Phytophthora Dieback Occurrence Survey

MRC Graphite - Munglinup

6 April, 2020

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Phytophthora Dieback Occurrence Survey
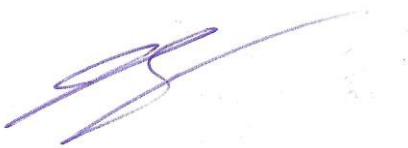
MRC Graphite - Munglinup

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MRC Graphite PTY LTD

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EXECUTIVE SUMMARY

MRC Graphite PTY LTD (MRC) is currently undertaking planning associated with development of a proposed Graphite mine and associated infrastructure within Mining Reserve R24714. To assist the planning process MRC require detailed understanding of environmental factors within the mining reserve including the occurrence of Phytophthora Dieback.

The current 2019 Phytophthora Dieback survey Study Area for the proposed MRC Graphite mine and associated infrastructure includes all areas of remnant vegetation within the proposed development area and Mining Reserve R24714. It also extends east of the reserve along Clayhole Road and south along Farmers Road, as these roads are proposed for use as mine access roads in the future.

Field survey was undertaken using survey methodologies referred to as linear and broad area surveys. The information produced using the linear survey method provides operational level disease hygiene information while the broad area assessment method only provides planning level disease occurrence information. A summary of key statistics for the MRC Graphite Study Area is presented in Table 1 below:

Table 1 – Summary of key statistics from the MRC Graphite Study Area

MRC Graphite Study Area – Summary of Key Statistics	
Area of Assessable Vegetation	1695.49 ha
2018 Survey Area (Glevan)	182.93 ha
Infested Vegetation	21.02 ha
High Confidence Uninfested Vegetation	49.81 ha
High Confidence Uninterpretable Vegetation	248.25 ha
Low Confidence Uninfested Vegetation	240.74 ha
Low Confidence Uninterpretable Vegetation	891.43 ha
Protectable Vegetation	1590.34
Unprotectable Vegetation	22.84
Not Yet Resolved	26.9 ha
Excluded	34.37 ha

No Phytophthora Dieback disease expression was observed in the R24174 Study Area. Uninfested vegetation was identified during linear surveys along the northern and eastern firebreaks in the areas previously assessed as the proteaceous dominant Kwongkan heath Threatened Ecological Community (TEC). Based on the findings of the linear survey, all areas of previously assessed Kwongkan TEC within the Study Area were classified as uninfested. All other vegetation units were assessed as uninterpretable. This includes the areas associated with the linear survey of tracks within the proposed development area.

The linear survey of proposed access roads determined that Clayhole Road must be excluded from Phytophthora Dieback assessment due to the completely degraded nature of vegetation. The vegetation along Farmers Road however is predominantly a proteaceous heath, consistent with the Kwongkan TEC, and is highly susceptible to Phytophthora Dieback in suitable conditions.

The vegetation along Farmers Road has experienced extensive historic site disturbance, is influenced by high-risk disease vectors and there is known historic disease occurrence. There was extensive visual evidence of disease expression across all areas of susceptible vegetation, however from 11 soil and tissue samples, only 3 positive recoveries of *Phytophthora* were achieved. This is not an uncommon issue for sampling programs in low rainfall areas and is compounded for this survey by the significantly below average rainfall that the area has experienced leading up the survey period.

While it is believed that the majority of the vegetation along Farmers Road is infested, only areas associated with positive sample recoveries can be accurately diagnosed and the remaining areas have been awarded the temporary classification of 'Not Yet Resolved". These areas will require additional sampling effort following a period of suitable rainfall.

Using the disease occurrence survey results, a protectability assessment was performed. The results of the protectability assessment are:

- All vegetation within R24174 can be considered to be protectable from future disease introduction and spread.

- All infested vegetation along Farmers Road is classified as unprotectable

- All uninterpretable vegetation along Farmers Road is classified as unprotectable as it receives uncontrolled runoff from the road and is situated downslope of areas with known disease occurrence

- All areas that are classified as 'Yet to be Resolved' have not yet been awarded a protectability classification.

A Risk assessment was also performed using the DBCA risk assessment process defined in the *Phytophthora Dieback Management Manual* (DBCA, 2017). The risk ratings are presented below:

- The risk rating for approximately 78ha of Kwongan TEC that will be traversed by the disturbance footprint is **HIGH** for all soil conditions.

- The risk rating for the Kwongan TEC that will not be traversed by the disturbance footprint is **MODERATE** in dry and moist soil and **HIGH** in wet soil conditions.

- The risk rating for all unsusceptible vegetation units covered by the disturbance footprint is **MODERATE** in dry soil and **HIGH** in moist and wet soil conditions.

- The risk rating for all unsusceptible vegetation units outside the disturbance footprint is **LOW** in dry and moist soil and **MODERATE** wet soil conditions.

CONTENTS

LIST OF ATTACHMENTS

1   INTRODUCTION

1.1   Background

MRC Graphite PTY LTD (MRC) is currently undertaking planning associated with development of a proposed Graphite mine and associated infrastructure within Mining Reserve R24714, covered by mining and exploration tenures M74/245, E74/565, L74/55 and G74/9 as well as pending tenure L74/56. To assist the planning process MRC require detailed understanding of environmental factors within the mining reserve including the occurrence of Phytophthora Dieback. This report presents the findings of a Dieback Occurrence survey performed by Great Southern Bio Logic within the Environmental Study Area (Study Area) 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.

1.2   Objectives

The objectives of the Phytophthora Dieback survey was to:

- determine the presence/absence of the disease within areas of remnant native vegetation within the Study Area;

- map the occurrence of the disease within areas of remnant native vegetation across the Study Area; and

- apply relevant criteria to areas of disease-free vegetation to determine the distribution of vegetation that can be protected from the future introduction and spread of the disease.

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 Study Area involving an analysis of known infestations, topography, geology, land use and access;

- completion of a comprehensive linear survey along all previously un-surveyed access tracks within the proposed project disturbance footprint;

- completion of a Broad Area survey across all previously unsurveyed vegetation within M74/245;

- completion of a comprehensive linear survey along existing firebreaks surrounding Mining Reserve R24714.

- undertake disease risk assessment for each vegetation unit within the field assessment areas;

- collection of field data using a hand help GPS unit. Field data includes disease evidence points, sample locations, demarcated disease hygiene category boundaries and survey effort track files;

- completion of a soil and tissue sampling program to verify field interpretation decisions. All samples were transported to the DBCA Vegetation Health Service (VHS) in Perth for analysis;

- application of protectable area criteria to the site to identify areas that can be considered protectable from future infestation by *Phytophthora* species; and

- development of a disease occurrence report inclusive of disease occurrence figures and associated spatial data. The report shall also present an assessment of the disease occurrence data against criteria in the *Phytophthora Dieback Management Manual* (DBCA 2017) and provide recommendations for the requirement of a Dieback Management Plan.

1.4 Site Characteristics

1.4.1 Study Area

The current 2019 Phytophthora Dieback survey Study Area for the proposed MRC Graphite mine and associated infrastructure includes all areas of remnant vegetation within the proposed development area and Mining Reserve R24714. It also extends east of the reserve along Clayhole Road and south along Farmers Road, as these roads are proposed for use as mine access roads in the future. The entire Study Area as shown in Figure 1, covers an area of approximately 1695.5 ha.

The Study Area is situated immediately east of the Munglinup River and is located approximately 3 km to the north of the Munglinup Townsite.

1.4.2 Land Use

Mining Reserve R24714 is largely vegetated with remnant native vegetation, however, there is evidence of historic and recent site disturbances, presumably associated with mineral investigations. Farmers Road is a partially sealed road that provides a main transport link for the local agricultural industry to the South Coast Highway, while Clayhole Road is a minor Road that only provides access to the immediately adjoining farms.

1.4.3 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 Munglinup. The long-term average annual rainfall data from Munglinup shows that that annual average rainfall is 525.3 mm/yr.

This is an important figure as the accepted distribution of *Phytophthora* is generally restricted by the 400mm isohyet with distribution in the 400-600mm/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 it can be seen that the Study Area experiences suitable climatic conditions for *Phytophthora* to have a significant impact in areas where sufficient soil moisture supports survival of the pathogen.

2 METHOD

In accordance with the agreed project scope of works, the field survey was undertaken using survey methodologies referred to as linear and broad area surveys. The linear survey and broad area survey methods are consistent with the DBCA guideline, *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (2015). The information produced using the linear survey method provides operational level disease hygiene information while the broad area assessment method only provides planning level disease occurrence information.

The field surveys were completed between the 3rd and 6th of November 2019 with a return visit to Farmers Road on 10th December 2019. Due to the mobility of the disease though autonomous spread and human vectoring, all operational scale disease occurrence data has a limited life of 12 months. Operational scale disease assessments are required prior to any soil disturbance activities. A summary of key survey activities is provided below.

2.1 Desktop Interpretation

The Study Area was subject to an initial desktop assessment involving a review of the Vegetation Health Service (VHS) *Phytophthora* sample database and examination of available aerial imagery to assess:

- the extent of assessable remnant native vegetation occurring within the Study Area;
- the known occurrence of Phytophthora Dieback within or influential to the Study Area;
- 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 Linear Survey

The operational scale linear survey was undertaken by a DBCA registered disease interpreter and involved visual diagnosis of the disease within areas of assessable remnant vegetation along existing tracks within the Study Area. Visual diagnosis was supported by laboratory assessment of soil and tissue samples.

