into any of the site categories (except Infested), and when moving across category boundaries.

Movement of vehicles and machinery within Uninterpretable areas should be under dry soil conditions.

Restrict access to Protectable Areas to dry soil conditions only, where possible. Where vehicles or machinery are required to access Protectable Areas in wet soil conditions, any soil or plant material present on the vehicles must be removed at designated hygiene points.

7 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.).

8 Appendices

Sample Summary

Four soil and tissue samples were taken during the assessment (Table 5).

Table 5 – Sample Results.

Sample Number	Plant Sampled	Easting	Northing	Result
Saltwater Gully DD01	***Banksia grandis***	**415339**	**6254537**	***P. cinnamomi***
Saltwater Gully DD02	***Xanthorrhoea preissii***	**415482**	**6254126**	***P. cinnamomi***
Saltwater Gully DD03	***Xanthorrhoea preissii***	**415295**	**6254325**	***P. cinnamomi***
Saltwater Gully DD04	***Styphelia species***	**415481**	**6253861**	***P. cinnamomi***

Phytophthora Dieback Occurrence Map

The provided maps are the Phytophthora Dieback occurrence maps. The project area is displayed as a blue boundary line. The following categories are also included:

- Infested (shown as a red). Determined from the assessment to have plant disease Phytophthora Dieback.
- Uninterpretable (shown as purple). Undisturbed areas where susceptible plants are absent, or too few to decide the presence or absence of Phytophthora Dieback.
- Excluded (shown as uncoloured). Areas of high disturbance where natural vegetation has been cleared and is unlikely to recover to a level that is interpretable.

Additional spatial data shown includes:

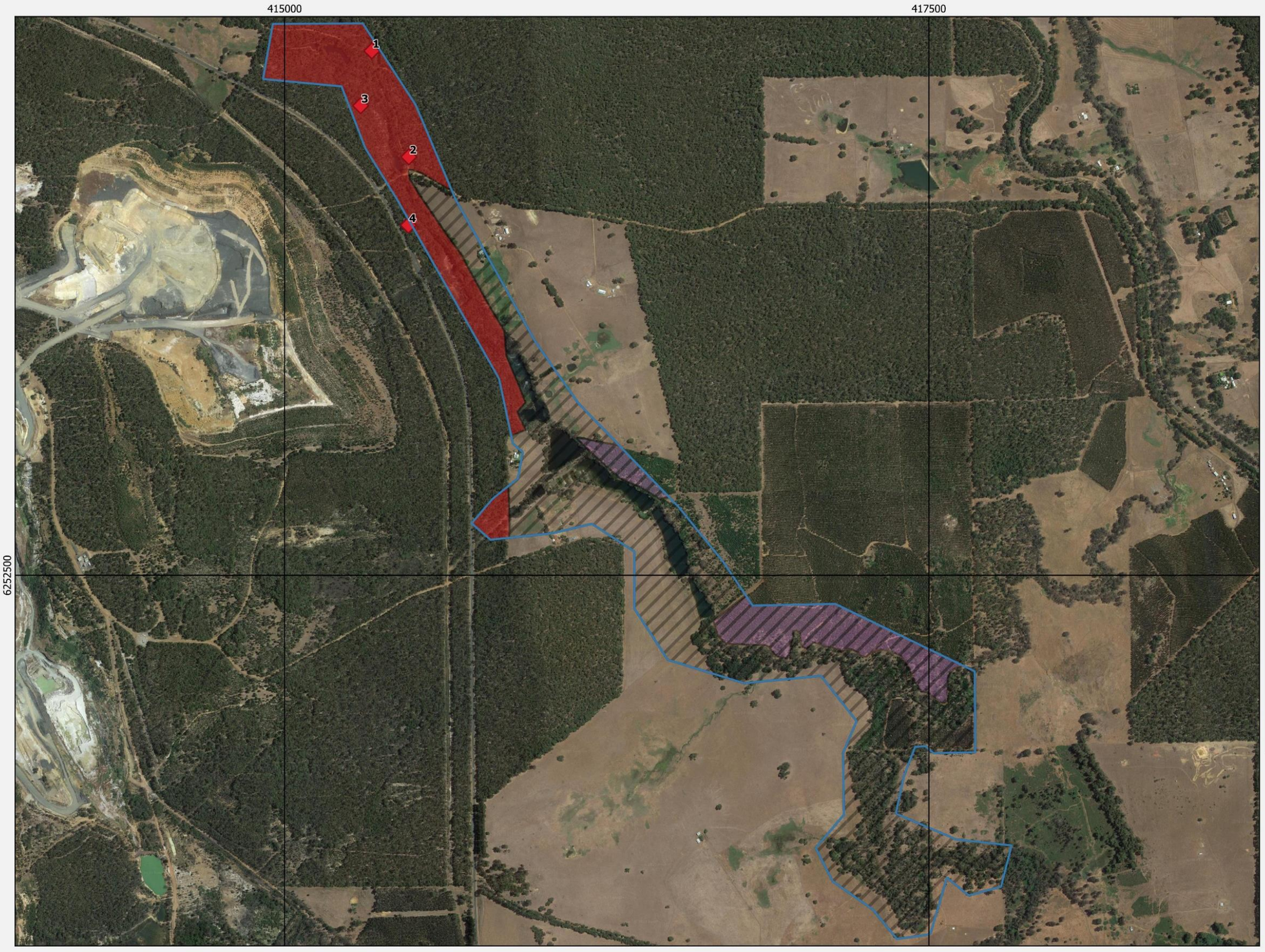
- Sample locations

Phytophthora Dieback is a dynamic disease with autonomous spread of the pathogen not expected to be more than three metres a year upslope in average conditions. In unusual circumstances, such as heavy spring, summer or autumn rainfall, the spread of the disease may be rapid and breach the buffers. These buffers however provide the best chance of hygienic operating conditions within Protectable Areas over a set twelve-month period. The information on Phytophthora occurrence maps then becomes obsolete.

Mapping Metadata

DATASET DESCRIPTION	
Title	Saltwater Gully Phytophthora Dieback Occurrence
Data Created	05-04-2023
Date Last Updated	05-04-2023
Abstract	Phytophthora Dieback Occurrence for Saltwater Gully.
Purpose	Dieback category boundary mapping
Document Number	GC-23-1530
Contact Organisation	Glevan Consulting
Contact Name	Liam Brown
Contact Position	Phytophthora Dieback Interpreter
Contact Phone	0477 799 55
Contact Email	liam.brown@glevan.com.au
Lineage	All field data recorded using ESRI Field Maps application on a GPS enabled tablet.
Datum / Coordinate System	GDA1994 Zone 50
Geographic Description	East of the Talison Lithium Greenbushes Site
Restrictions	None

Phytophthora Dieback Occurrence Map (includes hygiene categories)



Talison

Saltwater Gully

Project No. GC-23-1530

Scale (@A3) =14000

LEGEND

PHYTOPHTHORA DIEBACK OCCURRENCE CATEGORIES

- Project Boundary
- Infested: Determined by a qualified interpreter to have plant disease symptoms consistent with the presence of P. cinnamomi
- Uninfested: Determined by a registered interpreter to be free of plant disease symptoms that indicate the presence of P. cinnamomi
- Uninfested, Unprotectable
- Uninterpretable: Undisturbed areas where susceptible plants are absent or too few to make a determination of the presence or absence of P. cinnamomi
- Uninterpretable, Unprotectable
- Temporarily Uninterpretable: Areas of disturbance where natural vegetation is likely to recover.
- Temporarily Uninterpretable, Unprotectable
- Not Yet Resolved: Phytophthora occurrence diagnosis cannot be made at the time of assessment because of inconsistent or incomplete evidence (including sample results)
- Not Yet Resolved, Unprotectable
- Excluded: Areas of high disturbance where natural vegetation has been cleared and is unlikely to recover to a level that is interpretable
- Excluded, Unprotectable

Samples

- Negative
- Positive

Assessment Completion	03/2023
Interpreter(s)	DD SH
Map expiry date	03/2024

Area Statement

Phytophthora Dieback Occurrence Category	Protectable Vegetation (Hectares)	Unprotectable Vegetation (Hectares)
Infested	0	31.46
Uninfested	0	0
Uninterpretable	0	15.90
Temporarily Uninterpretable	0	0
Not Yet Resolved	0	0
Assessed Area Total	47.36	
Excluded Area	0	99.22
Project Area Total	146.58	

Map produced by Danica Delaporte, Projection UTM Zone 50, Datum GDA94

Figure 2 – Saltwater Gully Phytophthora Dieback Occurrence Map.