Where identified, the occurrence of the disease was mapped using a hand-held GPS unit and demarcation of disease hygiene boundaries was performed in the field using appropriately coloured flagging tape. All potentially uninfested areas upslope of infestations were traversed on foot to confirm the absence of the disease.

The operational scale disease occurrence categories are referred to as *Infested, High Confidence Uninfested* and *High Confidence Uninterpretable*. Demarcation of disease occurrence boundaries was performed in accordance with the requirements defined in the *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (2015). Flagging tape used for demarcation of disease occurrence boundaries is defined below:

- Infested vegetation – Dayglo Pink tape
- Uninterpretable – Pink and Black striped tape
- Uninfested – No demarcation

Demarcation tapes are tied on trees and other suitable bushes or shrubs, along the category boundary. Knots on the demarcation tapes face the category being demarcated. When demarcating infested or uninterpretable vegetation adjoining uninfested vegetation, the tapes are placed 20m into the uninfested vegetation to allow a buffer between the hygiene categories.

Field data including disease presence and vegetation information was collected using a hand-held GPS unit and converted to ArcGIS™ shapefiles. Collected field data included all sample locations, a point file of all identified individual plant deaths attributed to *Phytophthora*, disease hygiene boundaries and track files of the area covered during survey.

2.3   Sampling Program

Sampling for Phytophthora Dieback involves the collection of soil and tissue samples from fresh deaths of plants considered to be reliable indicator species of *Phytophthora* expression. Where suspicious deaths were identified, soil and root tissue material was 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)**.**

2.4   Broad Area Survey

The Broad Area survey involves extrapolation of disease occurrence data from the linear survey, across areas that were not subject to intensive ground coverage. Extrapolation is performed using topography, location of high-risk disease vectors and results of the linear disease occurrence survey. Available flora and vegetation survey results were also used to extrapolate the distribution of uninfested and uninterpretable vegetation.

The Broad Area planning scale disease occurrence categories are referred to as *Low Confidence Uninfested* and *Low Confidence Uninterpretable*. These categories are not demarcated.

2.5   Disease Risk Assessment

The disease risk assessment for each vegetation unit was performed using the DBCA risk assessment process defined in the *Phytophthora Dieback Management Manual* (DBCA, 2017). The risk assessment requires consideration of soil moisture, likelihood of introducing or spreading Phytophthora Dieback and consequence of introducing Phytophthora Dieback to an area. Application of the risk assessment process provides a risk rating which determines the need for a Phytophthora Dieback Management Plan (PDMP).

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 (400mm to 600mm 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 600mm of annual rainfall or are water gaining sites in the 400mm -600mm 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 3ha with a minimum axis greater than 100m, and not down slope of an infested area;

- Linear assessment areas longer than 100m after the application of appropriate disease category buffers;

- Have controllable human vectors; and

- Include high conservation and/or socio-economic values.

4 RESULTS AND DISCUSSION

The proposed MRC Graphite, Munglinup Study Area is shown in Figure 1. As reported previously it comprises remnant vegetation in Mining Reserve R24714 and within the road reserves of both Clayhole Road and Farmers Road. For reporting purposes, the results of field survey provided below are presented separately for the R24714 and the road reserves

4.1 Desktop

4.1.1 Previous interpretation data

A previous disease occurrence survey was performed by in 2018 by Glevan Consulting. The survey area covered by Glevan covered approximately 247 ha including sections of Mills Road, Reynolds Road and existing exploration tracks within exploration tenement M74/245 that were accessible in 2018. The area covered by Glevan Consulting that is within exploration tenement M74/245 and intersects with the current Study Area is shown in Figure 2.

The results of the 2018 survey identified that 228 ha of the assessed area was uninterpretable while the remainder was uninfested. All uninfested vegetation was associated with the access from Mills Road to the north and west, which have not been re-assessed during the current assessment.

The 2018 assessment included the collection of 9 soil and tissue samples from which one positive result was obtained. This positive sample was collected from the South Coast Highway in Munglinup and does not directly influence the Study Area.

A review of the VHS positive sample recovery database also shows a single positive sample recovery from Farmers Road, collected in 2012 however a previous assessment report was not available for this area.

4.1.2 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). The extent of areas considered to be assessable due to the presence of remnant vegetation was initially determined during a review of available aerial imagery and refined during field assessment.

4.1.3 Previous Flora and Vegetation Surveys

A series of vegetation and flora surveys have been previously conducted across R24714. The first was performed by Ecologia in 2015, titled *Munglinup Graphite Project Flora and Fauna Assessment,* which identified four individual floristic units within the Study Area. Since 2018, Woodman Environmental completed a series of flora and vegetation surveys, these being:

- *Detailed Flora and Vegetation Assessment – Spring 2018 and 2019*

- *Targeted search for TEC 'Proteaceae Dominated Kwongkan Shrublands of the southeast coastal floristic province of Western Australia' and habitat for the Threatened taxon Rhizanthella johnstonii, 2018*

- *Environmental. Desktop Review of Potential Regional Extent of Vegetation Units and regional survey, 2019 and 2020*

During the Detailed Flora and Vegetation Woodman's identifies 17 vegetation units across R24714, these being described in table 1 below.

Table 1 – Vegetation Units associated with the Munglinup Mining Reserve (R24714)

VU	Code	Description
1	**LWEsppMr**	Low mallee woodland to open woodland of mixed species including Eucalyptus leptocalyx subsp. leptocalyx, Eucalyptus flocktoniae subsp. flocktoniae, Eucalyptus uncinata, Eucalyptus suggrandis subsp. suggrandis and Eucalyptus phaenophylla subsp. interjacens over tall to mid shrubland of mixed species usually dominated by Melaleuca rigidifolia and occasionally Melaleuca subfalcata, Melaleuca calycina and Melaleuca lateriflora over low open to sparse shrubland of mixed species including Grevillea oligantha, Daviesia articulata, Daviesia lancifolia, Hibbertia pungens and Grevillea pectinata over low sparse sedgeland of mixed species dominated by Gahnia ancistrophylla, Gahnia aristata and Tetraria sp. Mt Madden (C.D. Turley 40 BP/897) on red-brown, orange-brown or grey-brown clay loam, usually with ironstone, sandstone or mixed colluvial gravel, on upper to mid slopes of valleys and low hills.
2	**LWEsppMspp**	Low mallee woodland to open woodland of mixed species including Eucalyptus flocktoniae subsp. flocktoniae, Eucalyptus leptocalyx subsp. leptocalyx, Eucalyptus suggrandis subsp. suggrandis, Eucalyptus conglobata subsp. conglobata and Eucalyptus phaenophylla subsp. interjacens over tall to mid shrubland to open shrubland of mixed species dominated by Melaleuca hamata, Melaleuca sapientes, Melaleuca lateriflora, Daviesia aphylla and Melaleuca undulata over low open to sparse shrubland of mixed species including Acacia ingrata, Grevillea pectinata, Aotus sp. Southern Wheatbelt (C.A. Gardner & W.E. Blackall 1412), Hibbertia psilocarpa and Chorizema nervosum over low open sedgeland of mixed species dominated by Gahnia ancistrophylla, Tetraria sp. Mt Madden (C.D. Turley 40 BP/897), Gahnia aristata and Lepidosperma gahnioides on red-brown to brown clay loam, usually with ironstone, sandstone or mixed colluvial gravel, on slopes valleys and low hills.
3	**LWEdMpHp**	Low mallee woodland dominated by Eucalyptus densa subsp. densa over tall shrubland dominated by Melaleuca pentagona var. pentagona and Banksia media over low sparse shrubland dominated by Hibbertia pungens on skeletal light brown clay loam with sandstone stones over sandstone outcropping on breakaways and ridges.
4	**LWEdAhGp**	Low mallee woodland of Eucalyptus densa subsp. densa over tall sparse shrubland dominated by Acacia harveyi and Hakea laurina over mid shrubland dominated by Gastrolobium parviflorum and Melaleuca thapsina over low shrubland dominated by Dampiera sp. Ravensthorpe (G.F. Craig 8277) (P3) on skeletal brown sandy loam with sandstone stones over sandstone outcropping on breakaways and ridges
5	**LMEsppMh**	Low isolated mallees of mixed species including Eucalyptus conglobata subsp. conglobata and Eucalyptus phaenophylla subsp. interjacens over tall shrubland dominated by Melaleuca hamata, Calothamnus quadrifidus subsp. quadrifidus, Melaleuca elliptica and occasionally Allocasuarina campestris over mid to low open shrubland of mixed species dominated by Astus tetragonus, Leucopogon cuneifolius, Philotheca gardneri subsp. gardneri and occasionally Hybanthus floribundus subsp. adpressus and Grevillea anethifolia over low open sedgeland of mixed species dominated by Tetraria sp. Mt Madden (C.D. Turley 40 BP/897), Lepidosperma sanguinolentum, Lepidosperma sp. Ravensthorpe (G.F. Craig 5188), Lepidosperma sp. 'Jerdacuttup (R.L. Barrett RLB 2770)' and Gahnia aristata on dark brown to brown clay loam with dolerite gravel and dolerite outcropping on upper and mid slopes of valleys
6	**LOWEeCvDs**	Low open mallee woodland of mixed species dominated by Eucalyptus ecostata and Eucalyptus pleurocarpa over tall to mid shrubland of mixed species dominated by Calothamnus villosus, Melaleuca hamata, Kunzea affinis, Acacia sulcata var. platyphylla and Melaleuca rigidifolia over low sparse shrubland of mixed species dominated by Darwinia sp. Lake Cobham (K. Newbey

VU	Code	Description
		3262), Leucopogon sp. Newdegate (M. Hislop 3585), Hemigenia teretiuscula, Philotheca gardneri subsp. gardneri and Calytrix leschenaultii over low open sedgeland of mixed species dominated by Lepidosperma sanguinolentum, Lepidosperma ?sp. Mt Short (S. Kern et al. LCH 17510) (P1), Lepidosperma rigidulum and Lepidosperma sp. 'Jerdacuttup (R.L. Barrett RLB 2770)' on brown sandy loam with sandstone gravel and stones and occasional sandstone outcropping on breakaways and ridges.
7	**LWEdGpHp**	Low mallee woodland to open forest dominated by Eucalyptus densa subsp. densa and occasionally Eucalyptus flocktoniae subsp. flocktoniae and Eucalyptus phaenophylla subsp. interjacens over tall to mid open shrubland of mixed species dominated by Gastrolobium parviflorum, Calothamnus quadrifidus subsp. quadrifidus, Hakea lissocarpha and occasionally Melaleuca hamata over low sparse shrubland of mixed species including Hibbertia pungens, Hibbertia gracilipes and Lasiopetalum rosmarinifolium over low sedgeland and forbland of mixed species including Tetraria sp. Mt Madden (C.D. Turley 40 BP/897), Lepidosperma sp. Ravensthorpe (G.F. Craig 5188), Lepidosperma sp. Bandalup Scabrid (N. Evelegh 10798), Lepidosperma sp. 'Jerdacuttup (R.L. Barrett RLB 2770)' and Stylidium albomontis on red-brown or light brown sandy loam with sandstone gravel and sandstone outcropping on breakaways and ridges.
8	**LWEoMhGa**	Low woodland of Eucalyptus occidentalis over tall open to sparse shrubland dominated by Melaleuca hamata and Acacia cyclops over mid open to sparse shrubland of mixed species including Hakea lissocarpha, Melaleuca glaberrima and Hakea nitida over low sparse shrubland of mixed species including Lasiopetalum rosmarinifolium, Hibbertia gracilipes, Dodonaea caespitosa and Thomasia angustifolia over low open to sparse sedgeland and rushland of mixed species dominated by Gahnia ancistrophylla, Lepidosperma sp. Bandalup Scabrid (N. Evelegh 10798), Lepidobolus preissianus, Lomandra micrantha subsp. teretifolia and Lepidosperma sanguinolentum over low sparse forbland and grassland of mixed species including Neurachne alopecuroidea, Chamaescilla corymbosa var. corymbosa, Goodenia affinis, Oxalis exilis and Lagenophora huegelii on orange-brown clay or sandy loam on river flats
9	**LWEoEqLs**	Low woodland of Eucalyptus occidentalis over low open mallee woodland of Eucalyptus quadrans over tall to mid open to sparse shrubland of mixed species including Acacia glaucoptera, Hakea lissocarpha, Acacia cyclops, Melaleuca acuminata subsp. acuminata and Acacia verriculum over low sparse shrubland of mixed species including Thomasia foliosa, Dodonaea caespitosa and Phyllanthus calycinus over low open to sparse sedgeland of mixed species dominated by Lepidosperma sp. Ravensthorpe (G.F. Craig 5188), Tetraria sp. Mt Madden (C.D. Turley 40 BP/897) and Lomandra effusa over low sparse forbland of mixed species including Lysimachia arvensis, Chamaescilla corymbosa var. corymbosa, Goodenia affinis, Oxalis exilis and Plantago hispida on brown clay loam with quartz gravel on valley slopes
10	**LOWEcMsppGa**	Low open mallee woodland dominated by Eucalyptus conglobata subsp. conglobata and occasionally Eucalyptus phaenophylla subsp. interjacens over tall to mid shrubland to open shrubland of mixed species dominated by Melaleuca hamata and Melaleuca lateriflora, and occasionally Melaleuca glaberrima, Santalum acuminatum and Acacia cyclops, over low sparse shrubland of mixed species including Lasiopetalum rosmarinifolium, Dodonaea caespitosa and Hakea lissocarpha over low open to sparse sedgeland, forbland and rushland of mixed species dominated by Gahnia ancistrophylla, Tetraria sp. Mt Madden (C.D. Turley 40 BP/897), Lepidosperma sp. Carracarrup Creek (S. Kern, R. Jasper, D. Brassington LCH 16738), Lepidobolus preissianus and Opercularia vaginata on red-brown or brown clay loam with dolerite and occasionally quartz stones on valley flats and slopes
11	**TSMuAs**	Tall to mid open to sparse shrubland dominated by Melaleuca uncinata over mid to low shrubland to open shrubland of mixed species dominated by Acacia sulcata var. platyphylla, Melaleuca elliptica and Astus tetragonus over low sparse shrubland of mixed species including Leptospermum

VU	Code	Description
		oligandrum and Styphelia sp. Cascades (R. Davis 11037) on brown clayey sand or clay loam with granite and quartz stones and often granite outcropping on low rises and slopes
12	**LWOFEoAc**	Low woodland to open forest dominated by Eucalyptus occidentalis and Melaleuca cuticularis over tall open shrubland of mixed species dominated by Acacia cyclops, Acacia saligna subsp. lindleyi ms and Labichea lanceolata subsp. brevifolia over low open to sparse sedgeland of mixed species including Chorizandra enodis, Gahnia trifida and Juncus pallidus over occasional low sparse chenopod shrubland dominated by Salicornia quinqueflora subsp. quinqueflora, Suaeda australis and Disphyma crassifolium subsp. clavellatum over low sparse forbland of mixed species including Cotula australis and *Cotula coronopifolia on grey-brown to clay or clay loam in narrow drainage line channels.
13	**LWEoLILf**	Low woodland dominated by Eucalyptus occidentalis over tall to mid shrubland to closed shrubland of mixed species dominated by Labichea lanceolata subsp. brevifolia, Acacia cyclops, Acacia sulcata var. platyphylla and Grevillea anethifolia over low sparse shrubland of mixed species including Thomasia angustifolia and Thomasia foliosa over low sparse sedgeland dominated by Lepidosperma fimbriatum and Lepidosperma sp. Bandalup Scabrid (N. Evelegh 10798) over low sparse forbland of mixed species including Dichondra repens, Cotula australis and Oxalis exilis on yellow-brown to light brown sand or sandy clay in broad drainage lines and adjacent flats
14	**LFEpMtAg**	Low open mallee forest dominated by Eucalyptus platypus subsp. platypus and occasionally Eucalyptus dielsii and Eucalyptus extensa over tall sparse shrubland of mixed species dominated by Melaleuca torquata, Melaleuca cucullata, Melaleuca acuminata subsp. acuminata, Acacia cyclops and Exocarpos sparteus over low sparse shrubland of mixed species dominated by Acacia glaucoptera and Exocarpos aphyllus over low sparse grassland dominated by Rytidosperma setaceum on grey, light brown or brown clay, clay loam or sandy clay with colluvial stones (frequently sandstone, quartz, irostone and laterite) on valley slopes and flats and undulating plains
15	**LWEsppMpBi**	Low mallee woodland dominated by Eucalyptus flocktoniae subsp. flocktoniae, Eucalyptus conglobata subsp. conglobata and Eucalyptus indurata over tall to mid shrubland dominated by Melaleuca pauperiflora subsp. pauperiflora and occasionally Choretrum glomeratum, Dodonaea stenozyga and Pultenaea calycina subsp. proxena (P4) over low shrubland dominated by Boronia inornata subsp. inornata on grey or grey-brown clay loam with calcareous stones on low rises on undulating plains
16	**LWEpBaMs**	Low mallee woodland dominated by Eucalyptus pleurocarpa and occasionally Eucalyptus uncinata over mid to low shrubland of mixed species dominated by Banksia armata var. ignicida, Banksia alliacea, Banksia obovata, Beaufortia micrantha and Leucopogon sp. Newdegate (M. Hislop 3585) over low open to sparse sedgeland of mixed species dominated by Mesomelaena stygia subsp. stygia, Lepidosperma sp. 'Clathrate (R.L. Barrett & G.F. Craig RLB 3570)', Caustis dioica, Lepidosperma carphoides and Lepidobolus chaetocephalus on grey-yellow, yellow-brown or grey-brown sandy or clay loam with lateritic gravel on undulating plains
17	**TSLiAcCd**	Tall open to sparse shrubland dominated by Lambertia inermis var. inermis and occasionally Nuytsia floribunda over mid shrubland to open shrubland of mixed species dominated by Adenanthos cuneatus, Allocasuarina humilis, Banksia baueri, Taxandria spathulata and Chamelaucium megalopetalum over low shrubland of mixed species including Conothamnus aureus, Petrophile teretifolia, Eutaxia inuncta, Jacksonia viscosa and Hibbertia gracilipes over low sedgeland and rushland of mixed species dominated by Caustis dioica, Chordifex sphacelatus, Hypolaena fastigiata, Lepidobolus chaetocephalus and Lyginia imberbis on grey-brown sand, occasionally with laterite gravel, on undulating plains

4.2 Summary of Key Statistics

A summary of key statistics for the MRC Graphite Study Area is presented in Table 2 below:

Table 2 – Summary of key statistics from the MRC Graphite Study Area

MRC Graphite Study Area – Summary of Key Statistics	
Area of Assessable Vegetation	1695.49 ha
2018 Survey Area (Glevan)	182.93 ha
Infested Vegetation	21.02 ha
High Confidence Uninfested Vegetation	49.81 ha
High Confidence Uninterpretable Vegetation	248.25 ha
Low Confidence Uninfested Vegetation	240.74 ha
Low Confidence Uninterpretable Vegetation	891.43 ha
Protectable Vegetation	1590.34
Unprotectable Vegetation	22.84
Not Yet Resolved	26.9 ha
Excluded	34.37 ha

4.3 Mining Reserve R24714

Disease occurrence and location of soil and tissue samples across the Mining Reserve 24714 is shown in Figure 2 and Appendix A presents the VHS laboratory certificates for all samples collected during the assessment. The protectability of remnant vegetation across R24714 has also been assessed and is presented in Figure 2 and discussed in Section 4.5.

4.3.1 Vegetation

During the Great Southern Bio Logic field survey of R24714 the vegetation areas classified as the Kwongkan TEC were considered to be highly interpretable for the occurrence of Phytophthora Dieback. Susceptible flora species occurring within this vegetation considered to be *Phytophthora* indicator species include:

- *Banksia armata;*
- *B. media;*
- *B. speciosa;*
- *Isopogon formosa;*

- *I. polycephalus;*
- *I. trilobus;*
- *Lambertia inermis;*
- *Xanthorrhoea platyphylla.*

4.3.2 Disease Expression

No Phytophthora Dieback disease expression was observed in the R24174 Study Area.

Vegetation impact was observed, however, the nature of impact included scattered deaths distributed throughout the vegetation with no observable pattern of disease spread. The observed plant deaths noted were largely attributed to drought stress and natural senescence. Significant recent fire impacts were also observed across the reserve.

4.3.3 Disease Occurrence and Hygiene categories

Phytophthora Dieback hygiene categories within R24714 are shown in Figure 2. Following the linear surveys, the majority of vegetation along the northern reserve firebreak was assessed as uninfested with uninterpretable vegetation occurring in creek lines. Significant areas of vegetation along the northern section of the eastern firebreak were also assessed as uninfested, however, towards the south of the reserve, uninfested vegetation was restricted to minor localised elevations with uninterpretable vegetation in creek-lines and associated lower areas. The entire southern firebreak was assessed as uninterpretable.

The linear survey of the tracks within the proposed development area within R24714 determined that all vegetation in this area is uninterpretable.

All disease hygiene categories assessed using the linear survey method have been classified as high confidence due to the intensity of the survey method. The high confidence data has been extrapolated across the remainder of R24714 using available vegetation data, topography and presence of disease vectors. Due to the absence of the disease within the surveyed areas, all Kwongkan TEC vegetation has been classified as uninfested while the remainder of the vegetation has been classified as uninterpretable based on the absence of susceptible species in the vegetation descriptions (Ecologia, 2015). All extrapolated disease hygiene categories are classified as low confidence.

4.3.4 Soil and Tissue Samples

A total of 6 soil and tissue samples were collected from R24714. Due to the extensive coverage of uninterpretable vegetation, 2 samples were collected from creek lines with no obvious vegetation impact. This sampling method does not target actual disease expression and so the confidence in negative sample results is low, however it does target the most likely location pathogen spores would be found if present on site and is consistent with the previous disease assessment (Glevan, 2019). The remaining 4 samples were collected from indicator species deaths identified during linear surveys of tracks and firebreaks. All samples returned negative results for *Phytophthora*.

4.4 Clayhole Road and Farmers Road

Disease occurrence and location of soil and tissue samples across the Study Area is shown in Figures 3a and 3b and Appendix A presents the VHS laboratory certificates for all samples collected during the assessment. The protectability of remnant vegetation across the Study Area has been assessed and is presented in Figures 3a and 3b and is discussed in Section 4.5.

4.4.1 Vegetation

The vegetation along Clayhole Road has been largely cleared and for this reason the Clayhole Road section of the alignment has been excluded from Phytophthora Dieback assessment in accordance with

the assessment criteria defined in Section 3. For the purpose of the Phytophthora Dieback survey, the vegetation along Farmers Road is described as being either a proteaceous heath, likely to be consistent with the Kwongkan TEC, or low-lying wetland vegetation dominated by unsusceptible flora species. Susceptible flora species occurring within the proteaceous heaths, considered to be *Phytophthora* indicator species include:

- *Banksia armata;*
- *B. media;*
- *Isopogon formosa;*
- *I. polycephalus;*
- *I. trilobus;*
- *Lambertia inermis;*
- *Xanthorrhoea platyphylla.*

During the assessment significant site disturbance was observed. Disturbance consisted of recent and historic gravel test pits and extraction sites. There were also several disturbance sites that appeared to be large drains or some other type of long, shallow, linear excavation. The disturbance was widely spread throughout the Farmers Road Study Area and it is therefore believed that the majority of the vegetation represents regrowth vegetation.

4.4.2 Disease Expression

Phytophthora Dieback was identified through fresh deaths of all susceptible species listed above. Due to the narrow, linear nature of the Farmers Road Study Area it was difficult to identify clearly delineated disease fronts, however, the visual expression included indicator species deaths (ISDs) across a significant time scale from very old through to very recent deaths. Some ISDs were only partial or staged deaths, which is diagnostic of non-*Phytophthora* related vegetation decline such as drought, insect or canker. However, most ISDs were full plant deaths which is diagnostic of *Phytophthora* as it kills plant root systems.

Plate 1: Fresh *Xanthorrhoea platyphylla* death with older deaths behind   Plate 2: Old *Banksia cirsioides* death with fresh death in background

4.4.3 Soil and Tissue Samples

A total of 11 soil and tissue samples were collected from the Farmers Road Study Area. Seven collected during the initial sampling strategy designed to support the identified field expression in November. However, only two samples returned positive results for *Phytophthora,* with one sample positive for *P. cryptogea* and one sample positive for *P. cinnamomi*. As the sample results were not consistent with visual disease expression, a follow up site visit was undertaken to review sample sites and collect additional samples.

An additional four samples were collected on 10 December, 2019 in areas where disease expression was consistent with disease occurrence but sample results were negative. Of these additional four samples, one returned a positive result for *P. cinnamomi*. This occurrence is located in a position directly upslope of previous negative samples and has been used to demonstrate the presence of the disease in the sample location and areas directly downslope.

All Farmers Road sample locations and results are presented on Figures 3a and 3b, which also show the locations of historic VHS positive sample records. A summary of the Farmers Road samples is presented in Table 3.

While a third positive sample was obtained in the follow up sampling program, the sample results still do not support the extent of visual disease expression symptoms observed across the majority of the Farmers Road Study Area.

Table 3 – Sample data from the Farmers Road Study Area

Soil and Tissue Sample Data – Farmers Road Study Area			
Sample label	Species sampled	Location	Sample result
Farmers Road 1	*X. platyphylla*	E 309212 N 6274883	*P. cryptogea*
Farmers Road 2	*X. platyphylla*	E 309615 N 6273755	Negative
Farmers Road 3	*X. platyphylla*	E 309689 N 6273479	Negative
Farmers Road 4	*X. platyphylla*	E 309699 N 6272664	Negative
Farmers Road 5	*B. media*	E 309678 N 6272260	Negative
Farmers Road 6	*X. platyphylla*	E 309154 N 6271016	*P. cinnamomi*
Farmers Road 7	*X. platyphylla*	E 308473 N 6268961	Negative
Farmers Road 8	*X. platyphylla*	E 309714 N 6273422	*P. cinnamomi*
Farmers Road 9	*X. platyphylla*	E 308697 N 6269640	Negative
Farmers Road 10	*B. media*	E 309643 N 6272710	Negative
Farmers Road 11	*X. platyphylla*	E 308114 N 6267853	Negative

4.4.4 Disease Occurrence and Hygiene categories

The disease occurrence and hygiene categories for the Farmers Road Study Area are presented on Figures 3a and 3b.   All vegetation that is associated with positive sample recoveries and all susceptible vegetation situated downslope of positive sample recoveries has been classified as infested.   All unsusceptible vegetation has been classified as uninterpretable. Several small areas along Farmers Road have been excluded from survey due to clearing or the degraded nature of vegetation.

Due to the conflict between visual disease expression and negative sample results, all susceptible vegetation that is not directly influenced by current or historic positive sample results has been classified as Not Yet Resolved (See Section 3).

4.4.5 Farmers Road Study Area Discussion

The vegetation along Farmers Road is predominantly a proteaceous heath, consistent with the Kwongkan TEC, that would be considered highly susceptible to Phytophthora Dieback in suitable conditions. While there are also some significant areas of unsusceptible vegetation, this is largely restricted to low lying creeks and wetlands.

The vegetation in the road reserve itself is considered to have a high risk of infestation from Farmers Road which is a partially sealed road that is well trafficked. Farmers Road drains into the road reserve and would be subject to regular shire maintenance programs, presumably undertaken in all weather conditions without appropriate hygiene. Further, the significant extent of previous site disturbance, evident across the entire Farmers Road Study Area, is further evidence of high-risk vectoring activities being undertaken, again presumably in all weather conditions without appropriate hygiene.

The single previous historic positive recovery, collected in 2012, demonstrates the disease has been present in the area for a period in excess of 8 years and it is likely to have been spread across the area by autonomous spread and human vectoring during this time. This is supported by the collection of two other *P. cinnamomi* recoveries while the recovery of *P. cryptogea,* further demonstrates *Phytophthora* occurrence along the road reserve.

Due to the extensive historic site disturbance, presence of several high-risk disease vectors, known disease occurrence and extensive disease expression across all areas of susceptible vegetation, it is believed that the majority of the Farmers Road Study Area is infested with Phytophthora Dieback. However, because of the high number of negative sample results, there is also potential for the presence of protectable areas of uninfested vegetation that may represent the Kwongkan TEC.

It is noted that the VHS sample analysis report includes the disclaimer:

> *NEG results cannot be used to represent a total absence of Phytophthora in the sampled area.*

This statement is made because there are several factors which may influence sample collections and analysis and result in a false negative. One factor is the difficulty in extracting positive *Phytophthora* recoveries from samples in low rainfall areas during very dry seasons. The BoM data from Munglinup in 2019 shows that while the annual average rainfall for Munglinup is 525.3mm, the 2019 annual rainfall was 332.6mm with below average rainfall in the months of September through to December, preceding and during the survey period. Because of the significantly lower rainfall experienced in the region it is considered likely that the majority of the negative samples recovered represent false negatives.

After consideration of factors including site characteristics, visual disease expression, negative sample results and the potential for high value protectable areas to exist, all areas of susceptible vegetation that are not directly influenced by positive sample results have been classified as Not Yet Resolved. This hygiene category is specially designed to be applied to vegetation in low rainfall zones and allows final determination of disease occurrence to be deferred until more suitable environmental conditions prevail. In order to resolve the disease occurrence within these areas a further field assessment to collect additional samples will be required following a winter season of average rainfall.

4.5 Protectability Assessment

The assessment of protectability for each area of assessable vegetation within the Study Area uses the protectability criteria presented in Section 3 applied to the vegetation under the circumstances observed during the disease occurrence survey.

4.5.1 Mining Reserve 24714

Due to the absence of high-risk disease vectors and the absence of disease expression within susceptible vegetation within Mining Reserve 24714, all vegetation can be considered to be protectable from future disease introduction and spread. Appropriate operational hygiene requirements will be required to ensure ongoing application of the protectable classification.

4.5.2 Farmers Road

- All infested vegetation along Farmers Road is classified as unprotectable
- All uninterpretable vegetation along Farmers Road is classified as unprotectable as it receives uncontrolled runoff from the road and is situated downslope of areas with known disease occurrence
- All areas that are classified as 'Yet to be Resolved' have not yet been awarded a protectability classification.

4.6 Limitation of results

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.

The disease occurrence data presented in this report is representative of the distribution of Phytophthora Dieback within assessable vegetation in the Study Area at the time of assessment. In accordance with DBCA guidelines (2015, 2017) Phytophthora Dieback occurrence data is valid for a period of 12 months from the date of assessment. After 12 months a disease re-check assessment is required and after three years a full re-assessment of the survey area will be required.

5 RISK ASSESSMENT FOR VEGETATION COVERED BY THE BROAD AREA SURVEY

As requested, Great Southern Bio Logic have undertaken a risk assessment for each vegetation unit subject to Broad Area survey only.

The risk assessment assumes the following

- All susceptible vegetation within R24714 is contained within the mapped distribution of the Kwongkan TEC (Fig 4) and are comprised of VU 16 and VU17.

- It is assumed that the extent of VU 16 and 17 is covered by the extent of the mapped Kwongkan TEC as shown in Figure 4.

- Vegetation units VU1 through to VU15 are all unsusceptible due to the absence or insufficient densities of susceptible species For the purpose of the risk assessment it is assumed they have the same potential risk factors associated with the risk of disease introduction.

- It is assumed that all works associated with the construction of the site layout as shown in Figure 4 will involve ground intrusive works and soil movement.

- It is assumed that site operation will be ongoing through all seasons and weather conditions

5.1 Predicted Soil Moisture.

As it is assumed site works and operation shall be conducted in all soil moisture conditions. A risk assessment for each soil moisture classification has been performed.

5.2 Predicted Likelihood of introducing or spreading Phytophthora Dieback

- Site disturbance will involve clearing, construction and extensive soil movement activities.

- Raw materials including gravel and sand for construction will be imported.

- Proposed access is via Clayhole Road and Farmers Road. Farmers Road is known to be infested by Phytophthora Dieback.

- The proposed activity is considered to be a complex activity with multiple operations, performed over an extended period of time.

The Likelihood of introducing Phytophthora Dieback to vegetation associated with the proposed disturbance footprint is rated **'ALMOST CERTAIN'**

The Likelihood of introducing Phytophthora Dieback to vegetation not associated with the proposed disturbance footprint is rated **'Unlikely'**

5.3 Consequence of Introducing Phytophthora Dieback

- The proposed disturbance area associated with the project is understood to be no greater than 350ha.

- The proposed disturbance area is situated on the Munglinup River.

- A future access corridor is proposed in the north east linking the proposed development to Clayhole Road. It is also proposed to widen the current western access corridor. Both areas intersect

Kwongkan TEC vegetation.The proposed new access from Clayhole Road covers an area of approximately 6ha. The remainder of the vegetation within the disturbance footprint has been classified as non-susceptible vegetation communities.

- Approximately 78ha of the Kwongkan TEC may be directly influenced by the future access corridor.

- The Kwongkan TEC is the only known, susceptible high value biodiversity asset that would be directly impacted by the introduction of the disease. Indirect impacts may be associated with downstream vectoring of the disease via the Munglinup River.

- Predicted impact of the disease in areas of Kwongkan TEC is high.

The consequence of introducing Phytophthora Dieback into the Kwongkan TEC is **'SIGIFICANT'**

The consequence of introducing Phytophthora Dieback into the non-susceptible vegetation units is **'MINOR'**

5.4 Dieback Risk Rating

The dieback risk rating for the Kwongkan TEC and other non-susceptible vegetation units is calculated using the tables below which are a direct excerpt from the *Phytophthora Dieback Management Manual* (DBCA, 2017). The various risk ratings are:

- The risk rating for approximately 78ha of Kwongan TEC that will be traversed by the disturbance footprint is **HIGH** for all soil conditions.

- The risk rating for the Kwongan TEC that will not be traversed by the disturbance footprint is **MODERATE** in dry and moist soil and **HIGH** in wet soil conditions.

- The risk rating for all unsusceptible vegetation units covered by the disturbance footprint is **MODERATE** in dry soil and HIGH in moist and wet soil conditions.

- The risk rating for all unsusceptible vegetation units outside the disturbance footprint is **LOW** in dry and moist soil and **MODERATE** wet soil conditions.

Tables 3-5: Dieback Risk Rating Tables from the Phytophthora Dieback Management Manual (DBCA, 2017)

DRY SOIL

LIKELIHOOD	CONSEQUENCE				
	Insignificant	Minor	Intermediate	Significant	Severe
Almost certain	Low	Moderate	High	High	High
Likely	Low	Moderate	Moderate	High	High
Possible	Low	Low	Moderate	Moderate	High
Unlikely	Low	Low	Low	Moderate	High
Very unlikely	Low	Low	Low	Moderate	High

MOIST SOIL

LIKELIHOOD	CONSEQUENCE				
	Insignificant	Minor	Intermediate	Significant	Severe
Almost certain	Low	High	High	High	High
Likely	Low	Moderate	High	High	High
Possible	Low	Moderate	Moderate	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very unlikely	Low	Low	Low	Moderate	High

WET SOIL

LIKELIHOOD	CONSEQUENCE				
	Insignificant	Minor	Intermediate	Significant	Severe
Almost certain	Low	High	High	High	High
Likely	Low	High	High	High	High
Possible	Low	Moderate	High	High	High
Unlikely	Low	Moderate	Moderate	High	High
Very unlikely	Low	Low	Moderate	Moderate	High

6 RECOMMENDATIONS

As shown in Figures 2, 3a and 3b, protectable vegetation has been identified within the MRC Graphite, Munglinup Study Area.

The DBCA *Phytophthora dieback management manual* (2017) guides the development of Phytophthora Dieback Management Plans (PDMP) for specific projects and is designed for application across lands vested with the DBCA during all potential soil movement activities. While not directly applicable to the proposed MRC Study Area as it is not part of the DBCA estate, development of a PDMP is considered Industry best practice. MRC have an existing disease management plan and it is recommended that this plan be reviewed and amended to incorporate disease occurrence data and consistency with the DBCA guidelines accepted by the Dieback management industry, other government authorities and regulatory agencies be developed.

The amended plan will need to address:

- Hygiene requirements associated with mitigating risks of importing the disease from infested and potentially infested areas of the Study Area to protectable vegetation within the Study Area;

- Protection of protectable areas within the Study Area;

- Application of hygiene during all potential soil moving activities inclusive of preliminary site investigations, construction works and post construction revegetation and ongoing maintenance.

7   REFERENCES

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8 REPORT DISCLAIMER

This report was prepared for MRC Graphite, solely for the purposes set out in the scope of works and it is not intended that any other person use or rely on the contents of this report.

Whilst the information contained in the Report is accurate to the best of our knowledge and belief, Great Southern Bio Logic and its agents cannot guarantee the completeness or accuracy of any of the descriptions or conclusions based on the information supplied to it or obtained during the site investigations, site surveys, visits and interviews. Furthermore, field and / or regulatory conditions are subject to change over time, and this should be considered if this report is to be used after any significant time period after its issue.

Great Southern Bio Logic and its agents have exercised reasonable care, skill and diligence in the conduct of project activities and preparation of this report. However, except for any non-excludable statutory provision, Great Southern Bio Logic and its agents provided no warranty in relation to its services or the report, and is not liable for any loss, damage, injury or death suffered by any party (whether caused by negligence or otherwise) arising from or relating to the services or the use or otherwise of this Report.

This report must be read, copied, distributed and referred in its entirety.

Figures

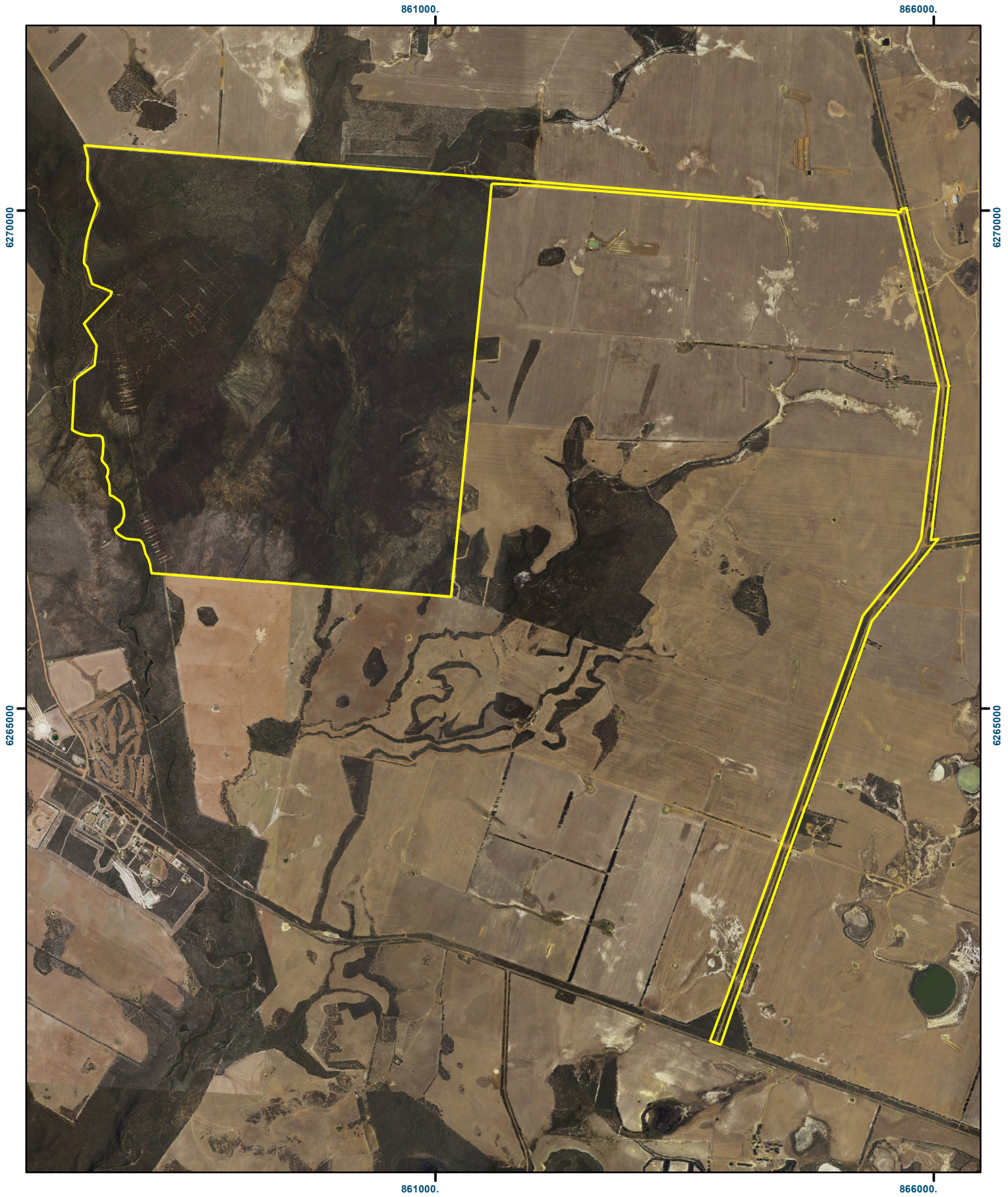*Phytophthora Dieback Occurrence Survey – MRC Graphite, Munglinup*

Figure 1:   MRC Graphite - Munglinup Study Area

LEGEND

▭ Study Area

Phytophthora Dieback Occurrence Survey
MRC Graphite - Munglinup prepared for
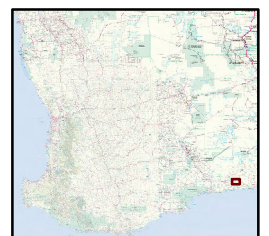MRC Graphite Pty Ltd, January 2020

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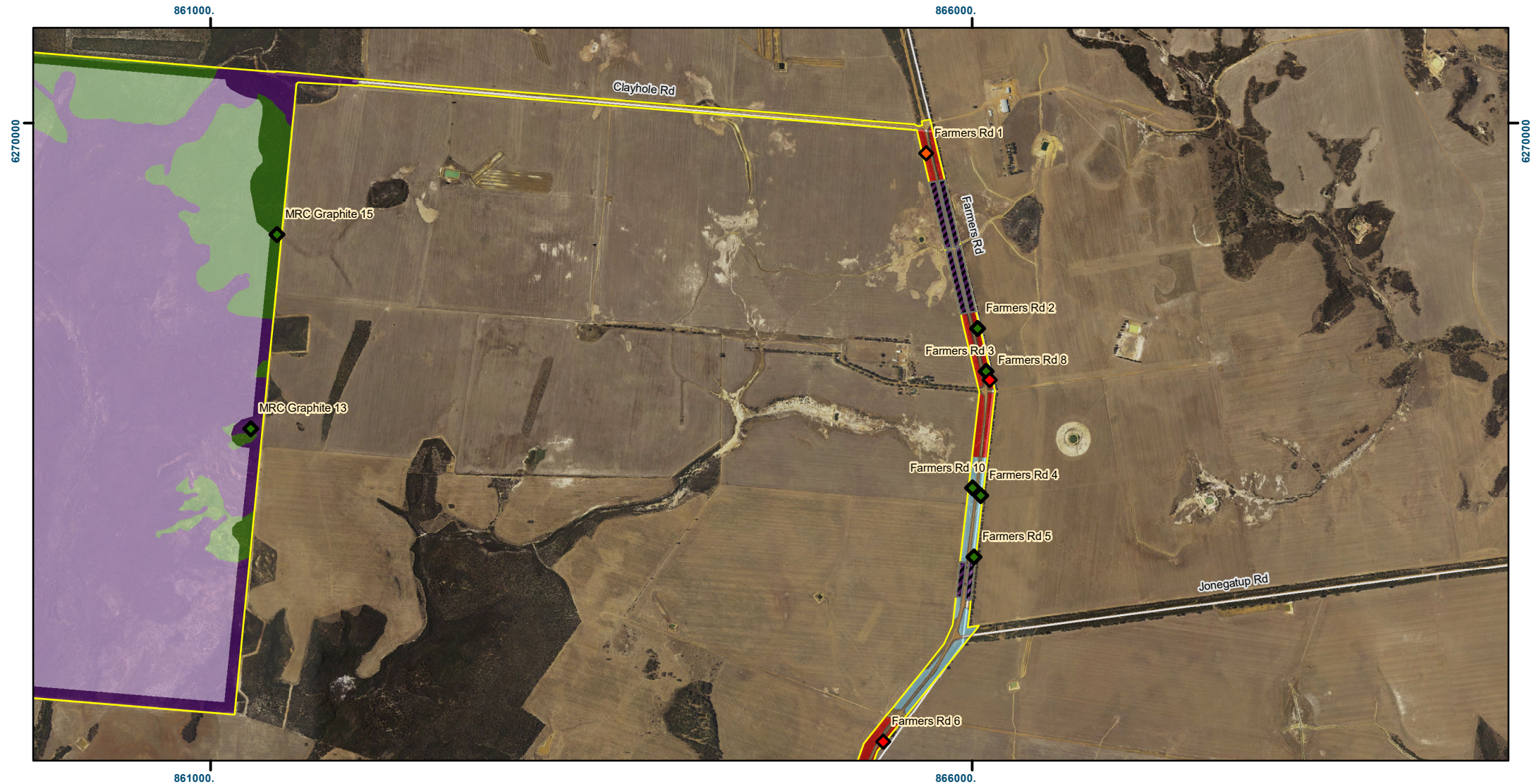on any information depicted.

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Date: 20-Jan-20
Image Source: Landgate Travellers Atlas 2009

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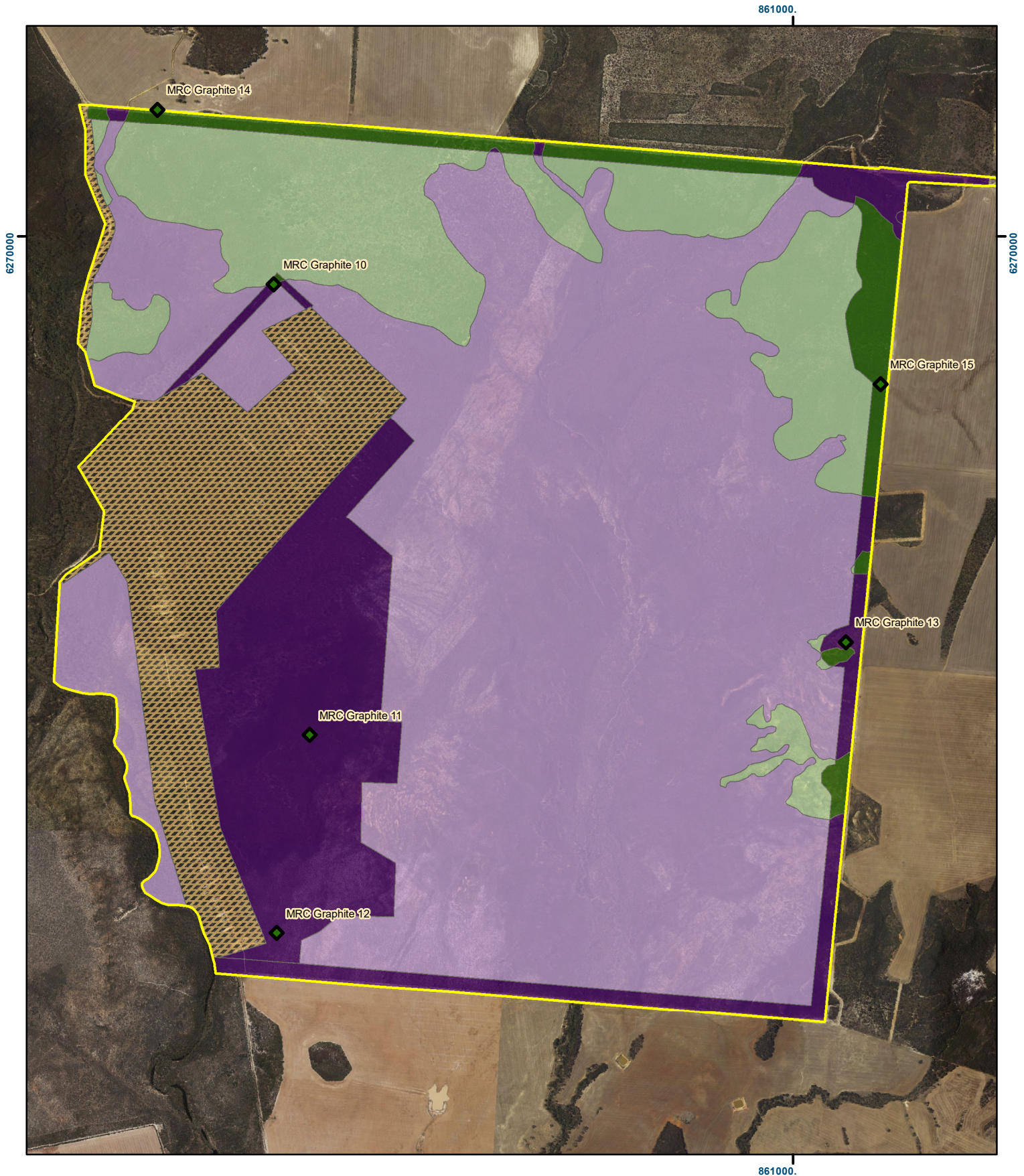
Figure 2: MRC Graphite - Mining Reserve 24714, Munglinup Showing Disease Status, Protectability and Sample Results

LEGEND

Disease Status
- 🟥 High Confidence Infested
- 🟩 High Confidence Uninfested
- 🟪 High Confidence Uninterpretable
- 🟦 Not Yet Resolved
- 🟩 Low Confidence Uninfested
- 🟪 Low Confidence Uninterpretable
- ▨ 2018 Assessment Area (Glevan)
- ⬜ Excluded

▨ Unprotectable

RESULT
- 🔶 P. cinnamomi
- 🔶 P. cryptogea
- 🔷 Negative
- 🔴 Historic Pc
- 🟨 Study Area
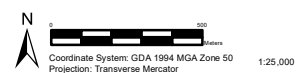
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Phytophthora Dieback Occurrence Survey
MRC Graphite - Munglinup prepared for
MRC Graphite Pty Ltd, January 2020

Figure 3a: MRC Graphite - Farmers Road (North), Munglinup Showing Disease Status, Protectability and Sample Results

Date: 20-Jan-20

Ref: GSBL386
Image Source: Landgate Travellers Atlas 2009

LEGEND

Disease Status
- High Confidence Infested
- High Confidence Uninfested
- High Confidence Uninterpretable
- Not Yet Resolved

- Low Confidence Uninfested
- Low Confidence Uninterpretable
- 2018 Assessment Area (Glevan)
- Excluded
- Unprotectable

Sample Result
- Historic Pc
- P. cinnamomi
- P. cryptogea
- Negative
- Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator

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Phytophthora Dieback Occurrence Survey
MRC Graphite - Munglinup prepared for
MRC Graphite Pty Ltd, January 2020
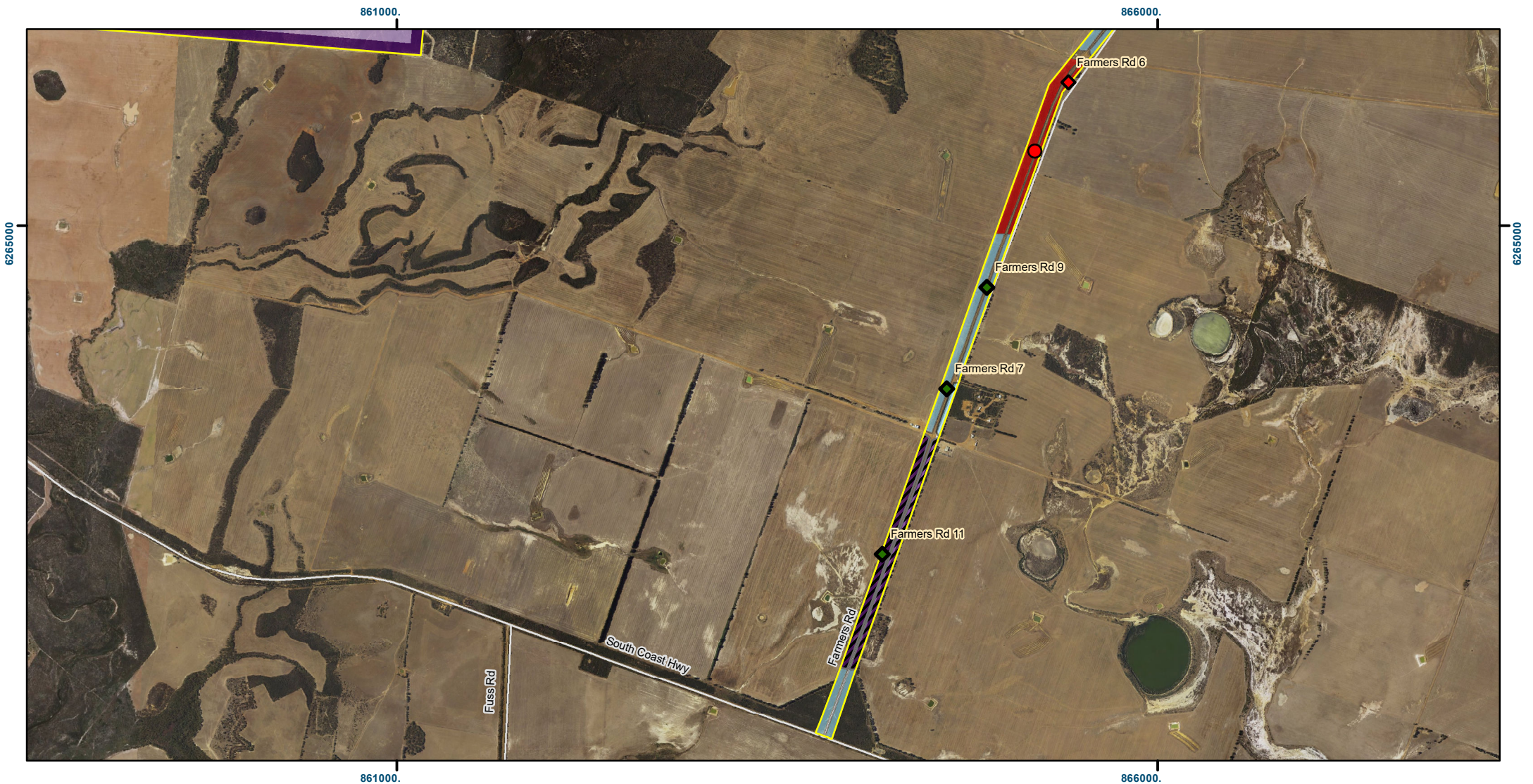
Figure 3b: MRC Graphite - Farmers Road (South), Munglinup Showing Disease Status, Protectability and Sample Results

**Figure 4: MRC Graphite - Mining Reserve 24714 Showing
Site Layout and Extent of Kwongkan Threatened Ecological Community**

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BIO LOGIC

LEGEND

- MRC Site Layout V10
- Kwongan TEC Extent
- Study Area

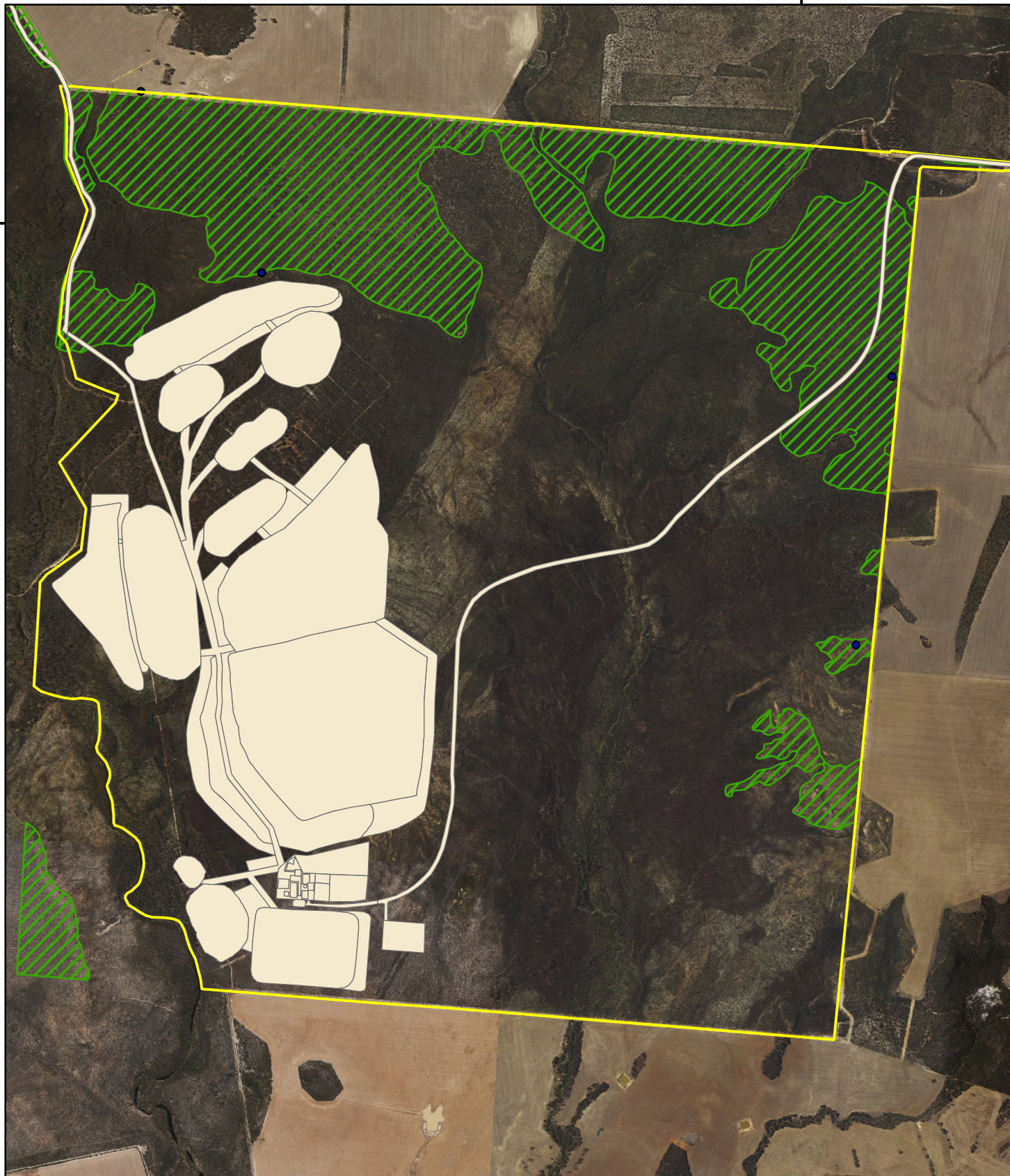Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
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Phytophthora Dieback Occurrence Survey
MRC Graphite - Munglinup prepared for
MRC Graphite Pty Ltd, January 2020

Appendix A

VHS soil and tissue sample analysis report

CONTACT DETAILS of sender

Name Jeremy Spencer
Fax No. Phone No. 0400 113 093
DPW Office or Company Name GS Bio Logic

Job Type (Please indicate)
Private

VHA use only	
Date received	8.11.19 21.11.19
Date faxed	12.12.19

GDA(1) GDA 94

SEND TO: Vegetation Health Service,
Ecosystem Health Branch – Dept. Parks
& Wildlife, 17 Dick Perry Ave,
KENSINGTON 6151
Phone: (08) 9334 0317
Fax: (08) 9334 0114

VHS Identification Number (VHS USE ONLY)	Sample Date	Sample label (Give location, eg. Forest Block or Shire, etc. and samplenumber)	Plant species sampled	Site Impact (2)	Zone 50 or 51	Map Reference (3)		Land Tenure (4)	RESULT s/s root (5)	RESULT bait (5)
VHS 40196	4/11/19	MRC Graphite 10	Isopogon polycephalus	L	51	E 301976 N 6274422		R		NEG
VHS 40197	4/11/19	MRC Graphite 11	Soil	L	51	E 302281 N 6272212		R		NEG
VHS 40198	4/11/19	MRC Graphite 12	Soil	L	51	E 302175 N 6271228		R		NEG
VHS 40199	4/11/19	MRC Graphite 13	B. falcata	L	51	E 304894 N 6301329		R		NEG
VHS 40200	4/11/19	MRC Graphite 14	X. platyphylla	L	51	E 301353 N 6275248		R		NEG
VHS 40201	4/11/19	MRC Graphite 15	B. falcata	L	51	E 304992 N 6274104		R		NEG

NOTES:
1. Please tick this box if your map references are supplied in the **GDA 94** standard. If not, please specify the datum used.
2. Site impact - Low, Moderate, or High (as in the Dieback Interpreter's Manual).
3. An MGA map reference with prefixes **must** be supplied for all samples.
4. Land tenure - State Forest (SF), National Park (NP), Reserve (R), Westrail (W), Private (P), Gravel Pit (GP), or other. (Other - describe in comments below).
5. Result codes used – CIN = *Phytophthora cinnamomi*, MUL = *P. multivora*, CRY = *P. cryptogea*, PI = *P. inundata*, ARE = *P. arenaria*, ELO = *P. elongata*, THE = *P. thermophila*, PM = *P. megasperma*, PN = *P. nicotianae*, CON = *P. constricta*, NEG = negative, SUB = subcultured for further tests

Please Note: a). NEG results cannot be used to represent a total absence of *Phytophthora* in the sampled area. b). Information from your samples will be incorporated into the VHS database and map products, which may be made available to the public and third parties to be used for research and other purposes.

COMMENTS:

CONTACT DETAILS of sender
Name _Jeremy Spencer_
Fax No. _____ Phone No. _0400 113 093_
DPW Office or Company Name _GS Bio Logic_

Job Type (Please indicate)
Private

VHA use only
Date received _8.11.19_
Date faxed _17.12.19_

GDA(1) GDA 94 _21.11.19_

SEND TO: Vegetation Health Service,
Ecosystem Health Branch – Dept. Parks
& Wildlife, 17 Dick Perry Ave.,
KENSINGTON 6151
Phone: (08) 9334 0317
Fax: (08) 9334 0114

VHS Identification Number (VHS USE ONLY)	Sample Date	Sample label (Give location, eg. Forest Block or Shire, etc. and samplenumber)	Plant species sampled	Site Impact (2)	Zone 50 or 51	Map Reference (3)	Land Tenure (4)	RESULT s/s root (5)	RESULT bait (5)
VHS 40189	3-11-19	Farmers Rd 1	X. platyphylla	M	51	E 309212 N 6274883	R		CRY
VHS 40190	3-11-19	Farmers Rd 2	X. platyphylla	M	51	E 309615 N 6273755	R		NEG
VHS 40191	3-11-19	Farmers Rd 3	X. platyphylla	M	51	E 309689 N 6273479	R		NEG
VHS 40192	3-11-19	Farmers Rd 4	X. platyphylla	M	51	E 309699 N 6272664	R		NEG
VHS 40193	3-11-19	Farmers Rd 5	B. media	M	51	E 309678 N 6272260	R		NEG
VHS 40194	3-11-19	Farmers Rd 6	X. platyphylla	M	51	E 309154 N 6271016	R		CIN
VHS 40195	5-11-19	Farmers Rd 7	X. platyphylla	M	51	E 308473 N 6268961	R		NEG

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COMMENTS:

ID by Murdoch Uni using DNA techniques = P. pseudocryptogea

Vegetation Health Service – Phytophthora sample information

Department of Parks and Wildlife

FORM FEM046

CONTACT DETAILS of sender

Name Jeremy Spencer

Fax No. _____ Phone No. 0400 113 093

DPW Office or Company Name GS Bio Logic

Job Type (Please indicate) Private

VHA use only
Date received 13.12.19
Date faxed 26.12.19

GDA(1) GDA 94

SEND TO: Vegetation Health Service, & Wildlife, 17 Dick Perry Ave, Ecosystem Health Branch – Dept. Parks KENSINGTON 6151
Phone: (08) 9334 0317
Fax: (08) 9334 0114

VHS Identification Number (VHS USE ONLY)	Sample Date	Sample label (Give location, eg. Forest Block or Shire, etc. and sample number)	Plant species sampled	Site Impact (2)	Zone 50 or 51	Map Reference (3)		Land Tenure (4)	RESULT s/s root (5)	RESULT bait (5)
VHS 40359	10-12-19	Farmers Rd 8	X. platyphylla	M	51	E 309714	N 6273422	R		CIN
VHS 40360	10-12-19	Farmers Rd 9	X. platyphylla	M	51	E 308697	N 6269640	R		NEG
VHS 40361	10-12-19	Farmers Rd 10	B. media	M	51	E 309643	N 6272710	R		NEG
VHS 40362	10-12-19	Farmers Rd 11	X. platyphylla	M	51	E 308114	N 6267853	R		NEG

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COMMENTS: