

LOT 393 LOWRIE ROAD, GWINDINUP
SAND AND GRAVEL PIT
DEVELOPMENT APPROVAL AND
EXTRACTIVE INDUSTRY LICENCE APPLICATION

PREPARED FOR:

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MARCH 2024

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LOT 393 LOWRIE ROAD, GWINDINUP DA AND EIL APPLICATION

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EXECUTIVE SUMMARY

Mario Michele Giacci is applying for a Development Approval (DA) and Extractive Industry License (EIL) for the extraction of sand and gravel on Lot 393 (Plan 159607) on Lowrie Road in Gwindinup. The applicant, who is also the landowner, holds current DA and EIL for the existing operations; however, changes to truck movements and operational hours are proposed and this necessitates new DA and EIL applications.

It is proposed that truck movements are increased to a maximum of 75 per day (150 one way trips) to cater for periods of highest demand; however, it is noted that average truck movements would be much lower than this. Operational hours are proposed to be extended to include a half day on Saturday, between 7 am and 1 pm.

The extraction area covers 31.4 ha and includes 18 stages as previously approved. Extraction commenced in 2018 and is progressing from south to north. It is anticipated that the life of the pit will extend past this EIL period (5 years) and a renewal application will be made in the future.

Lot 393 is zoned "Rural" in the Shire of Capel Local Planning Scheme No. 8. The property used to be mostly covered in blue gums that were harvested in 2018 ahead of extraction commencing. The northwestern part of the property was part of a mineral sands mine that has now been rehabilitated. There are some patches of remnant native vegetation across Lot 393 and some sporadic individual native trees or shrubs. The proponent holds a clearing permit (CPS 7171/2) to gradually remove remaining native vegetation within the approved EIL area.

The post-excavation landform is designed with maximum batters of 1:6 and with the pit floor level no closer than 4.0 m to the maximum groundwater level. The pit will be rehabilitated to a mixture of pasture and native vegetation as previously approved. Native vegetation will be established in two corridors, combined area of 12.8 ha.

The closest residence is located more than 500 m to the northeast of Lot 393. A Dust Management Plan and a Noise Management Plan have been prepared to minimise impacts on surrounding residences. Additional management plans are also in place for weeds and dieback, stormwater, and rehabilitation.

The proponent has operated numerous extractive industries (formerly as Giacci Brothers Pty Ltd and currently as MGM Bulk) and is very experienced in the basic raw material industry. The pit will be securely fenced, signed, and will operate in a safe and efficient manner.

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1. INTRODUCTION

Mario Michele Giacci, (the applicant) is the owner of Lot 393 (Plan 159607) on Lowrie Road in Gwindinup (the property) and holds current Development Approval (DA) and Extractive Industry License (EIL) for the extraction of sand and gravel on the property (the project). An initial DA and EIL were granted for the property in 2017 and a subsequent DA and EIL granted in 2019 and have since been renewed, with the latest DA dated 30 March 2022.

This DA and EIL application incorporates the following changes compared to the previously approved DA:

- Increase the maximum number of truck movements to 75 per day (150 one way trips).
- Operate half days on Saturdays from 7 am to 1 pm.

Both of these changes will help the site operator to better meet the demand from its clients and remain competitive against other operators in the sector.

This report provides supporting information for the DA and EIL applications submitted to the Shire of Capel (the Shire) by the applicant. The report describes the project site and the surrounds, the planning context, works completed to date, and works still proposed to be undertaken. Furthermore, the potential environmental and social impacts of the project and their management are addressed.

2. BACKGROUND INFORMATION

2.1 LOCATION, AREA AND OWNERSHIP OF PROPERTY

Lot 393 is owned by Mario Michele Giacci and is located on Lowrie Road, approximately 3.5 km south of Boyanup, as shown in Figure 1. The property covers a total area of approximately 52 ha in two parts separated by Morris Road, with the larger portion of land to the east totalling 40.94 ha and the smaller portion to the west totalling 10.94 ha (Figure 2). Works are only proposed to be conducted in the eastern portion of Lot 393 and for the purposes of this report that will be what is referred to as 'Lot 393' or 'the property'. Access to the site is gained from Lowrie Road. The Certificate of Title is provided as Appendix 1.

2.2 DETAILS OF APPLICANT

The applicant is the landowner Mario Michele Giacci (PO Box 1263, Bunbury WA 6231). The applicant has extensive experience in the extractive industry business through previous directorship of Giacci Brothers Pty Ltd and current directorship of MGM Bulk. This has included several EILs within the Shire, including one on neighbouring Lot 287. MGM Bulk operates out of Picton and maintains a sizable fleet of machinery and trucks.

2.3 LAND USE AND ZONING

Lot 393 is zoned 'Rural' under the Greater Bunbury Regional Scheme (GBRS) and the Shire's Local Planning Scheme (LPS) No.8. Under LPS No.8, the property is also located within two Special Control Areas: (SCA) 6 — Strategic Minerals and Basic Raw Materials and SCA 8 — Regional Ecological Linkages (Figure 2). The property contains one shed (Figure 3) and previously contained mostly blue gums, which were harvested in 2018. There are some remnant patches of native vegetation and isolated native trees and shrubs. The 10.94 ha area of Lot 393 west of Morris Road and the northwestern corner of the property were previously part of mineral sand mining operations. These areas have been rehabilitated and signed off as completed by the Department of Mines, Industry Regulation and Safety.

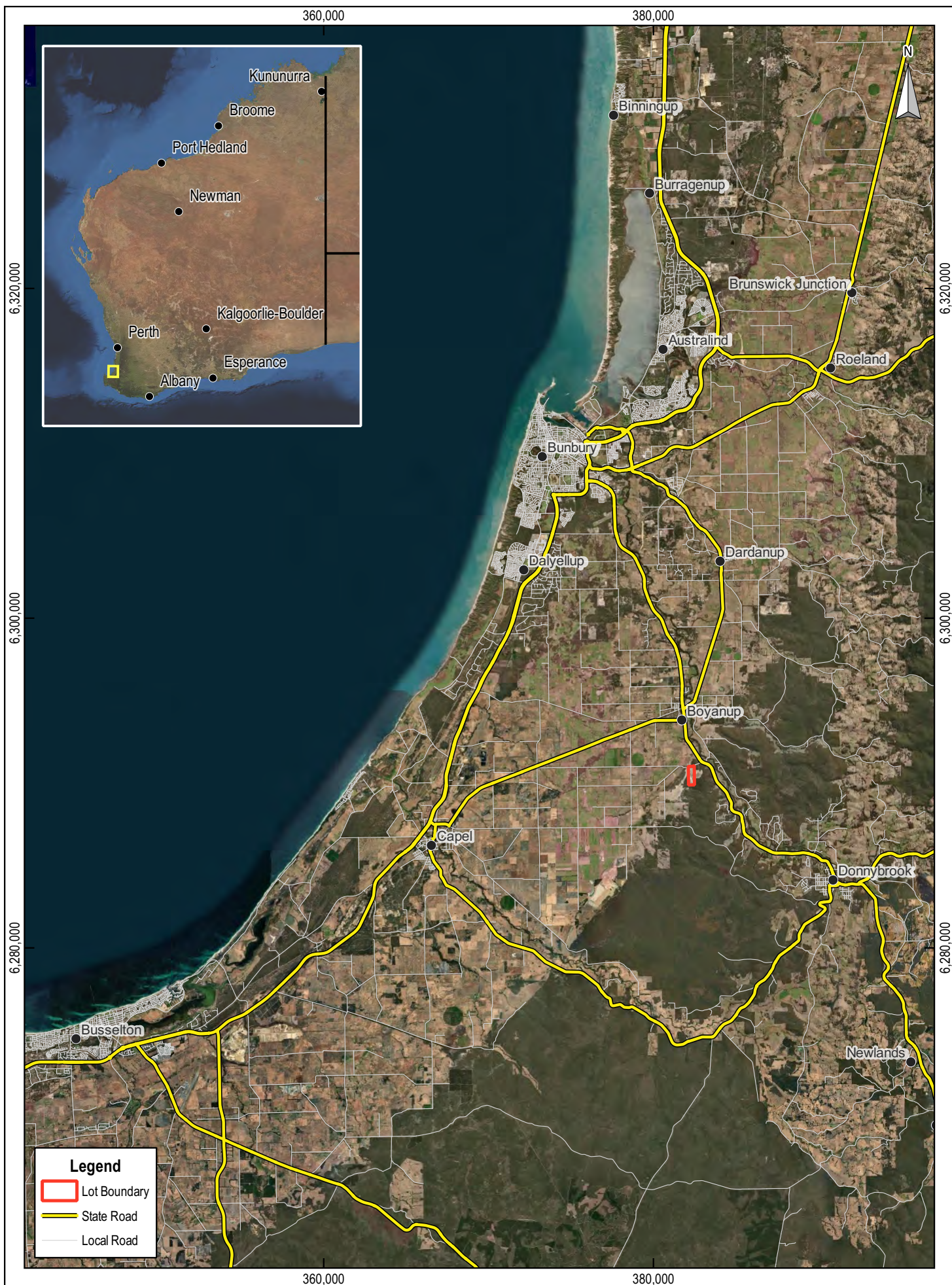
Under the GBRS, the land surrounding Lot 393 is zoned either 'Rural', 'Priority Agriculture', 'State Forest', or 'Local Distributor Road' (Figure 2). There remains a Mineral Sands Caveat (in favour of Cristal Mining Limited) to protect mineral sand mining rights on the property. Sealed Lowrie Road runs along the northern property boundary and unsealed Morris Road runs between the western and eastern parts of Lot 393 (Figure 2).

Zoning and land use of adjacent properties are described in Table 1 and shown in Figure 2.

Table 1: Zoning and Land Use of Properties Adjacent to Lot 393

Property	Zoning	Landuse
Lot 287 (Plan 100056)	Rural	Active sand and gravel extraction, blue gum plantation, no residences.
Lot 101 (Plan 232802)	Rural	Previously used for mineral sand mining, subsequently rehabilitated to mixture of pasture and native vegetation. No residences.
Lot 105 (Plan 232802)	Rural	Portion of property was previously used for mineral sand mining and subsequently rehabilitated. Also contains remnant native vegetation. No residences.
Lot 3287 (Plan 253361)	Rural	Previously used for mineral sand mining, subsequently rehabilitated to mostly pasture, contains a dam, no residences.
Lot 107 (Plan 232802)	Rural	Covered in remnant native vegetation. No residences.

Property	Zoning	Landuse
Lot 427 (Plan 034760)	Reserve 18237	Reserved for the purpose of Landscape Protection. Contains remnant native vegetation. No residences.
Lot 477 (Plan 034756)	Reserve 2307	Reserved for Public Purpose and Recreation. Contains remnant native vegetation. No residences.
Lot 31 (Plan 214856)	Reserve 25500	Regional Open Space, reserved for Public Purpose and Recreation. Remnant native vegetation. No residences.
Lot 26 (Plan 143766)	Rural	Remnant native vegetation. Dwelling, outbuildings, and a dam.
Lot 395 (Plan 205097)	Rural	Remnant native vegetation. No residences.
Lot 458 (Plan 034756)	Reserve 2307	Reserved for Public Purpose. Remnant native vegetation. No residences.



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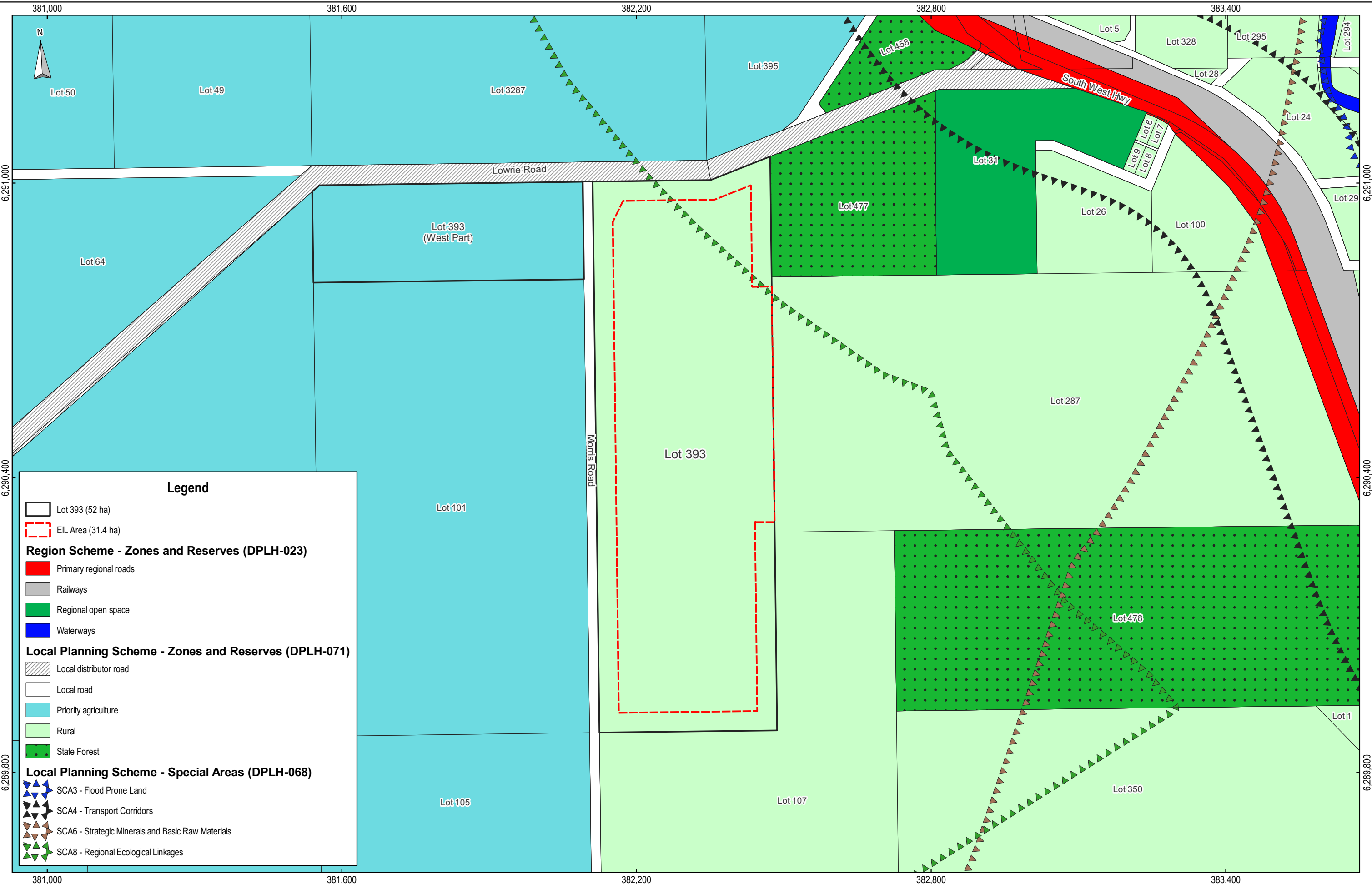
Mario Michele Giacci
 Lot 393 Lowrie Road, Gwindinup

Figure 1

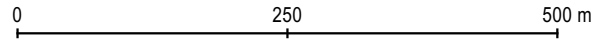
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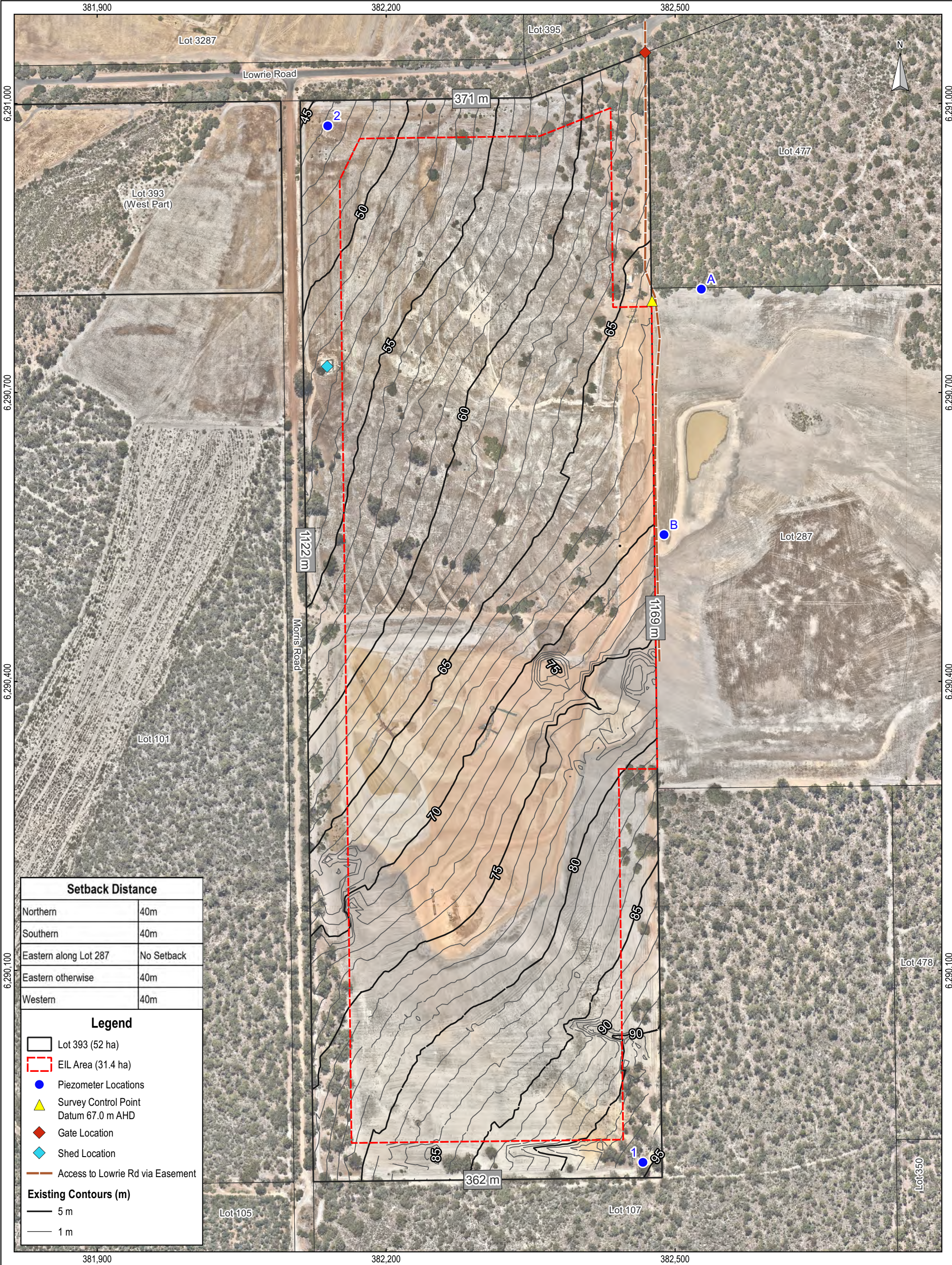


Mario Michele Giacci
Lot 393 Lowrie Road, Gwindinup

Figure 2

Land Use

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Setback Distance	
Northern	40m
Southern	40m
Eastern along Lot 287	No Setback
Eastern otherwise	40m
Western	40m

Legend	
	Lot 393 (52 ha)
	EIL Area (31.4 ha)
	Piezometer Locations
	Survey Control Point Datum 67.0 m AHD
	Gate Location
	Shed Location
	Access to Lowrie Rd via Easement

Existing Contours (m)	
	5 m
	1 m

2.4 SOILS AND TOPOGRAPHY

The high point on Lot 393 is at 96 m Australian Height Datum (AHD), situated in the southeast corner of the property (Figure 3). From there the land slopes down at a near constant grade to a low point of 45 m AHD at the northwestern corner of the property.

The majority of the property falls within the Whicher Scarp Soil Landscape System, with the northwestern corner in the Forrestfield System (Table 2) (DPIRD-064). Historical excavation along the western boundary of Lot 393 and recent extraction on southern parts of Lot 393 and neighbouring Lot 287 confirm the presence of gravel under a layer of sand of varying depth. Material with increasing clay content is present under the gravel.

Lot 393 is located away from wetlands and waterways on well-draining soils making the risk of acid sulfate soil (ASS) low. The Australian Soil Resource Information System maps the extraction area on Lot 393 as 'Extremely Low Probability/Low Confidence' for the risk of ASS (CSIRO 2014).

Table 2: Proposed Extraction Area Soil Landscape System Descriptions

Soil Landscape System	Description
Whicher Scarp System	Low scarp and raised platform, on the northern edge of the Donnybrook Sunkland Sandy gravel and pale deep sands, loamy gravel and non-saline wet soils.
Forrestfield System	Undulating foot slopes of the Darling and Whicher Scarps. Duplex sandy gravels, pale deep sands and grey deep sandy duplexes.

2.5 GROUNDWATER

Two piezometers were installed on Lot 393 in September 2016 and their locations are shown on Figure 3. Readings taken over October-December 2016 are shown in Table 3. Groundwater level data is also available from two piezometers on adjacent Lot 287 from September 2012 (Table 4). On Lot 393, the southeastern bore was consistently dry with groundwater level more than 8.8 m below the natural ground surface, whereas in the northwestern bore groundwater was approximately 5.5 m below the natural ground level. On Lot 287, groundwater was 7.8 m below the natural ground level.

The lowest point of excavation is proposed to be 45 m AHD in the northwest corner of extraction area, more than 4 m above the recorded maximum groundwater level in the area. In other, higher parts of the extraction area, the depth to groundwater can be expected to be even greater.

Table 3: Groundwater Levels in the Proposed Extraction Area on Lot 393

Piezometer	Ground Level (AHD)	Groundwater Depth from Natural Ground Level	Groundwater Level (AHD)	Sampling Date
1 (southeast)	94.30 m	More than 8.8 m as bore dry	Bore dry at 85.50 m	18 Oct 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	2 Nov 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	14 Dec 2016
2 (northwest)	45.80 m	5.25 m	40.55 m	18 Oct 2016
		5.35 m	40.45 m	2 Nov 2016
		5.74 m	40.06 m	14 Dec 2016

Table 4: Groundwater Levels on Lot 287 in September 2012

Piezometer	Ground Level (AHD)	Groundwater Depth from Natural Ground Level	Groundwater Level (AHD)
A	68.20 m	7.85 m	60.35 m
B	70.90 m	7.84 m	63.06 m

2.6 SURFACE WATER

The project site is situated at the eastern edge of the catchment of Gynudup Brook, a tributary of the Capel River that discharges into the Indian Ocean at Geographe Bay. There are no watercourses on Lot 393 due to the well-draining soil and lack of upstream catchment area (the site is within 600m of the upstream watershed). Lot 393 slopes to the northwest, as shown in Figure 3. Surface flow is only likely to occur during intense rainfall events. Any surface flow leaving Lot 393 does so across the western boundary adjacent to Morris Road. On the northern half of the Morris Road boundary there are shallow open drains that direct runoff under the road through 300 mm culverts and into the adjacent property. This property contains the completed Gwindinup North mineral sand mine. The reconstructed landform includes a drainage/sumpland that flows southwest through minor water courses and drains to join Gynudup Brook. On the southern half of the Morris Road boundary there is an unformed dirt road and surface flow across the road to the west is possible as no roadside drainage is in place.

The Gynudup Brook catchment downstream of the project site is almost entirely cleared agricultural land. Land use is primarily beef and dairy grazing. The hydrology of the catchment has been extensively modified as a result of agriculture and includes many artificial drains constructed to alleviate water logging. The Elgin Main Drain, located 12 km downstream of the project area, diverts all flow in Gynudup Brook at that point.

The location of the extraction area is compliant with the advice of Water Quality Protection Note no. 15 (Department of Water and Environmental Regulation, DWER 2019). It is not within a proclaimed Public Drinking Water Supply Area, land subject to seasonal flooding, or defined floodplain and is well separated from all waterways with the nearest being Gynudup Brook, approximately 1 km west of the extraction area, and Preston River, approximately 1.2 km to the east.

2.7 VEGETATION AND FAUNA

The property used to be mostly covered in blue gums that were harvested in 2018. There are some patches of remnant native vegetation and some sporadic individual native trees or shrubs comprising mainly *Corymbia calophylla*, *Eucalyptus marginata*, *Xylomelum occidentale*, *Agonis flexuosa*, and *Xanthorrhoea* sp.

According to the CPS 7171 decision report, vegetation condition on the property ranged from Completely Degraded to Degraded following Keighery (1994). This condition assessment was based on a site visit by the former Department of Environment Regulation in 2016 that also described the application area as comprising of mainly non-native Eucalyptus species with scattered native trees over weeds. A survey of Whicher Scarp in 2008 recorded that the application area did not retain remnant native vegetation (Keighery et al. 2008). Two declared pest species under the BAM Act and several common weed species are known to be present on the property.

A black cockatoo habitat assessment conducted by Greg Harewood (2016) found the extraction area to contain foraging habitat (Appendix 2). Evidence of use was low given the paucity of Marri trees, which are a favoured food source for all three species of black cockatoos. No evidence of black cockatoos roosting within the survey area was found. The project involves clearing of up to eight trees with hollows that are potentially large enough for black cockatoo nesting. As part of the previous EIL process, the proponent committed to installing two artificial cockatoo nesting hollows for each of these trees cleared, totalling up to 16 artificial hollows. The installation will be gradual and, as of August 2023, 14 artificial nesting hollows have been installed on the property. The proponent holds a clearing permit (CPS 7171/2) to gradually remove remaining native vegetation within the approved EIL area.

2.8 CROWN LAND AND RESERVES

There are three reserves in close vicinity to the application area as shown in Figure 2:

- Reserve 2307 (Lot 477) – “Landscape Protection” (to the northeast).
- Reserve 25500 (Lot 31) – “Landscape Protection” (to the northeast).
- Reserve 18237 (Lot 478) – “Landscape Protection” (to the east).

2.9 ABORIGINAL HERITAGE

Lot 393 falls within the South West Native Title Settlement Area; however, this does not preclude development from taking place on this privately owned property. There are no registered Aboriginal Sites within the application area; however, one Other Heritage Place (ID 18941) called Gynudup Brook Ephemeral Creeks intercepts the northwest corner (Appendix 3) (DPLH 2024). ID 18941 is listed as Creation/Dreaming Narrative and Water Source. The status of the site is 'Historic', which is defined as:

"Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals" (see Appendix 3).

The 'Historic' status of the site does not limit the use of the site for extraction.

2.10 EXISTING PUBLIC UTILITIES AND SERVICES

No utilities (water, power, or telecommunications) traverse Lot 393. The site has direct access onto Lowrie Road through the northeast corner, which has satisfactory sighting distance for trucks to enter and leave and is being used by extractive industry both on Lot 393 and adjacent Lot 287.

3. PLANNING AND POLICY SETTING

3.1 STATE PLANNING STRATEGY (2050)

The strategy identifies the Greater Bunbury Area as 'Regional Urban Area' (WA Gov 2021). This includes the subject land and identifies the need for further strategic and structure planning in the area. Since the time of this strategy, a number of more detailed studies have been undertaken, including the majority of the policies and plans described throughout Section 3.

The State Planning Strategy identifies the Greater Bunbury Area progressing towards becoming a continuous urban area with the Perth and Peel regions. It highlights the importance of mining growth in the region, noting that: *"Mining and downstream processing continues to be a key economic driver for the South West sector"* (WA Gov 2021). The strategy identifies six key principles to guide land use planning and development, of which the following relate to the proposal:

- Economy: Facilitate trade, investment, innovation, employment, and community betterment.
- Environment: Conserve the State's natural assets through sustainable development.
- Regional Development: Build the competitive and collaborative advantages of the region.

3.2 GREATER BUNBURY REGION SCHEME

Lot 393 is zoned 'Rural' under the Greater Bunbury Region Scheme (GBRS). The purpose of the 'Rural' zone is:

"to provide for the sustainable use of land for agriculture, assist in the conservation and wise use of natural resources including water, flora, fauna and minerals, provide a distinctive rural landscape setting for the urban areas and accommodate carefully planned rural living developments."

In addition, under the GBRS *Strategic Minerals and Basic Raw Materials Resource Policy* (DLPH 2018), the extraction area in the northwestern portion of Lot 393 is located within a buffer area for Titanium-Zircon mineralisation. Minerals are protected on site via an existing Caveat in favour of Cristal Mining Limited. Extractive operations on Lot 393 have, to date, not encountered mineral strata. In the unlikely event that minerals are encountered, work will be stopped to ensure protection of this resource and contact will be made with the relevant authority. On this basis, the proposal is consistent with the strategic resource area as it will enable the extraction of basic raw materials while ensuring appropriate measures are in place to protect mineral deposits should they be encountered.

3.3 GREATER BUNBURY STRATEGY (2013)

The Greater Bunbury Strategy (DPLH 2013) is the primary strategic document and Structure Plan prepared by the Department of Planning – now Department of Planning, Lands and Heritage (DPLH) – to guide urban, industrial, and regional land use within the City of Bunbury and Shires of Capel, Dardanup, and Harvey. The subject site is located within the area classified as "Residual of study area: rural (no change to land use)". Under the strategy:

"Rural land is to be retained for primary production, natural resource management and its landscape characteristics that define the rural character of the Greater Bunbury sub-region."

The strategy outlines challenges for sustainable Greater Bunbury, which specifically include the lack of suitable fill for new greenfield developments with drainage issues. The Department of Planning response to this challenge was to identify and safeguard the resources required for extractive industries, future fill requirements and construction. The proposal is consistent with the intent of the strategy as it makes use of the basic raw material available in the region while retaining the rural landscape values of the property in the long term through rehabilitation to pasture and native vegetation.

3.4 SHIRE OF CAPEL LOCAL PLANNING STRATEGY

The Shire's Local Planning Strategy (LPS) (Shire of Capel 2023a) is a vision for the development and long-term planning within the Council boundary over the next 15 years and was endorsed in June 2023. It is a two part strategy, with part 1 focused on overall vision including strategies and actions and part 2 addressing background, relevant policies and the justification for the LPS. The LPS has replaced the Shire's Land Use Strategy 1999.

The LPS Part 1 sets strategies under six key Future Directions: community, environment, economy, leadership, infrastructure and communication. Whilst all of the six have some relevance to the proposal, the most relevant is the environment as it covers natural resources (Shire of Capel 2023a):

Environment: natural resources – such as soil, water, rivers, wetlands, coastline, minerals, basic raw materials, and biodiversity are managed in a sustainable way that does not degrade the environment or reduce the quality of life within the Shire.

The proposal is consistent with the intent of the environmental and other strategies and actions as it will enable the use of increasingly rare basic raw materials in accordance with the GBRS and Basic Raw Materials Policy while ensuring that the end landform and landscape outcomes are benefiting the 'Rural' values and improved environmental outcomes. In particular:

- This DA/EIL does not propose anything that will further significantly change the landscape in a way that has not already been approved by Shire.
- Due to historical clearing, the property holds limited environmental values and only minor further clearing is required for the extractive operations. A clearing permit from DWER is in place for the removal of remaining patches of native vegetation within the extraction area.
- After extraction, 18.6 ha will be returned to pasture. This will support local rural and agricultural pursuits.
- After extraction, 12.8 ha will be rehabilitated to native vegetation, resulting in net gain in native vegetation on the property and improving ecological connectivity in the local area.
- Artificial black cockatoo nesting boxes are used to address the loss of trees with hollows.
- To minimise the impact of extraction activities on sensitive land uses, plans to manage dust, noise, stormwater, weeds, and dieback have been developed (Appendix 4, Appendix 9, Appendix 10, Appendix 12).
- This site provides local employment opportunities within the Shire.
- Resources from this site are being used in local and regional developments, which provides further local employment opportunities, and reduces transport costs.

3.5 SHIRE OF CAPEL TOWN PLANNING SCHEME NO. 8

The Shire's LPS No.8 came into effect in July 2023 (Shire of Capel 2023b). Under LPS No.8, Lot 393 is zoned as 'Rural', the objectives of which are:

- To provide for the maintenance or enhancement of specific local rural character.
- To protect extensive agricultural activities such as cropping and grazing and intensive uses such as horticulture as primary uses, with other rural pursuits and rural industries as secondary uses in circumstances where they demonstrate compatibility with the primary use.
- To maintain and enhance the environmental qualities of the landscape, vegetation, soils and water bodies, in order to protect sensitive areas especially the natural valley and watercourse systems from drainage.
- To provide for the operation and development of existing, future and potential rural land uses by limiting the introduction of sensitive land uses in the Rural zone.

- To provide for a range of non-rural land uses where they have demonstrated benefit and are compatible with surrounding rural uses.

The proposed DA/EIL is in line with Rural zoning provided that development approval is granted by the Shire. Once extraction of sand and gravel is completed, the final landform will consist of 18.6 ha of pasture that aligns with preserving the local rural character of the area and provide for future rural use (Figure 6). Additionally, 12.8 ha of native vegetation corridors will be established, which will enhance local environmental qualities (Figure 6). Stormwater measures outlined in Appendix 9 will minimise or negate any potential impact on sensitive areas, such as Gynudup Brook, by effectively managing drainage.

Lot 393 also falls within two SCAs, as detailed in Table 5.

Table 5: LPS No. 8 Special Control Areas on Lot 393

Zone	Objectives	Within Extraction Area
SCA 6 – Strategic Minerals and Basic Raw Materials	To identify areas where basic raw materials and strategic mineral resources need to be protected from incompatible land uses in line with the Greater Bunbury Region Scheme Strategic Minerals and Basic Raw Materials Resource Policy 2018.	Yes
SCA 8 – Regional Ecological Linkages	To identify significant ecosystems on the Scheme Map as a Special Control Area and to provide measures to ensure that land use and development within its boundaries are regulated and managed to protect significant ecological linkages, foreshore environments, biodiversity, and environmental quality.	Yes

The proposed EIL is aligned with the purpose of SCA6 as it is a compatible land use in line with the *Greater Bunbury Region Scheme* (WA Gov 2014), see Section 3.2 for more detail. The proposal also aligns with SCA 8 as clearing of native vegetation is minimal and the proposed rehabilitation will result in an increase of native habitat compared to what was previously on the property (See Section 5.9) and the formation of a 12.8 ha native vegetation corridor. Additionally, artificial nesting hollows for black cockatoo use have been installed to offset the loss of any naturally formed hollows through vegetation clearing. Currently, 14 artificial nesting hollows or 'Cockatubes' have been installed on the property. These artificial nesting hollows are monitored and maintained as an ongoing part of site operations and positively contribute to final environmental outcomes.

3.6 SHIRE OF CAPEL EXTRACTIVE INDUSTRY LOCAL LAW 2016

This DA/EIL application has been prepared in accordance with the Shire's Extractive Industry Local Law (Shire of Capel 2016). Setbacks have been described in further details in Section 4.2.

3.7 SHIRE OF CAPEL LOCAL PLANNING POLICY 6.2

Local Planning Policy 6.2 Extractive Industries (LPP6.2) (Shire of Capel 2023c) has been implemented by the Shire in 2023 with the objective to sustainably manage extractive industries and regional supply needs without causing disruption to the amenity, environment, or function of transport networks within the Shire, as follows:

- Ensure extractive industries do not adversely affect the environment or the amenity of the locality during or after extraction.
- Ensure extractive industries are in the most appropriate locations.

- Ensure volumes of extraction occurs where the available haulage routes and road hierarchy are satisfactory or can be upgraded to support an extractive industry without affecting the safety of road users and the sustainability of the transport network.
- Achieve a high level of staged rehabilitation to native vegetation where required or where clearing of remnant native vegetation is proposed and approved.
- Achieve a high level of groundwater resource protection.
- Clearly outline matters required to be addressed by proponents.
- To provide clarity of the development assessment process for proponents and the broader community.
- Inform the community and stakeholders of the importance of a rigorous assessment process and the reasoning for the Shire's policy stance.

The LPP6.2 applies to all extractive industry proposals for properties zoned 'Rural' under the LPS No.8, which includes Lot 393. The proposal and associated supporting documentation is consistent with the purpose of LPP6.2 as it is within an appropriate location with available haulage routes, proposes a high level of staged rehabilitation including native vegetation, will increase local biodiversity value after extraction, support future rural use (Section 5.9), and it will not impact on groundwater resources (Section 2.5).

3.8 STATE PLANNING POLICY 2.4 - PLANNING FOR BASIC RAW MATERIALS

State Planning Policy 2.4 - Planning for Basic Raw Materials (DLPH 2021a) (SPP2.4) was prepared under the *Planning and Development Act 2005*. The intent of SPP2.4 is to ensure basic raw materials (BRM) and extractive industries matters are considered during planning and development decision-making, and to facilitate the responsible extraction and use of the State's BRM resources. The objectives of this policy are to:

- Ensure BRM and its regional importance is considered at the earliest stages of the planning process.
- Protect BRM in SGS areas and ES by avoiding encroachment from incompatible land uses.
- Ensure BRM resources are used efficiently in land use planning and development.
- Identify BRM extraction opportunities through sequential land use without compromising the final intended land use.
- Ensure the extraction of BRM avoids, minimises, or mitigates any adverse impacts on the community, water resources, and biodiversity values.

The proposed extractive operations are in line with the objectives of SPP2.4 as follows:

- The proposed operations facilitate sequential land uses without compromising planned post-extraction landuse (rural) or other potential future landuse.
- The proposed operations have been designed to avoid, minimise and mitigate impacts on the community, water resources and biodiversity values. A range of management plans are in place and rehabilitation will establish both pasture and native vegetation post extraction.

SPP2.4 is associated with a guideline document *State Planning Policy 2.4 - Planning for Basic Raw Materials Guidelines* (DPLH 2021b). Section 4 of this guideline lists a number of factors that should be considered in the assessment of proposals to establish, extend, or expand an extractive industry operation, as well as managing the potential impacts of the operation. Information to address these factors has been included in this supporting document to the DA and EIL application.

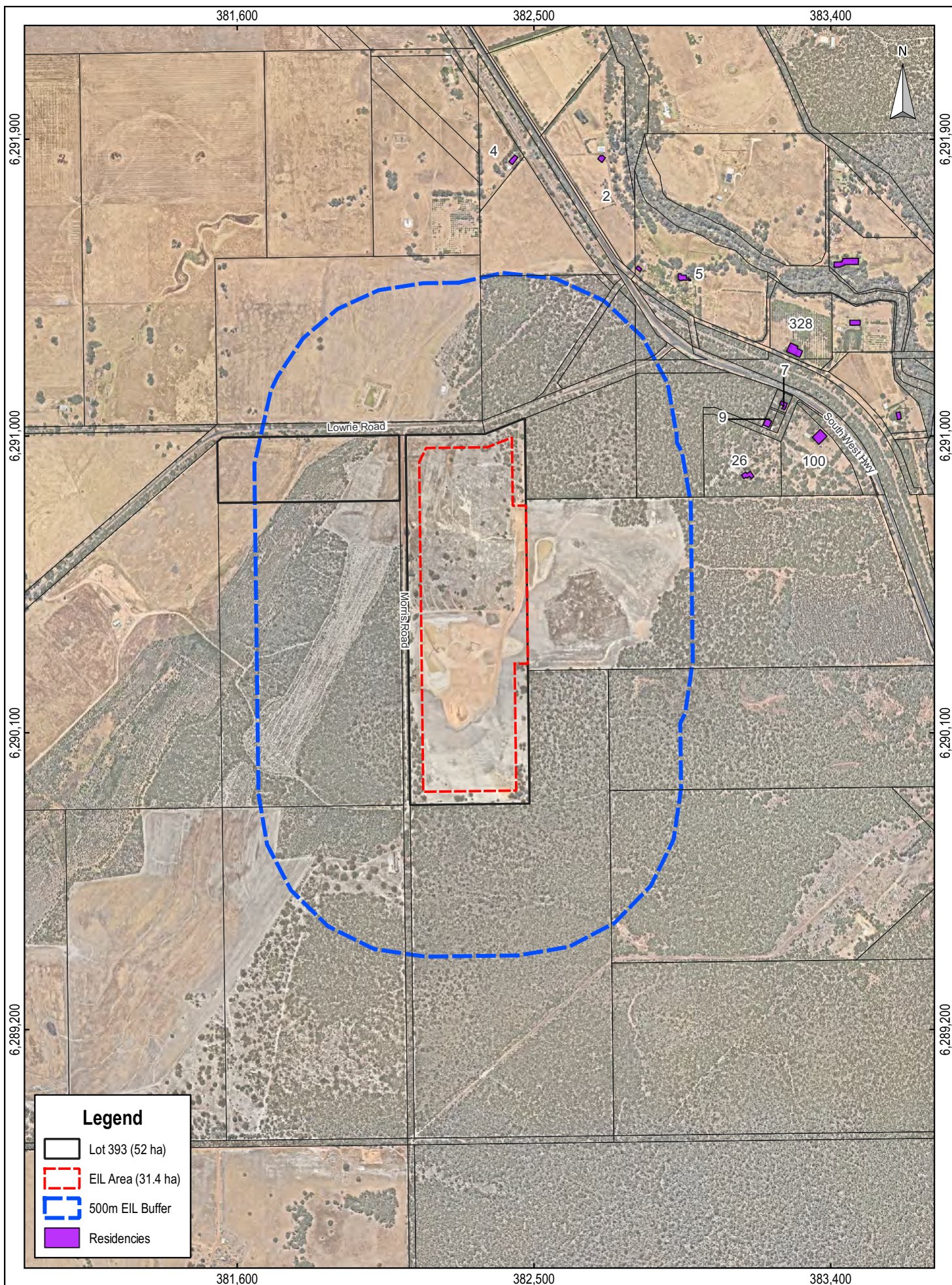
3.9 STATE PLANNING POLICY 3.7 - PLANNING IN BUSHFIRE PRONE AREAS

State Planning Policy 3.7 - Planning in Bushfire Prone Areas (SPP3.7) (DPLH 2015) directs how land use should address bushfire risk management in Western Australia. It applies to all land that has been designated as bushfire prone by the Department of Fire and Emergency Services. While parts of Lot 393 are designated as bushfire prone, the proposed extraction operation does not involve intensification of land-use and does not increase the threat of bushfire. Therefore, exemptions from the requirements of SPP3.7 are expected to apply (similarly to previous applications).

3.10 SEPARATION DISTANCES BETWEEN INDUSTRIAL AND SENSITIVE LAND USES

Guidance for the Assessment of Environmental Factors No.3: *Separation Distances between Industrial and Sensitive Land Uses* was prepared by the Environmental Protection Authority (EPA 2005). It sets generic separation distances for various types of industrial operations and sensitive land uses. For 'Extractive Industry - Sand and Limestone', the main potential impacts are identified as noise and dust and the generic separation distance to sensitive land uses is set at 300–500 m depending on the size of the operations.

The proposed extraction operations are at least 500 m from sensitive landuses with the closest residence located on Lot 5 to the northeast and situated 566 m from the proposed EIL boundary (Figure 4). Based on this, the operations are in line with the generic separation guidance and there is a lower risk of adverse impacts. Additional measures that are proposed to be undertaken by the site operator to reduce the risk of noise and dust are covered in Section 5.2 and Section 5.3 respectively.



Scale: 1: 15,000
 Original Size: A4
 Aerial Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 4
Sensitive Receptors

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 Australia
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 www.mbsenvironmental.com.au

MBS
 ENVIRONMENTAL

4. DEVELOPMENT PROPOSAL

4.1 SUMMARY OF WORKS

In summary, the extraction operations will proceed in stages and comprise of the following:

- Vegetation clearing (minimal).
- Remove and stockpile topsoil, litter, and any overburden.
- Extract sand and gravel material in 18 stages (in accordance with the Works and Excavation Plan, shown in Figure 5).
- Crush and screen gravel with a mobile crusher.
- Load trucks and transport sand and gravel off site.
- Form final landform in accordance with the Final Development Plan (Figure 6).
- Rip pit floor, replace topsoil and other overburden, and rehabilitate.

Further information on the proposed operations is provided below.

4.2 EXTRACTION AREA AND SETBACKS

The proposed extraction area has not changed since the previous approval and covers a total area of 31.4 ha, as shown in Figure 5. The setbacks from property boundaries have also not changed since the previous approval being 40 m along all boundaries apart from the section between Lot 393 and Lot 287 where the setback has been removed to connect the two adjacent pits (Figure 6).

4.3 NATURE AND DURATION OF PROPOSED EXCAVATION

Pre-extraction estimates of sand and gravel volumes for the extraction area were approximately 300,000 m³ of sand and 870,000 m³ of gravel. The operations commenced in 2018 and, so far, approximately half of the pit has been extracted. Allowing for variation in market demand for the resource, the pit is expected to last for another five to 10 years, with rehabilitation activities likely extending beyond this time frame.

4.4 STAGES AND TIMING

Eighteen stages of approximately 2 ha each will be excavated in numerical sequence (Figure 5). Once a stage is completed, rehabilitation in accordance with the Rehabilitation and Decommissioning Programme will commence (Appendix 5). By January 2024, Stages 1 and 2 and most of Stages 4 and 5 have had extraction activities completed with rehabilitation works underway. Operations are currently active in Stages 6 to 9, including crushing and screening plant, material stockpiles, an access track, and a turnaround area. Rehabilitation of these stages has commenced where possible, particularly along eastern batter slopes. Stage 3, which sits at the common boundary with Lot 287, remains partly open to facilitate access to both properties.

4.5 CLEARING METHODOLOGY

The 18 stages will be pegged and flagged to clearly mark the extent of clearing and excavation. The remaining vegetation will be cleared with a bulldozer in stages. Some of the cleared vegetation will be mulched and used in the native vegetation rehabilitation areas. Some logs and larger branches will be salvaged and relocated to buffer zones along the boundaries or into native vegetation rehabilitation areas to add to habitat formation.

4.6 DEPTH AND DESCRIPTION OF OVERBURDEN

Thickness of topsoil is expected to be approximately 100-150 mm with minimal other overburden. Topsoil will be removed with a bulldozer and stockpiled in windrows to a maximum height of 4 m for later use in rehabilitation. Any

overburden will be similarly stockpiled. Whenever possible, stripped topsoil will be directly transferred into rehabilitation areas and spread across finalised land surfaces to avoid stockpiling, thus maximising seed and microbial benefits. All movement and stockpiling of topsoil and overburden will be conducted in accordance with dieback requirements, as noted in Section 5.6.

4.7 EXCAVATION METHODS

Sand and gravel extraction will mostly proceed in a northerly direction (Figure 5). Where necessary, a 4 m high noise bund will be constructed (Section 5.2). The crushing of gravel (by way of a mobile rotary impact crusher and/or jaw crusher) and any screening will be undertaken on the floor of the extraction area, more than 500 m from the closest residence to maximise noise amelioration. Face batters will be maintained at no steeper than 1:2 and no higher than 4m. Material will be stockpiled as required (to a maximum height of 4 m) prior to loading onto trucks (by loader). Final batters (maximum 1:6 slopes) will be formed with a bulldozer and/or loader in accordance with the Finished Development Plan (Figure 6) prior to rehabilitation (see Section 5.9).

4.8 DEPTH AND EXTENT OF EXCAVATION

The extent of excavation is detailed on the Works and Excavation Plan (Figure 5) and the Finished Development Plan (Figure 6). The pit is designed with maximum 1:6 final batter slopes extending to a maximum depth of approximately 5 m to cater for possible deeper gravel areas. As the pit is located on a slope the pit floor will also slope with the lowest point being 45 m AHD in the northwest corner, which remains approximately 4 m above maximum groundwater level.

It is noted that, while the maximum final batter slopes is 1:6, this does not mean that all slopes will be 1:6. As shown in the Finished Development Plan (Figure 6), the slope is 1:6 mainly along the edges of the pit, whereas the pit floor is much gentler.

4.9 ACCESS TO SITE

Access to the site will be from Lowrie Road via the existing access road in the northeast corner of Lot 393 (Figure 3). This access road is also used for operations on Lot 287. The crossover from Lowrie Road to the site track has been sealed and caters for road train truck configuration take-off and radii. Trucks leaving the site drive in both directions on Lowrie Road. The site has easy access to South Western Highway as Lowrie Road connects to it approximately 500 m east of the crossover. A traffic impact assessment has been undertaken for the operations (Stantec 2023) (Appendix 11) and the findings are described further in Section 4.10.

Within the property, adequate unsealed access to the individual stages will be established as needed. This will include loading and turnaround facilities for all required plant and vehicles, which will be temporary in nature.

4.10 NUMBER AND SIZE OF TRUCKS

It is expected that several truck configurations will be used to haul material from the extraction site, primarily in gauge semi-trucks and RAV Pocket Road Trains. The traffic assessment (Appendix 11) considered truck configurations of up to 27.5 m long. It was previously estimated that the average number of truck movements would be approximately 10 to 20 per day over the lifetime of the pit. However, the number of truck movements per day will be variable depending on market demand.

During large hauling campaigns the number of trucks could potentially reach a maximum of 75 per day (150 one way trips). In the quiet periods between contracts, no truck movements are expected (as has occurred in the past) and these periods can last for several months. The overall number of trucks over the lifetime of the pit is limited by the finite sand/gravel resource available in the pit. Therefore, the higher the number of trucks per day, the faster the pit will be exhausted and the operations will cease permanently.

Lowrie Road currently has permit status for road train configuration vehicles and forms part of the Shire's regional road network. Cristal Mining Limited hauled mineral sands from their operations via Lowrie Road and South Western Highway to Bunbury Port. Primary industry in the local area also makes use of this route. Furthermore, the existing sand and gravel extraction operations on Lot 393 and Lot 287 use this route.

A traffic impact assessment was undertaken for the site in 2023 by Stantec Australia Pty Ltd (Stantec 2023) that assessed the impact of the development on the adjacent road network and also focused on access arrangements to and from the site (Appendix 11). The analysis was conducted on a maximum scenario of 14 truck movements per hour (seven trucks in and seven out), equating to a maximum of 150 movements over an 11 hour operational day (75 trucks in and out). It was concluded that the existing access to and from site on Lowrie Road is sufficient and the existing Basic right turn and the Auxiliary left turn lanes already in place where Lowrie Road exits onto South Western Highway provide good Safe Intersection Sight Distance, which will significantly reduce the risk of major crashes. Therefore, the additional truck movements in and out of the intersection are less likely to contribute to additional crashes (Appendix 11). It is noted that the assessment was undertaken on a maximum scenario and on average the truck volumes are likely to be much lower than assessed and are unlikely to have a substantial long-term impact on traffic operations and the overall safety of the road network around it.

4.11 OPERATING HOURS

The operating hours of the site are proposed to be limited to between 7 am and 6 pm Monday to Friday and between 7 am to 1 pm on Saturdays, with no operations on Sundays or Public Holidays. The current DA permits operations Monday to Friday and the addition of half day on Saturday is necessary to cater for clients who also operate on Saturdays. There are other extractive sites within Shire that are approved to operate half days on Saturdays and it is also common practice in other local government areas.

4.12 PROPOSED INFRASTRUCTURE

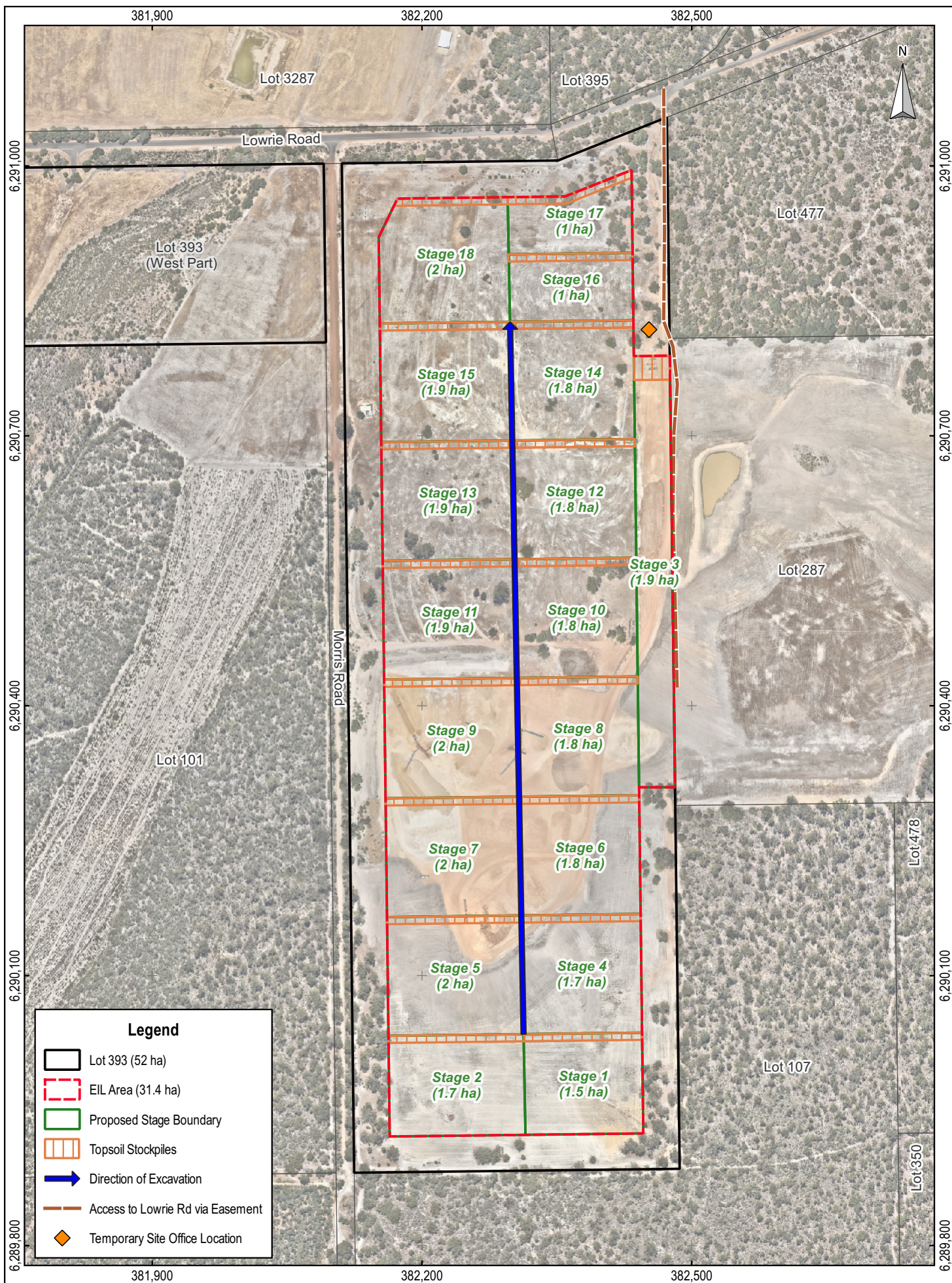
No permanent buildings or other infrastructure are proposed to be constructed on Lot 393. A transportable office and a portable toilet will be located on site (Figure 5).

4.13 PUBLIC DANGER

The site access gate is located at the start of the access track off Lowrie Road and is locked when no personnel are on site. Entry signage is in place and will be maintained, warning the public of potential dangers. Warning signs (no more than 200 m apart) will also be placed along the property boundary. The property is securely fenced.

4.14 SURVEY INFORMATION

Verification of the original survey information by Thompson Surveying is provided in Appendix 6. Further, a copy of the Existing Contour and Feature Plan (Figure 3) including the location of datum peg as requested by the Shire, and this is provided in size A1 in Appendix 7. A copy of the Finished Development Plan (Figure 6) is also provided in size A1 in Appendix 8.



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Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50

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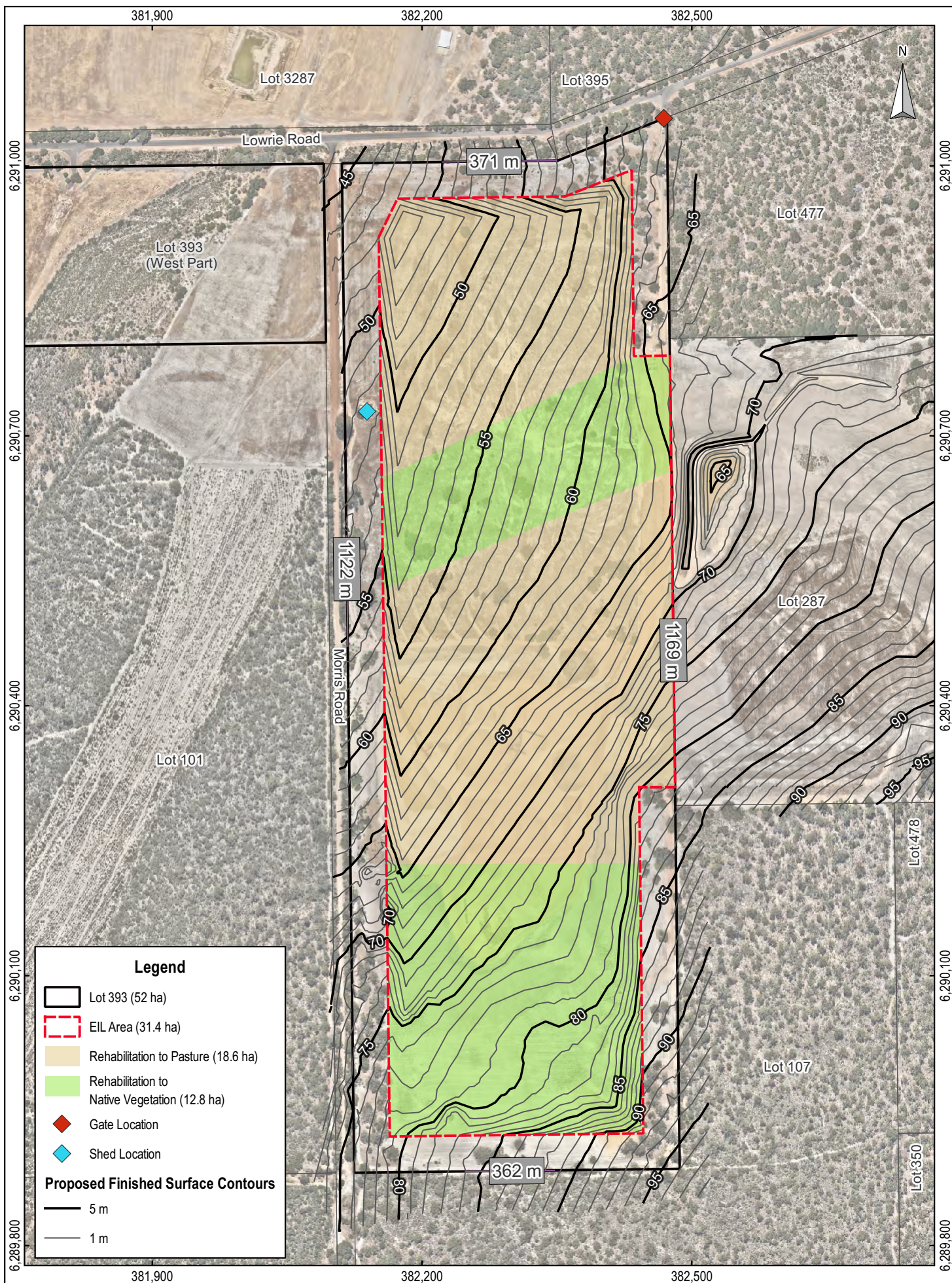
Mario Michele Giacci
Lot 393 Lowrie Road,
Gwindinup

Figure 5

Excavation Works Plan

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Scale: 1: 5,500
 Original Size: A4
 Air Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

0 100 200 m

Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 6

Finished Development Plan

Martinick Bosch Sell Pty Ltd
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 www.mbsenvironmental.com.au

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5. ENVIRONMENTAL MANAGEMENT

5.1 DRAINAGE

Lot 393 shares a Stormwater Management Plan with neighbouring Lot 287 South Western Highway, which allows for appropriate management of stormwater across the combined sites. A revised Stormwater Management Plan (Rev7) is included in this DA/EIL application package (Appendix 9).

5.2 NOISE

A noise assessment was undertaken by Lloyd George Acoustics (2021) for the similar sand and gravel extraction operations on the adjoining property (Lot 287). The assessment found that extractive operations on Lot 287 could be undertaken in compliance with all applicable regulatory requirements subject to appropriate management measures being in place. The operations on Lot 393 are further removed from sensitive receptors than those on Lot 287, with no sensitive premises within 500 m of the operations on Lot 393. Therefore, it is expected that the operations on Lot 393 can be managed so that they remain in compliance with noise regulations. Based on the noise assessment outcomes and recommendations for Lot 287 and onsite observations on Lot 393 so far, a separate Noise Management Plan has been developed (Appendix 12) and will be implemented on Lot 393 to reduce noise at the closest residences.

5.3 DUST

The Dust Management Plan for Lot 393 (Appendix 4) describes potential sources of dust generation and associated management measures. Dust management on the property will include prevention actions, monitoring and mitigation measures, and reporting and complaints procedures.

5.4 HYDROCARBONS AND CHEMICALS

No fuel or lubricant storage will take place on site. A refuelling vehicle, fitted with appropriate spill prevention and mitigation equipment, will visit site as required to refuel on site plant. No major repairs or maintenance will take place on site.

5.5 WEEDS

Weed control will be conducted during the extraction works on an as-needed basis to minimise weed occurrence in the operational and stockpiling areas. In addition to broad spectrum herbicides, weed specific herbicides will be used where appropriate to target broadleaf, grass, geophyte, and woody weeds. Targeted control will be undertaken for any identified pest weed species. Management of weeds is addressed in more detail in the accompanying Weed and Dieback Management Plan (Appendix 10). Weed control will also be undertaken during rehabilitation works as described in the Rehabilitation and Decommissioning Programme (Appendix 5).

5.6 DIEBACK

In November 2017, a dieback assessment (for *Phytophthora cinnamomi*) was undertaken and management measures developed by Bark Environmental (Bark Environmental 2014). Due to high degree of historical disturbance to the site and paucity of native vegetation, the entire Lot 393 was assessed as 'Excluded' (presence or absence of dieback could not be determined). This means that the occurrence of dieback on the property cannot be ruled out. Dieback is known to be present on the adjacent Lot 287. For the purposes of the extractive operations, Lot 393 will be considered dieback affected and the aim of dieback management will be to minimise further spread. Further information on dieback prevention and management is detailed in the Weed and Dieback Management Plan Appendix 10. The Weed and Dieback Management Plan includes the 2017 site assessment and management recommendations from Bark Environmental.

5.7 ABORIGINAL HERITAGE

As detailed in Section 2.9, there are no registered aboriginal heritage sites on the property. Should any potential artifacts or remains be discovered during operations, all works in the vicinity will stop immediately and the matter will be referred to DPLH. If bones are discovered, the police will immediately be advised. The applicant notes that it is an offence to knowingly cause damage to an Aboriginal cultural heritage site under the *Aboriginal Heritage Act 1972*.

5.8 SCREENING OF VISUAL IMPACTS

The majority of the extraction works are screened from public roads or residences in the vicinity due to long separation distances and presence of screening vegetation. The proposal consists of staged extraction and some of the stages are higher in the landscape meaning they may be partly visible, mostly to the west and north. The property is well screened to the south, east, and west by remnant vegetation from non-residential neighbouring properties. Along the northern boundary, a 25 m wide band of vegetation screens operations from Lowrie Road.

The gradual nature of the clearing and rehabilitation measures will ensure that any visual impacts will be as short in duration as possible. Rehabilitation of the extraction area to a mixture of pasture and native vegetation will blend the site into the surrounding landscape.

5.9 REHABILITATION AND DECOMMISSIONING

A Rehabilitation and Decommissioning Programme is included as Appendix 5. The objectives of rehabilitation and decommissioning of the site are as follows:

- Establish stable and safe landform.
- Remove any temporary infrastructure and debris.
- Establish 18.6 ha of pasture as indicated in Figure 6 to cater for future rural use.
- Establish 12.8 ha of native vegetation corridors for wildlife (Figure 6).

The proposed rehabilitation has not changed from what has been previously approved; however, following the granting of the previous DA, the applicant engaged Tranen Revegetation Southwest to develop a Revegetation Implementation Plan (RIP) (included as attachment to Appendix 5). The RIP is in draft format and will be finalised in consultation with the Shire following granting of the DA/EIL.

6. OTHER APPROVALS

The applicant holds a Clearing Permit (CPS 7171/2) for the removal of native vegetation within the approved extraction area on Lot 393 and an Environmental Licence (L9267/2020/1) for the crushing of gravel on both Lot 287 and Lot 393. Abstraction of groundwater, if necessary, will be subject to a licence from DWER.

7. CONCLUSION

Lot 393 provides a valuable sand and gravel resource for the local construction industry. It has an established, active pit with good access to a major regional road and nearby communities. The proposed changes will help provide a more secure supply of sand and gravel at a time of high demand. There is very little remnant native vegetation left within the proposed extraction area and it is in degraded condition, making the site more suitable for extraction than other more densely vegetated sites. The pit will be mostly screened from surrounding areas, with gradual rehabilitation to pasture and native vegetation ensuring the site will blend into the surrounding landscape.

The site is well removed from sensitive premises, with the nearest residence over 500 m away, and specific management plans are in place for noise and dust. Progressive rehabilitation to pasture and native vegetation will ensure that in the long-term the rural character and environmental values of the area is maintained.

The proposed changes to truck numbers and operational hours are not expected to result in any significant additional impacts compared to the currently approved project, rather it is expected that it will increase the utilisation of the available resources with minimal additional impact.

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APPENDICES

APPENDIX 1: CERTIFICATE OF TITLE

WESTERN



AUSTRALIA

REGISTER NUMBER 393/DP159607	
DUPLICATE EDITION 6	DATE DUPLICATE ISSUED 2/7/2015

RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
1215FOLIO
880

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 393 ON DEPOSITED PLAN 159607

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

MARIO MICHELE GIACCI OF 418 DUCANE ROAD, GELORUP

(T N047021) REGISTERED 30 JUNE 2015

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.

* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.

Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1215-880 (393/DP159607).
 PREVIOUS TITLE: This Title.
 PROPERTY STREET ADDRESS: 79 LOWRIE RD, GWINDINUP.
 LOCAL GOVERNMENT AREA: SHIRE OF CAPEL.

NOTE 1: A000001A LAND PARCEL IDENTIFIER OF BOYANUP AGRICULTURAL AREA LOT 393 (OR THE PART THEREOF) ON SUPERSEDED PAPER CERTIFICATE OF TITLE CHANGED TO LOT 393 ON DEPOSITED PLAN 159607 ON 08-MAY-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.

NOTE 2: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE OR ON THE CURRENT EDITION OF DUPLICATE CERTIFICATE OF TITLE.

APPENDIX 2: BLACK COCKATOO HABITAT ASSESSMENT

**Black Cockatoo
Habitat Assessment
of
Proposed Clearing Area
(CPS 7171/1)
Lot 393 - Morris Road**



Gwindinup

December 2016

Version 1

On behalf of:

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SUMMARY

This report details the results of a black cockatoo habitat assessment of a proposed clearing areas (Clearing Application CPS 7171/1) within Lot 393 Morris Road, Gwindinup (the survey area) (Figures 1 and 2).

The landowner (Mr Mario Giacci) has applied for an Area Permit to clear 34.2 hectares of native vegetation within Lot 393 for the purpose of extractive industry (Figure 2).

A preliminary site assessment of the survey area was completed by Department of Environment Regulation (DER) officers on 8 September 2016 and it was concluded that “the application area may contain significant roosting and foraging habitat, and may include nesting hollows, for black cockatoos”. Based on this information, the Department of Parks and Wildlife (DPaW) have requested that a survey is conducted to identify trees with a diameter at breast height of greater than 500 millimetres and trees that may contain suitable nesting hollows for black cockatoos (DER 2016a).

The black cockatoo habitat assessment of the survey area was carried out on the 30 November and 3 December 2016 by Greg Harewood (Zoologist).

The assessment identified 156 trees within the survey area with a DBH of ≥ 50 cm (Figure 3). Most (147 – ~94%) of these trees did not appear to contain hollows of any size or contained apparent hollows that appeared unlikely to be suitable for black cockatoos to use for nesting.

Nine trees (9 – ~6%) appeared to contain hollows possibly large enough for black cockatoos to use for nesting, though this assessment was based on the size of the entrance into an apparent hollow only. Eight of these apparent hollows showed no actual evidence of being used by black cockatoos for nesting (currently or previously), suggesting they have in fact not been used for this purpose.

One tree contained an apparent large hollow with significant rub marks around its entrance. This evidence can be attributed to black cockatoos using the hollow for some purpose, possibly as a “drink” tree (given absence of actual chew marks – a tree where the hollow contains rainwater used by black cockatoos to drink) or possibly for nesting, in the recent past.

The survey area was also found to contain foraging habitat though evidence of use seems low given the paucity of marri trees which are a favoured food source for all three species of black cockatoos. No evidence of black cockatoos roosting within the survey area was found.

It is recommended that this report be forward to the DER/DPaW for review so as to allow for the assessment of the clearing permit application to proceed.

Based on their comments and as indicated in their recent letter (DER 2016a) it may be necessary to provide information on how the proposed activity will be carried out to avoid or minimise the potential impacts on the black cockatoo habitat identified, if it is assessed as likely to be significant. Once the proposal is finalised it may also be necessary to refer it to the

federal DoTEE for assessment under the *Environment Protection and Biodiversity Conservation Act 1999* with respect to impact on black cockatoo habitat.

The following recommendations are provided for consideration during ongoing planning. This listing is not exhaustive and management actions should be finalised after liaison with relevant regulatory authorities.

- Future planning for the proposed development should aim to minimise the need to clear areas of native vegetation as much as reasonable and practicable so as to reduce potential impacts and therefore simplify the approval process.
- Consideration should be given to modifying the application area to avoid some or all those trees identified as having large hollows possibly suitable for black cockatoos and in particular the tree containing a hollow observed to be in recent or current use by black cockatoos (Figure 3).
- In addition to any fauna management requirements which may form part of the clearing permit when/if granted by the DER, it is recommended that a suitably qualified “fauna specialist” (or “fauna spotter”) be present during clearing operations to supervise any animal handling and the capture of injured fauna if required with particular attention being paid to the potential hollow bearing trees identified during this assessment.
- All hollow bearing trees should be felled, if possible, in a manner that minimises the chance of any fauna species inhabiting the hollows being injured or killed. This should include felling trees in a direction where hollow entrances are facing upwards and pushing trees over as slow as possible.
- Hollows within felled trees should be examined for fauna species immediately after felling and any animals captured should be relocated to nearby retained habitat.
- If possible, clearing should be undertaken to avoid the breeding season of black cockatoos. The breeding season for the three black cockatoo species generally occurs between July and February (which includes an incubation period of ~29 days and a nesting period of ~70 to ~75 days).
- It is however possible for breeding to take place outside of this period and therefore, irrespective of when clearing is undertaken, and within a week prior to clearing commencing identified tree hollows should be inspected for evidence of black cockatoo breeding activity and the appropriate action taken.
- Any proposed re-vegetation and rehabilitation strategies should utilise a high percentage of local, dieback resistant native species commonly used by black cockatoos. In this instance, it is recommended that marri (*Corymbia calophylla*) be the main species. Peppermint (*Agonis flexuosa*) trees should also be considered given that western ringtail possums area, known to persist in nearby areas and will benefit from additional planting in this area where currently habitat is generally very

marginal. Plantings should be at a density that ultimately creates canopy connectivity between trees.

- Once all facets of the proposal to clear vegetation from the site are finalised and agreeable to the DER, consideration should also be given to referring the proposal to the DotEE to ensure compliance with the *EPBC Act*.

1. INTRODUCTION

This report details the results of a black cockatoo habitat assessment of a proposed clearing areas (Clearing Application CPS 7171/1) within Lot 393 Morris Road, Gwindinup (the survey area) (Figures 1 and 2).

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2. SCOPE OF WORKS

To comply with DPaW’s request the scope of works has been defined as:

1. Carry out a black cockatoo habitat assessment (habitat trees, existing and potential nest hollows, foraging and roosting habitat) of trees within the proposed clearing area; and
2. Provide a report summarising results.

Note: For the purposes of this proposal the term “black cockatoo” is in reference to Baudin’s black cockatoo *Calyptorhynchus baudinii*, Carnaby’s black cockatoo *Calyptorhynchus latirostris* and the forest red-tailed black cockatoo *Calyptorhynchus banksii naso*.

3. METHODS

3.1 FAUNA HABITATS

The vegetation communities, soils and landforms observed during the site reconnaissance survey have been used as the basis for a classification of the survey area into broad fauna habitat types.

3.2 BLACK COCKATOO HABITAT ASSESSMENT

The following methods were employed to comply with the defined scope of works and are based on guidelines published by the federal Department of the Environment and Energy

(DotEE) (SEWPaC 2012) which states that surveys for Carnaby's, Baudin's and forest red-tailed black cockatoo habitat should:

- be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken;
- maximise the chance of detecting the species' habitat and/or signs of use;
- determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km);
- account for uncertainty and error (false presence and absences); and
- include collation of existing data on known locations of breeding and feeding birds and night roost locations.

Habitat used by black cockatoos have been placed into three categories by the DotEE (SEWPaC 2012) these being:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

So as to comply with the requested scope of works and in line with the published guidelines, the black cockatoo habitat assessment has included a daytime reconnaissance survey of the site (carried out on the 30 November and 3 December 2016 by Greg Harewood (Zoologist)) and a review of available literature utilising the following methods.

3.2.1 Black Cockatoo Breeding Habitat

The black cockatoo breeding habitat assessment has involved the identification of all suitable breeding trees species within the survey area that have a Diameter at Breast Height (DBH) of equal to or over 50cm. The DBH of each tree was estimated using a pre-made 50 cm "caliper".

Target tree species included marri and jarrah and any other *Corymbia/Eucalyptus* species of a suitable size that are present. Peppermints, *banksia*, sheoak and melaleuca tree species (for example) were not be assessed as they typically do not develop hollows that are used by black cockatoos. Non-endemic, planted trees were also not assessed (i.e. blue-gums), as these also do not typically develop hollows that are then used by black cockatoos.

The location of each tree identified as being over the threshold DBH was recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees observed to contain hollows (of any size/type) were marked with "H" using spray paint.

Potential hollows were placed into one of four categories, based on the size of the apparent hollow entrance, these being:

- Small = $\sim < 5\text{cm}$ diameter (i.e. entrance too small for a black cockatoo);
- Medium = $\sim 5\text{cm}-10\text{cm}$ diameter (i.e. entrance too small for a black cockatoo);
- Large = $\sim > 10\text{cm}$ diameter (entrance large enough for a black cockatoo but possible hollow appears to be unsuitable for nesting i.e. wrong orientation, too small, too low or too shallow); or
- Large (cockatoo) = $\sim > 10\text{cm}$ diameter (entrance appears big enough to provide access to a possible hollow that may be suitable for a black cockatoo to use for nesting).

Based on this assessment trees present within the survey area have then been placed into one of four categories:

- Tree $< 50\text{cm}$ DBH or an unsuitable species (not assessed/recorded);
- Tree $\geq 50\text{cm}$ DBH, no hollows seen;
- Tree $\geq 50\text{cm}$ DBH, one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree $\geq 50\text{cm}$ DBH, one or more hollows seen, with at least one considered suitable for black cockatoos to use for nesting.

For the purposes of this study a tree containing a potential cockatoo nest hollow has been defined as:

Generally, any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for occupation by black cockatoo for the purpose of nesting/breeding. Hollows that had an entrance greater than about 10cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk, was recorded as a “potential nest hollow”.

Identified hollows were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches).

A review of available literature will be carried out to determine the location/extent of any known/likely black cockatoo breeding habitat areas in the vicinity of the survey area.

3.2.2 Black Cockatoo Foraging Habitat

The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around base of trees) observed during the field survey was recorded. The nature and extent of potential foraging habitat present was also documented irrespective of the presence of any actual foraging evidence.

A review of available literature was carried out to determine the location/extent of any known/likely black cockatoo foraging habitat areas in the vicinity of the survey area.

3.2.3 Black Cockatoo Roosting Habitat

Direct and indirect evidence of black cockatoos roosting within trees on site was noted if observed (e.g. branch clippings, droppings or moulted feathers).

A review of available literature was also carried out to determine the location/extent of any known/likely black cockatoo roosting habitat areas in the vicinity of the survey area.

4. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. It should also be recognised that site conditions can change with time.

During the black cockatoo habitat survey trees with hollows were searched for. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

5. RESULTS

5.1 FAUNA HABITATS

Descriptions and examples images of the fauna habitats/dominant vegetation types present within the subject site are provided in Table 1. The density and extent of the remnant vegetation present can also be seen in Figure 2.

In general terms the fauna habitats present are all highly degraded, a consequence of historical clearing, presumably several decades ago, followed by livestock grazing and then

the planting of plantation timber. There is also evidence of some previous small scale gravel/sand extraction.

Remnant native vegetation within the survey area is now represented by scattered trees of various species amongst blue-gums over a sparse groundcover of introduced grasses/weeds. There is little or no native understory is now present. Many of the native trees present are relatively small in size, suggesting they are regrowth from the historical clearing event.

Table 1: Example Images of the Fauna Habitats within the Survey Area

Fauna Habitat Description	Example Image
<u>Totally Cleared</u> Almost completely cleared areas with only a small number of scattered trees. Groundcover is dominated by sparse pasture grasses/weeds.	
<u>Bluegum Plantation</u> Bluegums are the most common tree species and are present in various densities across almost the entire survey area. They are densest in the northern half of the property where native trees (mostly jarrah) are absent or present as widely scattered specimens only. In the south bluegums are represented by more scattered individuals, with native trees being more common. Groundcover is dominated by pasture grasses/weeds.	

Fauna Habitat Description	Example Image
<u>Jarrah (and Marri) Open Woodland</u> Jarrah and a small number of marri trees are present in most vegetated areas to some degree but are most common in the southern half of the property where they form a sparse open woodland. Also present are scattered woody pear trees and occasional bluegums. Peppermint and WA Christmas trees are represented by only a few specimens. Groundcover is dominated by pasture grasses/weeds.	

Overall the fauna biodiversity likely within the subject site would be very low, however given the presence of woodland vegetation and trees with hollows, the remnants still have value for some fauna species able to persist in degraded habitats of this type. Most of the fauna species likely to be present would however be common, widespread species (mainly birds), with a few exceptions (e.g. black cockatoos).

5.2 BLACK COCKATOO HABITAT ASSESSMENT

5.2.1 Black Cockatoo Breeding Habitat

Trees considered potentially suitable for black cockatoos to use as nesting habitat (using DotEE criteria - SEWPaC 2012, but ultimately subject to a suitable hollow being present or developing and a range of other factors) which were found within the survey area comprised the following species:

- Jarrah - *Eucalyptus marginata*;
- Marri – *Corymbia calophylla*; and
- Dead unidentified species.

It should be noted that the likelihood of particular tree species developing hollows suitable for black cockatoos to use for breeding varies considerably. For example available data suggests that jarrah (*Eucalyptus marginata*) rarely produces hollows large enough for black cockatoos. As an example, Kirkby (2009) reports that from a database of 109 confirmed black cockatoo nest trees throughout the jarrah forest only six were located in jarrah trees.

A summary of the “black cockatoo habitat” trees observed within the survey area is provided in Table 1 below. The location of each habitat tree recorded is shown in Figure 3.

Table 1: Summary of Potential Black Cockatoo Habitat Trees (DBH $\geq$ 50cm) within the Survey Area

Total Number of Habitat Trees	Number of Trees with <u>No Hollows</u> Observed	Number of Trees with Hollows Considered <u>Unsuitable</u> for Nesting Black Cockatoos	Number of Trees with Hollows Considered <u>Possibly Suitable</u> for Nesting Black Cockatoos	Tree Species		
				Jarrah	Marri	Dead Unidentified
156	89	58	9	140	10	6

The assessment identified 156 trees within the survey area with a DBH of $\geq$ 50cm. Most (89 – ~57%) of these trees did not appear to contain hollows of any size. Fifty-eight trees (~37%) were assessed as possibly having hollows, but of a size too small for black cockatoos to utilise. Nine trees (9 – ~6%) appeared to contain hollows possibly large enough for black cockatoos to use for nesting, though this assessment was based on the size of the entrance into an apparent hollow only. Eight of these apparent hollows showed no actual evidence of being used by black cockatoos for nesting (currently or previously), suggesting they have in fact not been used for this purpose.

One tree contained an apparent large hollow with significant rub marks around its entrance. This evidence can be attributed to black cockatoos using the hollow for some purpose, possibly as a “drink” tree (given absence of actual chew marks – a tree where the hollow contains rainwater used by black cockatoos to drink) or possibly for nesting in the recent past.

Additional details of each tree can be found in Appendix A.

A review of available data revealed no documented breeding records from the vicinity of the subject site (i.e. within 10km). The subject site does however fall within the mapped breeding range of Carnaby’s black-cockatoo as depicted in the most current recovery plan produced by DPaW (Figure 2 - DEC 2012).

The corresponding DPaW recovery plan for Baudin’s and the forest red-tailed black-cockatoo (DEC 2007) does not specifically define any known breeding areas for either species. Johnstone and Kirkby (2011) also do not specifically mention breeding areas of either species within the area though both are noted as utilising marri trees (and other tree species) for breeding in the south west.

While no breeding data appears to exist for the general area this could simply be a consequence of a lack of survey work or a lack of publicly available data. Based on available vegetation mapping it is however estimated that there is approximately 15,100 ha of native

vegetation within 10 km the survey area. Given this fact, there is significant potential for breeding to take place in the wider area (assuming the presence of suitable trees).

5.2.2 Black Cockatoo Foraging Habitat

Following is a list of the flora species recorded within the survey area that are known to be used as a food source by one or more species of black cockatoo:

- Jarrah - *Eucalyptus marginata*;
- Marri - *Corymbia calophylla*; and
- Common Grass Tree - *Xanthorrhoea preissii* (only a few specimens present).

It should be noted that the degree to which black cockatoos feed on these respective plant species varies. Marri, for example, is the most favoured food source for all three species of black cockatoo in this area of their range. Marri is, compared to jarrah relatively rare in the survey area. Other plant species such as the common grass tree would make up only a small proportion of any one birds diet and in the case of some species are not foraged upon at all.

Very little evidence of black cockatoos foraging within the survey area was observed during the field assessment. The only evidence seen was all in the form of a small amount of chewed marri fruits at one location. Based on the marks left on the fruit body this activity was attributed to Baudin's black-cockatoo.

Based on available vegetation mapping it is estimated that there is approximately 15,100 ha of native vegetation within 10 km the survey area (~44% of total area), much of which is very likely to represent potential black cockatoo foraging habitat of some type. It is not possible to accurately calculate the actual extent of foraging habitat within the proposed clearing area itself given it is mainly comprised of scattered, individual trees.

5.2.3 Black Cockatoo Roosting Habitat

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

A review of available data shows one documented roost site just east of the survey area (DoP 2011), though as with breeding habitat the lack of records could simply be a consequence of a lack of survey work or a lack of publicly available data. Given the relatively large extent of remnant vegetation still present within 10km of the survey area (~15,100 ha) there is likely to be numerous roosting opportunities present in the general vicinity.

6. CONCLUSION & RECOMMENDATIONS

The assessment reported on here was primarily undertaken to identify trees with a diameter at breast height of greater than 50cm and trees that may contain suitable nesting hollows for black cockatoos within the survey area, as requested by DPaW.

The assessment identified 156 trees within the survey area with a DBH of ≥ 50 cm (Figure 3). Most (147 – ~94%) of these trees did not appear to contain hollows of any size or contained apparent hollows that appeared unlikely to be suitable for black cockatoos to use for nesting.

Nine trees (9 – ~6%) appeared to contain hollows possibly large enough for black cockatoos to use for nesting, though this assessment was based on the size of the entrance into an apparent hollow only. Eight of these apparent hollows showed no actual evidence of being used by black cockatoos for nesting (currently or previously), suggesting they have in fact not been used for this purpose.

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The survey area was also found to contain foraging habitat though evidence of use seems low given the paucity of marri trees which are a favoured food source for all three species of black cockatoos. No evidence of black cockatoos roosting within the survey area was found.

It is recommended that this report be forward to the DER/DPaW for review so as to allow for the assessment of the clearing permit application to proceed.

Based on their comments and as indicated in their recent letter (DER 2016a) it may be necessary to provide information on how the proposed activity will be carried out to avoid or minimise the potential impacts on the black cockatoo habitat identified, if it is assessed as likely to be significant. Once the proposal is finalised it may also be necessary to refer it to the federal DoTEE for assessment under the *Environment Protection and Biodiversity Conservation Act 1999* with respect to impact on black cockatoo habitat.

The following recommendations are provided for consideration during ongoing planning. This listing is not exhaustive and management actions should be finalised after liaison with relevant regulatory authorities.

- Future planning for the proposed development should aim to minimise the need to clear areas of native vegetation as much as reasonable and practicable so as to reduce potential impacts and therefore simplify the approval process.
- Consideration should be given to modifying the application area to avoid some or all those trees identified as having large hollows possibly suitable for black cockatoos

and in particular the tree containing a hollow observed to be in recent or current use by black cockatoos (Figure 3).

- In addition to any fauna management requirements which may form part of the clearing permit when/if granted by the DER, it is recommended that a suitably qualified “fauna specialist” (or “fauna spotter”) be present during clearing operations to supervise any animal handling and the capture of injured fauna if required with particular attention being paid to the potential hollow bearing trees identified during this assessment.
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- Once all facets of the proposal to clear vegetation from the site are finalised and agreeable to the DER, consideration should also be given to referring the proposal to the DotEE to ensure compliance with the *EPBC Act*.

7. REFERENCES

Department of Environment and Conservation (DEC) (2007). Forest Black Cockatoo (Baudin's Cockatoo - *Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan. Department of Environment and Conservation, Perth, Western Australia.

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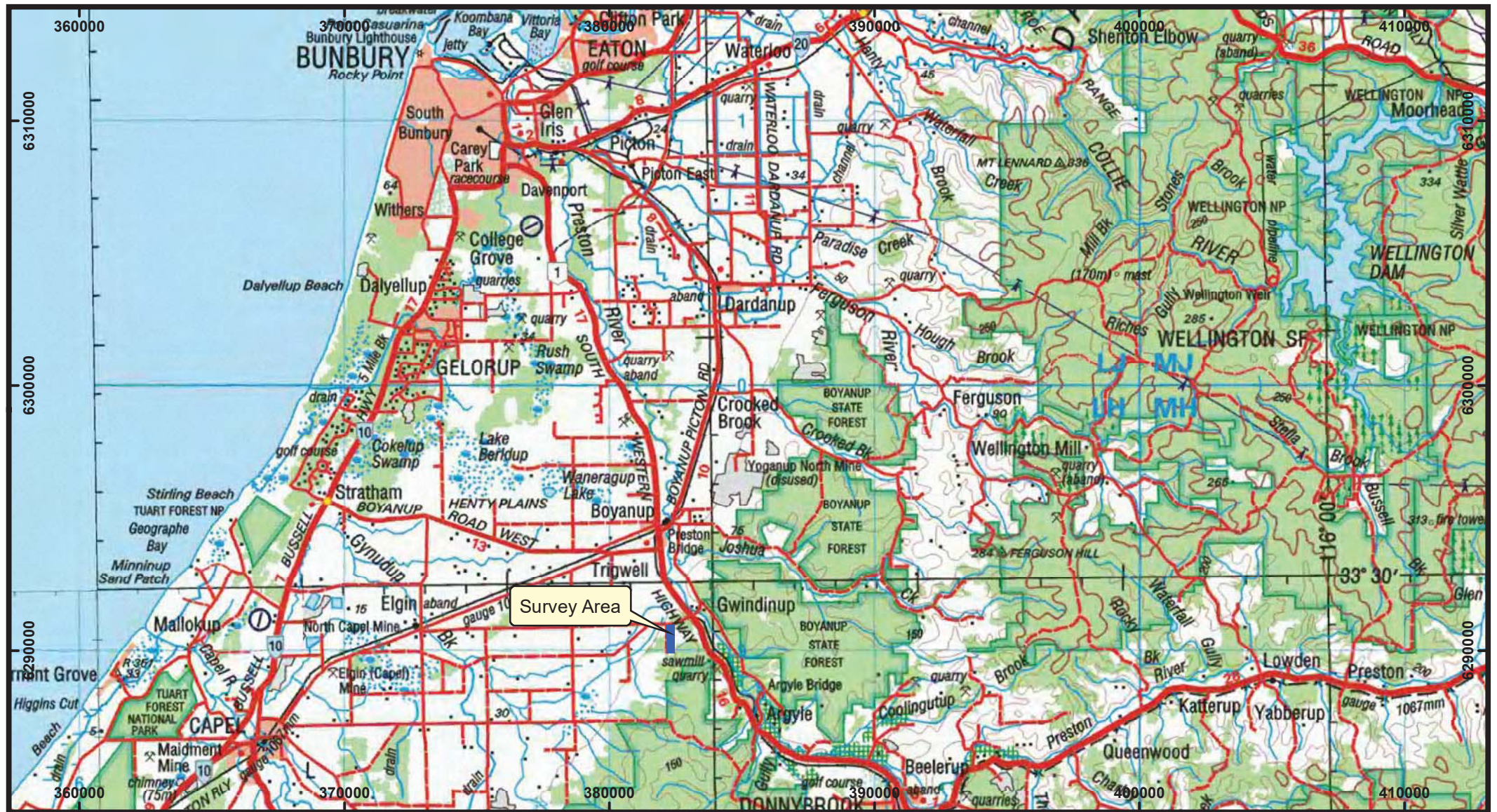
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Johnstone, R. E. & Kirkby, T. (2011). Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes. Report for the Department of Planning, Western Australia.

Kirkby, T. (2009). Results of Black Cockatoo Survey at Lot 2 Dawesville. Unpublished report for WA Limestone.

FIGURES



Legend

 Survey Area



0 5 10 15 20
Kilometres



Drawn: G. Harewood
Date: Dec 2016
Scale: 1:200,000

Projection/Coordinate System: UTM/MGA Zone 50

Lot 393 Gwindinup
(CPS 7171/1)

Survey Area & Surrounds

Figure: 1



Legend

- Lot 393 Boundary
- CPS 717/1 Clearing Area



0 50 100 150 200
Metres



Drawn: G. Harewood

Date: Dec 2016

Scale: 1:5,000

Projection/Coordinate System: UTM/MGA Zone 50

Lot 393 Gwindinup
(CPS 7171/1)

Air Photo

Figure: 2



Legend

- Lot 393 Boundary
- CPS 717/1 Clearing Area

- Habitat Tree - One or more large hollows possibly suitable for black cockatoos
- Habitat Tree - One or more possible small/medium hollows
- Habitat Tree - No hollows seen



Lot 393 Gwindinup
(CPS 7171/1)

**Habitat Trees
(DBH $\geq$ 50cm)**

Projection/Coordinate System: UTM/MGA Zone 50

Figure: 3

APPENDIX A

HABITAT TREE DETAILS

Habitat Trees (DBH $\geq$ 50cm)
Datum - GDA94

Waypoint Number	Zone	mE	mN	Tree Species	DBH (cm)	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001	50H	382212	6290526	Jarrah	>50	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt002	50H	382289	6290520	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Fissure between two trunks
wpt003	50H	382324	6290481	Dead Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt004	50H	382323	6290462	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Large low shallow spout
wpt005	50H	382334	6290462	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt006	50H	382316	6290438	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt007	50H	382312	6290439	Dead Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt008	50H	382323	6290432	Dead Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt009	50H	382316	6290423	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt010	50H	382345	6290427	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt011	50H	382342	6290434	Dead Unknown	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Large low shallow spout
wpt012	50H	382363	6290488	Dead Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt013	50H	382417	6290488	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt014	50H	382435	6290486	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt015	50H	382438	6290496	Dead Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt016	50H	382461	6290492	Dead Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt017	50H	382465	6290512	Dead Unknown	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt018	50H	382403	6290508	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt019	50H	382400	6290503	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt020	50H	382401	6290516	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt021	50H	382391	6290537	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt022	50H	382392	6290550	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt023	50H	382416	6290551	Jarrah	>50	20+	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt024	50H	382424	6290553	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt025	50H	382410	6290696	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt026	50H	382456	6290711	Jarrah	>50	15-20	2+	Small-Large	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt027	50H	382458	6290749	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt028	50H	382443	6290765	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt029	50H	382424	6290759	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt030	50H	382424	6290768	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt031	50H	382438	6290802	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt032	50H	382456	6290811	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt033	50H	382456	6290830	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt034	50H	382452	6290844	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt035	50H	382439	6290845	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt036	50H	382458	6290863	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt037	50H	382435	6290897	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt038	50H	382451	6290893	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt039	50H	382426	6290908	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt040	50H	382418	6290927	Jarrah	>50	10-15	0		No Signs	No Signs	No	
wpt041	50H	382440	6290935	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt042	50H	382442	6290936	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt043	50H	382363	6290967	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt044	50H	382358	6290959	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt045	50H	382352	6290955	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt046	50H	382344	6290958	Jarrah	>50	10-15	0		No Signs	No Signs	No	
wpt047	50H	382345	6290967	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt048	50H	382340	6290969	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt049	50H	382350	6290967	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt050	50H	382345	6290737	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt051	50H	382315	6290642	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt052	50H	382316	6290642	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt053	50H	382311	6290643	Jarrah	>50	20+	1	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt054	50H	382310	6290644	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt055	50H	382309	6290652	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt056	50H	382310	6290646	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt057	50H	382316	6290570	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt058	50H	382269	6290624	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt059	50H	382236	6290630	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt060	50H	382231	6290630	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt061	50H	382205	6290705	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt062	50H	382204	6290573	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt063	50H	382199	6290574	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt064	50H	382188	6290578	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt065	50H	382204	6290338	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt066	50H	382183	6290237	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt067	50H	382212	6290199	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt068	50H	382222	6290179	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt069	50H	382226	6290177	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt070	50H	382226	6290183	Dead Unknown	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt071	50H	382174	6290122	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt072	50H	382172	6290110	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt073	50H	382211	6290094	Jarrah	>50	20+	1	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt074	50H	382161	6290029	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt075	50H	382158	6290027	Marri	>50	20+	0		No Signs	No Signs	No	
wpt076	50H	382172	6290016	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt077	50H	382169	6290021	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt078	50H	382173	6289989	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt079	50H	382165	6289990	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt080	50H	382176	6289984	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt081	50H	382175	6289972	Dead Unknown	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt082	50H	382167	6289968	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt083	50H	382160	6289932	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt084	50H	382207	6289970	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt085	50H	382265	6289969	Dead Unknown	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown

Waypoint Number	Zone	mE	mN	Tree Species	DBH (cm)	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt086	50H	382272	6289899	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt087	50H	382313	6289918	Jarrah	>50	15-20	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Possibly too low/shallow
wpt088	50H	382328	6289955	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt089	50H	382334	6289947	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt090	50H	382338	6289952	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt091	50H	382414	6289946	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt092	50H	382440	6289935	Jarrah	>50	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt093	50H	382446	6289920	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt094	50H	382441	6289909	Marri	>50	20+	0		No Signs	No Signs	No	
wpt095	50H	382432	6289909	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt096	50H	382458	6289901	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt097	50H	382457	6289917	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt098	50H	382459	6289946	Jarrah	>50	20+	1	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt099	50H	382466	6289948	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt100	50H	382456	6289957	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt101	50H	382460	6289970	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt102	50H	382469	6289985	Jarrah	>50	20+	2+	Small-Large	No Signs	No Signs	No	Too low/shallow
wpt103	50H	382454	6289984	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt104	50H	382442	6289989	Marri	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt105	50H	382425	6289987	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt106	50H	382443	6290049	Jarrah	>50	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt107	50H	382470	6290065	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt108	50H	382418	6290116	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt109	50H	382426	6290144	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt110	50H	382414	6290151	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt111	50H	382391	6290170	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt112	50H	382394	6290174	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt113	50H	382407	6290179	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt114	50H	382394	6290205	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt115	50H	382404	6290231	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt116	50H	382433	6290232	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt117	50H	382461	6290225	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt118	50H	382466	6290236	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt119	50H	382464	6290302	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt120	50H	382400	6290273	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt121	50H	382396	6290288	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt122	50H	382378	6290258	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt123	50H	382371	6290257	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt124	50H	382365	6290264	Jarrah	>50	20+	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt125	50H	382353	6290240	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt126	50H	382344	6290254	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt127	50H	382319	6290296	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt128	50H	382304	6290288	Jarrah	>50	20+	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt129	50H	382303	6290354	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt130	50H	382239	6290406	Jarrah	>50	20+	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt131	50H	382237	6290423	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt132	50H	382225	6290435	Dead Unknown	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt133	50H	382324	6290224	Jarrah	>50	15-20	1	Small	Bees	No Signs	No	Internal dimensions of hollows unknown
wpt134	50H	382335	6290201	Jarrah	>50	20+	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt135	50H	382330	6290127	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt136	50H	382306	6290119	Marri	>50	20+	0		No Signs	No Signs	No	
wpt137	50H	382298	6290109	Jarrah	>50	20+	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt138	50H	382291	6290097	Jarrah	>50	15-20	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt139	50H	382259	6290121	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt140	50H	382251	6290135	Jarrah	>50	15-20	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt141	50H	382259	6290104	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt142	50H	382264	6290095	Jarrah	>50	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt143	50H	382242	6290088	Jarrah	>50	15-20	1	Small	Bees	No Signs	No	Internal dimensions of hollows unknown
wpt144	50H	382227	6290075	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt145	50H	382202	6290043	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt146	50H	382228	6290022	Marri	>50	20+	2+	Small-Large (cockatoo)	No Signs	Cockatoos	Yes	Rub marks - "drink" tree?
wpt147	50H	382293	6290051	Jarrah	>50	15-20	1	Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt148	50H	382351	6290013	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt149	50H	382381	6290029	Marri	>50	20+	0		No Signs	No Signs	No	
wpt150	50H	382398	6290024	Jarrah	>50	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt151	50H	382407	6290075	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt152	50H	382349	6290108	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt153	50H	382359	6290205	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt154	50H	382368	6290203	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt155	50H	382361	6290207	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt156	50H	382361	6290216	Jarrah	>50	20+	0		No Signs	No Signs	No	

DISCLAIMER

This fauna assessment report (“the report”) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood (“the Author”). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

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The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

APPENDIX 3: HERITAGE SEARCH

Search Criteria

No Aboriginal Cultural Heritage (ACH) Register in Custom search area - Line with 1m buffer - 115.730555982632°E, 33.51388628741°S (GDA94) : 115.733195276302°E, 33.51388628741°S (GDA94) : 115.734418363613°E, 33.513492698206°S (GDA94) : 115.734547109646°E, 33.5241547547376°S (GDA94) : 115.730577440304°E, 33.5242263077243°S (GDA94) : 115.730555982632°E, 33.5138683970305°S (GDA94) : 115.730555982632°E, 33.5139041777859°S (GDA94)

Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the *Aboriginal Heritage Act 1972*.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via <https://achknowledge.dplh.wa.gov.au/ach-enquiry-form> and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land **within or adjacent to** the following Indigenous Land Use Agreement(s): Gnaala Karla Booja Indigenous Land Use Agreement.

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The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DEMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at <https://www.wa.gov.au/organisation/departments/departments-of-the-premier-and-cabinet/south-west-native-title-settlement>.

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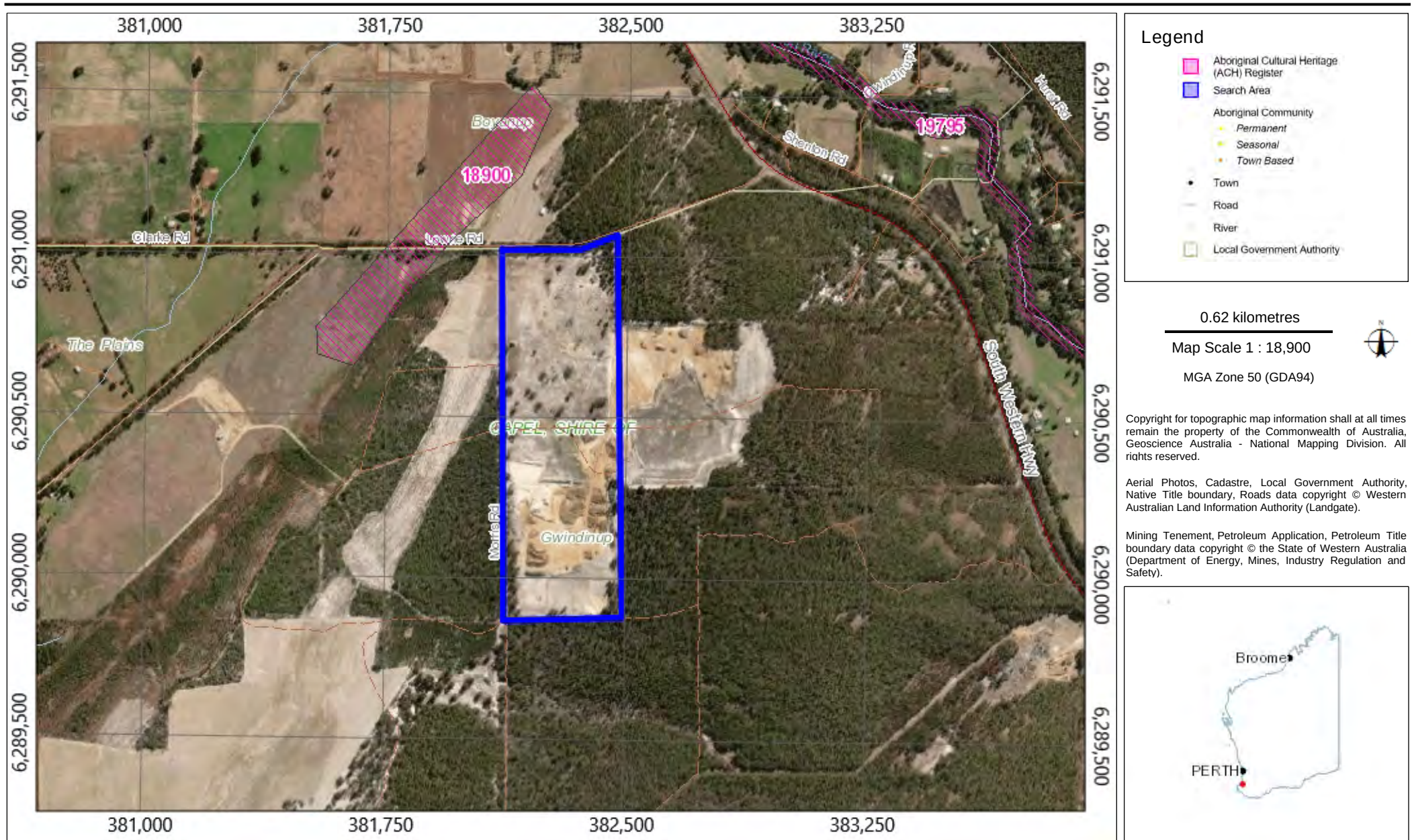
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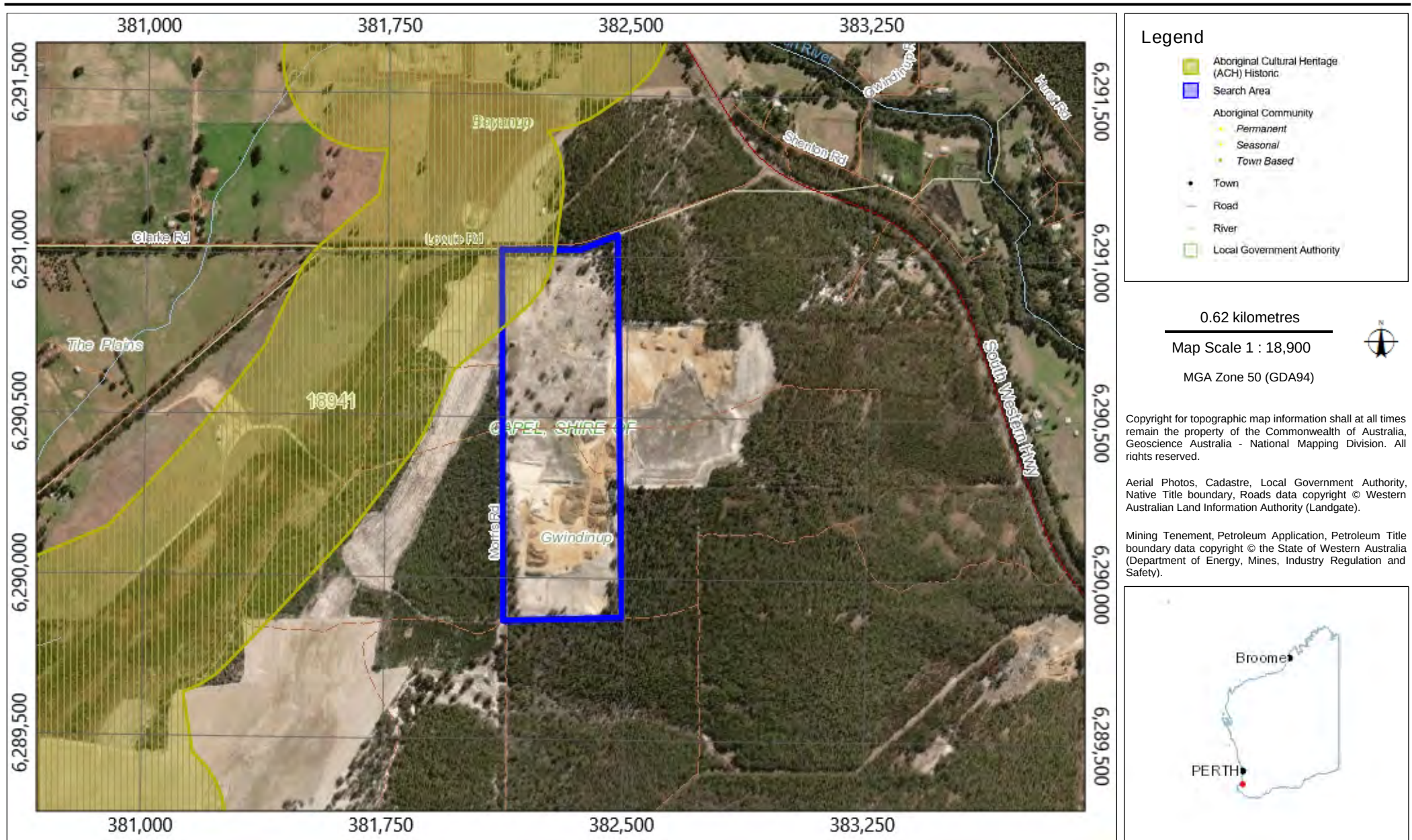
ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
18941	Gynudup Brook Ephemeral Creeks	No	Yes	No	No Gender / Initiation Restrictions	Historic	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	



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APPENDIX 4: DUST MANAGEMENT PLAN

DUST MANAGEMENT PLAN

LOT 393 LOWRIE ROAD, GWINDINUP

PREPARED FOR:

MARIO MICHELE GIACCI

MARCH 2024

PREPARED BY:

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LOT 393 LOWRIE ROAD, GWINDINUP DUST MANAGEMENT PLAN

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- Appendix 1: Wind Roses
- Appendix 2: Risk Assessment
- Appendix 3: Dust Complaint Form

1. INTRODUCTION

1.1 PURPOSE

Mario Michele Giacci (the applicant) has an existing Development Approval (DA) and Extractive Industry Licence (EIL) for the extraction of sand and gravel on Lot 393 Lowrie Road, Gwindinup (the property) within the Shire of Capel (Figure 1). This Dust Management Plan (DMP) has been prepared for the purposes of a 2023 DA/EIL application and replaces all previously submitted DMPs.

This DMP was prepared in accordance with the Department of Environment and Conservation's (DEC — now Department of Water and Environmental Regulation) *"A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities"* (DEC 2011). This DMP should be read in conjunction with the DA and EIL report.

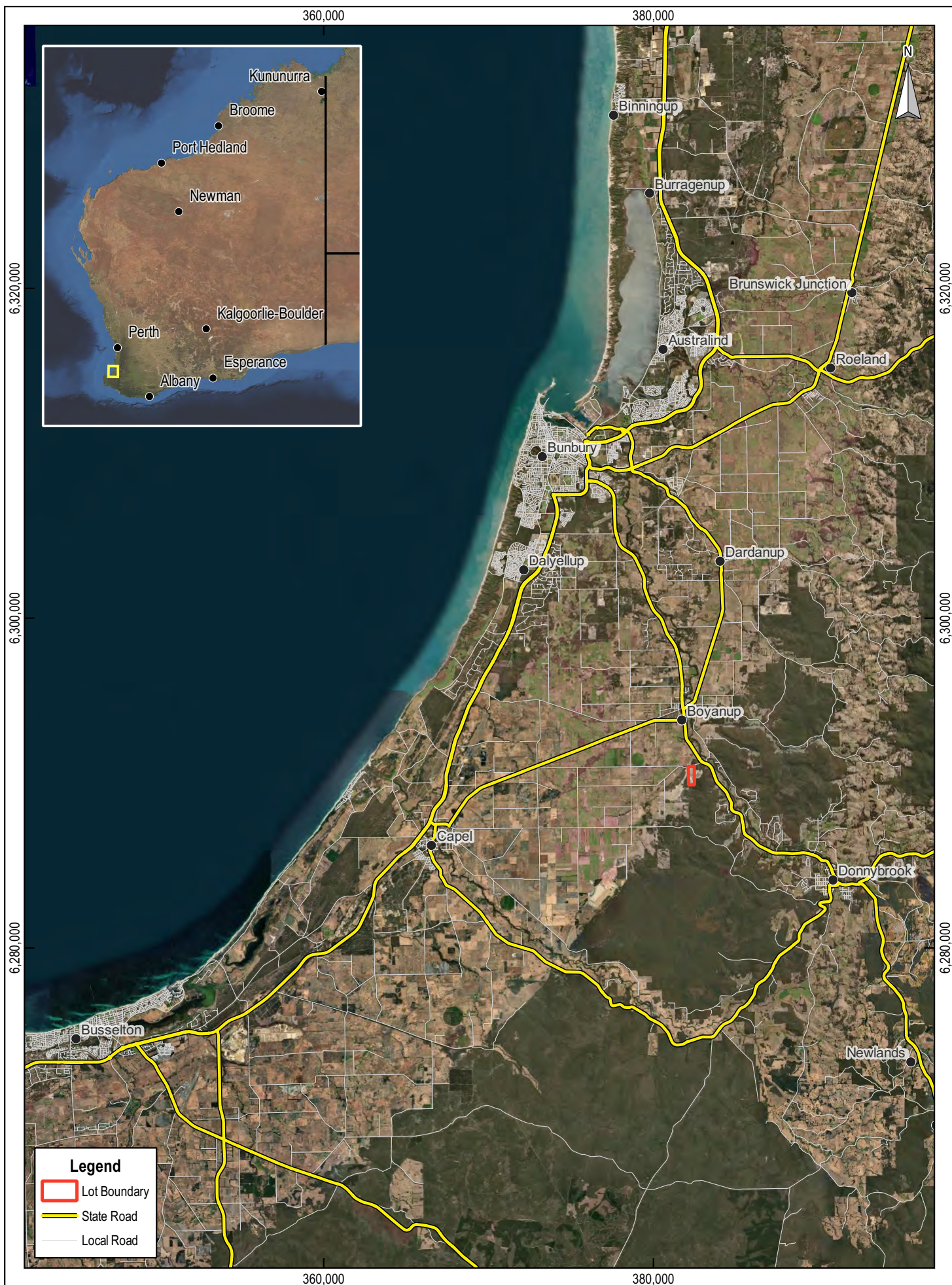
1.2 SCOPE

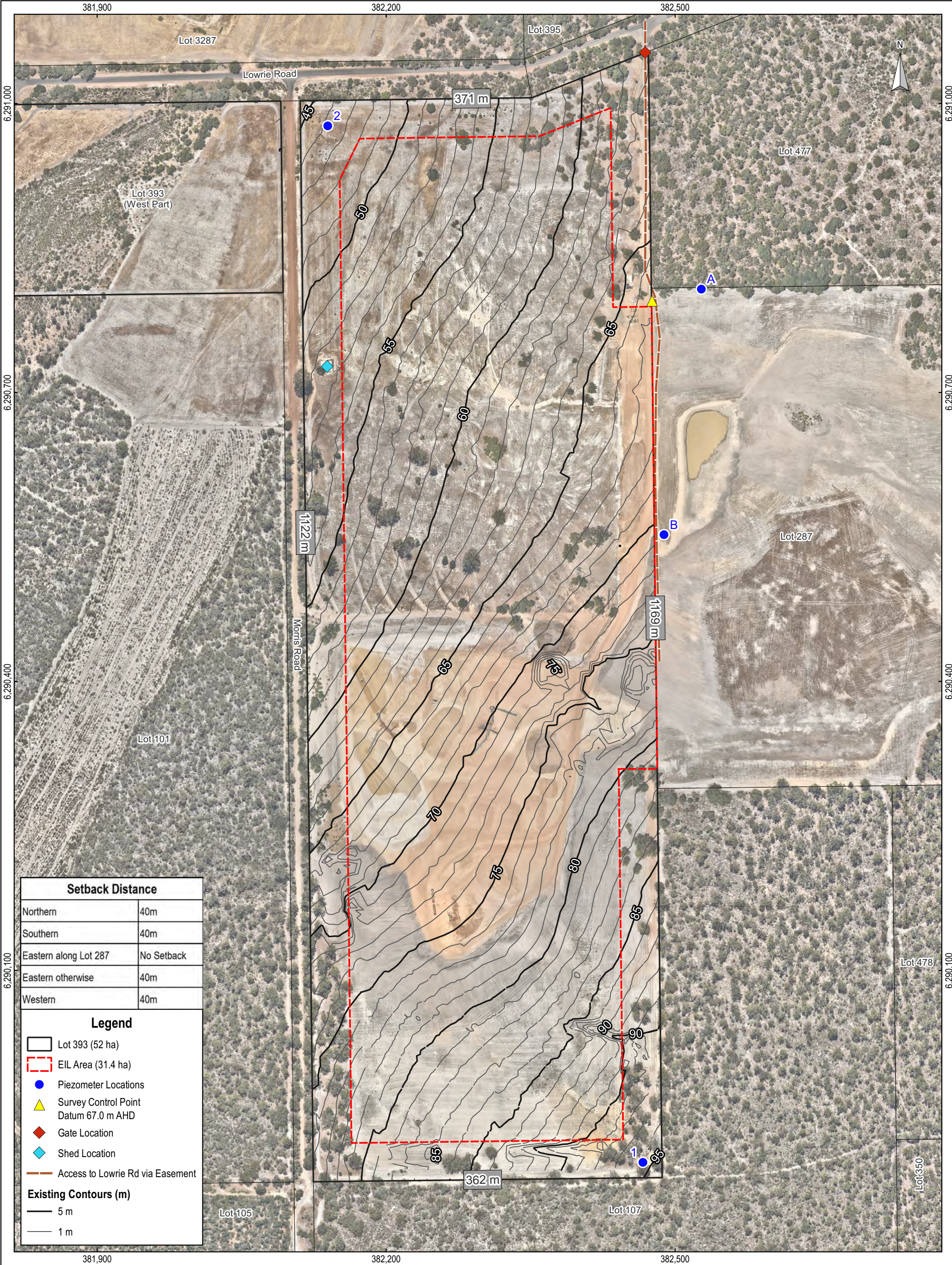
The scope of this DMP includes the following:

- Description of the existing environment and identification of sensitive receptors.
- Identification of potential sources of dust associated with the operations.
- Identification of roles and responsibilities.
- A site risk assessment for dust.
- Description of appropriate dust prevention, monitoring, and mitigation measures.
- A dust complaints process.

1.3 OBJECTIVE

The objective of this DMP is to minimise dust emissions generated by sand and gravel extraction operations on Lot 393.





Setback Distance	
Northern	40m
Southern	40m
Eastern along Lot 287	No Setback
Eastern otherwise	40m
Western	40m

Legend	
	Lot 393 (52 ha)
	EIL Area (31.4 ha)
	Piezometer Locations
	Survey Control Point Datum 67.0 m AHD
	Gate Location
	Shed Location
	Access to Lowrie Rd via Easement

Existing Contours (m)	
	5 m
	1 m

Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Source: Extraction area contours from Thompson Surveying 2017
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 75 150 m

Mario Michele Giacci
Lot 393 Lowrie Road, Gwindinup

Figure 2
Existing Contours and Features

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2. EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the project area is Mediterranean, with cool wet winters and hot dry summers. Bureau of Meteorology (BoM) long-term average climate data for the closest meteorological station (Donnybrook, 9 km southeast of the property) is shown in Figure 3. The average annual rainfall is 970.4 mm, mean minimum temperatures between 5°C and 15°C and mean maximum temperatures between 16°C and 31°C (BoM 2023).

Long-term wind roses for Donnybrook (BoM 2023) indicate prevailing winds comprise morning easterlies and afternoon westerlies (Appendix 1).

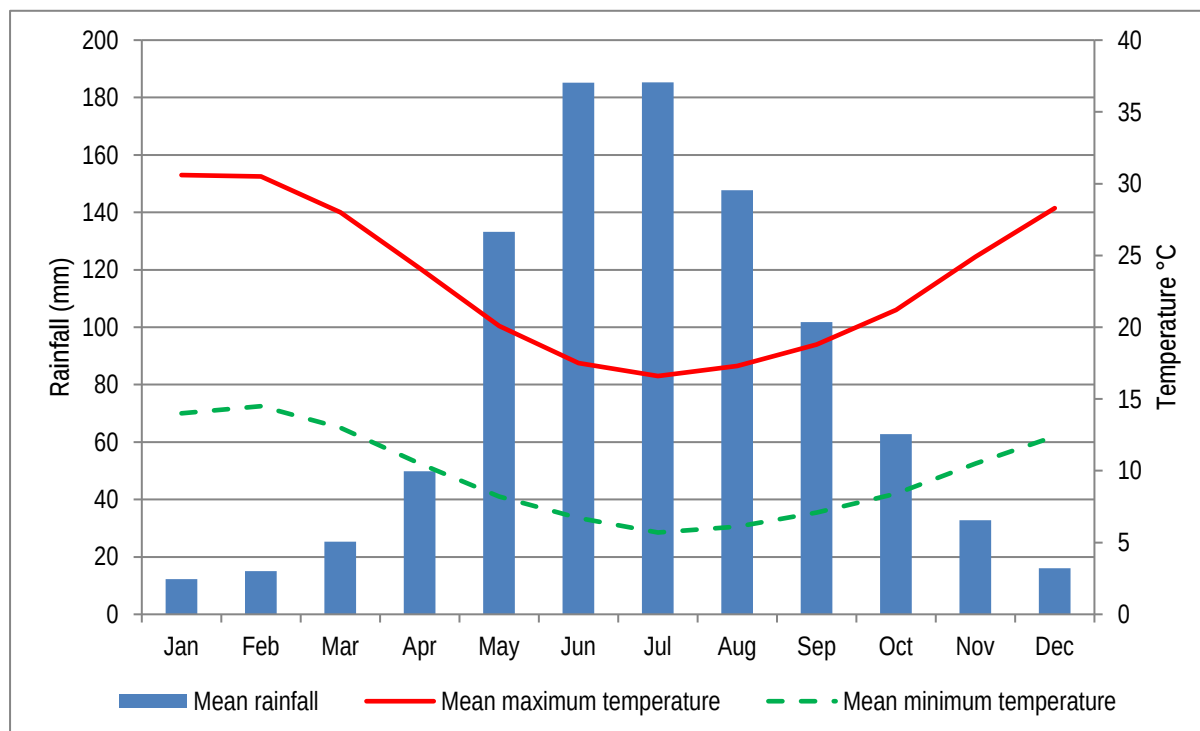


Figure 3: Climate Statistics (1900-2023) for BoM Station 9534

2.2 LAND USE

Lot 393 is located on Lowrie Road within the Shire of Capel, approximately 3.5 km south of Boyanup and approximately 26 km southeast of Bunbury (Figure 1). The property covers a total area of approximately 52 ha and is zoned Rural under the Shire of Capel Local Planning Scheme (LPS) No.8 and the Greater Bunbury Region Scheme (WA Gov 2014). LPS No.8 maps the property within two Special Control Areas (SCA): SCA6 - Strategic Minerals and Basic Raw Materials, and SCA8 - Regional Ecological Linkages (Shire of Capel 2023).

The property contains one shed (Figure 2) and was previously covered in mostly *Eucalyptus saligna* (blue gums), which were harvested in 2018. There are some remnant patches of native vegetation and isolated native trees and shrubs. The 10.94 ha area of Lot 393 west of Morris Road and the northwestern corner of the property were previously part of mineral sand mining operations. These areas have been rehabilitated and signed off as completed by the Department of Mines, Industry Regulation and Safety.

2.3 LANDFORM AND SOILS

The high point on Lot 393 is at 96 m Australian Height Datum (AHD), situated in the southeast corner of the property (Figure 2). From there the land slopes down at a near constant grade to a low point of 45 mAHd at the northwestern corner of the property.

Two soil and landform systems are mapped within and surrounding the proposed extraction area (DPIRD-064):

- Whicher Scarp System: low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel, and non-saline wet soils. Jarrah-marri forest and woodland.
- Forrestfield System: undulating foot slopes of the Darling and Whicher Scarps. Duplex sandy gravels, pale deep sands, and grey deep sandy duplexes.

The majority of the property falls within the Whicher Scarp System with the northwestern corner in the Forrestfield System. Historical excavation along the western boundary of Lot 393 and recent extraction on southern parts of Lot 393 and neighbouring Lot 287 confirm the presence of gravel under a layer of sand of varying depth.

The Australian Soil Resource Information System maps the extraction area on Lot 393 as 'Extremely Low Probability/Low Confidence' for the risk of acid sulfate soil (CSIRO 2014).

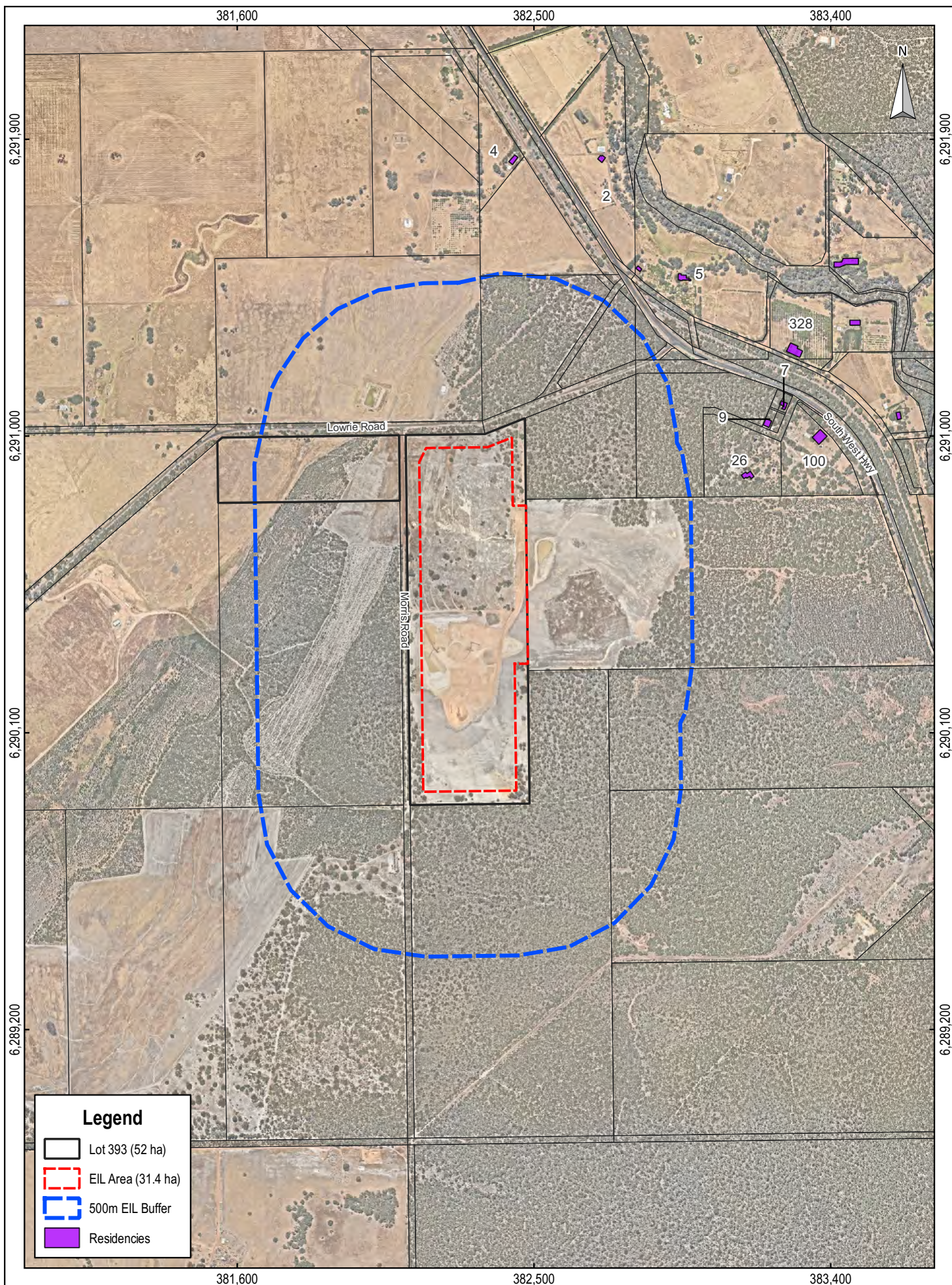
2.4 VEGETATION

The property used to be mostly covered in blue gums that were harvested in 2018. There are some patches of remnant native vegetation and some sporadic individual native trees or shrubs comprising mainly *Corymbia calophylla*, *Eucalyptus marginata*, *Xylomelum occidentale*, *Agonis flexuosa*, and *Xanthorrhoea* sp.

According to the CPS 7171 decision report, vegetation condition on the property ranged from Completely Degraded to Degraded following the Keighery scale (1994). This condition assessment was based on a site visit by the former Department of Environment Regulation in 2016 that also described the application area as comprising of mainly non-native Eucalyptus species with scattered native trees over weeds. A survey of Whicher Scarp in 2008 recorded that the application area did not retain remnant native vegetation (Keighery et al. 2008).

2.5 SENSITIVE RECEPTORS

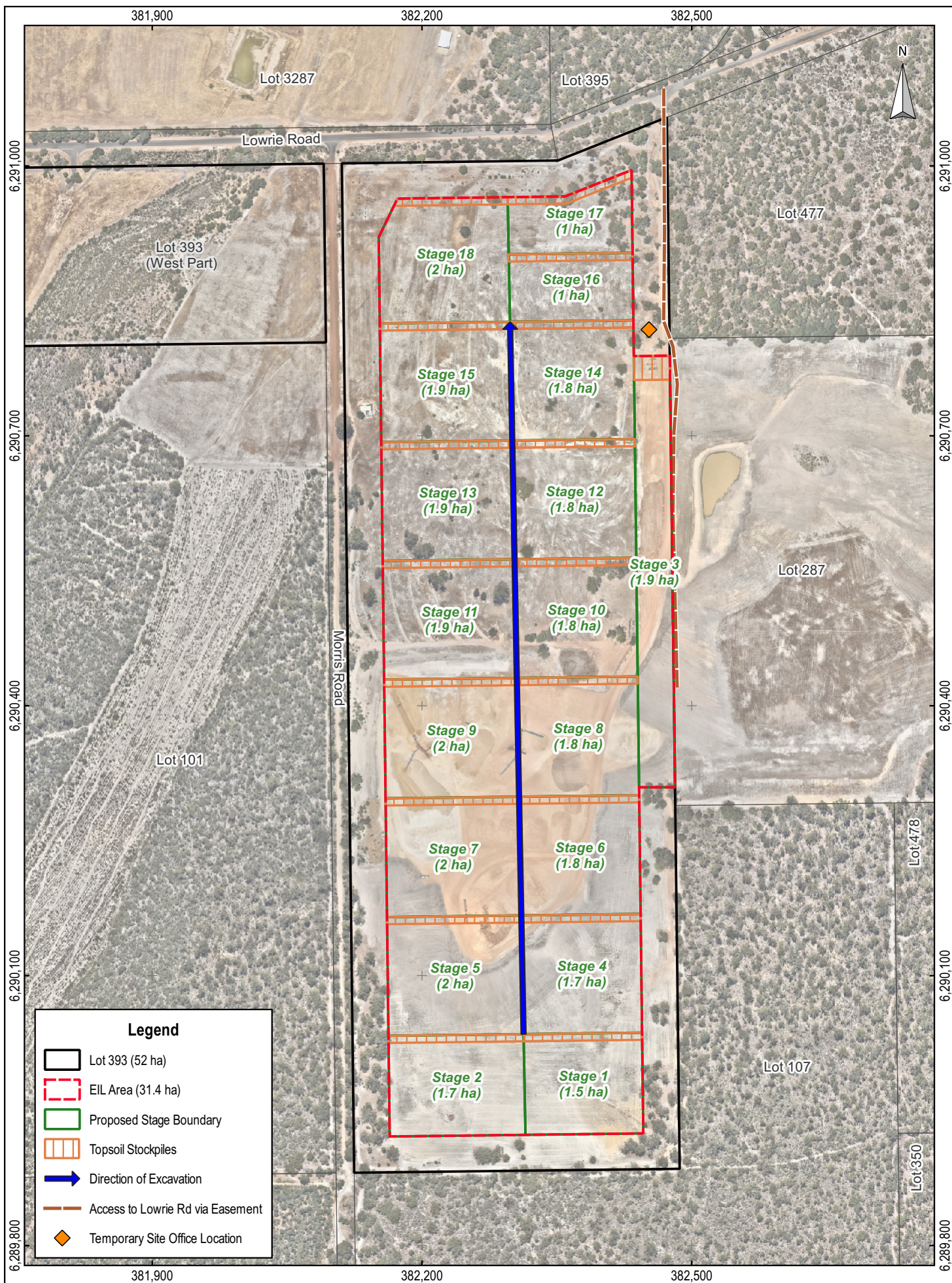
For dust management purposes, the key sensitive receptors around an extractive industry site are residential dwellings. There are no residences within 500 m of Lot 393, therefore, it is considered that there are no sensitive receptors within a notable distance (Figure 4). For residential dwellings beyond 500 m, there is ample vegetation screening them from operations on the property. The land surrounding Lot 393 is zoned either 'Rural' or 'Reserve' (Shire of Capel 2023). They include land uses of sand and gravel extraction, remnant bushland, rehabilitation projects from past mineral sand mining, and pasture (Figure 4).



3. POTENTIAL SOURCES OF DUST

The proposed project layout is shown in Figure 5. Potential sources of dust associated with the sand and gravel extraction operations include following:

- Vegetation clearing, topsoil stripping, and stockpiling.
- Sand and gravel extraction, crushing, stockpiling, and loading activities.
- Wind borne dust from exposed surfaces, including cleared land, topsoil and resource stockpiles, and tracks.
- Vehicle movements on internal unpaved roads.
- Loading of haulage trucks.
- Poorly contained truck loads.
- Rehabilitation works, including final contouring, ripping, and spreading of topsoil and other materials.



Scale: 1: 5,500
Original Size: A4
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50

0 100 200 m

Mario Michele Giacci
Lot 393 Lowrie Road,
Gwindinup

Figure 5

Excavation Works Plan

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4. SITE RISK ASSESSMENT

Dust potentially generated as part of the extraction operations is expected to be free of contaminants and pollutants. The adverse effects of dust generation from the site would typically be 'nuisance dust'.

A risk assessment was prepared based on the DEC *"A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities"* (DEC 2011). The risk assessment for the proposed extractive operations is provided in Appendix 2.

It calculates the risk of dust impacts and the need for management controls based on the nature of the site and the proposed operations as well as the proximity of sensitive receptors and prevailing winds. The risk assessment assumes that vegetation clearing will be gradual and proceed in stages and that revegetation will follow gradually in stages as well. Prevailing summer winds are morning easterlies and afternoon westerlies, and these have been taken into consideration in the risk assessment.

A site classification score of 264 was calculated for the on-site works, placing this development in a Classification 2 (Low Risk) category (between 200 and 399 points). Based on the Low Risk classification, the following are required (DEC 2011):

- Contingency plan detailing activities to be undertaken should dust impacts occur.
- Monitoring requirements.

These are both addressed in Section 5.

Because the closest sensitive receptors are over 500 m distance from the proposed operations, dust impacts to these residences are not likely to be significant with dust management actions in place (see Section 5).

5. DUST MANAGEMENT ACTIONS

5.1 DUST PREVENTION

The Site operator will implement the following measures to prevent dust generation from site activities:

- Vegetation clearing and topsoil removal will only be undertaken on days of conducive wind strength and conditions to ensure windblown dust is minimised.
- Vegetation clearing and ground disturbance will be gradual in nature and proceed in stages (Figure 5).
- Rehabilitation will also be gradual in nature and proceed in stages, closely following the completion of extraction.
- Topsoil stockpiles will be no greater than 2 m in height and other stockpiles will not exceed 4 m in height.
- A vehicle speed limit of 20 km/h will be implemented across the site.
- A water cart with a capacity greater than 10,000 L will be available when required and will undertake preventative watering of access tracks, working areas, and stockpiles during dry periods.
- Trucks leaving the site will be required to have their load covered and tailgates and draw-bars clear of dust producing material prior to exiting the property. Appropriate signage will be erected at the site exit advising truck drivers to cover loads and clean their vehicle as required prior to entering public roads.

5.2 DUST MONITORING AND MITIGATION

The Site operator will implement the following measures to monitor and mitigate dust generation from site activities:

- Visual monitoring of dust generation from the operations will be undertaken on an ongoing basis.
- Should excessive dust generation be observed onsite and there is a risk of dust being blown off site, additional watering of dust sources with the water cart will be organised. Alternative dust controls, such as chemical dust suppressants or dust fencing, may also be considered for more persistent sources of dust.
- When weather conditions negate the effectiveness of dust prevention and mitigation measures and dust continues to be blown off site, the dust generating activities will cease until conditions improve and compliance with this DMP can be achieved.

5.3 DUST COMPLAINTS

The dust complaints process is as follows:

- A sign will be erected at the entrance to the extraction site advising the public on the appropriate contact in the event of a complaint.
- In the event of receiving a complaint, the EIL licensee will complete a Dust Complaint Form (Appendix 3), investigate, and resolve the complaint within four hours.
- A copy of the completed Dust Complaint Form will be forwarded to the Shire of Capel for their records.
- If required, a review of the DMP will be undertaken to refine dust prevention, monitoring, and mitigation measures.

6. ROLES AND RESPONSIBILITIES

Roles and responsibilities with respect to dust management are outlined in Table 1.

Table 1: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	• Will have overall responsibility for the dust management of the operations. • Will provide information for site operators and truck drivers on dust management objectives, and dust management measures to be undertaken on site (prevention, monitoring, and mitigation). • Will be responsible for resolving any persistent dust management issues. • Will be responsible for administering the dust complaints process.
All personnel	• Will be familiar with potential sources of dust associated with own role and how to minimise dust generation. • Will implement the dust prevention, monitoring and mitigation measures as described in this plan and as advised by the EIL Licensee. • Will be responsible for reporting any persistent dust management issues to the EIL Licensee.

7. REFERENCES

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Shire of Capel. 2023. *Local Planning Scheme No. 8*. Gazetted on 17 July 2023. <https://www.capel.wa.gov.au/local-planning-schemes.aspx> (accessed August 2023).

APPENDICES

APPENDIX 1: WIND ROSES

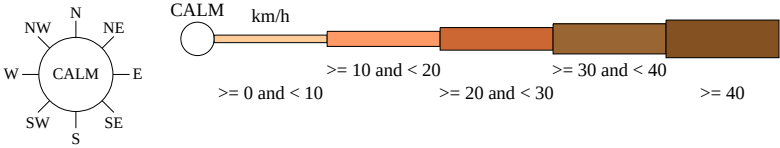
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 10 Aug 2023)

Custom times selected, refer to attached note for details

DONNYBROOK

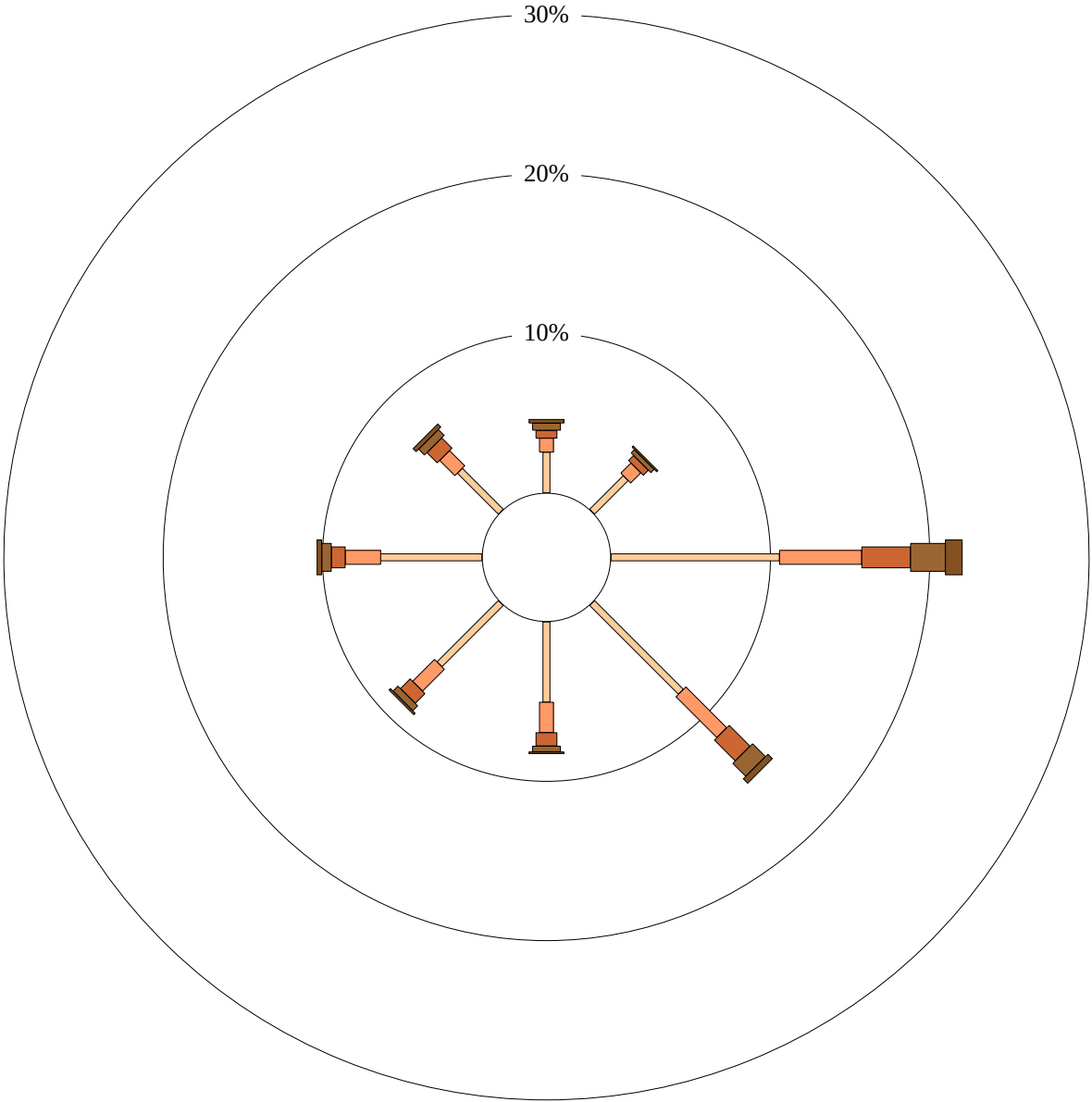
Site No: 009534 • Opened Jan 1900 • Still Open • Latitude: -33.5719° • Longitude: 115.8247° • Elevation 63m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
23300 Total Observations

Calm 20%



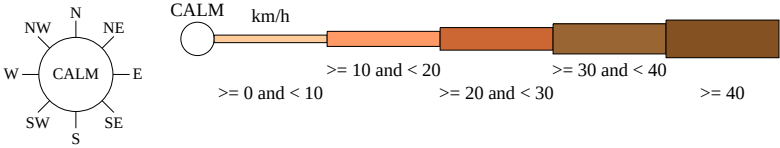
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 10 Aug 2023)

Custom times selected, refer to attached note for details

DONNYBROOK

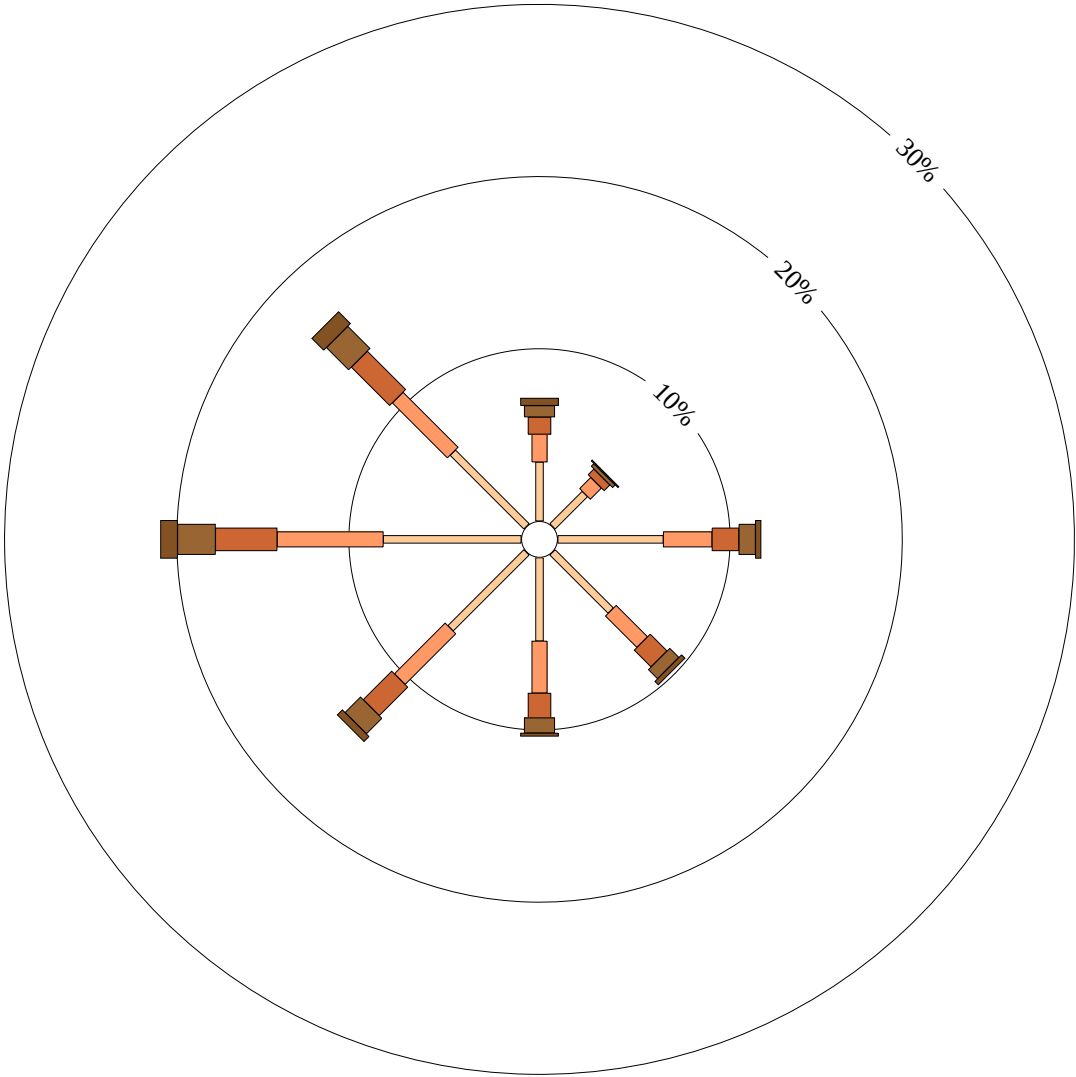
Site No: 009534 • Opened Jan 1900 • Still Open • Latitude: -33.5719° • Longitude: 115.8247° • Elevation 63m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
20359 Total Observations

Calm 5%



APPENDIX 2: RISK ASSESSMENT

Site Risk Assessment/Classification for Activities Generating Uncontaminated Dust

Part A - Nature of site

Item	Score Options				Allocated Score
1. Nuisance potential of soil, when disturbed.	Very low.....1	Low.....2	Medium.....4	High.....6	4
2. Topography and protection provided by undisturbed vegetation.	Sheltered and screened.....1	Medium screening.....6	Little screening.....12	Exposed and wind prone.....18	6
3. Area of site disturbed by the works.	Less than 1 ha.....1	Between 1-5 ha.....3	Between 5-10 ha.....6	More than 10 ha.....9	3
4. Type of work being done.	Roads or shallow trenches.....1	Roads, drains, and medium depth sewers.....3	Roads, drains, sewers, and partial earthworks.....6	Bulk earthworks and deep trenches.....9	9
TOTAL score for Part A					22

Part B - Proximity of site to other land uses

Item	Score Options				Allocated Score
1. Distance of other land uses from site.	More than 1 km.....1	Between 1 km and 500 m.....6	Between 100 m and 500 m.....12	Less than 100 m.....18	6
2. Effect of prevailing wind direction (at time of construction) on other land uses.	Not affected.....1	Isolated land uses affected by one wind direction.....6	Dense land uses affected by one wind direction.....9	Dense/sensitive land uses highly affected by prevailing winds.....12	6
TOTAL score for Part B					12

Site Classification Score (A x B) = 264

APPENDIX 3: DUST COMPLAINT FORM

DUST COMPLAINT FORM

Property: Lot 393 Lowrie Road, Gwindinup

Complaint date: _____

Complaint time: _____

Received by: _____

Complainant's Details

Name: _____

Telephone: _____

Affected address: _____

Complaint Details (attach report if insufficient space)

Action Taken (attach report if insufficient space)

Actions recorded by: _____

Date: _____

Copy to Shire of Capel: ☐ (tick)

APPENDIX 5: REHABILITATION AND DECOMMISSIONING PROGRAMME

REHABILITATION AND DECOMMISSIONING PROGRAMME

LOT 393 SOUTH WESTERN HIGHWAY, GWINDINUP

PREPARED FOR:

MARIO MICHELE GIACCI

FEBRUARY 2024

PREPARED BY:

Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005
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LOT 393 LOWRIE ROAD, GWIN DINUP REHABILITATION AND DECOMMISSIONING PROGRAMME

Distribution List:

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Final Report Rev2	Kirsi Kauhanen	Kristy Sell	29 March 2019
Draft Report	Sharon Rose	Kirsi Kauhanen	27 February 2024
Final Report Rev3	Sharon Rose	Kirsi Kauhanen	29 February 2024

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1. INTRODUCTION

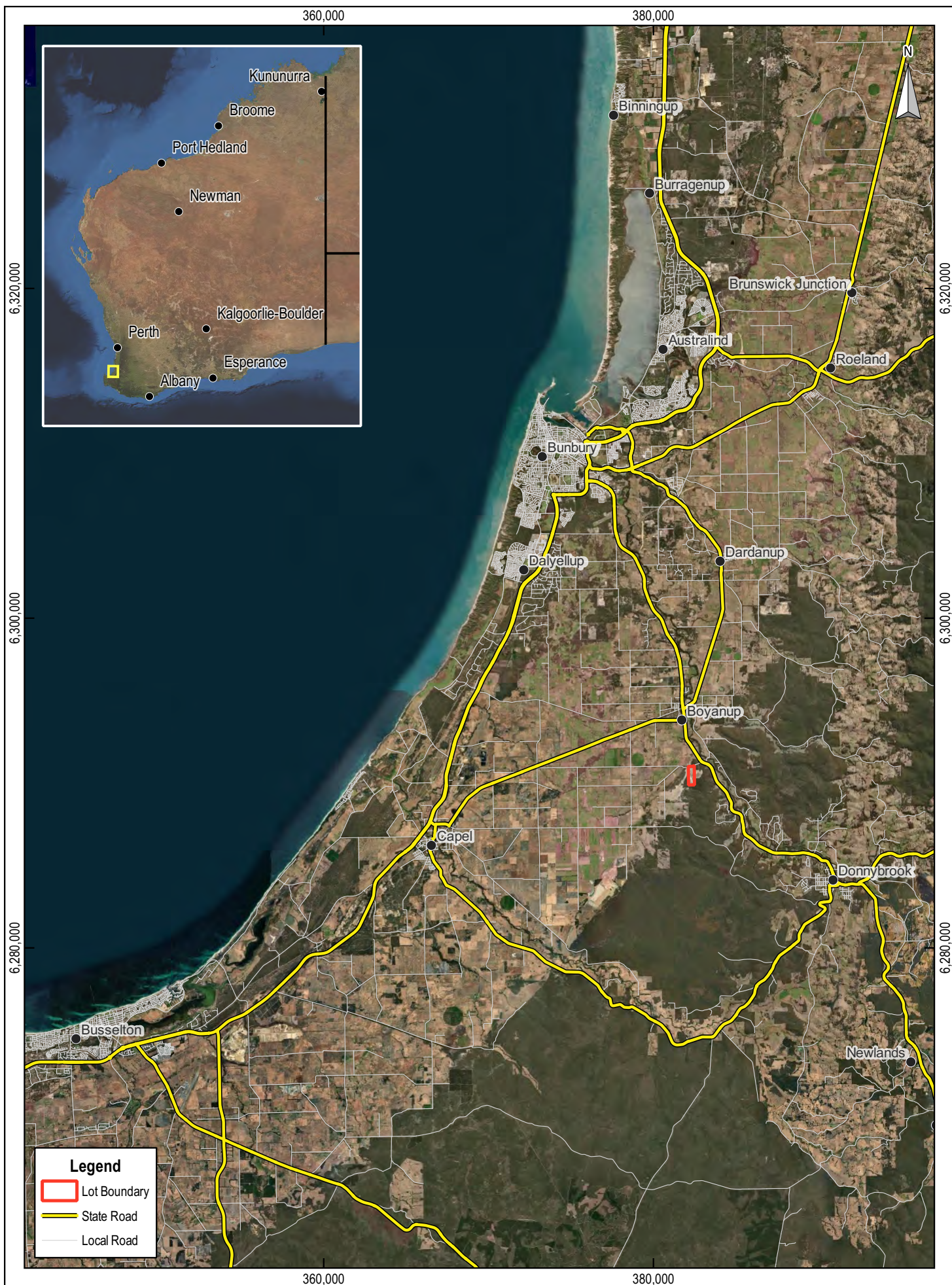
This Rehabilitation and Decommissioning Programme (R&D Programme) has been prepared for sand and gravel extraction operations on Lot 393 Lowrie Road (Plan 159607) in Gwindinup within the Shire of Capel (Figure 1). It outlines how the extraction area – totalling 31.4 ha – will undergo gradual rehabilitation following the staged sand and gravel extraction (Figure 2). The rehabilitation will consist of 18.6 ha of pasture and 12.8 ha of native vegetation corridors for wildlife. This R&D Programme has been prepared to address requirements of the Shire of Capel Extractive Industry Local Law 2016 and Local Planning Policy 6.2 and will be submitted as an appendix of the application for a Development Approval and Extractive Industry Licence (DA/EIL). This document is only to address requirements from the Shire of Capel and should be read in conjunction with the DA/EIL application report and related plans.

2. OBJECTIVES AND SCOPE

The objectives of rehabilitation and decommissioning on Lot 393 are as follows:

- Establish stable and safe landform.
- Remove any temporary infrastructure, rubbish, and debris.
- Establish 18.6 ha of pasture as indicated in Figure 3 to cater for future rural use.
- Establish 12.8 ha of native vegetation corridors for wildlife (Figure 3).

Rehabilitation measures to pasture are detailed in this document whereas rehabilitation to native vegetation is described in a separate plan (Appendix 1).



Scale: 1:300000
 Original Size: A4
 Image: ESRI World Imagery
 Grid: GDA94 / MGA zone 50

0 5 10 km

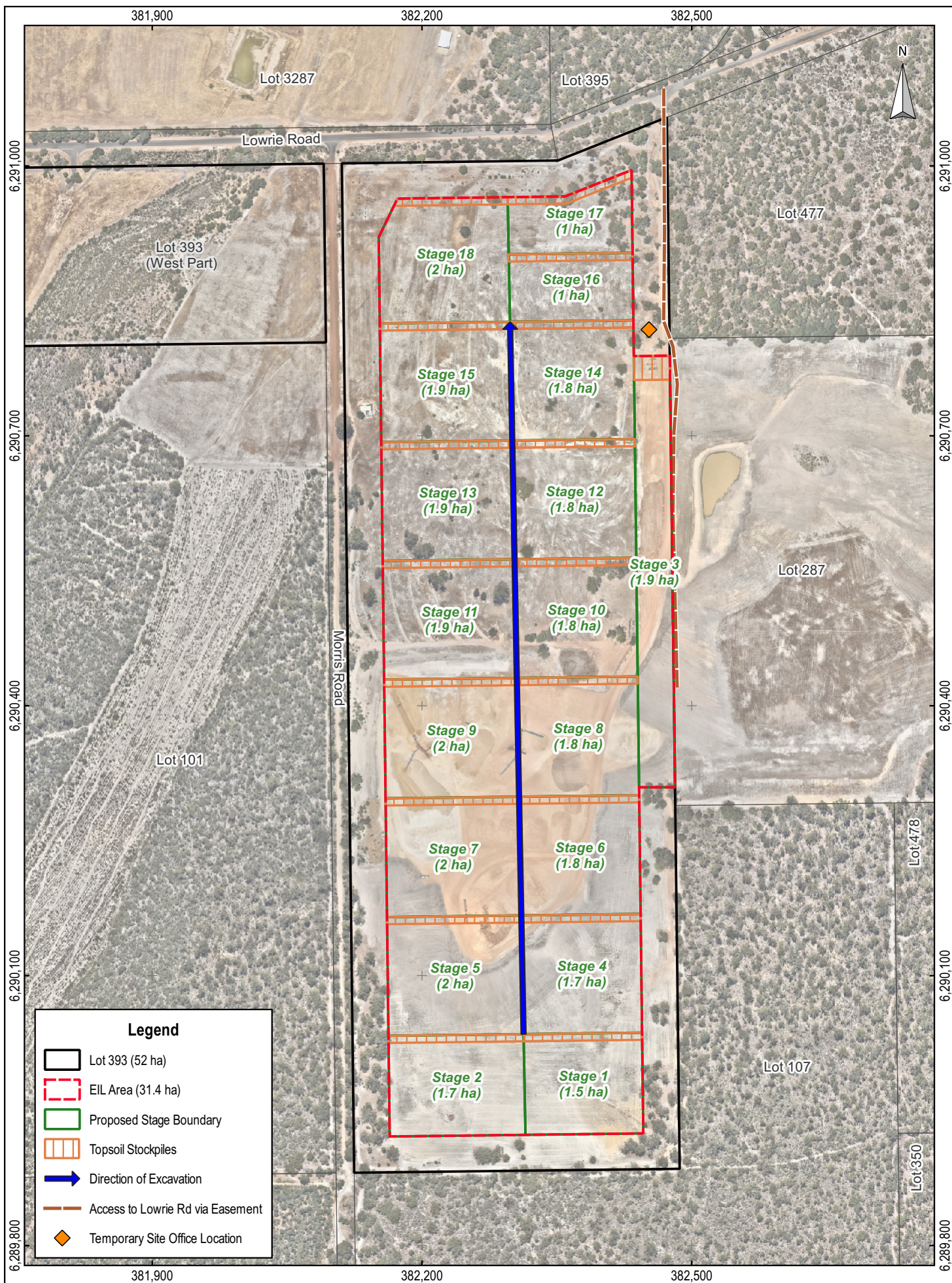
Mario Michele Giacci
 Lot 393 Lowrie Road, Gwindinup

Figure 1

Location

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 West Perth WA 6005
 Australia
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 www.mbsenvironmental.com.au

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Scale: 1: 5,500
 Original Size: A4
 Air Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

0 100 200 m

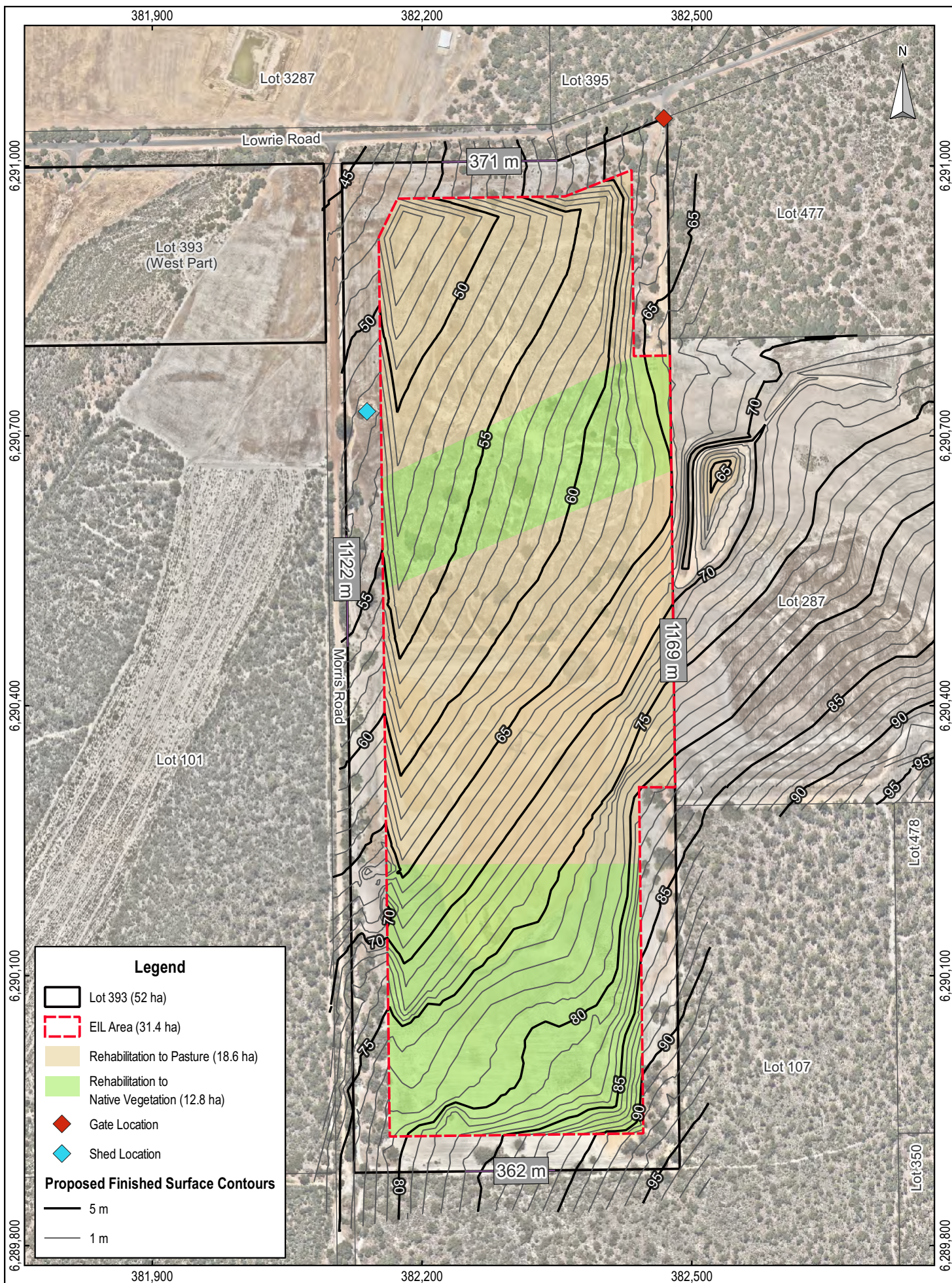
Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 2

Excavation Works Plan

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Scale: 1: 5,500
 Original Size: A4
 Air Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

0 100 200 m

Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 3

Finished Development Plan

Martinick Bosch Sell Pty Ltd
 4 Cook St
 West Perth WA 6005
 Australia
 t: +61 8 9226 3166
 info@mbsenvironmental.com.au
 www.mbsenvironmental.com.au

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3. SITE CHARACTERISTICS

3.1 LOCATION AND OWNERSHIP OF PROPERTY

Under the ownership of Mario Michele Giacci, Lot 393 is located on Lowrie Road in Gwindinup, Shire of Capel, approximately 21 km southeast of the Bunbury Central Business District (Figure 1). The property covers a total area of approximately 52 ha, comprising two parts that are separated by Morris Road, with the larger portion of land to the east totalling 40.94 ha and the smaller portion to the northwest totalling 10.94 ha. The proposed extraction area (also referred to as the site) covers 31.4 ha on the eastern portion of the property (Figure 2).

3.2 LAND USE AND ZONING

Lot 393 is zoned “Rural” under the Shire of Capel Town Planning Scheme (TPS) No.8 (Shire 2023b). Under the TPS No. 8, the property also falls within two Special Control Areas (SCA):

- SCA 6 – Strategic Minerals and Basic Raw Materials.
- SCA 8 – Regional Ecological Linkages.

The property has been historically largely cleared of native vegetation (Landgate 2023). Blue gums were planted across most of the property, though these were harvested in 2018 in preparation for sand and gravel extraction activities. Some patches and isolated individuals of native vegetation remain, as described in Section 3.4.

The northwestern corner of the extraction/rehabilitation area was previously part of a mineral sand mining operation conducted by Cristal Mining Limited. This area has been rehabilitated to pasture and signed off as completed by the Department of Mines, Industry Regulation and Safety — now known as the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS). There remains a Mineral Sands Caveat (in favour of Cristal Mining Limited) to protect mineral sand mining rights on the property. Sealed Lowrie Road runs along the northern property boundary and unsealed Morris Road runs between the western and eastern parts of the property.

3.3 SURROUNDS

The adjacent private properties have rural zoning and contain a mixture of pastures and native vegetation. There is an active extractive site to the east on Lot 287 – which is also owned by Mario Michele Giacci – and a finished mineral sands mine to the west that is under rehabilitation. There are three reserves in close vicinity, some of which are covered by the Management Plan for the Gwindinup Reserves (Jennings and Pearce, Year unknown). Vegetation in the reserves has been described as predominately Marri woodland with a diverse understorey, influenced by the changing soil type.

3.4 VEGETATION

As noted in Section 3.2, the property was mostly covered in deliberately planted blue gums, which were harvested in 2018. There are some patches of remnant native vegetation and some sporadic individual native trees or shrubs comprising mainly *Corymbia calophylla*, *Eucalyptus marginata*, *Xylomelum occidentale*, *Agonis flexuosa*, and *Xanthorrhoea* sp.

The proponent holds a clearing permit (CPS 7171/2) from the Department of Water and Environmental Regulation (DWER) to gradually remove the remaining native vegetation within the approved extraction area.

Due to the lack of indicator species within the approved extraction area, the presence or absence of dieback cannot be determined. For revegetation purposes, the area should be considered as potentially dieback infested.

3.5 SOILS AND TOPOGRAPHY

The high point on Lot 393 is at 96 m Australian Height Datum (AHD), situated in the southeast corner of the property (Figure 2). From there the land slopes down at a near constant grade to a low point of 45 m AHD at the northwestern corner of the property.

The majority of the property falls within the Whicher Scarp Soil Landscape System, with the northwestern corner in the Forrestfield System (Table 1) (DPIRD 2022). Based on extraction undertaken on Lot 393 and neighbouring Lot 287 so far, the topsoil layer is thin with a significant litter component; below this there is a general grading from sand through to gravel with varying grades of sandy gravel and gravelly sand mixes depending on the location. The sands are predominately white, with some yellow sands at isolated points. Clay lies underneath the varying depths of gravel.

Table 1: Soil Landscape Systems in the Extraction/Rehabilitation Area

Soil Landscape System	Description
Whicher Scarp System	Low scarp and raised platform, on the northern edge of the Donnybrook Sunkland Sandy gravel and pale deep sands, loamy gravel and non-saline wet soils.
Forrestfield System	Undulating foot slopes of the Darling and Whicher Scarps. Duplex sandy gravels, pale deep sands and grey deep sandy duplexes.

3.6 GROUNDWATER

Two piezometers were installed on Lot 393 in September 2016 and their locations are shown on Figure 2. Readings taken over October-December 2016 are shown in Table 2. Groundwater level data is also available from two piezometers on adjacent Lot 287 from September 2012 (Table 3). On Lot 393, the southeastern bore was consistently dry with groundwater level more than 8.8 m below the natural ground surface, whereas in the northwestern bore maximum groundwater level was approximately 5.5 m below the natural ground level. On Lot 287, maximum groundwater level was 7.8 m below the natural ground level.

The lowest point of excavation is proposed to be 45 m AHD in the northwest corner of extraction area, more than 4 m above the maximum groundwater level for that area. In other, higher parts of the extraction area, the depth to groundwater can be expected to be greater.

Table 2: Groundwater Levels in the Proposed Extraction Area on Lot 393

Piezometer	Ground Level (AHD)	Groundwater Depth from Natural Ground Level	Groundwater Level (AHD)	Sampling Date
1 (southeast)	94.30 m	More than 8.8 m as bore dry	Bore dry at 85.50 m	18 Oct 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	2 Nov 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	14 Dec 2016
2 (northwest)	45.80 m	5.25 m	40.55 m	18 Oct 2016
		5.35 m	40.45 m	2 Nov 2016
		5.74 m	40.06 m	14 Dec 2016

Table 3: Groundwater Levels on Lot 287 in September 2012

Piezometer	Ground Level (AHD)	Groundwater Depth from Natural Ground Level	Groundwater Level (AHD)
A	68.20 m	7.85 m	60.35 m
B	70.90 m	7.84 m	63.06 m

3.7 SURFACE WATER

The property is situated at the eastern edge of the catchment of Gynudup Brook, a tributary of the Capel River, which discharges into the Indian Ocean at Geographe Bay (DWER 2018a). There are no wetlands or watercourses at the site due to the well-draining soil and lack of upstream catchment area; the extraction area is within 500m of the upstream watershed. The extraction area is not within a proclaimed Public Drinking Water Supply Area, land subject to seasonal flooding, or defined floodplain, and is well separated from all waterways (DBCA 2023, DPIRD 2023a, DPIRD 2023b, DWER 2023, DWER 2018b) with the nearest being Gynudup Brook approximately 1 km west of the extraction area.

Lot 393 slopes to the northwest as shown in Figure 2. Surface flow is only likely to occur during intense rainfall events. Any surface flow leaving Lot 393 does so across the western boundary adjacent to Morris Road. On the northern half of the property, Morris Road has shallow open drains that direct runoff under the road through 300 mm culverts and into the adjacent property. This property contains the completed Gwindinup North mineral sand mine. The reconstructed landform includes a drainage/sumpland that flows southwest through minor water courses and drains to join Gynudup Brook. On the southern half of the boundary, Morris Road is an unformed dirt road and surface flow across the road to the west is possible during heavy rainfall events.

The Gynudup Brook catchment downstream, west of Lot 393, is almost entirely cleared agricultural land. Land use is primarily beef and dairy grazing. The hydrology of the catchment has been extensively modified by agricultural activity and includes multiple constructed artificial drains to alleviate water logging. The Elgin Main Drain is located 12 km downstream of the extraction site and diverts all flow into Gynudup Brook.

4. ON-SITE WORKS

The project site has been divided into 18 stages, each no more than 2 ha in size (Figure 2). Extraction operations will be comprised of the following:

- Remove vegetation, including any remaining native vegetation.
- Remove topsoil, litter, and any present overburden, and stockpile these.
- Extract sand and gravel material in 18 stages (in accordance with the Excavation Works Plan (Figure 2).
- Crush gravel with a mobile crusher.
- Transport sand and gravel off site.
- Form final batters (1:6) and other landform (approximately 1:20) in accordance with the Final Development Plan (Figure 3).
- Rip pit floor, replace topsoil and any other overburden, and revegetate with mixture of pasture (18.6 ha) and native vegetation (12.8 ha) (Figure 3).

Once excavation of sand and gravel has been completed, the stage will be rehabilitated as excavation moves forward. Rehabilitation to native vegetation will cover 12.8 ha and rehabilitation to pasture will cover approximately 18.6 ha. The following sections describe general rehabilitation measures, though it is noted that some of these works will be undertaken already prior to or during the extractive operations in preparation for rehabilitation.

4.1 BLUE GUM REMOVAL

The blue gums and their stumps on Lot 393 were removed in 2018..

4.2 CLEARING AND HANDLING OF NATIVE VEGETATION

- Clearing of native vegetation will be undertaken gradually in stages. Clearing will not be undertaken between 1 July and 28 February each year in accordance with Clearing Permit CPS 7171/2, to avoid disturbing any potential black cockatoo breeding.
- Some of the cleared vegetation, such as canopy material and smaller branches, will be mulched. As far as practicable, mulching will be undertaken during or immediately after vegetation clearing and transferred directly to a native vegetation rehabilitation area. When necessary, mulch will be stockpiled for later use but will only be stockpiled for as short duration as possible to maximise the microbial health of the mulch.
- Other plant matter, such as larger branches and tree trunks removed from the clearing areas will be transferred to the native vegetation rehabilitation areas to create microhabitats and assist with topsoil retention.

4.3 SOIL MANAGEMENT AND EARTHWORKS

- Removal of topsoil (approximately 100 mm thick) and remaining litter will proceed in stages ahead of extraction. When possible, stripped topsoil will be directly transferred to rehabilitation areas and spread across finalised land surfaces to avoid stockpiling, thus maximising native seed and microbial benefits. When necessary, topsoil will be stockpiled for later use in windrows to a maximum height of 4 m.
- Sand and gravel extraction will proceed in stages of no more than 2 ha in accordance with the EIL report.
- Dust generation from topsoil and other stockpiles (wind erosion) will be minimised as necessary with water truck (spraying water).

- As each stage of extraction is completed, the permanent landform contours will be established in accordance with the latest approved Final Development Plan. Batter slopes will be 1:6 maximum whilst the pit floor will be flat to gently sloping (1:20). The final contours shall be achieved and confirmed by way of digital survey.
- Drainage management will be in accordance with a separate Stormwater Management Plan (MBS Environmental 2024a).
- Ripping will be undertaken as detailed below in Section 4.4.
- To further manage runoff, increase infiltration, and reduce sediment movement post mining, contour banks will be constructed along the final landform contour at 100 m intervals. These are to be constructed during post mining rehabilitation works for each stage after completion of material extraction.
- The stockpiled topsoil/litter mix will be replaced across the rehabilitation areas.

4.4 RIPPING

In native vegetation rehabilitation areas, ripping will be undertaken along contour lines to a minimum of 600 mm deep with approximately 1 m centres between lines. In the pasture rehabilitation areas, ripping will be undertaken along contour lines to 300 to 500 mm with 1 to 2 m centres between lines. In both rehabilitation areas, this will promote root penetration and runoff infiltration, assisting with revegetation establishment.

4.5 DRAINAGE MANAGEMENT

Drainage management will be in accordance with a separate Stormwater Management Plan (MBS Environmental 2024).

4.6 EROSION AND SEDIMENT CONTROL

Erosion and sediment control measures are described in the separate Dust Management Plan (MBS Environmental 2023) and Stormwater Management Plan (MBS Environmental 2024a).

4.7 REVEGETATION - PASTURE

The focus of pasture rehabilitation is to stabilise the soil and provide an area for stock grazing in line with the rural zoning of the area. Pasture is well suited to the finished soil profile of topsoil over heavy gravelly clay, with the clay layer providing a moisture and nutrient reservoir. It is likely to be more productive than the deep sands found in nearby paddocks.

Pasture rehabilitation will take place gradually in stages after the extraction process has finished (as indicated in Figure 3). Once the landform has been finalised and the soil preparation works have been undertaken, pasture will be established as follows:

- The site will be allowed to wet up with autumn rains before fertiliser is applied at 200 kg/ha of NPK + Trace Elements.
- A pasture species mix will be direct seeded into the topsoil by appropriate machinery. This will include a mix of annual grasses, clovers, and other species suitable for sand over gravel/clay soils. Seeding will only take place once sufficient rains have fallen to allow for successful germination (DPIRD 2020).
- Pasture seed will be sown at a rate of 25 kg/ha.

4.8 NATIVE VEGETATION REHABILITATION

A Revegetation Implementation Plan has been drafted to the Shire of Capel requirements and is provided as Appendix 1. This document is expected to be finalised once DA is granted.

4.9 WEED AND PEST MANAGEMENT

- Where necessary, weeds will be controlled prior to seeding/planting with a glyphosate or selective herbicide; for example, Fluazifop may be used as a grass specific herbicide and Metsulfuron-methyl for geophytes. The spraying will extend 2 m out from the edge of the rehabilitation area to minimise new weed encroachment.
- Spot spraying with glyphosate or a selective herbicide will also be undertaken as necessary after seed germination and plant establishment.
- Manual weed removal will also be undertaken as required after seed germination and plant establishment to support the achievement of completion criteria.
- The stock-proof fence will be maintained around the property to protect the rehabilitation.

Weed management will be conducted in accordance with the Weed and Dieback Management Plan (MBS Environmental 2024b) and aim to control weeds that could outcompete the desired revegetation, species that are declared pest plants, weeds of national significance, and priority weeds of concern for the region.

4.10 DIEBACK MANAGEMENT

Due to the lack of sufficient native vegetation within the proposed extraction area, the occurrence of dieback cannot be determined and the area will be considered potentially dieback infected. Dieback management measures applicable to the extractive operations, rehabilitation actions, and decommissioning are detailed in the Weed and Dieback Management Plan (MBS Environmental 2024b).

4.11 ACCESS

Access to the extraction area (and rehabilitation areas) will be maintained off Lowrie Road. Access will also be maintained through the use of a fire break compliant track around the edge of the property, which will be constructed to allow access at all times of the year. To minimise unauthorised access, the site is securely fenced with a site access gate located at the start of the track off Lowrie Road, the gate is kept locked when no personnel are on site. Entry signage that warns the public of potential dangers is in place and will be maintained. Warning signs will be placed no more than 200 m apart along the property boundary. All signage, fencing, gates, and locks will be maintained.

4.12 DECOMMISSIONING

As part of decommissioning, any temporary site infrastructure (e.g. portable toilets) and waste/debris will be removed.

4.13 SCHEDULE OF WORKS

An indicative annual schedule of works has been developed for rehabilitation, as shown in Table 4. Extraction occurs in approximately 2 ha stages moving in a south to north direction. The pace of extraction will be dependent on demand for sand and gravel, and this will also drive the pace of rehabilitation works.

Table 4: Indicative Annual Rehabilitation Schedule

No	Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Sand and gravel extraction.												
2	Seedling orders due												
3	Seed/cuttings collection												
4	Primary rehabilitation earthworks: reinstating embankments, ripping												
5	Topsoil resspreading in rehabilitation areas												
6	Pre-planting/seeding weed control												
7	Seeding pasture												
8	Seeding of native species seeding - if any												
9	Planting native seedlings												
10	Maintenance weed control - as required												

5. MONITORING AND MAINTENANCE

5.1 PASTURE

Pasture monitoring and maintenance will be ongoing for the life of the extraction process and two years after the last seeding. Two permanent monitoring points will be established per hectare of pasture rehabilitation, which will be visited in March, July, and October for a visual inspection, photographed, and progress notes recorded. Maintenance will be undertaken as necessary to address any issues identified through monitoring. Records of monitoring and maintenance works will be maintained by MGM.

Monitoring and maintenance measures to be undertaken in the pasture rehabilitation areas are summarised in Table 5. The stock-proof fence will also be inspected and opportunistic records made of any issues requiring follow up.

Table 5: Monitoring and Maintenance Measures - Pasture

Monitoring	Maintenance
Success of pasture establishment (plant vigour/resilience).	Re-seed areas of poor success. Trial alternative pasture species.
Weed infestations.	Control weeds by manual removal or herbicide application.
Soil issues (e.g. areas lacking growth vigour).	Mitigate poor soils.
Erosion damage.	Repair erosion damage.
Boundary fence damage.	Fix fence.

5.2 NATIVE VEGETATION

Monitoring and maintenance of native vegetation rehabilitation areas is described in the draft Revegetation Implementation Plan (Appendix 1).

6. COMPLETION CRITERIA

6.1 PASTURE

Completion criteria for pasture rehabilitation are presented in Table 6. The completion criteria for pasture rehabilitation is expected to be achieved within two years of a particular stage undergoing pasture seeding, however if this is not the case, then rehabilitation works will continue until the completion criteria have been achieved. As the extraction and rehabilitation works are staged, the completion criteria will be achieved gradually across the site.

Table 6: Completion Criteria

Aspect	Completion Criteria
Landform	Final landform is in accordance with an approved post-extraction plan.
Pasture cover	Pasture cover is sufficient to stabilise soil.
Significant Weeds	No declared pest plants or Weeds of National Significance present.
Bare Ground	No bare patches of ground more than 30 m ² in size.

6.2 NATIVE VEGETATION

Completion criteria for native revegetation are presented in the draft Revegetation Implementation Plan (Appendix 1).

7. RECORD KEEPING, AUDITING, AND REPORTING

7.1 RECORD KEEPING

The applicant is responsible for collecting and maintaining records on the implementation of this R&D Programme. This will include, but is not limited to, the following data:

- Date and location of landform finalisation.
- Date and location of preparatory earthworks (e.g. spreading of topsoil and/or mulch, ripping).
- Date and location of revegetation actions (e.g. planting and seeding).
- Date and location of weed control actions.
- Date and location of monitoring, maintenance, and mitigation actions.
- Monitoring reports issued by consultants (e.g. environmental specialist).
- Invoices relating to the implementation of the R&D Programme.

7.2 REPORTING AND AUDITING

It is expected that the Shire of Capel will require an annual audit of compliance to be prepared by a suitably qualified independent expert. This audit will cover the conditions of the DA/EIL and also include a progress report on the R&D Programme, including the following:

- Details of completed, ongoing, and future rehabilitation areas.
- Photos of rehabilitation areas.
- Monitoring and reporting details, if available.
- Start and completion dates, and expected start dates, if applicable.
- A map depicting the rehabilitation areas and their completion progress.

The environmental specialist will prepare reports for each of the monitoring surveys detailing findings, progress towards completion criteria, and recommendations for management actions. These reports can be used as evidence for the annual compliance audit.

8. REVISIONS

This R&D Programme takes an adaptive approach to monitoring and management and will be adjusted over time where necessary to achieve the best rehabilitation outcomes. The R&D Programme will be reviewed annually based on the outcomes of ongoing monitoring and revegetation success rates, and changes will be made where necessary.

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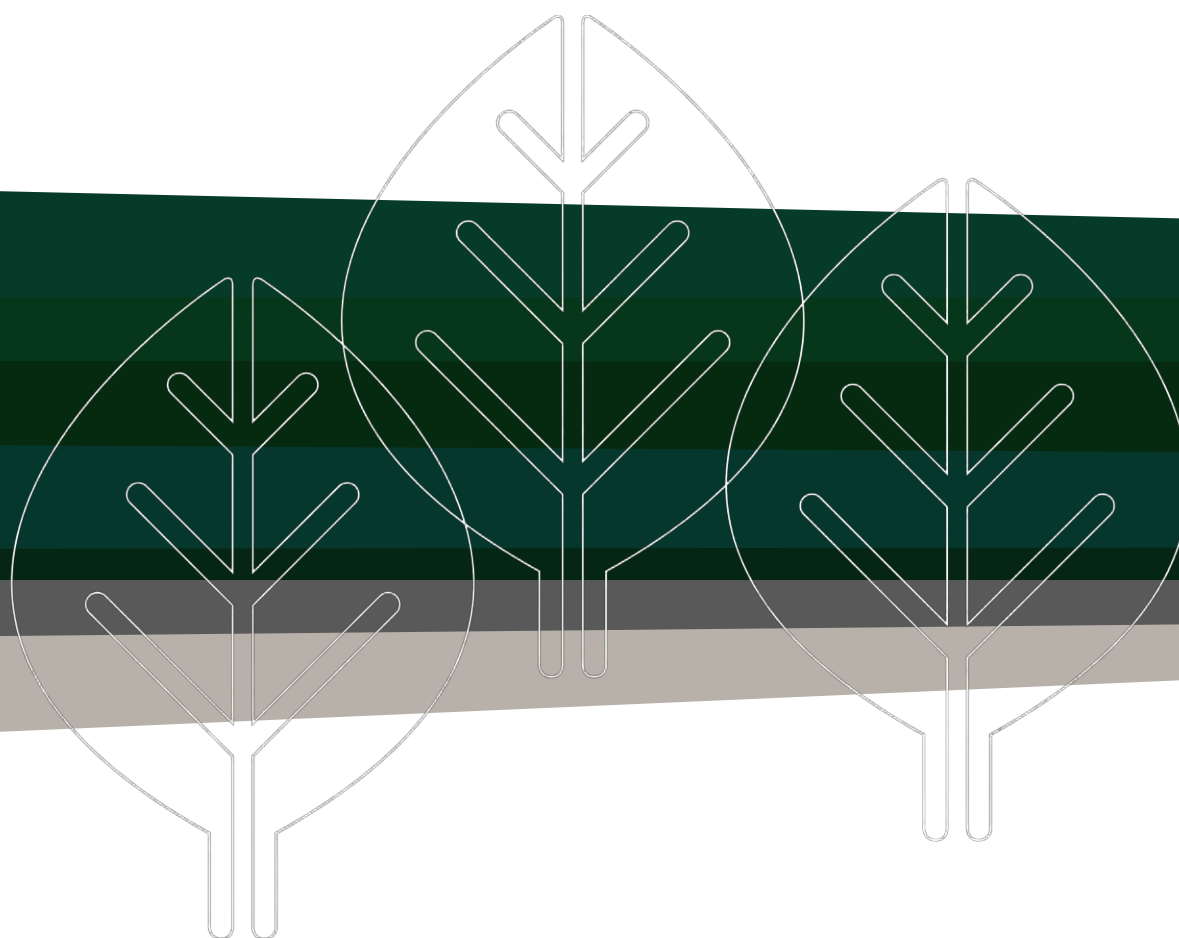
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APPENDICES

APPENDIX 1: DRAFT REVEGETATION IMPLEMENTATION PLAN (TRANEN 2023)



Lot 393 Lowrie Rd, Gwindinup
Revegetation Implementation Plan
MGM Quarries
P995B-01-00
February 2023

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1 INTRODUCTION AND BACKGROUND

Tranen Revegetation Southwest (Tranen) were commissioned by MBS Environmental (MBS) on behalf of MGM Quarries to prepare a Revegetation Implementation Plan (RIP) for a sand pit located on Lot 393 Lowrie Road, Gwindinup within the Shire of Capel (Appendix 1– Site Map).

This RIP is focussed only on the rehabilitation of native vegetation on Lot 393 and does not include the pasture rehabilitation, which is covered under a separate implementation plan. The RIP only applies to the following staged extraction areas:

- Stages 1 to 7; and
- Partial sections of stages 11 to 15.

1.1 Scope and Purpose

The scope of this Revegetation Implementation Plan includes all future rehabilitation at the site based on the proposed future sand and gravel extraction works at Lot 393 (Section 2.2).

This Revegetation Implementation Plan does not replace the Rehabilitation and Decommissioning Program and Native Vegetation Rehabilitation Plan prepared under CPS 7171-2, but rather the three documents will exist in parallel for the two separate approval processes (i.e. Revegetation Implementation Plan for the local government DA/EIL process and the Rehabilitation and Decommissioning Program and Native Vegetation Rehabilitation Plan for the state government environmental approval process). The Revegetation Implementation Plan is an operational document that provides an additional level of practical detail regarding the implementation of the Rehabilitation and Decommissioning Program and Native Vegetation Rehabilitation Plan.

2 BACKGROUND

2.1 Site Location and Description

Lot 393, Lowrie Road is located in Gwindinup in the Shire of Capel approximately 21 km south east of the Bunbury CBD. Lowrie Road and the site are accessible via Southwest Highway which runs north to southeast between Bunbury and Donnybrook. Lot 393 covers a total area of 52 ha, of which the proposed extraction area is 31.4 ha.

The property was historically cleared (more than 20 years ago) removing most of the native vegetation and blue gums were then planted across most of the property. These blue gums were harvested in 2018, as well as patches of native vegetation and sporadic individual native trees and shrubs. These were cleared under a clearing permit (CPS 7171/2) issued by the Department of Water and Environmental Regulation. The northwest corner of the site had previously formed part of a former mineral sands mine and has since been rehabilitated as pasture (rehabilitation signed off by Department of Mines, Industry Regulation and Safety).

Current land uses adjacent to the site include private properties with rural zoning, an active extraction site to the east on Lot 287 and completed mineral sands mine to the west. There are also three reserves within close vicinity to the site, some of which are covered by a Reserves Management Plan. Vegetation in these reserves are described as being predominantly Marri woodland with a diverse understorey, influenced by soil type.

2.2 Sand and Gravel Extraction Works

A works and excavations plan has been developed for Lot 393 and is shown in Appendix 3. The area within the EIL boundary has been split into 18 blocks, with final batters being a maximum of 1:6 slope and the remainder of the site being a 1:20 slope.

The staging of rehabilitation shall progressively follow sand and gravel extraction stages which are proposed to start at block 1 and proceed north to block 18. Each block shall be rehabilitated progressively to either native vegetation or pasture as excavation activities are completed in order to allow the next stage of extraction to occur. How quickly the extraction shall occur through each block is not able to be accurately determined as this is based on consumer demand for both of these resources and may take several years.

The stages to be rehabilitated to native vegetation shall be similar in approach in terms of landform creation, soil preparation and stabilisation, and tubestock and seed. The only difference shall be in the quantities of materials (i.e. mulch, tubestock and seed). Implementation strategies and methodologies are detailed below (Sections 5 to 8).

2.3 Objectives of Rehabilitation

The objectives for the native vegetation rehabilitation of Lot 393 are to align with the EIL conditions including:

- a) Establish self-sustaining native vegetation that is suitable for the purpose of a 'wildlife corridor'.
- b) Provide future nesting and foraging habitat for black cockatoos including Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and potentially also the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*).

- c) Enhance connectivity between areas of good quality remnant native vegetation on surrounding properties.

Species lists (specified in Appendix 4) and management zones (described in Sections 5.2 to 5.4) have been designed to fulfil the requirements of the above conditions as well as maximise the success of revegetation in the modified post extraction environment.

The remnant vegetation on Lot 393 belongs to two vegetation units, the Whicher and the Cartis Complexes (MBS, 2021). Post-excavation, it is considered that the batters and upper slope of the site are considered suitable to re-establish these types of woodland communities. As the excavation stages progress in a northerly direction, it is expected that the groundwater level will get closer to the surface and therefore alternate species compositions and vegetation communities will be required. As specified in sections 5.2 to 5.4, the management zones have therefore been designed to transition from a Whicher woodland to a Cartis woodland.

Completion criteria (Section 8.3) have been developed based on the above objectives, pre-clearance survey data as well as Tranen's experience on similar projects. These completion criteria set out the overall outcomes of revegetation works (i.e. topsoil, weed cover, density and diversity).

3 ENVIRONMENTAL CONTEXT

3.1 Landform and soils

The majority of the extraction areas and therefore rehabilitation areas fall within the Whicher Scarp System which is comprised of sandy gravel, pale deep sands and loamy gravel along a low scarp. Towards the north-western boundary, the extraction area intersects the Forrestfield System comprising of variable duplex sandy gravels and pale to grey deep sands at the undulating foot slopes of the Whicher Scarp (see Appendix 2).

3.2 Hydrology

A Stormwater Management Plan for Lot 393 has been developed by MBS (MBS, 2022). All surface water shall be captured within each excavation stage via 'v' drains which then lead to a retention pond located in the North-west corner of each as shown in the figure on the next page (Figure 2 Stormwater Management Measures, MBS Stormwater Management Plan, December 2022). All surface runoff is to be captured onsite, with no runoff to leave the site, up to and including a 1% AEP.



3.3 Herbivores

Herbivores have the potential to severely compromise rehabilitation success by grazing on native seedlings and germinants. During Tranen's site inspection, kangaroos within and surrounding the site were observed as being abundant. To limit their impact on successful native rehabilitation, Tranen proposes fencing to mitigate the impact from herbivores and details are provided in subsequent sections of this plan.

3.4 Climate

The regional climate is described as warm Mediterranean, with winter rainfall of 600 to 1000 mm and five to six dry months per year (Beard 1990). The closest meteorological station (ID 009534) is located in Donnybrook, approximately 12 km southwest of the Project. Mean annual rainfall is 969.8 mm and mean maximum temperature is 16.6°C in July and 30.6°C in January (BoM, 2023)

Prevailing summer winds are light south-easterlies in the early hours of the morning and at night with stronger south-westerlies present during the day. The winter wind pattern is dominated by the eastward progression of rain bearing low pressure systems and associated cold fronts with winds in a south-westerly to north-westerly arc (BoM, 2022).

3.4.1 Climate Change

Climate change modelling and future projections for NRM regions within Australia have been undertaken by CSIRO and the Bureau of Meteorology through the 2015 initiative *Climate Change in Australia* (CSIRO & BoM 2015). The subject site falls within the Southern and South-Western Flatlands West (SSWWF) sub-cluster which comprises NRM regions in the southwest of WA. Key conclusions from the work include high to very high confidence predictions that the following trends shall occur in the SSWWF subcluster:

- Average temperatures shall continue to increase in all seasons (very high confidence).
- More hot days and warm spells are projected with very high confidence. Fewer frosts are projected with high confidence.
- A continuation of the trend of decreasing winter rainfall is projected with high confidence. Spring rainfall decreases are also projected with high confidence. Changes in other seasons are unclear, although downscaling suggests a continuation of the observed autumn declines.
- Increased intensity of extreme rainfall events is projected, with high confidence.
- Mean sea level shall continue to rise and height of extreme sea-level events shall also increase (very high confidence).
- A harsher fire-weather climate in the future (high confidence).
- On annual and decadal basis, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years and for rainfall. However, SSWWF is one region of the world with very high model consensus on forced drying during the observed period and in the near-term.

3.4.2 Climate Change Consequences for Revegetation

Little is known about the ability of native flora species in the southwest to adapt to a changing climate especially with specific reference to the targeted species of this revegetation program, and which also occur in surrounding remnant vegetation. Some work has been undertaken on WA Eucalyptus species and their capacity to cope with a changing climate (DEC 2013). This work (which was limited to three Eucalyptus species) showed evidence that species which are widespread, having evolved under highly variable environments, retain high potential to adjust to environmental change, through either phenotypic plasticity or locally adapted sub-populations, or both (DEC 2013).

As shown in Table 1 the species targeted have geographic ranges which span across large portions of Western Australia across multiple IBRA regions which by their very nature represent geographically distinct bioregions based on climate, geology, landform, native vegetation and species information. Based on the wide geographic spread of the target species and the findings of DEC (2013), it could be speculated that these species have a strong propensity to adjust to changes in climate, however it is acknowledged that this has not been verified in the literature for the target species (Appendix 4). It is further considered that if the potential of these species to adapt to climate change was found to be lacking then the implications would extend far beyond the subject revegetation works.

Table 1: Targeted revegetation species and their geographic range

Species	Common Name	IBRA regions										
		Carnarvon	Coolgardie	Avon Wheatbelt	Esperance Plains	Geraldton Sandplains	Great Victorian Desert	Jarrah Forrest	Mallee	Swan Coastal Plain	Warren	Yalgoo
<i>Acacia extensa</i>	Wiry Wattle				✓			✓		✓	✓	
<i>Acacia pulchella</i>	Prickly Moses			✓	✓	✓		✓	✓	✓	✓	✓
<i>Acacia saligna</i>	Orange Wattle		✓	✓	✓	✓		✓	✓	✓	✓	✓
<i>Adenanthos meisneri</i>								✓		✓	✓	
<i>Agonis flexuosa</i>	Peppermint				✓	✓		✓		✓	✓	
<i>Allocasuarina fraseriana</i>	Sheoak							✓		✓	✓	
<i>Allocasuarina humilis</i>	Dwarf Sheoak			✓	✓	✓		✓	✓	✓	✓	
<i>Banksia attenuata</i>	Slender Banksia			✓	✓	✓		✓	✓	✓	✓	
<i>Banksia grandis</i>	Bull Banksia			✓	✓	✓		✓	✓	✓	✓	
<i>Bossiaea eriocarpa</i>	Common Brown Pea			✓	✓	✓		✓		✓		
<i>Bossiaea ornata</i>	Broad Leaf Brownd Pea				✓			✓				
<i>Calothamnus quadrifidus</i>	One-sided Bottlebrush	✓	✓	✓	✓	✓		✓	✓	✓		✓
<i>Corymbia calophylla</i>	Marri			✓	✓	✓		✓		✓	✓	
<i>Corymbia haemotoxylon</i>	Mountain Marri					✓		✓		✓		
<i>Eremaea pauciflora</i>			✓	✓	✓	✓		✓	✓	✓		
<i>Eucalyptus marginata</i>	Jarrah			✓	✓	✓		✓	✓	✓	✓	
<i>Hakea amplexicaulis</i>	Prickly Hakea							✓	✓	✓	✓	
<i>Hakea lissocarpa</i>	Honey Bush			✓	✓	✓		✓	✓	✓	✓	
<i>Hardenbergia comptoniana</i>	Native Wisteria				✓	✓		✓		✓	✓	
<i>Hemiandra pungens</i>	Snakebush			✓	✓	✓		✓	✓	✓	✓	
<i>Hibbertia hypericoides</i>	Yellow Buttercups			✓	✓	✓		✓	✓	✓	✓	
<i>Hibbertia racemosa</i>	Stalked Guinea Flower	✓			✓	✓		✓	✓	✓	✓	✓
<i>Hypocalymma angustifolium</i>	Whyte Mrytle			✓	✓	✓		✓	✓	✓	✓	
<i>Jacksonia furcellata</i>	Grey Stinkwood			✓	✓	✓		✓	✓	✓	✓	
<i>Kennedia coccinea</i>	Coral Vine			✓	✓	✓		✓	✓	✓	✓	
<i>Kennedia prostrata</i>	Running Postman		✓	✓	✓	✓		✓	✓	✓	✓	✓
<i>Kunzea glabrescens</i>	Spearwood				✓			✓		✓	✓	
<i>Lechenaultia biloba</i>	Blue Lechenaultia		✓	✓	✓	✓		✓	✓	✓	✓	
<i>Melaleuca thymoides</i>				✓	✓			✓	✓	✓	✓	
<i>Patersonia occidentalis</i>	Purple Flag		✓	✓	✓	✓		✓	✓	✓	✓	✓
<i>Patersonia umbrosa</i>	Yellow Flag			✓	✓			✓	✓	✓	✓	
<i>Xanthorrhoea brunonis</i>				✓	✓	✓		✓	✓	✓	✓	✓
<i>Xanthorrhoea preissii</i>	Grass Tree			✓		✓		✓		✓	✓	
<i>Xylomelum occidentale</i>	Woody Pear							✓		✓	✓	

3.5 Existing and Future Uses

Current land uses on Lot 393 include sand and gravel mining activities, rehabilitated land and remnant bushland.

Proposed future land uses shall include further sand and gravel extraction with progressive native and pasture rehabilitation activities. Following the cessation of sand and gravel extraction, rehabilitation and ongoing rehabilitation maintenance activities shall occur until completion criteria are reached. Native rehabilitation activities on Lot 393 shall establish vegetation communities that align with the objectives specified in Section 2.3. Weeds on Lot 393 shall require on-going maintenance, especially in the early years to establish native species. However, given the abundance of weeds in adjacent farmland, there will always be potential for on-going weed incursion from the immediate area.

4 RISK ASSESSMENT

A risk assessment has been undertaken in order to identify all known risks to the revegetation works to reduce uncertainty around delivering the objectives described in Section 2.3. The risk assessment has been based on templates within the *Biodiversity Conservation Trust – Revegetation Plan Template*, developed by the NSW Government (2020). Where appropriate, terminology has been altered within the likelihood of occurrence, consequence and evaluation criteria to ensure relevance to the WA context and the project context.

The risk assessment has considered major risks in each phase of the revegetation works being:

- Pre-installation (planning and material sourcing)
- Installation (landform, site preparation, revegetation, weed/herbivore management)
- Post installation (revegetation progress, site maintenance, access and weather)

Risks were assessed prior to mitigation measures with several risks in the 'High' category meaning an undesirable level of risk to rehabilitation objectives. Following mitigation measures proposed within this plan, all risks were able to be downgraded to the 'Medium' or 'Low' categories meaning risks can be managed to achieve rehabilitation objectives with proposed controls.

The full risk assessment is located in Appendix 5 and within Table 3.

5 IMPLEMENTATION STRATEGY

Implementation shall occur progressively, with each stage being rehabilitated with either pasture or native vegetation upon completion of sand and gravel extraction (refer to Section 2.2 and Appendix 2). Each stage to be rehabilitated with native vegetation is to be similar in approach in terms of landform creation, soil preparation and stabilisation, and tubestock and seed. The only differences will be in the quantities of materials (i.e. mulch, tubestock and seed) for each stage. Appendix 4 details the recommended species and their corresponding quantities for the revegetation activities proposed in each management zone.

The following section provides a summary of the overarching revegetation strategy for each of the three management zones.

- Management Zone 1 – Batter
- Management Zone 2 – Upper Slope
- Management Zone 3 – Lower Slope

Management Zones are also shown in Appendix 6.

5.1 General

5.1.1 Signage

Signage advising the public, contractors, and employees that rehabilitation works are being progressively undertaken shall be placed on the entry gate into the active site. In addition, rehabilitation areas where there is a direct interface with access tracks and turnarounds shall be clearly delineated with a visible barrier and signage installed stating 'rehabilitation works in progress'.

5.1.2 Staging of Works

Rehabilitation works shall be staged over several years depending on how quickly each stage of excavation occurs. The exact timing of the completion of each stage shall vary depending on the market demand for the resource at the time. Upon completion of each stage of sand extraction, rehabilitation works shall immediately commence to ensure the batters are stabilised as soon as practicable. Based on the sand extraction schedule (Section 2.2), rehabilitation shall occur starting from Stage 1 and then continue in a northern direction to Stage 18. This is to limit any potential disturbance to the rehabilitation post-extraction, which could impact its success.

Details on the approach taken for each stage and their associated management zones can be found in Sections 5.2, 5.3 and 5.4.

5.2 Management Zone 1 – Batter

The batter spans the south to southwest corner of the EIL perimeter. This area spans from the top of the batter down towards the toe and ranges in elevation between 78 – 94 mAHD. However, this will vary as some batters may be smaller than others.

Once the 1:6 reprofiling of the batters has been completed, site topsoil or a constructed topsoil shall be spread evenly across the batter face. For soil stability, dust suppression, seed retention and increasing soil microbial activity, a thin layer of mulch (if not already in the topsoil) shall be spread across the area. The batter shall then be ripped to a depth of 300-500mm at 2 metre intervals along the contour to assist in breaking compaction and water infiltration. The topsoil / mulch shall then be driven over with tracked earthmoving machinery up and down the face of the batter to create imprints in the soil (track-rolled). This shall assist in soil stability and seed retention. Large woody debris may also be placed in isolated clumps across this zone to assist in slowing water flow and providing habitat for fauna and flora. Weed control shall then be completed to target any weed germination that has occurred due to the soil disturbance.

Native seed and a cover crop of native everlastings shall be broadcast over this area at a rate of 4 kg/ha and 5 kg/ha respectively. Seedlings shall be installed at 1 plant / 10m².

5.3 Management Zone 2 – Upper Slope

The upper slope elevation is between 65 – 78 mAHD. The soil profile changes from the toe of the batter and the groundwater level is closer to the surface; therefore, an alternate vegetation community is to be considered for this area.

Commencing from the interface with the toe of the batter, the area shall be a 1:20 slope with either site topsoil and/or a constructed topsoil thinly spread across the surface. Mulch (if not a constructed topsoil) shall be spread across the area for soil stability and then ripped to a depth of 300-500mm at 2 metre intervals along the contour to break surface compaction. The surface between riplines is to be scarified to a depth of 50mm to create micro-niches for seed entrapment. Woody debris may also be spread across this zone for additional soil stability and habitat. Weed control shall then be completed to target any weed germination that has occurred due to the soil disturbance.

Native seed shall be broadcast at a rate of 3 kg/ha. Seedlings shall be installed at 1 plant / 10m².

5.4 Management Zone 3 – Lower Slope

The lower slope elevation is between 51 – 65 mAHD. The groundwater level is closer to the surface and the soil profile is dominated by sandy soils and therefore an alternate vegetation community has been considered for this area, which is to resemble a Cartis Woodland community.

The implementation strategy for this management zone will be the same as for Management Zone 2 - Upper Slope in terms of landform creation, soil preparation and stabilisation, and tubestock and seed. The only difference will be in the quantities of materials (i.e. mulch, tubestock and seed).

Native seed shall be broadcast at a rate of 3 kg / ha. Seedlings shall be installed at 1 plant / 10m².

6 ADVANCE PLANNING AND MANAGEMENT

6.1 Vegetation Retention and Clearing

Clearing of remnant vegetation shall occur as part of these excavation works. All efforts shall be made, where possible, to limit the amount of native vegetation to be cleared during excavation works. Prior to any clearing works occurring, all efforts shall be made to opportunistically harvest any plants, cuttings, or seed material possible that could be used in the rehabilitation of the site.

6.2 Topsoil Recovery and Management

There will be some clearing of isolated pockets of sporadic bushland during excavation activities. These isolated pockets are degraded, with a dominant overstorey and non-existent middle and understorey structure. Where these isolated pockets are being cleared, the topsoil shall be utilised in the native vegetation rehabilitation areas, as it is likely that a native seed bank is present, and it could add additional value to the native rehabilitation outcomes. The first 50 mm of topsoil shall be stripped, as it contains around 94% of the seed bank, and this shall be stockpiled separately. If possible, direct transfer is the preferred option as it is the most successful for regeneration potential (no stockpiling). Should the topsoil need to be stockpiled, then the stockpile shall be up to a maximum of 2 m tall, with a flat top to maximise surface area and prevent erosion and loss of material. It is recommended that stockpile be left for no longer than 2-3 weeks, as the regeneration from topsoil when spread significantly drops if left longer than this.

6.3 Erosion Management

Water erosion is not anticipated to be a significant issue across the site if the appropriate earthworks recommended in the Stormwater Management Plan are implemented. Should these recommendations fail, then immediate remediation works shall commence to ensure there is minimal impact to the success of the rehabilitation works.

Wind erosion may occur in drier conditions with high winds. After topsoil is spread, mulch shall be applied across the batters to stabilise the soil surface, assist with moisture retention, and minimise erosion. Mulch shall only be spread in areas with natural topsoil, as constructed topsoil shall already have mulch incorporated within it. The batters shall then be ripped along the contour and tracked vertically, whilst the upper and lower slope areas shall be ripped along the contour only.

6.4 Mulch Supply

6.4.1 Imported Mulch

There shall be insufficient quantities of site mulch for use in the rehabilitation works, and mulch shall need to be imported from offsite. Any mulch that is to be brought onsite must have originated from a dieback free area that is of similar vegetation type and/or has been

composted for a period of between 3-6 months so that any pathogens and weed seeds are likely to have been neutralised. Mulch to be a nominal 10 – 50mm in diameter.

6.5 Native Seed, Cutting, and Transplant Recovery

Prior to any clearing occurring at the site, efforts should be made to recover as much seed and plant material as possible that can be used in the rehabilitation program. This may also include transplanting some species such as *Xanthorrhoea sp.* Any remaining material required for the implementation of the program shall be sourced from within a 50 km radius from the site, if possible. Should the range need to be extended due to the availability of suitable material approval shall be sought from the relevant government authority.

6.6 Dieback Management

A Dieback Management Plan has been developed for this site due to it being located within the 'vulnerable zone' for Phytophthora disease to develop (Bark Environmental, 2017). The plan shall be followed by all personnel, machinery and vehicles entering the site, and requires all machinery, vehicles, and equipment to be cleaned down prior to being onsite to remove any foreign soil and seeds entering the site.

7 IMPLEMENTATION METHODOLOGY

The implementation program shall commence with provenance seed and cutting recovery, landform creation (batter, upper and lower slopes), site preparation (including fencing and mulching) and weed management, and then followed by seed broadcasting and seedling planting. Species selected shall be sourced locally from the vegetation both within site and surrounding areas where possible, as the plants propagated shall already be adapted to the local environmental conditions.

The techniques listed below are based on best management practices that Tranen believe are the most practical and cost-effective for the site conditions and appropriate to meet the required outcomes for the site.

7.1 Weed Management

Ongoing weed management shall occur during the extraction works to ensure adequate control of weeds onsite. Once a rehabilitation area has been formed (i.e. batter, upper and lower slopes) and topsoil and mulch have been installed, two weed control events shall occur on rehabilitation areas prior to commencement of seeding and tubestock works.

An initial weed control event shall be undertaken to target any weed germination that has occurred due to the initial disturbance, and additional follow-up control shall occur once the ripping has been completed to target any secondary germination. This shall occur for each stage area once ready for native rehabilitation. The role of the weed control program is not to eradicate the weeds, but to manage them in order to allow the natives to establish themselves and create a self-sustaining ecological community.

Herbicides shall be selected for the target species, considering the surrounding environment and the constraints this may present. Where appropriate, selective herbicides (i.e., grass or broadleaf-specific) shall be favoured over general knockdown herbicides to keep off-target damage to a minimum. In some instances, alternative control methods such as manual removal shall be considered where appropriate. Below is a list of the common herbicides that will likely be used onsite.

Herbicide	Use
Glyphosate Biactive	Broadleaf and grasses
Fluazifop	Grass specific
Metsulfuron-methyl	Geophytes

All herbicide application records are to be kept as required under Department of Health WA regulations (an example of a record sheet for this project can be found in Appendix 8). Only herbicides authorised for use in Australia are to be used.

7.2 Surface Preparation

7.2.1 Bulk Earthworks (including Topsoil and Mulch Spreading)

- **Management Zone 1 – Batter:** The batters with a slope of 1:6 shall be formed ensuring that the batter is reprofiled into the surrounding landform at the top. Either topsoil sourced from clearing works onsite, or a constructed topsoil consisting of a blend of subsoil and mulch shall be spread across the face of the batter at a depth of approx. 50 mm, utilising earthmoving equipment such as a dozer, loader and/or posi-track skid steer.

Mulch shall then be installed to a depth of 25 mm by mechanical and manual means. A posi-track or similar shall be utilised for the bulk of the spreading, and some minor manual raking to finish off levels. The site shall then be ripped on the contour to break compaction. The topsoil / mulch shall then be driven over with tracked earthmoving machinery up and down the face of the batter to create imprints in the soil (track-rolled) prior to seeding and tubestock installation.

- **Management Zone 2 – Upper Slope:** The upper slope shall be a 1:20 and profiled to tie in with the toe of the batter. Either topsoil sourced from clearing works onsite, or a constructed topsoil consisting of a blend of subsoil and mulch shall be spread across the upper slope area at a depth of approx. 50 mm, utilising earthmoving equipment such as a dozer, loader and/or posi-track skid steer.

Mulch shall then be installed to a depth of 25 mm by mechanical and manual means. A posi-track or similar shall be utilised for the bulk of the spreading, and some minor manual raking to finish off levels. The site shall then be ripped on the contour to break compaction, and then scarified between the rip lines prior to seeding and tubestock installation.

- **Management Zone 3 – Lower Slope:** The bulk earthworks shall be similar to that of the Management Zone 2 – Upper Slope approach with a 1:20 slope (landform creation and topsoil and mulch spreading).

7.2.2 Topsoil Respreading

Prior to the topsoil being spread across the site, testing of the following parameters shall be completed to ensure it is suitable for rehabilitation:

- Organic carbon
- pH
- Plant available nutrients
- Molar Ethanol Droplet (MED) test

Topsoil sourced from clearing works onsite, or a constructed topsoil consisting of a blend of subsoil and mulch shall be spread across the face of the batters at a depth of approx. 50 mm, utilising earthmoving equipment such as a dozer, loader and/or posi-track skid steer.

7.2.3 Erosion Management

Water erosion is not anticipated to be an issue in the native rehabilitation areas if the recommended actions in the Storm Water Management Plan are implemented. Additional management controls involving surface preparation techniques shall also be used to further assist by increasing water infiltration and providing added stabilisation. These controls include installing a 25 mm mulch layer across the batter face and all slopes, vertically tracking of the mulch on batters, ripping across the contours, and the installation of woody debris.

After a major storm event the site shall be inspected for any erosion within 5 days the event. Shall significant water erosion be present then additional measures to rectify the issue and stabilise shall be undertaken. These may include but not be limited to rock placement, matting and coir logs. Any mitigation works completed shall be reinspected two weeks post-install to ensure it remains in-tact and again after the next major storm event to determine success and if further modification may be required.

Wind erosion is not expected to be an issue as mulch shall be applied to all the native rehabilitation areas.

7.2.4 Ripping / Scarification

Following bulk earthworks, where it is specifically mentioned, the management zones shall be ripped to aerate and decompact the soil from the civil works to improve vegetation establishment. Rip lines are to be installed at 2 m intervals (where possible) across the contour of the slope at an optimal depth of 300-500 mm using a dozer with a single tine across the management zones.

Where specified, scarification shall occur immediately prior to the broadcast of seed. Scarification shall occur in the first 50 mm of soil, any greater than this may result in the seed being buried too deep. Scarifying to the above specification creates micro-niches that create optimum conditions for the seeds to germinate in.

7.2.5 Coarse Woody Debris

There may be some woody debris located onsite and/ or from remnant vegetation clearing activities that could be utilised on the slopes to provide additional stabilisation and habitat creation. Any large pieces of woody debris shall be placed in Management Zone 1 as a priority to assist in sediment capture and encourage fauna utilisation as it is located near existing vegetation. Smaller pieces of debris can be used in Management Zone 2 and 3 for additional stabilisation and habitat.

7.3 Mulching

Following bulk earthworks (landform re-creation and topsoil installation) on the batters and slopes, the mulch shall be spread to a depth no greater than 25 mm to provide dust suppression, erosion control and provide additional carbon for soil microbiological activity. For the batters, the mulch shall then be track-rolled vertically via machine to create micro-niches which shall assist seed capture.

Mulch shall need to be imported from offsite and should ideally be sourced locally (where possible), composted for a period of 3-6 months, and regularly turned over during this period prior to being brought onto site. All mulch shall be either certified as meeting the Australian Standard for composts, soil conditioners and mulches (AS 4454-2012) or all efforts made to match these standards. The heat build-up and regular turning over of the stockpiles will assist in killing any weed seeds, pathogens and diseases (i.e. dieback) that may be present prior to being brought onto site. Mulch application shall occur on all three Management Zones.

7.4 Fence Installation

There are high kangaroo populations within and surrounding the site, which shall impact the success of the rehabilitation through grazing pressure. A “rural style” kangaroo fence shall be installed around each of the native rehabilitation areas. The fence shall be 1500 mm high and shall be composed of ringlock and steel posts. Box strainers shall be used at all changes in direction. The addition of kangaroo escape gates is to be considered as part of the fencing design.

7.5 Species Selection and Plant Allocations

The species are to be based on reference ecosystems both adjacent and/or within the site as well with similar soil and hydrological properties. Species shall only be indigenous to the local area, with a focus on more common species with the highest likelihood of success and that are readily available.

A proposed species list and associated quantities for each of the management zones can be found in Appendix 4.

7.6 Provenance Seed Collection and Supply

A provenance seed and cutting collection program shall commence over the spring and summer periods and shall occur over several years depending on the staged extraction of the sand and gravel, and the areas that are ready for rehabilitation. Seed shall be collected from onsite and within 50 km of the site, where possible. Should species or insufficient quantities not be collected within this provenance range, material shall be sourced from other local areas. The seed and cuttings collected shall be used in seedling propagation and direct seeding activities.

7.7 Seedling Propagation

All seedlings shall be sourced from NIASA certified nurseries, with preference given to local suppliers where possible. All tubestock shall be either forestry tubes or deep cells. Hardening off timeframes for each species are provided for in Appendix 4.

7.8 Direct Seeding

Direct seeding of suitable native species shall be undertaken. This shall occur in either vertically tracked areas or areas where scarification has taken place. The species mix shall

be selected based on available native species, with a particular focus on species that have a higher probability of establishing via seed.

Direct seeding is to be undertaken at the recommended rate of 4 kg per hectare for Management Zone 1 – Batters and 3 kg per hectare for Management Zones 2 and 3, using a native seed mix suitable for site conditions for the batters and slopes. The seed shall be pre-treated and then pre-coated with mycorrhizal fungi mix prior to being hand broadcast. Hand broadcasting is the preferred method as it ensures even and adequate coverage. The expected death rate of germinants from seed over the first three years can be found below. This is a very preliminary estimate only, based on previous experiences with projects of a similar nature. Germination rates and survival from direct seeding is highly variable due to a wide range of environmental factors.

Year	Native Germination Expected Death Rate
1	50 - 70%
2	20 - 30%
3	10 - 20%

Native everlastings shall also be hand broadcast at a rate of 5 kg/ha as a cover crop on the batters to provide soil stability as well as protection for native germinants. Over several years everlasting densities shall reduce as native germinants begin to establish and increase in height.

7.9 Seedling Planting

Planting of tubestock shall be undertaken along the rip lines at the required density and species distribution. Planting shall be via planting tubes to ensure safety of operators and provide accurate and effective planting. A single 10 g native fertiliser tablet shall be installed with each seedling (except for species in the Proteaceae family) to provide immediate nutrients to establishing plants. Planting is only proposed for species where seed is difficult to collect, and cuttings were used. Seedlings would be planted at a density of 1 plant / 10m² (1,000 stems / ha).

Below is a table that outlines the expected seedling death rate for the first three years post-install. This is an estimate only based on previous experiences with projects of a similar nature.

Year	Native Tubestock Expected Death Rate
1	30 - 50%
2	10 - 30%
3	<5 - 10%

7.10 Works Schedule

The extraction staging plan can be found in Appendix 2. Staging shall commence from cell 1 and working in a northerly direction to cell 18.

An indicative works schedule has been developed for rehabilitation based on estimated extraction projections and is detailed in Appendix 7.

8 POST-INSTALLATION MANAGEMENT

Rehabilitation success depends not only on the installation program and timing, but also upon the post-installation management and frequent review of methods and procedures. Regular monitoring is required to track progress and identify any problems before they have any serious impacts. Maintenance of weeds and native vegetation shall ensure maximum survival and growth rates and indicate any site related influences.

8.1 Rehabilitation Monitoring

As rehabilitation shall occur progressively as each stage is completed, monitoring shall need to be undertaken over several years or potentially longer depending on the demand for the resource. Each of the rehabilitation stages shall be monitored bi-annually and maintained (as required) for a 2-year period after installation. After a two-year period, these stages shall then be monitored annually in Spring. The final monitoring shall occur 5 years after the entire site has been rehabilitated. At present it is unclear when this shall be.

A total of two monitoring quadrats per hectare shall be established. The quadrats shall be square 10m x 10m in size and randomly established, ensuring representation of all vegetation types and rehabilitation management zones. Each quadrat shall be clearly marked, and the corner of the quadrat GPS marked. A photo of the quadrat shall be taken from the NW corner. Within the quadrat a 1m x 1m quadrat shall be setup to capture seed germination. The following quantitative and qualitative data shall be recorded within each quadrat:

Quantitative Data	Qualitative Data
Density (stems / m ²) native vegetation	The health of native vegetation
Native species present (species richness)	The health of weeds
Weed species present	Soil movement
Projected native foliage cover (% cover)	Fauna and pest activity
Total weed cover	Comparison of quadrats to remainder of site
Vegetation structure representation by stem count	

In addition to the quadrats, a total of 13 photo monitoring points shall also be established across the site to provide qualitative data and a direct visual capture of progress. Fence droppers shall be used, and the direction of the photo shall be recorded to ensure consistency with each monitoring assessment.

A visual assessment of the entire site through site traverses is to be undertaken as part of each monitoring event to provide a broader picture of success and identify the progress of areas that are not captured by the quadrat data.

Additional informal monitoring of site progress is to be undertaken regularly in addition to formal monitoring events where possible.

A report is to be provided for each monitoring event to document the findings and provide recommendations for any additional actions required to achieve the project targets. The revegetation contractor shall undertake the field monitoring assessment and provide this data to the environmental consultant to compile the report.

8.2 Site Maintenance

This plan has been designed to maximise the chances of a success by the early identification of factors that may have the biggest impact and finding solutions for their management. There are however a number of factors outside of normal control which may influence the outcome such as adverse weather conditions (i.e. droughts and storms), unauthorised access, and pests and diseases. The monitoring shall identify these issues and so that they can be dealt with in an appropriate manner.

Maintenance activities may include:

- On-going weed management (spring, summer, autumn and winter);
- Re-planting in areas of poor response (winter);
- Fence inspection / repair (monthly); and
- Disease and pest control (as required).

Weeds shall almost certainly continue to have an impact on the rehabilitation progress and their management shall be the principal maintenance activity. The extent of weed control required for spring, summer, autumn and winter weeds shall be determined through the monitoring.

Remedial planting operations shall be required if the seed germination or seedlings are not progressing towards the defined success targets. Direct seeding shall only be used as a remedial action if the surface can be appropriately prepared. Otherwise, seedling planting shall be the preferred revegetation method. In some instances, it may be more cost effective to re-start the revegetation operation rather than continuing in problematic areas. This shall be established through the monitoring program.

8.3 Completion Criteria and Success Targets

Table 2 below shows the overall completion criteria and interim targets for the revegetation works, developed for the purposes of the Revegetation Implementation Plan to satisfy Shire of Capel approval processes.

Table 2: Completion criteria for the Revegetation Implementation Plan

Aspect	Completion criteria	Interim Targets	Primary Assessment Method
Landform	Batter angles do not exceed 1:6 [vertical to horizontal] Upper and lower slope angles do not exceed 1:20 (vertical to horizontal)	Final landform is in accordance with the final contour plan for those areas already rehabilitated.	Survey pickup
Soil Profile	All rehabilitated batters and slopes contain 50 mm of topsoil as either: • Topsoil from clearing; or • Constructed topsoil utilising subsurface soils and site and/or imported mulch.	Topsoil has been replaced in those areas already rehabilitated.	Site preparation plans/ earthworks logs
Slope Stability	Slopes are stable	Potential threats to slope stability are identified and mitigated.	Quadrat / site traverse
Vegetation – Species Composition	≥60% of species represented after 5 years (minimum of 10 species per quadrat)	• First year - 80% of species planted / seeded represented • Second year - 70% of species planted / seeded represented	Quadrat / site traverse: Species count
Vegetation – Density	2,000 stems per hectare in each of the extraction cells where native rehabilitation works are required and consists of the following: • ≥750 upper storey stems per hectare • ≥1,250 other strata stems per hectare	<u>First year</u> • Upper storey 1,100 plants per hectare • Other strata species 1,600 plants per hectare <u>Second year</u> • Upper storey 900 plants per hectare • Other strata species 1,400 plants per hectare	Quadrat: Native stem density count
Vegetation – Condition	Vegetation is self-sustaining (i.e. evidence of plant maturity, flowering and seed set observed).	Potential threats to establishing self-sustaining vegetation are identified and mitigated.	Quadrat: Native stem density count and plant growth
Vegetation – Extent	All areas disturbed that are marked as native vegetation rehabilitation (12.8 ha) are to be rehabilitated.	Progressive native vegetation rehabilitation follows gradual clearing.	Ongoing rehabilitation monitoring
Weed Management	≤20% weed cover. No declared weeds present onsite	Weed control undertaken and weeds not out-competing the revegetation.	Quadrat / site traverse: Projected weed cover

9 CONTINGENCY AND MANAGEMENT ACTIONS

Contingency actions are only required if progress towards completion criteria is not being achieved. Contingency actions therefore would only be undertaken during the post-installation phase of works.

Some activities such as weed control, translocation, tubestock planting and direct seeding can result in variable outcomes, due to uncontrollable or unpredictable factors like extreme weather events, seasonal variation in rainfall or temperature and differences in landform, soil or biology. In addition, if predation (by rabbits for example) and/or physical disturbance (such as vandalism) occur these factors may impact outcomes within management areas.

Rehabilitation works shall move at the pace of the sand and gravel extraction which shall be determined by demand for these resources. It is anticipated that extraction works should be complete within a period of five years (length of EIL approval), however this will depend on the demand for the resource. Upon completion of all extraction and rehabilitation activities an additional three years of monitoring and maintenance shall be undertaken to ensure completion targets are met.

As extraction in each block is completed, the same block shall be rehabilitated with native vegetation (if required) meaning each rehabilitated block(s) may vary by multiple years in age. Having native rehabilitation blocks of multiple ages shall allow greater scope to learn as rehabilitation progresses to refine the approach to the site conditions leading to overall greater success.

The primary method of developing contingency actions shall be from both formal and informal monitoring specified in Section 8.1. A report is to be provided for each monitoring event to document the findings and provide recommendations for any additional actions required to achieve the project targets. These contingency measures may include:

- On-going weed management,
- Re-planting in areas of poor response;
- Erosion repair;
- Fence repair; and
- Disease and pest control.

10 RECORD KEEPING, AUDITING AND REPORTING

Tranen shall provide information to supplement and support wider reporting through regular monitoring reports to be provided bi-annually for a 2-year period after installation, then annually during spring thereafter, up to 5-years post installation.

Monitoring reports shall contain the following information:

- The date(s) each area was revegetated;
- The locations of each revegetated area;
- Descriptions of revegetation activities undertaken for the monitoring period;
- Summary of quadrat data for all vegetation types and rehabilitation management zones
- Photo of quadrat (NW corner)
- Photos from additional monitoring points (13 in total)
- Comments from visual assessment by site traverses
- Recommendations for any contingency measures.

In addition to the above monitoring and record keeping, Tranen understand that the Shire requires 3rd party auditing of the rehabilitation works in order to maintain transparency. Tranen's reports and other data can be provided to the Shire if requested to facilitate this process.

11 REVISIONS

Revisions and amendments to the plan may be required in the event that:

- The scope of works changes from that described in Section 1.1;
- Improvements to the rehabilitation approach are discovered during implementation and post installation management phases; and test
- Monitoring results indicate that progress towards completion criteria is not satisfactory.

12 REFERENCES

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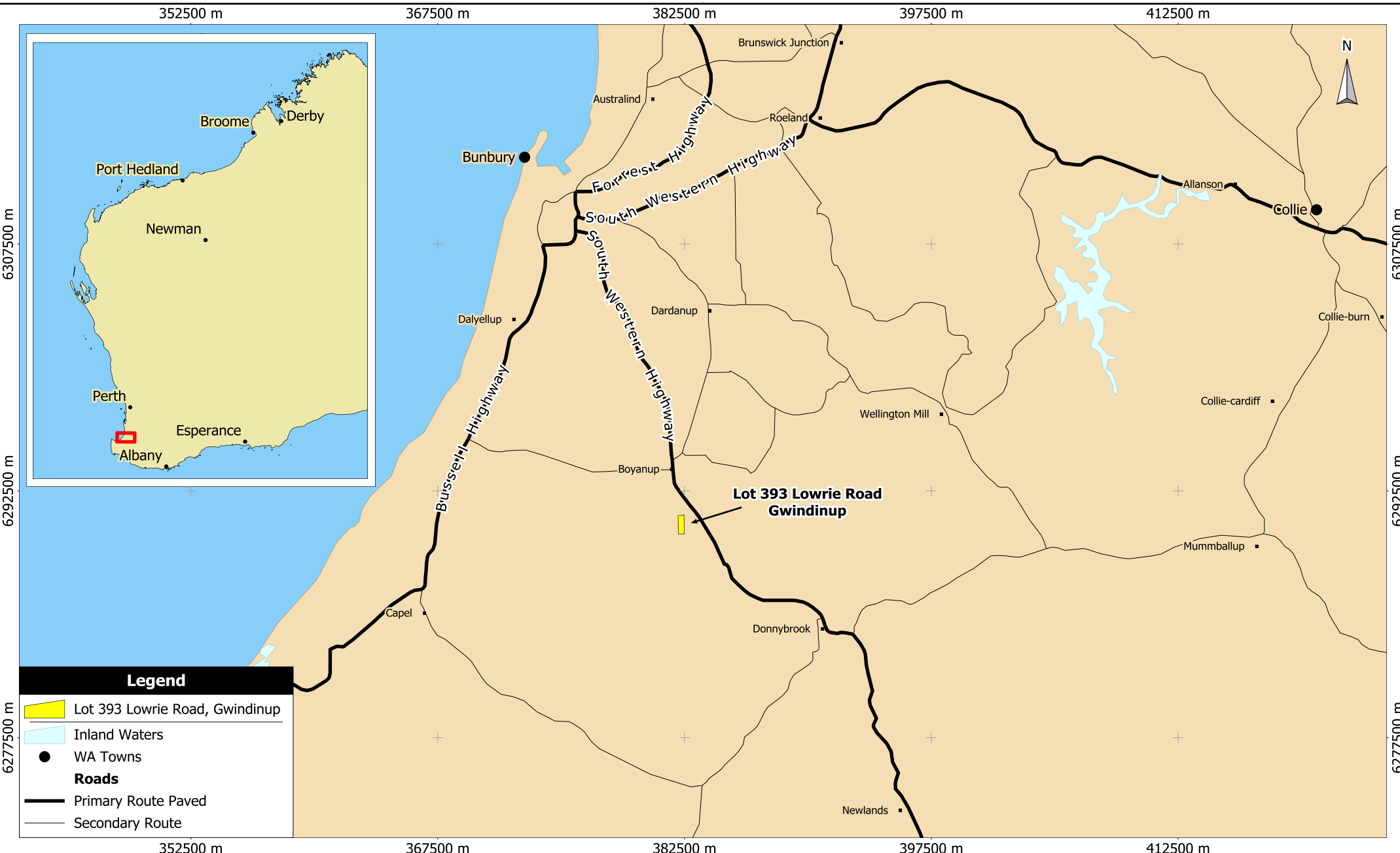
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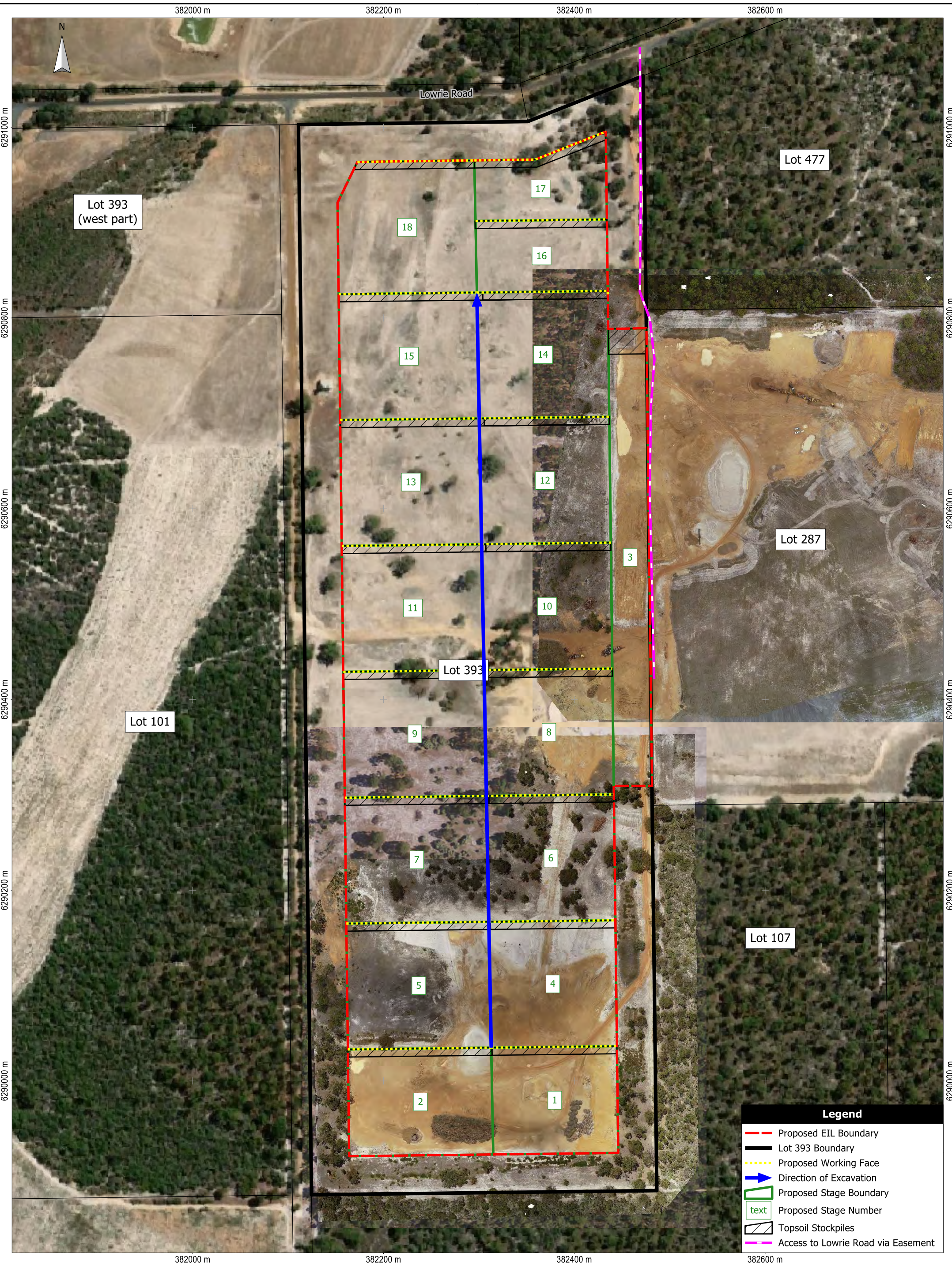
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Appendix 1 Site Location



Appendix 2 Site Extraction Plan



Scale: 1:3500
Original Size: A3
Air Photo Date: November 2020 for southern part
of Lot 393 and Lot 287, January 2019 for rest.
Grid: MGA94(50) 0 100 m

Mario Michele Giacci
Lot 393 Lowrie Road, Gwindinup
EIL Application

Figure 4

Works and Excavation

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Appendix 3 Site Vegetation Complexes



Appendix 4 Species List and Allocations

Species	Form	Seed / Tubestock / Cuttings	MANAGEMENT ZONES		
			Batters	Upper Slope	Lower Slope
Acacia extensa	S	S	x	x	
Acacia pulchella	S	S	x	x	x
Acacia saligna	S	S		x	x
Adenanthos meisneri	S	C		x	x
Agonis flexuosa	T	S, T		x	x
Allocasuarina fraseriana	T	S, T	x	x	
Allocasuarina humilis	S	S		x	x
Banksia attenuata	T	S, T	x	x	
Banksia grandis	T	S, T	x	x	
Bossiaea eriocarpa	S	T		x	x
Bossiaea ornata	S	S	x	x	
Calothamnus quadrifidus	S	S		x	x
Corymbia calophylla	T	S, T	x	x	x
Corymbia haematoxylon	T	S, T	x	x	
Eremaea pauciflora	S	S, T	x	x	x
Eucalyptus marginata	T	S, T	x	x	x
Hakea amplexicaulis	S	S, T	x	x	x
Hakea lissocarpha	S	S, T	x	x	x
Hardenbergia comptoniana	H	S	x	x	x
Hemiandra pungens	H	C		x	x
Hibbertia hypericoides	S	C	x	x	x
Hibbertia racemosa	S	C		x	x
Hypocalymma angustifolia	S	T		x	x
Jacksonia furcellata	S	S, T	x	x	x
Kennedia coccinea	H	S	x	x	
Kennedia prostrata	H	S	x	x	x
Kunzea glabrescens	S	S		x	x
Lechenaultia biloba	H	C		x	x
Melaleuca thymoides	S	S, T	x	x	x
Patersonia occidentalis	H	T	x	x	x
Patersonia umbrosa	H	T	x	x	
Rhodanthe chlorocephala*	H	S	x		
Stirlingia latifolia	S	S	x		x
Xanthorrhoea brunonis	S	S		x	x
Xanthorrhoea preissii	S	S		x	x
Xylomelum occidentale	T	S, T		x	x

S = Seed

T = Tubestock

C = Cuttings

* = cover crop only

Rehabilitation Zone	Area (m2)	Density (plants / m2)	Total Tubestock
Management Zone 1 - Batters	21,175	0.10	2,118
Management Zone 2 - Upper Slope	57,518	0.10	5,752
Management Zone 3 - Lower Slope	43,278	0.10	4328
TOTAL	121,971		12,197

Species	Form	Seed / Tubestock / Cuttings	Batters		Upper Slope		Lower Slope	
			%	Qty	%	Qty	%	Qty
Agonis flexuosa	T	S, T			3	173	5	216
Allocasuarina fraseriana	T	S, T	5	106	3	173		
Banksia attenuata	T	S, T	3	64	5	288		
Banksia grandis	T	S, T	3	64	3	173	5	216
Corymbia calophylla	T	S, T	5	106	5	288	5	216
Corymbia haematoxylon	T	S, T			3	173		
Eucalyptus marginata	T	S, T	5	106	3	173	5	216
Xylomelum occidentale	T	S, T			3	173	5	216
Acacia extensa	S	S						
Acacia pulchella	S	S						
Acacia saligna	S	S						
Adenanthos meisneri	S	C			5	288	3	130
Allocasuarina humilis	S	S,T	3	64			5	216
Bossiaea eriocarpa	S	T			3	173		
Bossiaea ornata	S	S						
Calothamnus quadrifidus	S	S						
Eremaea pauciflora	S	S, T	3	64	5	288	5	216
Hakea amplexicaulis	S	S, T	7	148	5	288		
Hakea lissocarpa	S	S, T	6	127	5	288	5	216
Hibbertia hypericoides	S	C	5	106	5	288	5	216
Hibbertia racemosa	S	C			5	288	5	216
Hypocalymma angustifolia	S	T			3	173	10	433
Jacksonia furcellata	S	S, T	8	169	5	288	5	216
Kunzea glabrescens	S	S						
Melaleuca thymoides	S	S, T	12	254	10	575	7	303
Stirlingia latifolia	S	S						
Xanthorrhoea brunonis	S	S						
Xanthorrhoea preissii	S	S						
Hardenbergia comptoniana	H	S						
Hemiandra pungens	H	C			5	288	5	216
Kennedia coccinea	H	S						
Kennedia prostrata	H	S						
Lechenaultia biloba	H	C			5	288	10	433
Patersonia occidentalis	H	T	15	318	5	288	10	433
Patersonia umbrosa	H	T	15	318	6	345		
Rhodanthe chlorocephala*	H	S						

S = Seed

T = Tubestock

C = Cuttings

* = cover crop only

Rehabilitation Zone	Area (m2)	Rate (kg / ha)	Total Seed (kg)
Management Zone 1 - Batters	21,175	4	8.470
Management Zone 2 - Upper Slope	57,518	3	17.255
Management Zone 3 - Lower Slope	43,278	3	12.983
TOTAL	121,971		38.708

Species	Form	Seed / Tubestock / Cuttings	Batters		Upper Slope		Lower Slope	
			%	Qty	%	Qty	%	Qty
Agonis flexuosa	T	S, T			3	0.518	4	0.519
Allocasuarina fraseriana	T	S, T	5	0.424	3	0.518		
Banksia attenuata	T	S, T	5	0.424	5	0.863		
Banksia grandis	T	S, T	5	0.424	5	0.863		
Corymbia calophylla	T	S, T	5	0.424	5	0.863	8	1.039
Corymbia haematoxylon	T	S, T	5	0.424	5	0.863		
Eucalyptus marginata	T	S, T	5	0.424	5	0.863	8	1.039
Xylomelum occidentale	T	S, T			4	0.690	10	1.298
Acacia extensa	S	S	5	0.424	8	1.380		
Acacia pulchella	S	S	5	0.424	8	1.380	8	1.039
Acacia saligna	S	S			4	0.690	4	0.519
Adenanthos meisneri	S	C						
Allocasuarina humilis	S	S	3	0.254	5	0.863		
Bossiaea eriocarpa	S	S						
Bossiaea ornata	S	S	5	0.424	3	0.518		
Calothamnus quadrifidus	S	S	3	0.254	5	0.863	10	1.298
Eremaea pauciflora	S	S, T	3	0.254	2	0.345	8	1.039
Hakea amplexicaulis	S	S, T	5	0.424	4	0.690	5	0.649
Hakea lissocarpha	S	S, T	3	0.254	3	0.518	2	0.260
Hibbertia hypericoides	S	C						
Hibbertia racemosa	S	C						
Hypocalymma angustifolia	S	T						
Jacksonia furcellata	S	S, T	3	0.254	2	0.345	3	0.389
Kunzea glabrescens	S	S				0.000	8	1.039
Melaleuca thymoides	S	S, T	6	0.508	8	1.380	8	1.039
Stirlingia latifolia	S	S	5	0.424				0.000
Xanthorrhoea brunonis	S	S			3	0.518	3	0.389
Xanthorrhoea preissii	S	S			3	0.518	3	0.389
Hardenbergia comptoniana	H	S	6	0.508	2	0.345	3	0.389
Hemiandra pungens	H	C						
Kennedia coccinea	H	S	8	0.678	1	0.173		
Kennedia prostrata	H	S	8	0.678	3	0.518	5	0.649
Lechenaultia biloba	H	C						
Patersonia occidentalis	H	T						
Patersonia umbrosa	H	T						
Rhodanthe chlorocephala*	H	S		10.588				

S = Seed

T = Tubestock

C = Cuttings

* = cover crop only

Appendix 5 Risk Assessment

Table 3: Risk assessment summary table

Section of revegetation plan	Risk description	Likelihood	Consequence	Initial risk rating	Mitigation action	Likelihood	Consequence	Revised risk rating
Pre-installation phase								
6.1, 6.5, 7.7	Poor recovery of native plants, cuttings and seed material from on-site as well as within 50 km of the site.	C	2	M	- Planned recovery programs by appropriately skilled contractors including any required regulatory permits in place prior to clearing activities - Provenance seed and cutting collection programs over the spring and summer period over several years in line with works schedule (Section 7.11). - Seed collected from remnant vegetation onsite as well as within 50 km of the site in order to source necessary amounts for rehabilitation.	B	2	L
7.6 and Appendix 4	Poor selection of native species and lack of suitability based on climatic, topographic and hydrological factors.	B	3	M	- Management zones developed and species selected on reference ecosystems both adjacent and/or within the site as well with similar soil and hydrological properties. - The species mix for direct seeding shall be selected based on available native species, with a particular focus on species that have a higher probability of establishing via seed. - Dampland community species to be used in highly modified landform areas noting the expected hydrological and soil conditions (i.e. pit base and lower batters).	A	3	L
7.8	Seedlings supplied for rehabilitation works are of poor quality.	C	2	M	- All seedlings sourced from NIASA certified nurseries, with preference given to local suppliers where possible. - All tubestock shall be either forestry tubes or deep cells.	A	2	L
6.4	Insufficient quantities of mulch for rehabilitation activities	C	2	M	- Source mulch from on-site from remnant vegetation proposed for clearing. Cleared material shall either be mulched shortly after being cleared and stockpiled, or the woody debris shall be stockpiled and mulched later depending on the time of year the clearing occurs - In order to make up the expected shortfall across site, importation of mulch as required ensuring originated from dieback free area of similar vegetation type and/or composted for period between 3-6 months so pathogens and weed seeds are neutralised.	A	2	L

6.6	Introduction of dieback infestations during rehabilitation activities	B	3	M	- Existing Dieback Management Plan to be followed by all personnel, machinery and vehicles entering the site which requires machinery, vehicles, and equipment to be washed down prior to being onsite to remove any foreign soil and seeds. - All materials (mulch) brought to site are certified as weed and dieback free.	A	3	L
Implementation and installation phase								
5.1.2, 7.4	Herbivores (in particular kangaroos) impact the success of rehabilitation through grazing pressure	D	3	H	- A "rural style" kangaroo fence shall be installed along the native rehabilitation area boundaries. - The fence shall be 1500mm high and shall be composed of ringlock and steel posts. Box strainers shall be used at all changes in direction. - Herbivore impacts shall be assessed through regular monitoring.	B	2	L
5, 5.2, 5.4, 7.2.1, 7.2.4, 7.2.5, 7.3	Landform does not blend with surrounding landscape and is unstable	D	3	H	- Proposed landform and stabilisation treatments for each management zone as specified (Sections 5.2 to 5.4). - Batters re-contoured to a 1:6 slope that shall create a stable landform profile that blends in with the surrounding environment and topography. - Upper and lower slope areas re-contoured to a 1:20 slope that shall create a stable landform profile that blends in with the surrounding environment and topography; - Batters and slopes shall either have site topsoil or a constructed topsoil utilising subsurface soils and site and/or imported mulch, spread across the face of the batters and the slopes (50mm depth). - Large woody debris may be placed over the upper face of the batters to provide additional stabilisation as well as habitat. - Large to medium woody debris may be placed over the slope to provide habitat and additional stabilisation. - Batters and slopes shall be ripped along the contour to assist in breaking compaction and water infiltration - Mulch shall be installed on batters and then tracked in utilising tracked earthmoving equipment (i.e. dozer or posi-trac) to assist in soil stabilisation and create holding points for native seed so it doesn't all end up at the toe of the batter (25mm depth). - Mulch shall be installed on slopes to assist in soil stabilisation (25mm). - Scarification to occur between rip lines on the slopes to create micro-niches and holding points for the seed.	B	2	L
5 and 7.1	Poor weed management leading to poor establishment of native vegetation	E	3	H	- Ongoing weed management shall occur during the extraction works to ensure adequate control of weeds onsite. - Once a rehabilitation area has been formed (i.e., batter, upper and lower slopes) and topsoil and mulch have been installed, two weed control events shall occur on rehabilitation areas prior to commencement of seeding and tubestock works. - An initial weed control event shall be undertaken to target any weed germination that has occurred due to the initial disturbance, and an additional follow-up control	B	2	L

					shall occur once the ripping has been completed to target any secondary germination. Herbicides shall be selected for the target species, taking into account the surrounding environment and the constraints this may present.			
7.11	Work phases undertaken out of season of without adequate lead times delaying and leading to poor rehabilitation outcomes.	C	2	M	Revegetation activities planned and executed in line with works schedule (Section 7.11) to avoid unnecessary delays and maximise rehabilitation outcomes.	B	2	L
7.2.4, 7.9 and 7.10	Poor germination/plant survival and soil hydraulic properties.	C	2	M	- Following bulk earthworks, where it is specifically mentioned, the management zones shall be ripped to aerate and decompact the soil from the civil works to improve vegetation establishment. - Rip lines are to be installed across the contour of the batter face and slopes at an optimal depth of 300-500mm using a dozer with a single tine. - Rip lines shall be spaced at two metre intervals where possible across the management zones. - Where specified, scarification shall occur immediately prior to the broadcast of seed (in first 50 mm of soil) to create micro-niches for seed germination. - Direct seeding is to be undertaken at the recommended rate of 4 kg per hectare, using a native seed mix suitable for site conditions. The seed shall be pre-treated and then pre-coated with mycorrhizal fungi mix prior to being hand broadcast. Hand broadcasting is the preferred method as it ensures even and adequate coverage. - Native everlastings shall also be hand broadcast on the batters only at a rate of 5 kg/ha as a cover crop to provide soil stability as well as protection for native germinants. - Planting of tubestock shall be undertaken along the rip lines at the required density and species distribution - 1 plant / 20m² (500 stems / ha). - A single 10 g fertiliser tablet shall be installed with each seedling (except for species in the Proteaceae family) to provide immediate nutrients to establishing plants.	B	2	L
Post installation phase								
5.1.1	Intended and unintended damage to rehabilitation from community, personnel or contractors.	C	2	M	Signage advising the public, contractors, and employees that rehabilitation works are being progressively undertaken shall be placed on the entry gate into the active site. In addition, rehabilitation areas where there is a direct interface with access tracks and turnarounds shall be clearly delineated with a visible barrier and signage installed stating 'rehabilitation works in progress'.	C	2	M

					Regular monitoring to inspect site for damage and any required repairs.			
8.1, 8.2	Poor rehabilitation progress towards completion criteria.	C	3	H	- Monitoring shall identify issues early before they have major impacts on rehabilitation and shall be undertaken over several years or potentially longer depending on the demand for sand resource (monitoring regime specified in Section 8.1). - Monitoring results shall trigger maintenance activities specified in Section 8.2 and may include: - On-going weed management; - Re-planting in areas of poor response; - Erosion repair; - Fence repair; and - Disease and pest control.	B	3	M
3.7, 8.2	Adverse whether including climate change on rehabilitation.	C	3	H	- Planting and seeding activities to be undertaken during winter season to take advantage of winter rain and maximise chance of successful germination and establishment. - Species selected shall be sourced locally and shall already be adapted to the local environmental conditions. - Species selected have geographic ranges which span across large portions of southern Western Australia and across multiple IBRA regions which may provide greater ability to adjust to predicted climate change in the region over the long term (DEC 2013).	3		M
8.2, 8.3	Soil moisture due to lack of rainfall / hot dry summers	C	3	H	- Monitor seedling survival over the summer period. - Have allowances in place for additional planting should there be high death rates recorded. Adjust infill planting methodology to include TerraCottem should significant deaths continue over multiple years.	3		M

Appendix 6 Native Rehabilitation Management Zones



Appendix 7 Indicative Works Schedule



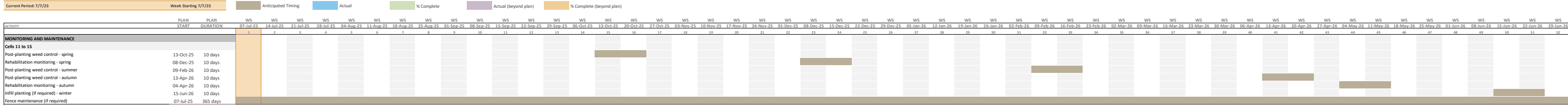
Lot 393 Lowrie Rd Rehabilitation Implementation Indicative Works Schedule - 2022/23

REVA

[illegible]

Overall Period: 3/7/23										Week Starting 3/7/23										1										Anticipated Timing										Actual										% Complete										Actual (beyond plan)										% Complete (beyond plan)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
ACTIVITY	PLAN START	PLAN START	PLAN PLAN	IDEAL START	ACTUAL START	ACTUAL START	ACTUAL ACTUAL	PERCENT COMPLETE	WS 03-Mar-23	WS 10-Mar-23	WS 17-Mar-23	WS 24-Mar-23	WS 31-Mar-23	WS 07-Apr-23	WS 14-Apr-23	WS 21-Apr-23	WS 28-Apr-23	WS 05-May-23	WS 12-May-23	WS 19-May-23	WS 26-May-23	WS 02-Jun-23	WS 09-Jun-23	WS 16-Jun-23	WS 23-Jun-23	WS 30-Jun-23	WS 07-Jul-23	WS 14-Jul-23	WS 21-Jul-23	WS 28-Jul-23	WS 04-Aug-23	WS 11-Aug-23	WS 18-Aug-23	WS 25-Aug-23	WS 01-Sep-23	WS 08-Sep-23	WS 15-Sep-23	WS 22-Sep-23	WS 29-Sep-23	WS 06-Oct-23	WS 13-Oct-23	WS 20-Oct-23	WS 27-Oct-23	WS 03-Nov-23	WS 10-Nov-23	WS 17-Nov-23	WS 24-Nov-23	WS 01-Dec-23	WS 08-Dec-23	WS 15-Dec-23	WS 22-Dec-23	WS 29-Dec-23	WS 05-Jan-24	WS 12-Jan-24	WS 19-Jan-24	WS 26-Jan-24	WS 02-Feb-24	WS 09-Feb-24	WS 16-Feb-24	WS 23-Feb-24	WS 01-Mar-24	WS 08-Mar-24	WS 15-Mar-24	WS 22-Mar-24	WS 29-Mar-24	WS 05-Apr-24	WS 12-Apr-24	WS 19-Apr-24	WS 26-Apr-24	WS 03-May-24	WS 10-May-24	WS 17-May-24	WS 24-May-24	WS 31-May-24	WS 07-Jun-24	WS 14-Jun-24	WS 21-Jun-24	WS 28-Jun-24	WS 05-Jul-24	WS 12-Jul-24	WS 19-Jul-24	WS 26-Jul-24	WS 02-Aug-24	WS 09-Aug-24	WS 16-Aug-24	WS 23-Aug-24	WS 30-Aug-24	WS 06-Sep-24	WS 13-Sep-24	WS 20-Sep-24	WS 27-Sep-24	WS 04-Oct-24	WS 11-Oct-24	WS 18-Oct-24	WS 25-Oct-24	WS 01-Nov-24	WS 08-Nov-24	WS 15-Nov-24	WS 22-Nov-24	WS 29-Nov-24	WS 06-Dec-24	WS 13-Dec-24	WS 20-Dec-24	WS 27-Dec-24	WS 03-Jan-25	WS 10-Jan-25	WS 17-Jan-25	WS 24-Jan-25	WS 31-Jan-25	WS 07-Feb-25	WS 14-Feb-25	WS 21-Feb-25	WS 28-Feb-25	WS 06-Mar-25	WS 13-Mar-25	WS 20-Mar-25	WS 27-Mar-25	WS 03-Apr-25	WS 10-Apr-25	WS 17-Apr-25	WS 24-Apr-25	WS 01-May-25	WS 08-May-25	WS 15-May-25	WS 22-May-25	WS 29-May-25	WS 05-Jun-25	WS 12-Jun-25	WS 19-Jun-25	WS 26-Jun-25	WS 03-Jul-25	WS 10-Jul-25	WS 17-Jul-25	WS 24-Jul-25	WS 31-Jul-25	WS 07-Aug-25	WS 14-Aug-25	WS 21-Aug-25	WS 28-Aug-25	WS 04-Sep-25	WS 11-Sep-25	WS 18-Sep-25	WS 25-Sep-25	WS 02-Oct-25	WS 09-Oct-25	WS 16-Oct-25	WS 23-Oct-25	WS 30-Oct-25	WS 06-Nov-25	WS 13-Nov-25	WS 20-Nov-25	WS 27-Nov-25	WS 04-Dec-25	WS 11-Dec-25	WS 18-Dec-25	WS 25-Dec-25	WS 01-Jan-26	WS 08-Jan-26	WS 15-Jan-26	WS 22-Jan-26	WS 29-Jan-26	WS 05-Feb-26	WS 12-Feb-26	WS 19-Feb-26	WS 26-Feb-26	WS 03-Mar-26	WS 10-Mar-26	WS 17-Mar-26	WS 24-Mar-26	WS 31-Mar-26	WS 07-Apr-26	WS 14-Apr-26	WS 21-Apr-26	WS 28-Apr-26	WS 05-May-26	WS 12-May-26	WS 19-May-26	WS 26-May-26	WS 02-Jun-26	WS 09-Jun-26	WS 16-Jun-26	WS 23-Jun-26	WS 30-Jun-26	WS 07-Jul-26	WS 14-Jul-26	WS 21-Jul-26	WS 28-Jul-26	WS 04-Aug-26	WS 11-Aug-26	WS 18-Aug-26	WS 25-Aug-26	WS 01-Sep-26	WS 08-Sep-26	WS 15-Sep-26	WS 22-Sep-26	WS 29-Sep-26	WS 06-Oct-26	WS 13-Oct-26	WS 20-Oct-26	WS 27-Oct-26	WS 03-Nov-26	WS 10-Nov-26	WS 17-Nov-26	WS 24-Nov-26	WS 01-Dec-26	WS 08-Dec-26	WS 15-Dec-26	WS 22-Dec-26	WS 29-Dec-26	WS 05-Jan-27	WS 12-Jan-27	WS 19-Jan-27	WS 26-Jan-27	WS 02-Feb-27	WS 09-Feb-27	WS 16-Feb-27	WS 23-Feb-27	WS 01-Mar-27	WS 08-Mar-27	WS 15-Mar-27	WS 22-Mar-27	WS 29-Mar-27	WS 05-Apr-27	WS 12-Apr-27	WS 19-Apr-27	WS 26-Apr-27	WS 03-May-27	WS 10-May-27	WS 17-May-27	WS 24-May-27	WS 31-May-27	WS 07-Jun-27	WS 14-Jun-27	WS 21-Jun-27	WS 28-Jun-27	WS 05-Jul-27	WS 12-Jul-27	WS 19-Jul-27	WS 26-Jul-27	WS 02-Aug-27	WS 09-Aug-27	WS 16-Aug-27	WS 23-Aug-27	WS 30-Aug-27	WS 06-Sep-27	WS 13-Sep-27	WS 20-Sep-27	WS 27-Sep-27	WS 04-Oct-27	WS 11-Oct-27	WS 18-Oct-27	WS 25-Oct-27	WS 01-Nov-27	WS 08-Nov-27	WS 15-Nov-27	WS 22-Nov-27	WS 29-Nov-27	WS 06-Dec-27	WS 13-Dec-27	WS 20-Dec-27	WS 27-Dec-27	WS 03-Jan-28	WS 10-Jan-28	WS 17-Jan-28	WS 24-Jan-28	WS 31-Jan-28	WS 07-Feb-28	WS 14-Feb-28	WS 21-Feb-28	WS 28-Feb-28	WS 06-Mar-28	WS 13-Mar-28	WS 20-Mar-28	WS 27-Mar-28	WS 03-Apr-28	WS 10-Apr-28	WS 17-Apr-28	WS 24-Apr-28	WS 01-May-28	WS 08-May-28	WS 15-May-28	WS 22-May-28	WS 29-May-28	WS 05-Jun-28	WS 12-Jun-28	WS 19-Jun-28	WS 26-Jun-28	WS 03-Jul-28	WS 10-Jul-28	WS 17-Jul-28	WS 24-Jul-28	WS 31-Jul-28	WS 07-Aug-28	WS 14-Aug-28	WS 21-Aug-28	WS 28-Aug-28	WS 04-Sep-28	WS 11-Sep-28	WS 18-Sep-28	WS 25-Sep-28	WS 02-Oct-28	WS 09-Oct-28	WS 16-Oct-28	WS 23-Oct-28	WS 30-Oct-28	WS 06-Nov-28	WS 13-Nov-28	WS 20-Nov-28	WS 27-Nov-28	WS 04-Dec-28	WS 11-Dec-28	WS 18-Dec-28	WS 25-Dec-28	WS 01-Jan-29	WS 08-Jan-29	WS 15-Jan-29	WS 22-Jan-29	WS 29-Jan-29	WS 05-Feb-29	WS 12-Feb-29	WS 19-Feb-29	WS 26-Feb-29	WS 03-Mar-29	WS 10-Mar-29	WS 17-Mar-29	WS 24-Mar-29	WS 31-Mar-29	WS 07-Apr-29	WS 14-Apr-29	WS 21-Apr-29	WS 28-Apr-29	WS 05-May-29	WS 12-May-29	WS 19-May-29	WS 26-May-29	WS 02-Jun-29	WS 09-Jun-29	WS 16-Jun-29	WS 23-Jun-29	WS 30-Jun-29	WS 07-Jul-29	WS 14-Jul-29	WS 21-Jul-29	WS 28-Jul-29	WS 04-Aug-29	WS 11-Aug-29	WS 18-Aug-29	WS 25-Aug-29	WS 01-Sep-29	WS 08-Sep-29	WS 15-Sep-29	WS 22-Sep-29	WS 29-Sep-29	WS 06-Oct-29	WS 13-Oct-29	WS 20-Oct-29	WS 27-Oct-29	WS 03-Nov-29	WS 10-Nov-29	WS 17-Nov-29	WS 24-Nov-29	WS 01-Dec-29	WS 08-Dec-29	WS 15-Dec-29	WS 22-Dec-29	WS 29-Dec-29	WS 05-Jan-30	WS 12-Jan-30	WS 19-Jan-30	WS 26-Jan-30	WS 02-Feb-30	WS 09-Feb-30	WS 16-Feb-30	WS 23-Feb-30	WS 01-Mar-30	WS 08-Mar-30	WS 15-Mar-30	WS 22-Mar-30	WS 29-Mar-30	WS 05-Apr-30	WS 12-Apr-30	WS 19-Apr-30	WS 26-Apr-30	WS 03-May-30	WS 10-May-30	WS 17-May-30	WS 24-May-30	WS 31-May-30	WS 07-Jun-30	WS 14-Jun-30	WS 21-Jun-30	WS 28-Jun-30	WS 05-Jul-30	WS 12-Jul-30	WS 19-Jul-30	WS 26-Jul-30	WS 02-Aug-30	WS 09-Aug-30	WS 16-Aug-30	WS 23-Aug-30	WS 30-Aug-30	WS 06-Sep-30	WS 13-Sep-30	WS 20-Sep-30	WS 27-Sep-30	WS 04-Oct-30	WS 11-Oct-30	WS 18-Oct-30	WS 25-Oct-30	WS 01-Nov-30	WS 08-Nov-30	WS 15-Nov-30	WS 22-Nov-30	WS 29-Nov-30	WS 06-Dec-30	WS 13-Dec-30	WS 20-Dec-30	WS 27-Dec-30	WS 03-Jan-31	WS 10-Jan-31	WS 17-Jan-31	WS 24-Jan-31	WS 31-Jan-31	WS 07-Feb-31	WS 14-Feb-31	WS 21-Feb-31	WS 28-Feb-31	WS 06-Mar-31	WS 13-Mar-31	WS 20-Mar-31	WS 27-Mar-31	WS 03-Apr-31	WS 10-Apr-31	WS 17-Apr-31	WS 24-Apr-31	WS 01-May-31	WS 08-May-31	WS 15-May-31	WS 22-May-31	WS 29-May-31	WS 05-Jun-31	WS 12-Jun-31	WS 19-Jun-31	WS 26-Jun-31	WS 03-Jul-31	WS 10-Jul-31	WS 17-Jul-31	WS 24-Jul-31	WS 31-Jul-31	WS 07-Aug-31	WS 14-Aug-31	WS 21-Aug-31	WS 28-Aug-31	WS 04-Sep-31	WS 11-Sep-31	WS 18-Sep-31	WS 25-Sep-31	WS 02-Oct-31	WS 09-Oct-31	WS 16-Oct-31	WS 23-Oct-31	WS 30-Oct-31	WS 06-Nov-31	WS 13-Nov-31	WS 20-Nov-31	WS 27-Nov-31	WS 04-Dec-31	WS 11-Dec-31	WS 18-Dec-31	WS 25-Dec-31	WS 01-Jan-32	WS 08-Jan-32	WS 15-Jan-32	WS 22-Jan-32	WS 29-Jan-32	WS 05-Feb-32	WS 12-Feb-32	WS 19-Feb-32	WS 26-Feb-32	WS 03-Mar-32	WS 10-Mar-32	WS 17-Mar-32	WS 24-Mar-32	WS 31-Mar-32	WS 07-Apr-32	WS 14-Apr-32	WS 21-Apr-32	WS 28-Apr-32	WS 05-May-32	WS 12-May-32	WS 19-May-32	WS 26-May-32	WS 02-Jun-32	WS 09-Jun-32	WS 16-Jun-32	WS 23-Jun-32	WS 30-Jun-32	WS 07-Jul-32	WS 14-Jul-32	WS 21-Jul-32	WS 28-Jul-32	WS 04-Aug-32	WS 11-Aug-32	WS 18-Aug-32	WS 25-Aug-32	WS 01-Sep-32	WS 08-Sep-32	WS 15-Sep-32	WS 22-Sep-32	WS 29-Sep-32	WS 06-Oct-32	WS 13-Oct-32	WS 20-Oct-32	WS 27-Oct-32	WS 03-Nov-32	WS 10-Nov-32	WS 17-Nov-32	WS 24-Nov-32	WS 01-Dec-32	WS 08-Dec-32	WS 15-Dec-32	WS 22-Dec-32	WS 29-Dec-32	WS 05-Jan-33	WS 12-Jan-33	WS 19-Jan-33	WS 26-Jan-33	WS 02-Feb-33	WS 09-Feb-33	WS 16-Feb-33	WS 23-Feb-33	WS 01-Mar-33	WS 08-Mar-33	WS 15-Mar-33	WS 22-Mar-33	WS 29-Mar-33	WS 05-Apr-33	WS 12-Apr-33	WS 19-Apr-33	WS 26-Apr-33	WS 03-May-33	WS 10-May-33	WS 17-May-33	WS 24-May-33	WS 31-May-33	WS 07-Jun-33	WS 14-Jun-33	WS 21-Jun-33	WS 28-Jun-33	WS 05-Jul-33	WS 12-Jul-33	WS 19-Jul-33	WS 26-Jul-33	WS 02-Aug-33	WS 09-Aug-33	WS 16-Aug-33	WS 23-Aug-33	WS 30-Aug-33	WS 06-Sep-33	WS 13-Sep-33	WS 20-Sep-33	WS 27-Sep-33	WS 04-Oct-33	WS 11-Oct-33	WS 18-Oct-33	WS 25-Oct-33	WS 01-Nov-33	WS 08-Nov-33	WS 15-Nov-33	WS 22-Nov-33	WS 29-Nov-33	WS 06-Dec-33	WS 13-Dec-33	WS 20-Dec-33	WS 27-Dec-33	WS 03-Jan-34	WS 10-Jan-34	WS 17-Jan-34	WS 24-Jan-34	WS 31-Jan-34	WS 07-Feb-34	WS 14-Feb-34	WS 21-Feb-34	WS 28-Feb-34	WS 06-Mar-34	WS 13-Mar-34	WS 20-Mar-34	WS 27-Mar-34	WS 03-Apr-34	WS 10-Apr-34	WS 17-Apr-34	WS 24-Apr-34	WS 01-May-34	WS 08-May-34	WS 15-May-34	WS 22-May-34	WS 29-May-34	WS 05-Jun-34	WS 12-Jun-34	WS 19-Jun-34	WS 26-Jun-34	WS 03-Jul-34	WS 10-Jul-34	WS 17-Jul-34	WS 24-Jul-34	WS 31-Jul-34	WS 07-Aug-34	WS 14-Aug-34	WS 21-Aug-34	WS 28-Aug-34	WS 04-Sep-34	WS 11-Sep-34	WS 18-Sep-34	WS 25-Sep-34	WS 02-Oct-34	WS 09-Oct-34	WS 16-Oct-34	WS 23-Oct-34	WS 30-Oct-34	WS 06-Nov-34	WS 13-Nov-34	WS 20-Nov-34	WS 27-Nov-34	WS 04-Dec-34	WS 11-Dec-34	WS 18-Dec-34	WS 25-Dec-34	WS 01-Jan-35	WS 08-Jan-35	WS 15-Jan-35	WS 22-Jan-35	WS 29-Jan-35	WS 05-Feb-35	WS 12-Feb-35	WS 19-Feb-35	WS 26-Feb-35	WS 03-Mar-35	WS 10-Mar-35	WS 17-Mar-35	WS 24-Mar-35	WS 31-Mar-35	WS 07-Apr-35	WS 14-Apr-35	WS 21-Apr-35	WS 28-Apr-35	WS 05-May-35	WS 12-May-35	WS 19-May-35	WS 26-May-35	WS 02-Jun-35	WS 09-Jun-35	WS 16-Jun-35	WS 23-Jun-35	WS 30-Jun-35	WS 07-Jul-35	WS 14-Jul-35	WS 21-Jul-35	WS 28-Jul-35	WS 04-Aug-35	WS 11-Aug-35	WS 18-Aug-35	WS 25-Aug-35	WS 01-Sep-35	WS 08-Sep-35	WS 15-Sep-35	WS 22-Sep-35	WS 29-Sep-35	WS 06-Oct-35	WS 13-Oct-35	WS 20-Oct-35	WS 27-Oct-35	WS 03-Nov-35	WS 10-Nov-35	WS 17-Nov-35	WS 24-Nov-35	WS 01-Dec-35	WS 08-Dec-35	WS 15-Dec-35	WS 22-Dec-35	WS 29-Dec-35	WS 05-Jan-36	WS 12-Jan-36	WS 19-Jan-36	WS 26-Jan-36	WS 02-Feb-36	WS 09-Feb-36	WS 16-Feb-36	WS 23-Feb-36	WS 01-Mar-36	WS 08-Mar-36	WS 15-Mar-36	WS 22-Mar-36	WS 29-Mar-36	WS 05-Apr-36	WS 12-Apr-36	WS 19-Apr-36	WS 26-Apr-36	WS 03-May-36	WS 10-May-36	WS 17-May-36	WS 24-May-36	WS 31-May-36	WS 07-Jun-36	WS 14-Jun-36	WS 21-Jun-36	WS 28-Jun-36	WS 05-Jul-36	WS 12-Jul-36	WS 19-Jul-36	WS 26-Jul-36	WS 02-Aug-36	WS 09-Aug-36	WS 16-Aug-36	WS 23-Aug-36	WS 30-Aug-36	WS 06-Sep-36	WS 13-Sep-36	WS 20-Sep-36	WS 27-Sep-36	WS 04-Oct-36	WS 11-Oct-36	WS 18-Oct-36	WS 25-Oct-36	WS 01-Nov-36	WS 08-Nov-36	WS 15-Nov-36	WS 22-Nov-36	WS 29-Nov-36	WS 06-Dec-36	WS 13-Dec-36	WS 20-Dec-36	WS 27-Dec-36	WS 03-Jan-37	WS 10-Jan-37	WS 17-Jan-37	WS 24-Jan-37	WS 31-Jan-37	WS 07-Feb-37	WS 14-Feb-37	WS 21-Feb-37	WS 28-Feb-37	WS 06-Mar-37	WS 13-Mar-37	WS 20-Mar-37	WS 27-Mar-37	WS 03-Apr-37	WS 10-Apr-37	WS 17-Apr-37	WS 24-Apr-37	WS 01-May-37	WS 08-May-37	WS 15-May-37	WS 22-May-37	WS 29-May-37	WS 05-Jun-37	WS 12-Jun-37	WS 19-Jun-37	WS 26-Jun-37	WS 03-Jul-37	WS 10-Jul-37	WS 17-Jul-37	WS 24-Jul-37	WS 31-Jul-37	WS 07-Aug-37	WS 14-Aug-37	WS 21-Aug-37	WS 28-Aug-37	WS 04-Sep-37	WS 11-Sep-37	WS 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28-Aug-40	WS 04-Sep-40	WS 11-Sep-40	WS 18-Sep-40	WS 25-Sep-40	WS 02-Oct-40	WS 09-Oct-40	WS 16-Oct-40	WS 23-Oct-40	WS 30-Oct-40	WS 06-Nov-40	WS 13-Nov-40	WS 20-Nov-40	WS 27-Nov-40	WS 04-Dec-40	WS 11-Dec-40	WS 18-Dec-40	WS 25-Dec-40	WS 01-Jan-41	WS 08-Jan-41	WS 15-Jan-41	WS 22-Jan-41	WS 29-Jan-41	WS 0

Current Period: 1/7/24										Week Starting 1/7/24		1				Anticipated		Actual		% Complete		Actual (beyond plan)		% Complete (beyond plan)																																																																																																																																																																																																								
ACTIVITY	PLAN START	PLAN START	PLAN START	IDEAL START	ACTUAL START	ACTUAL START	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE	CELL ID	01-Jul-24	05-Jul-24	WS	11-Jul-24	WS	17-Jul-24	WS	23-Jul-24	WS	29-Jul-24	WS	03-Aug-24	WS	09-Aug-24	WS	15-Aug-24	WS	21-Aug-24	WS	27-Aug-24	WS	01-Sep-24	WS	07-Sep-24	WS	13-Sep-24	WS	19-Sep-24	WS	25-Sep-24	WS	01-Oct-24	WS	07-Oct-24	WS	13-Oct-24	WS	19-Oct-24	WS	25-Oct-24	WS	31-Oct-24	WS	06-Nov-24	WS	12-Nov-24	WS	18-Nov-24	WS	24-Nov-24	WS	30-Nov-24	WS	06-Dec-24	WS	12-Dec-24	WS	18-Dec-24	WS	24-Dec-24	WS	30-Dec-24	WS	05-Jan-25	WS	11-Jan-25	WS	17-Jan-25	WS	23-Jan-25	WS	29-Jan-25	WS	04-Feb-25	WS	10-Feb-25	WS	16-Feb-25	WS	22-Feb-25	WS	28-Feb-25	WS	06-Mar-25	WS	12-Mar-25	WS	18-Mar-25	WS	24-Mar-25	WS	30-Mar-25	WS	05-Apr-25	WS	11-Apr-25	WS	17-Apr-25	WS	23-Apr-25	WS	29-Apr-25	WS	05-May-25	WS	11-May-25	WS	17-May-25	WS	23-May-25	WS	29-May-25	WS	04-Jun-25	WS	10-Jun-25	WS	16-Jun-25	WS	22-Jun-25	WS	28-Jun-25	WS	04-Jul-25	WS	10-Jul-25	WS	16-Jul-25	WS	22-Jul-25	WS	28-Jul-25	WS	03-Aug-25	WS	09-Aug-25	WS	15-Aug-25	WS	21-Aug-25	WS	27-Aug-25	WS	02-Sep-25	WS	08-Sep-25	WS	14-Sep-25	WS	20-Sep-25	WS	26-Sep-25	WS	02-Oct-25	WS	08-Oct-25	WS	14-Oct-25	WS	20-Oct-25	WS	26-Oct-25	WS	01-Nov-25	WS	07-Nov-25	WS	13-Nov-25	WS	19-Nov-25	WS	25-Nov-25	WS	01-Dec-25	WS	07-Dec-25	WS	13-Dec-25	WS	19-Dec-25	WS	25-Dec-25	WS	31-Dec-25	WS	06-Jan-26	WS	12-Jan-26	WS	18-Jan-26	WS	24-Jan-26	WS	30-Jan-26	WS	05-Feb-26	WS	11-Feb-26	WS	17-Feb-26	WS	23-Feb-26	WS	01-Mar-26	WS	07-Mar-26	WS	13-Mar-26	WS	19-Mar-26	WS	25-Mar-26	WS	
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Appendix 8 Record Keeping Template

LOT 393 LOWRIE RD NATIVE REHAB PROVENANCE SEED DETAILS

[illegible]

LOT 393 LOWRIE RD NATIVE REHAB
CELL REHABILITATION DETAILS

Rehab Cell No:	
Activity Date:	
Conducted By:	

Action Undertaken		
Date	Activity	Description
	(e.g. Seeding, planting, weed control, seed pre-treatment, seed collection, topsoil construction, rabbit control, etc.)	(e.g. Seed broadcasting rate and qty, seedling rate and qty, provenance seed qty and age, topsoil installation and age, etc.)

Additional Comments
(Additional information about site conditions, rainfall totals prior and after, and other general comments)

Prior Works History		
Date	Activity	Description
	(Works completed previously)	(Works completed previously)

** Attach species list, maps, photos, etc. as req'd

**LOT 393 LOWRIE RD NATIVE REHAB
TOPSOIL RECORDS**

[illegible]

LOT 393 LOWRIE RD NATIVE REHAB IMPORTED MATERIAL REGISTER

[illegible]

LOT 393 LOWRIE RD NATIVE REHAB
QUADRAT MONITORING SHEETS

Quadrat Information	
Site / Quadrat Name:	
Quadrat GPS Location:	1) 2) 3) 4)
Current Site Conditions:	

Native Species	Nov-23	Apr-24	Nov-24	Apr-25	Comments:
<i>Trees</i>					
<i>Shrubs</i>					
<i>Groundcovers</i>					
TOTAL					

Weed Species	Nov-23	Apr-24	Nov-24	Apr-25	Comments:
TOTAL					

Density	Nov-23	Apr-24	Nov-24	Apr-25	Comments:
Total Native Stems Rec.					
Native Stem Density (stems / m2)					
Total Weed Stems Rec.					
Weed Stem Density (stems / m2)					

Diversity	Nov-23	Apr-24	Nov-24	Apr-25	Comments:
Total Native Species Rec.					
Total Weed Species Rec.					

Cover	Nov-23	Apr-24	Nov-24	Apr-25	Comments:
% Native Cover					
% Weed Cover					
% Soil Cover					

Structure	Nov-23	Apr-24	Nov-24	Apr-25	Comments:
% Understorey					
% Middlestorey					
% Overstorey					

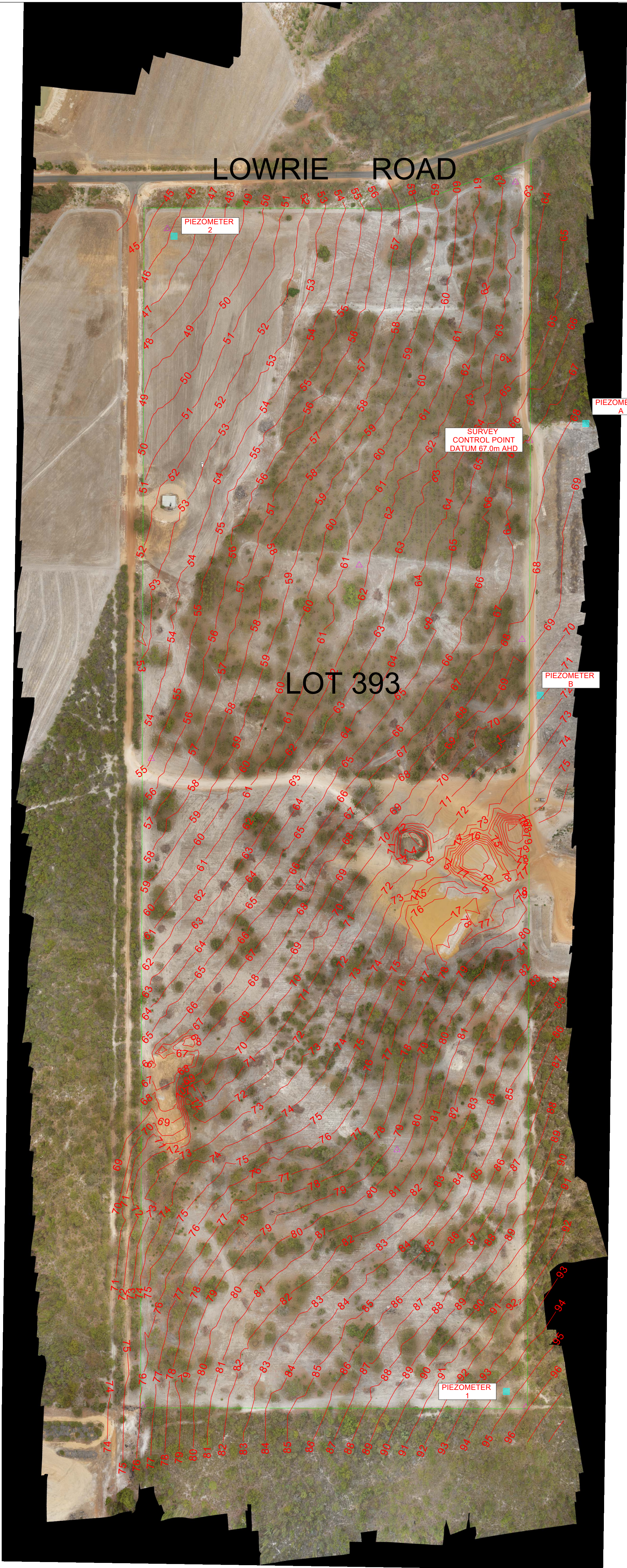
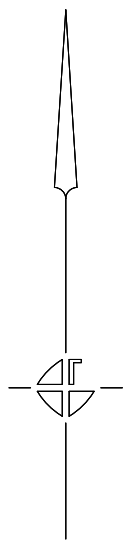
Other	Nov-23	Apr-24	Nov-24	Apr-25	Comments:
Presence of Fauna					
Presence of Disease / Pests					

Additional Comments:

Weed Control and Herbicide Daily Usage Form

Project No / Name		Temp - min / max, °C	
Project Manager		Wind - min / max, km/h	
Area treated, ha		Dew - None / Light / Heavy	
Supervisor		Operator 2	
Operator 1		Operator 3	
Date		Start / Finish Times	
Treatment types: Spray / Basal Bark / Drill & Fill / Cut & Paint / Manual removal (cross out not applicable)			
Herbicides etc sprayed	Dilution rate with water *	Herbicides for BB, D&F, C&P	Dilution rate
Glyphosate 360 or 540	100 or 70 mL / 10 L	Glyphosate 360 or 540	45/55 or 40/60 with water
Metsulfuron methyl		Total glyphosate used, mL	
Garlon		Garlon	18 m L/ L diesel
Other (specify)		Total Garlon used, mL	
Agral wetting agent	1.3 mL / 10 L	Total diesel used, L	
Enviro dye Red or Blue	10 mL / 10 L	Triple rinsing of sprayers	
Total herbicide used, mL		Comments	
Total water used, L			
Main weeds targetted			
* Manufacturer's general recommendation only - check for particular species and write in actual used			

APPENDIX 6: SURVEY VERIFICATION



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Licensed Surveyors, Project Managers
& Engineering Surveyors
A.C.N. 008 938 903 ABN 59 166 330 334
Unit 6, 18 Casuarina Drive, Bunbury
PO Box 1719 BUNBURY WA 6231
Phone: (08) 9721 4000 Fax: (08) 9721 2720
eMail: info@thompsons surveying.com.au

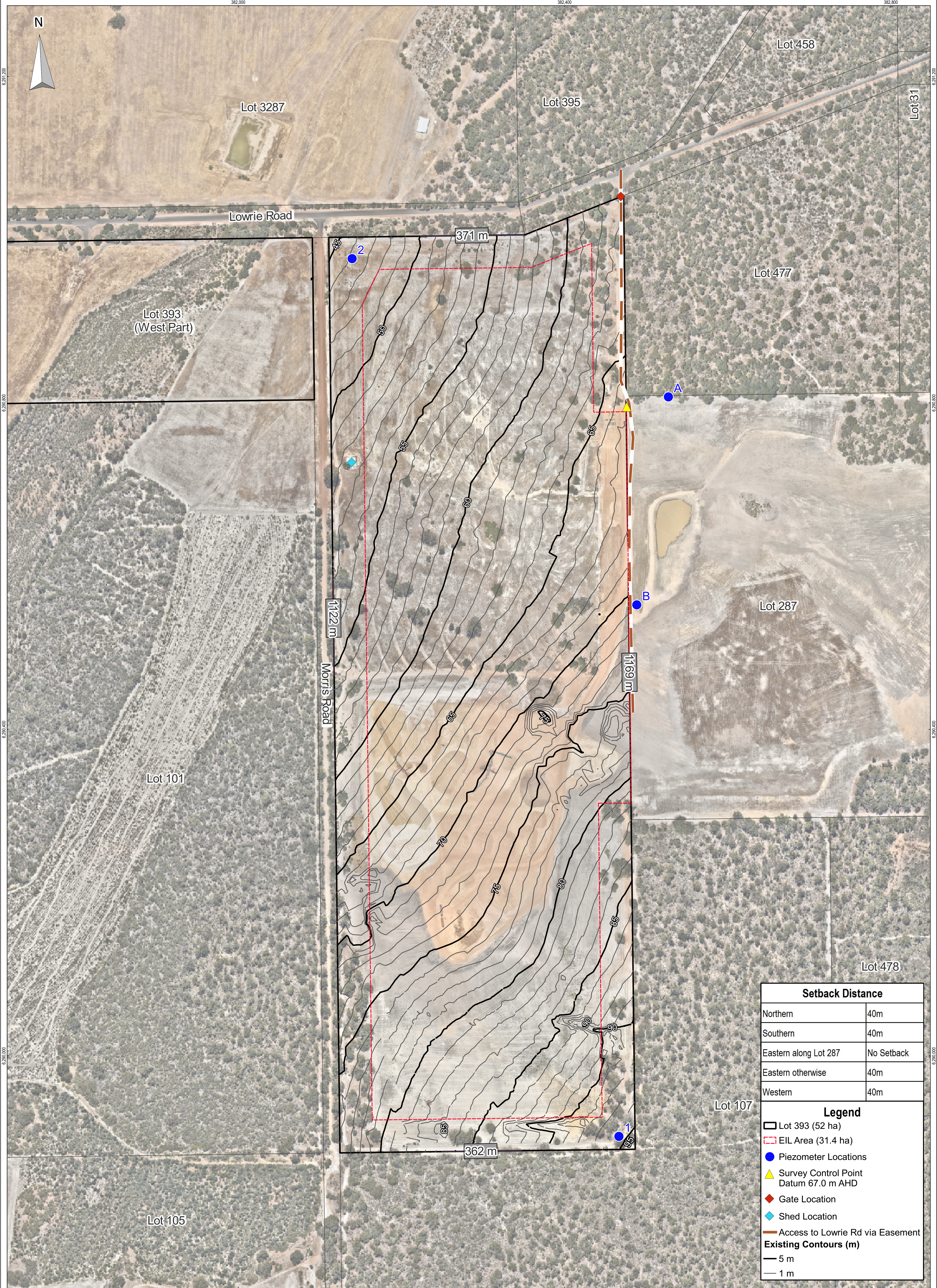


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File No.		17028		Date:	18/Apr./2017		CLIENT:		MARIO GIACCI								
Scale (@A1)	Vert:	N/A		Checked		PROJECT:		LOT 393 LOWRIE ROAD GWINDINUP									
	Hor:	1 : 2000		PS													
Computer Reference		Z:\PS\17028		Revision-		1		TITLE:		EXISTING SITE							
Drg No.		DWG 17028 ORIG		Sheet		1 of 1		DATUM		HOR:		B.C.G. 94		VERT:		A.H.D.	

APPENDIX 7: EXISTING CONTOUR AND FEATURE PLAN (A1)



Setback Distance	
Northern	40m
Southern	40m
Eastern along Lot 287	No Setback
Eastern otherwise	40m
Western	40m

Legend	
	Lot 393 (52 ha)
	EIL Area (31.4 ha)
	Piezometer Locations
	Survey Control Point Datum 67.0 m AHD
	Gate Location
	Shed Location
	Access to Lowrie Rd via Easement
Existing Contours (m)	
	5 m
	1 m

APPENDIX 8: FINISHED DEVELOPMENT PLAN (A1)



APPENDIX 9: STORMWATER MANAGEMENT PLAN

STORMWATER MANAGEMENT PLAN

LOT 393 LOWRIE ROAD AND
LOT 287 SOUTH WESTERN HIGHWAY,
GWINDOW
(REV 7)

PREPARED FOR:

MARIO MICHELE GIACCI

FEBRUARY 2024

PREPARED BY:

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MBS
ENVIRONMENTAL

LOT 393 LOWRIE ROAD AND LOT 287 SOUTH WESTERN HIGHWAY STORMWATER MANAGEMENT PLAN

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Final Report	Michael Dufty	Kirsi Kauhanen	27 February 2024

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APPENDICES

Appendix 1:	Hydrological Calculations — Lot 393 Lowrie Road
Appendix 2:	Hydrological Calculations — Lot 287 Southwestern Highway

1. INTRODUCTION

1.1 BACKGROUND AND SCOPE

Mario Michele Giacci is the owner of Lot 393 Lowrie Road (Lot 393) and Lot 287 South Western Highway (Lot 287) (the properties) in Gwindinup, located within the Shire of Capel (Figure 1). Mr Giacci holds Development Approvals (DA) and Extractive Industry Licences (EIL) from the Shire of Capel for extraction of sand and gravel on the properties. The most recent DA/EIL application for Lot 287 provides for the extension of extraction further to the east.

Shire of Capel Local Planning Policy LPP6.2 Extractive Industries specifies that DA and EIL applications include a Stormwater Management Plan. Previous DA condition (e) for Lot 393 (from 2022) also states following:

- e) *Prior to Commencement a detailed Engineering design plan of the stormwater disposal system shall be submitted for approval of the Shire of Capel, and thereafter implemented in accordance with the approved plan to the satisfaction of the Shire of Capel.*

This Stormwater Management Plan (SMP) has been prepared to address the above requirements. It has been developed with reference to the Department of Water and Environmental Regulation (DWER) submission to the 2019 DA/EIL applications, which recommend:

- Cut-off bunds will be constructed along boundaries to the Extractive Industry (EI) area to prevent any external runoff from entering active EI areas.
- All stormwater runoff from active EI areas shall be contained onsite initially, through detention ponds and settling pits, to achieve effective removal of sediment and turbidity.
- All runoff from active EI areas shall be contained onsite initially, through the detention pond (as described) to achieve effective removal of sediment and turbidity.
- Stormwater management structures shall be designed to manage at minimum the calculated runoff, with detention ponds / sediment traps designed and built to an adequate standard and capacity, prior to extraction beginning.
- Any EI licence include a condition whereby following the occurrence of a rainfall event greater than the 10-year / 2-hour Average Recurrence Interval, the proponent shall inspect the site and within 48 hours report to the Shire, with details of impacts and remediation actions (if required).
- Stormwater detention ponds include an overflow spillway, or acceptable alternative, to manage discharge of excess water in events up to and including the 100-year Average Recurrence Interval / 1% annual exceedance probability.
- A 'Stormwater Management Plan' be prepared, including details of the proposed measures taken to manage and contain calculated runoff within each stage of the proposed extractive activity.

This SMP (Rev7) supersedes all previous revisions of the plan. It includes amendments made following a review of stormwater leaving the site on Lot 393 in 2022 during high rainfall events. Key amendments include changing assumptions regarding soil profile and runoff coefficients (see Section 2.3) and pit depth (see Section 3), and increasing the size of the retention ponds (see Section 3.3). Indicative proposed locations for ponds and drains have been amended to match installation in areas that have been completed. At the time of preparation of this SMP, Stages 1 to 11 of Lot 287 and Stages 1 and 2, and most of 4 and 5 of Lot 393 have had extraction activities completed and rehabilitation works commenced.

1.2 OBJECTIVE

The objective of this SMP is to reduce the potential of impacts from extractive activities on downstream waters, specifically sediment and turbidity impacts caused by stormwater runoff from disturbed areas.

This will be achieved by the construction of stormwater management structures to contain initial runoff from extraction areas from rainfall events up to 10% Annual Exceedance Probability (AEP) and 2 hours duration. AEP is the currently preferred terminology for rainfall event probability, as used in the current edition of Australian Rainfall and Runoff (Ball et al. 2019). A 10% AEP event is equivalent to a 10-year Average Recurrence Interval specified in the DWER comments (see Section 1.1).

2. HYDROLOGY AND CATCHMENTS

2.1 CATCHMENTS

The project site is situated at the eastern edge of the catchment of Gynudup Brook, a tributary of the Capel River that discharges into the Indian Ocean at Geographe Bay. There are no watercourses at the site due to the well-draining soil and lack of upstream catchment area (the site is within 500 m of the upstream watershed). Almost the entire extraction area is within the Gynudup brook catchment, which drains west. A small area of proposed extraction (approximately 1.3 ha) at the eastern limit of the extraction area on Lot 287 is within the Preston River Catchment and drains east toward the Preston River. The location of the project site and relevant catchments are shown in Figure 1. Most of the Lot 287 extraction area is within the upstream catchment of Lot 393.

The extraction areas within the Gynudup Brook catchment slope to the northwest, while extraction areas in the Preston River catchment slope northeast and east (Figure 2). Surface flow is only likely to occur during intense rainfall events. Any surface flow leaving the extraction areas of Lot 287 does so across the western boundary into Lot 393, with the exception of the 1.3 ha in the Preston River catchment.

Any surface flow leaving Lot 393 does so across the western boundary adjacent to Morris Road. On the northern half of Lot 393, Morris Road has shallow open drains that direct runoff under the road and into the adjacent property through 300-mm culverts (Figure 2). This property contains the completed Gwindinup North mineral sand mine. The reconstructed landform includes a drainage/sumpland that flows southwest through minor water courses and drains to join Gynudup Brook. On the southern half of the boundary, Morris Road is an unformed dirt road and natural surface flow across the road to the west is possible as no roadside drainage is in place.

On Lot 287, any water leaving the extraction area that is located within the Preston River Catchment will drain toward the eastern property boundary, which adjoins the South Western Highway Road reserve — approximately 300 m from the extraction area. Any natural runoff from the eastern portion of Lot 287 (within Preston River catchment) also drains this way. Any flow leaving the property will be intercepted by the highway's drainage infrastructure, where it would mix with road and railway runoff that flows toward the Preston River, a further 200 m to the east.

The Gynudup Brook catchment downstream of the project site is almost entirely cleared agricultural land. Land use is primarily beef and dairy grazing. The hydrology of the catchment has been extensively modified as a result of agriculture and includes many artificial drains constructed to alleviate water logging. The Elgin Main Drain, located 12 km downstream of the project area, diverts all flow in Gynudup Brook at that point.

Nutrient concentrations in Gynudup Brook are elevated due to poor soils and agricultural land use. It is categorised as a 'recovery waterway' in the Revitalising Geographe Waterways initiative as nutrient concentrations do not meet water quality targets (DWER/DPIRD 2018).

The Preston River catchment is 1,136 km² with headwaters 80 km inland in the Darling Range and flows to Leschenault Estuary at Vittoria Bay near Bunbury. The hydrology is significantly altered via river straightening near the Bunbury township and a water supply dam (Glen Mervyn Dam). The Lower Preston catchment is about two thirds cleared. The catchment contains multiple sources of nutrient pollution including urban areas, beef and dairy grazing, abattoirs, Dardanup wastewater treatment plant, and septic tanks (DWER/DPIRD 2024).



2.2 RAINFALL AND CLIMATE

The properties experience warm summers and cold winters with a winter dominant rainfall pattern (BoM 2016a). Mean annual rainfall recorded by the Bureau of Meteorology (BoM) at Donnybrook (9 km southeast of Lot 393) is 970.4 mm (BoM 2024).

Rainfall Intensity Frequency Duration (IFD) data for the project site from the BoM is shown in Table 1. This data is from the 2016 revision of design rainfalls by BoM (BoM 2016b).

Table 1: Rainfall Intensity Frequency Duration Data for Lot 393 and Lot 287

Duration	Annual Exceedance Probability					
	50%	20%	10%	5%	2%	1%
1-h	19.9	25.8	30.0	34.5	40.8	46.0
2-h	25.4	32.8	38.3	44.0	52.2	58.9
3-h	29.3	37.9	44.3	51.0	60.6	68.6
6-h	37.5	48.7	57.2	66.1	78.8	89.4
12-h	47.7	62.1	73.0	84.5	101.0	115.0
24-h	59.6	77.2	90.3	104.0	124.0	141.0
48-h	73.2	93.0	107.0	122.0	144.0	161.0
72-h	82.5	103.0	118.0	132.0	153.0	170.0
96-h	90.5	112.0	126.0	140.0	161.0	177.0
120-h	98.1	120.0	134.0	148.0	168.0	183.0
144-h	106.0	128.0	142.0	156.0	175.0	190.0

Source: Bureau of Meteorology (BoM 2016b)

2.3 RUNOFF COEFFICIENT AND CATCHMENT YIELD

Over the various revisions of this SMP, guidance regarding runoff estimation methods has changed and therefore the runoff estimates have varied. This SMP Rev7 follows guidance provided in the revised Water Quality Protection Note No. 15 Basic Raw Materials Extraction (DWER 2019). This specifies that for calculation of runoff from the 10% AEP 2-hour rainfall event, a minimum runoff coefficient of 0.1 should be adopted for sand pit floors and 0.8 for gravel pits.

The soil profile in the extraction areas at both Lots 287 and 393 is sand over gravel, with material of higher clay content underneath. Majority of the sand and gravel will be removed by the planned excavation, with some sandy topsoil and overburden returned as part of rehabilitation. Based on this and supported by observations of high runoff from excavated areas in August 2022, the gravel pit coefficient has now been adopted for revised pond designs for the active and completed pit areas.

All calculations are provided in Appendix 1 and Appendix 2.

2.4 PEAK FLOW

Peak flows were estimated for a 1% AEP event for spillway design and drain capacity using the empirical rational method for the cleared catchment and using the Regional Flood Frequency Estimation (RFFE) model of the current edition of Australian Rainfall and Runoff (Ball et al. 2019) for rehabilitated or natural catchments. For the empirical method, a runoff coefficient of 0.54 was adopted based on a rolling catchment with bare ground in line with methods

in Carey et al. (2015). The time of concentration was calculated based on Horton's n of 0.275 (bare ground) (Carey et al. 2015).

Calculated flows are given in Table 2. All calculations are provided in Appendix 1 and Appendix 2.

Table 2: Calculated 1% AEP Peak Flows

Catchment	Area (ha)	1% AEP flow (m ³ /s)	Method
Upstream Catchment	31.9	0.25	RFFE
Lot 287 EIL Stages 1–19 (west)	32.9	4.5	Empirical Rational
Lot 287 Stage 20 (northeast)	1.8	0.3	Empirical Rational
Lot 287 Stage 21 (southeast)	0.5	0.1	Empirical Rational
Lot 393 Stages 1 and 2 combined.	3.2	0.53	Empirical Rational
Lot 393 Stage 3 and Lot 287 Stage 8 combined	2.9	0.53	Empirical Rational
Lot 393 Individual Stages (4 – 18)	2 (maximum)	0.41	Empirical Rational
Lot 393 Complete Excavation (bare ground)	31.4	4.20	Empirical Rational
Lot 393 Complete Excavation (rehabilitated)	31.4	0.26	RFFE

3. STORMWATER MANAGEMENT

3.1 OPERATIONAL CONTEXT

As described in the DA/EIL applications, extraction in Lot 393 is being carried out in 18 stages of approximately 2 ha each, commencing at the southern (upstream) end of the site and gradually moving north. Stages 1 and 2, and most of stages 4 and 5 have had extraction activities completed and rehabilitation works are underway. Operations are currently active in stages 6 to 9, including crushing and screening plant, material stockpiles, access track and turnaround area. Rehabilitation of these stages has commenced where possible, particularly along eastern batter slopes. Stage 3, at the common boundary of the properties, was cleared together with Stage 8 of Lot 287 and remains partly open to facilitate access to both properties. Going forward, extraction will proceed stage by stage, with a new stage commencing as an open stage is rehabilitated (landform reinstated, topsoil returned). Each stage will be excavated to full depth before commencement of the next stage of extraction.

Extraction in Lot 287 is being carried out in 21 stages, with each stage a maximum 2 ha in size, commencing at the western end of the property. At the time of writing of this plan, stages 1 to 11 have been excavated and are undergoing rehabilitation. Stages 12 to 21 are an extension to the previously approved pit and subject to a current DA/EIL application. Extraction is proposed to proceed stage by stage, with a new stage commencing as an open stage is rehabilitated (landform reinstated, topsoil returned).

3.2 DIVERSION BANKS

To divert 'clean' runoff from upstream catchments around the active extraction area, diversion banks will be constructed along sections of the eastern boundary of the Lot 393 extraction area and the southern boundary of the Lot 287 extraction area, with indicative alignments shown in Figure 2. Stage 3 of Lot 393 and Stage 8 of Lot 287 were developed together to connect the extraction area between the two properties and therefore no diversion banks are necessary along this section of property boundary. An additional diversion bank will be constructed along the northeast boundary of Lot 287 to prevent runoff from exiting the northern boundary (in line with pre-existing drainage management), instead diverting it to the eastern boundary (Figure 2).

Banks are to be constructed to the following specifications:

- Only clean material that is free of roots, stumps, or debris to be used.
- Minimum crest width — 0.5 m.
- Maximum bank grade — 2:1 (horizontal to vertical).
- Minimum height — 0.5 m.
- Aligned to ensure positive drainage.
- Runoff discharges downstream of active stage.

As the purpose of the diversion banks is to divert clean water from active extraction areas, the diversion banks will be removed when rehabilitation earthworks on the adjacent stage are completed. A maximum of two stages (250 m) in Lot 393 are expected to require diversion banks in place at any time. Diversion banks are not required on the south, west, or north sides of the Lot 393 extraction area as on those sides the natural topography of the site will result in no substantial surface flow into the extraction area. The diversion bund on the northeast boundary of Lot 287 will be kept permanently as it will support the pre-existing drainage arrangements along this boundary.

Maximum flood flow for the entire upstream catchment of the excavation area for a 1 % AEP flood event is 0.25 m³/s. This corresponds to a flow depth of 0.16 m at the diversion bund, providing 0.34 m freeboard. Since the flow diversion banks are split along the eastern boundary, they will not intercept runoff from the entire upstream catchment and peak flows experienced at the banks will be less than half the whole catchment flow. Flow calculations are provided in Appendix 1 and Appendix 2.

3.3 RETENTION PONDS AND CATCH DRAINS

On Lot 287, a major retention pond has been constructed in the northwest part of the extraction area (mainly stages 4 and 6), where extraction has already been completed. This pond has capacity to provide retention for runoff from the other west draining stages on Lot 287. Two smaller ponds are required in the future at the downstream edges of stages 20 and 21, as these stages drain eastwards away from the major retention pond. These two stages have separate catchments from the rest of the extraction area on Lot 287 and do not receive runoff from any other stages. Some minor runoff from the western edges of Lot 287 will enter stage 3 of Lot 393 and so, in this case, the pond catchments do not precisely match the stage areas. Further information on retention pond specifications is provided in Appendix 2 and Section 3.3.1.

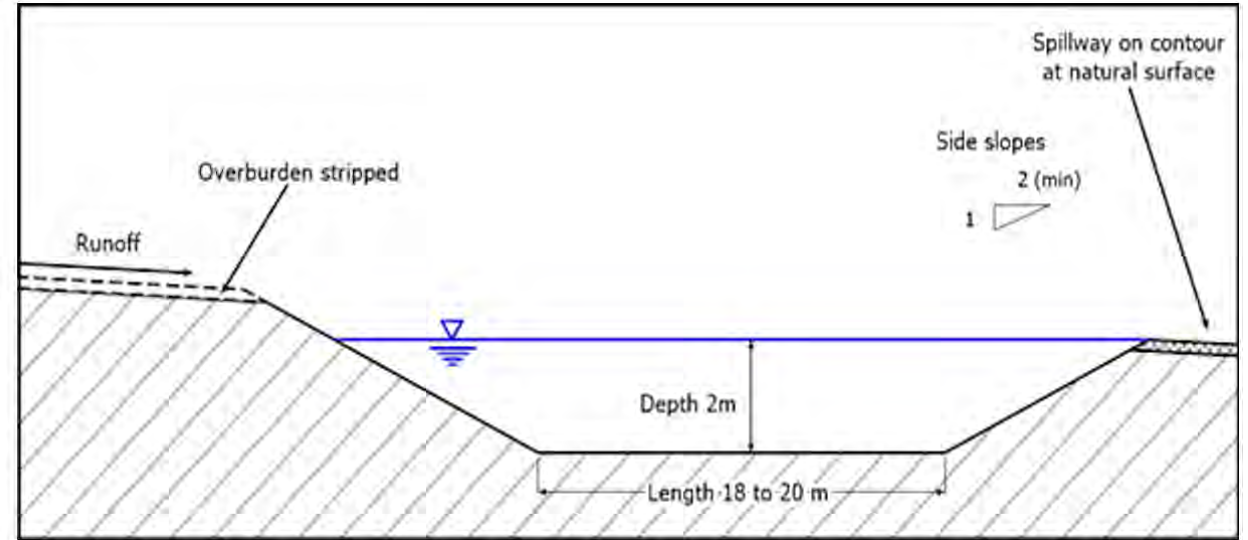
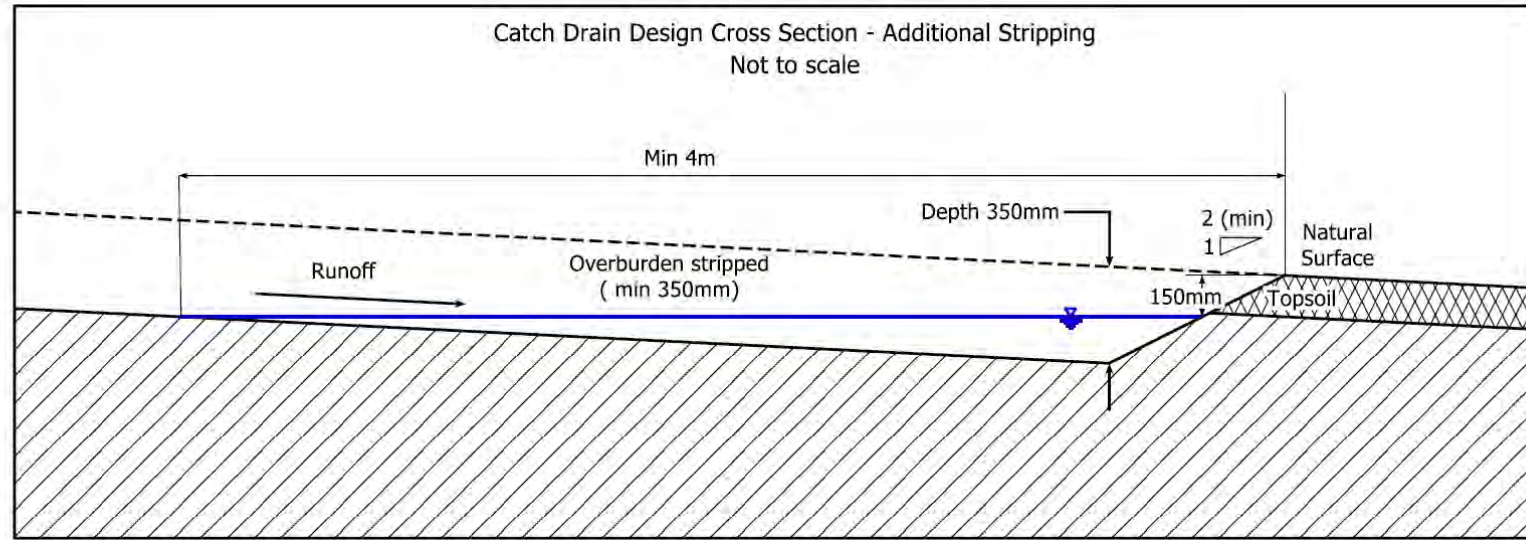
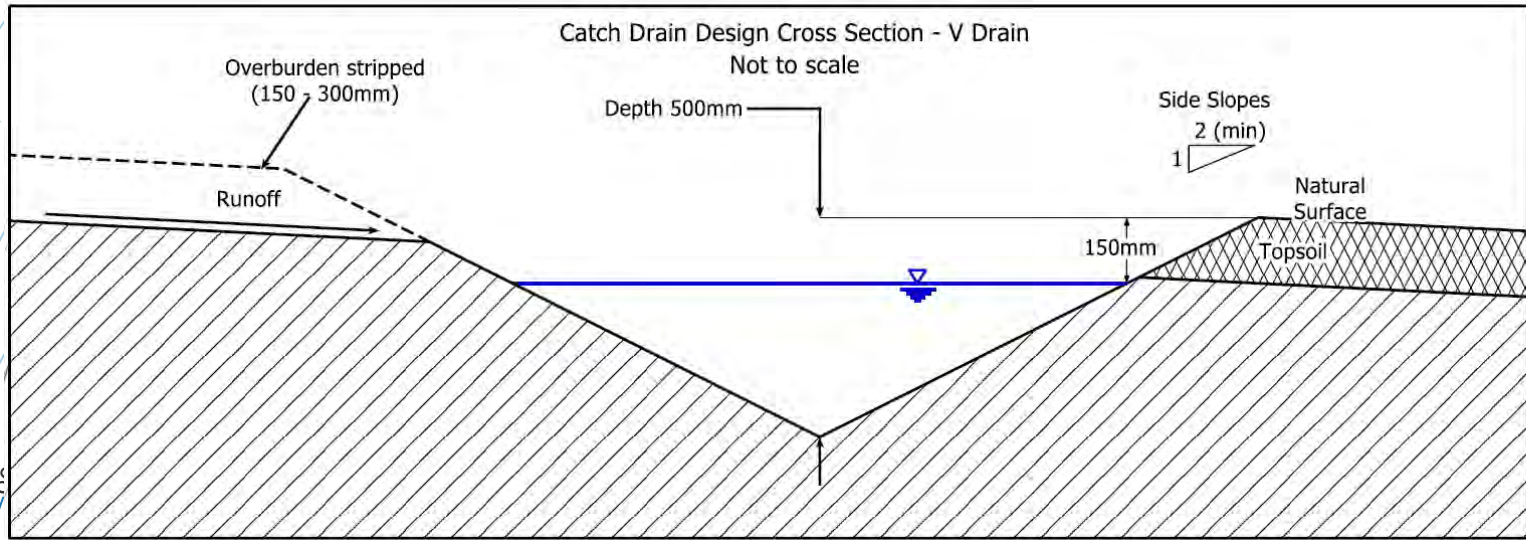
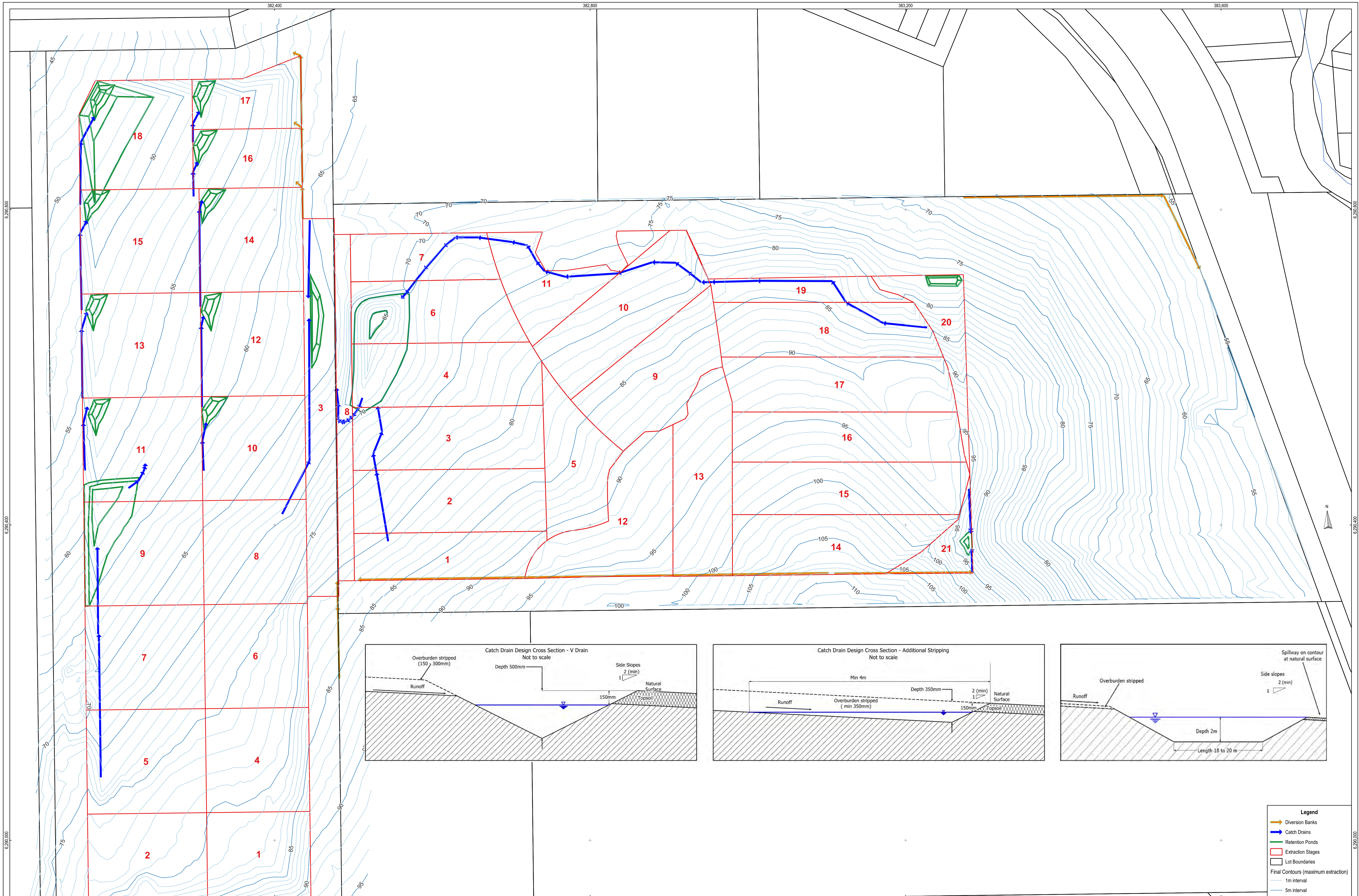
As extraction on Lot 393 commenced at the upstream (southern end) of the site, the approach to stormwater management is different to Lot 287. As presented in the previous revisions of the SMP, the initial calculations based on extraction to the maximum approved depth indicated that the resulting pit landform on Lot 393 would have sufficient water storage capacity to provide the required runoff retention. Additional retention was only expected to be required temporarily in the active stages that had not yet reached the final depth. However, extraction to August 2022 indicated that sand and gravel resource is not consistently present to the full approved depth of the pit, resulting in a shallower final pit depth that has insufficient capacity for runoff retention. Therefore, the stormwater management measures have been revised to increase runoff retention.

A large retention pond will be used to capture runoff from most of stages 1 to 9 (excluding stage 3) totalling approximately 15 ha. This pond is currently in stage 9, however the location may be adjusted as part of rehabilitation once the active operational areas move further north. This pond could be removed completely in the future if sufficient containment is installed downstream. Details of the retention volume and spillway size for this catchment are provided in Appendix 1 and Section 3.3.1.

For the remaining stages 10 to 18 on Lot 393, small ponds will be constructed gradually for each stage as the stage is commenced. Approximately 2-m depth containment ponds will need to be retained at each stage or alternatively, these ponds can be removed if downstream ponds are constructed to a larger size able to contain the runoff from upstream stages. The construction of small ponds for each stage could be avoided all together by constructing a large retention pond in the northwest (downstream) corner of the extraction area prior to proceeding with further stages. This option has been tentatively shown in Figure 2 in addition to the option of smaller ponds for each stage.

Catch drains will be constructed on the downstream boundaries of each stage to direct runoff to the corresponding retention pond (Figure 2). Stripping of topsoil and the removal of overburden at the time of clearing (and stockpiling this material on the downstream side, as described in the EIL application) will be sufficient to direct any runoff reaching the boundary of a stage into the retention pond.

Figure 2 shows the locations of stormwater management measures.



- Legend**
- ➡ Diversion Banks
 - ➡ Catch Drains
 - ▭ Retention Ponds
 - ▭ Extraction Stages
 - ▭ Lot Boundaries
 - Final Contours (maximum extraction)
 - 1m interval
 - 5m interval

Scale: 1: 2,090
Original Size: A1
Grid: GDA94 / MGA zone 50 (EPSG:28350)
0 100 200 m

Mario Michele Giacci
Lot 393 Lowrie Road and
Lot 297 Southwestern Highway
Stormwater Management Plan

Figure 2
Stormwater Management Measures

3.3.1 Retention Pond Specification

Retention ponds are to be constructed with sufficient capacity to retain the 10% AEP 2-hour duration runoff volume from the upstream cleared area, assuming a runoff coefficient of 80%. Table 3 presents the required capacity for each retention pond. Details of calculations are provided in Appendix 1. The storage requirements can be met by constructing a 600 m³ capacity pond for each stage except Lot 287 Stages 20 and 21 (which require 260 m³ and 140 m³) and the major retention pond for Lot 287, which requires 10,400 m³. As the retention ponds are to be created by excavation of the natural surface, there is no embankment subject to failure due to overtopping and no requirement to maintain freeboard.

Lot 393 Stages 1 to 9 (excluding 3) are now directed to a retention pond in stage 9. This has an estimated capacity of 6,000 m³ to a full level of 61.5 m Australian Height Datum (mAHD). This is sufficient capacity for the upstream catchment of the pond, comprising most of Stages 1 to 9 (15 ha), which has a required containment volume of 4,596 m³. If retained, as this pond is constructed above-ground it will need freeboard to be maintained to avoid overtopping and potential wall failure. A spillway will be required to achieve this and should be constructed in natural ground to the east of the embankment at least 0.5 m below the minimum crest level of the embankment. The embankment should be constructed from selected material placed and compacted in controlled layers.

Table 3: Runoff Capacity Required for Retention Ponds

Lot	Stage	Area (ha)	10% AEP 2 hour Runoff Volume (m ³)
Lot 393	1 [#]	1.5	459.6
	2 [#]	1.7	520.9
	3*	2.9	888.6
	4 [#]	1.7	520.9
	5 [#]	2.0	612.8
	6 [#]	1.8	551.5
	7 [#]	2.0	612.8
	8 [#]	1.8	551.5
	9 [#]	2.0	612.8
	10	1.8	551.5
	11	1.9	582.2
	12	1.8	551.5
	13	1.9	582.2
	14	1.8	551.5
	15	1.9	582.2
	16	1.0	306.4
	17	1.0	306.4
	18	2.0	612.8
	Total to Stage 9 [#]	15.0	4,596
	Total 1 to 18	31.5	9,958
Lot 287	1 to 19*	32.5	9,970
	20	0.8	257
	21	0.5	139
	Total 1 to 21	33.8	10,367

* Stage 3 Lot 393 and stage 8 Lot 287 adjusted as some runoff flows between them.

[#] Stages 1 to 9 excluding Stage 3 directed to combined retention pond as of 2023.

Ponds other than the existing Lot 287 pond and Lot 393 Stage 9 pond are to be constructed to the following specification:

- Pond to be excavated below the natural surface.
- The downstream side of the pond to be constructed along the natural contour for a distance of at least 4 m to provide a level spreader discharge spillway in event of overtopping.
- Side slopes to be no steeper than 2:1 (horizontal to vertical).

Recommended pond depth is 2 m below surface, which will result in the pond dimensions shown in Figure 2, but deeper or shallower ponds are acceptable provided the specifications for containment volume and spillway are met. The designs shown in Figure 2 achieve the specification for ponds that are 2 m deep, with a spillway of 20-m length, and floor length of 18 m (20 m for stage 3).

As removal of product during excavation will result in a lowering of the surface level surrounding the retention ponds in the eastern stages of Lot 393, the ponds will need to either be excavated initially to a greater depth to allow for this, or deepened once excavation of the adjoining stage to the west commences. Alternatively, as described in Section 3.3, these small ponds can be removed or not constructed at all, if other sufficiently large containment is available downstream within the extraction area.

An effective level spreader spillway for the retention ponds is provided by the construction of the downstream edge on contour for a minimum length of 4 m. The 1% AEP flood flow is 0.53 m³/s for the largest catchment (Lot 393 Stage 3). Calculated flow depth for the minimum level spillway length of 4 m at this flow is 0.061 m. As the ponds are excavated, there is no possibility of embankment failure due to spillway erosion (see Appendix 1).

A schematic cross section of a retention pond meeting the specification is shown in Figure 3.

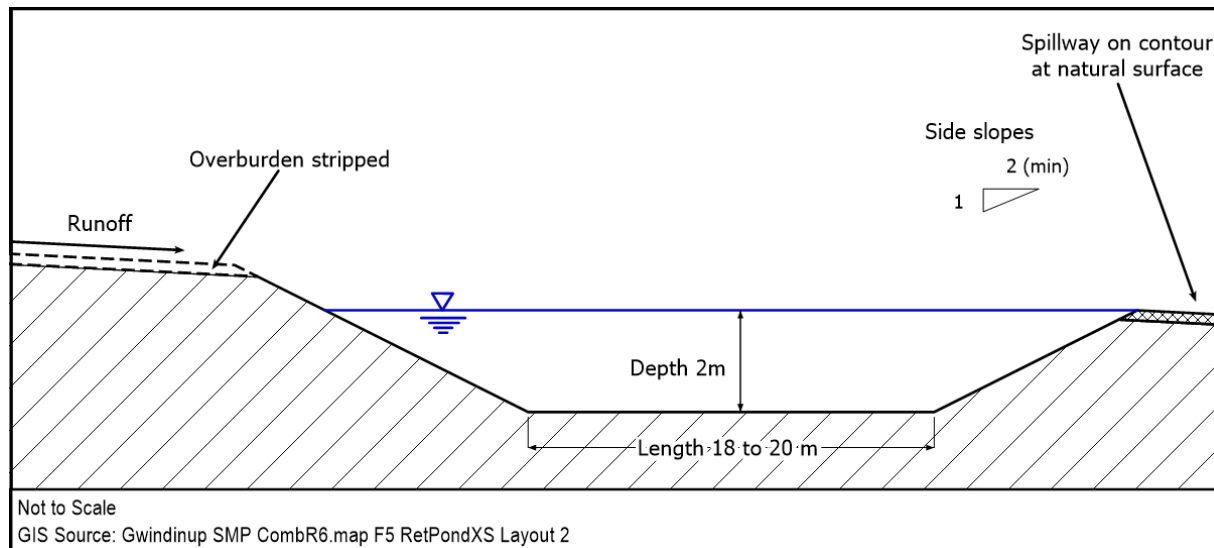


Figure 3: Retention Pond Design Cross-section

The main retention pond on Lot 287 was constructed during 2023 (Figure 4). This was constructed by a combination of excavation and building up of a downstream wall and provides retention volume for Stages 1 to 19 of Lot 287. The pond has a storage volume to full level (69 mAHD) of approximately 10,000 m³ with 1 m freeboard. This is sufficient to contain the design runoff for a 10% AEP 2-hour rainfall event, which is 9,970 kL (Table 3). This volume has been calculated based on DWER guidance for bare ground pit floors (Appendix 2). Actual runoff is expected to be much lower considering rehabilitation works will be completed progressively as extraction activity progresses. Furthermore, extraction activities have already been completed for Stages 1 to 11. The pond spillway is a channel

cut into natural ground to the south of the dam wall, maintaining separation between overflows and the dam wall to avoid risk of wall failure during overflow. This spillway needs to pass a 1% AEP flood peak flow of 4.5 m³/s with a maximum flow depth of 0.5 m.

The access track from Lowrie Road to Lots 393 and 287 currently runs immediately downstream (west) of the major retention pond. The access track includes drains and a culvert, which will act to concentrate any overflow from the pond. In order to manage and diffuse these flows, outflow from the culvert is directed to the retention pond in Lot 393 Stage 3, which, via a drain and spreader bunds, will discharge across the undisturbed pasture of Lot 393. The drain and spreader bunds will be moved as extraction on Lot 393 progresses to ensure discharge is not directed into active stages. Discharge will eventually move to completed areas once contour bunds are installed and vegetation reestablished.

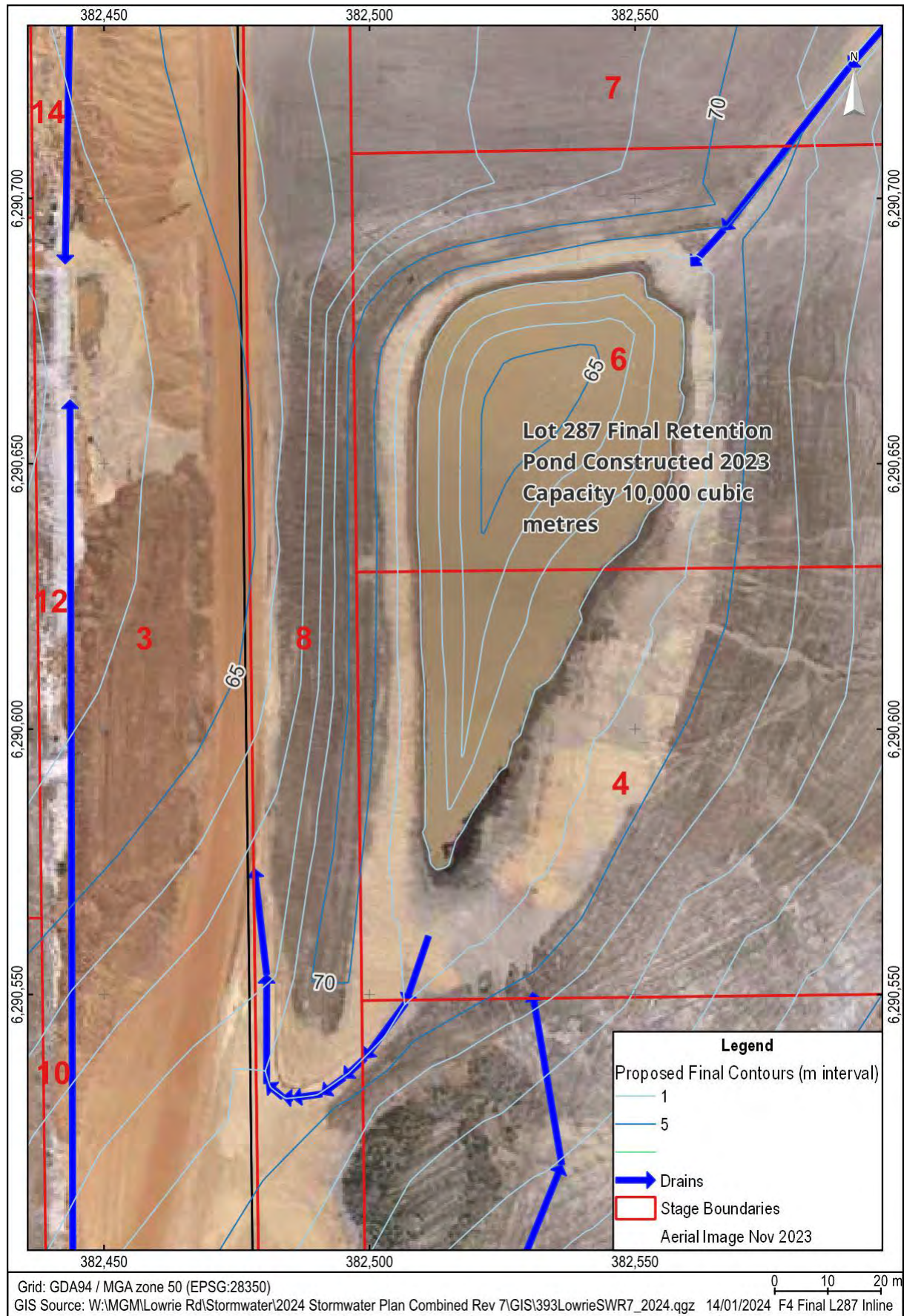


Figure 4: Major Retention Pond Lot 287

3.3.2 Catch Drain Specifications

Catch drains are to be constructed to the following specifications on each stage in Lot 393:

- Drains to follow the downstream external boundary of the stage (slope 3% to 4%, up to 20 m inside the boundary once final excavation is completed, as shown in Figure 2).
- Drains are to be constructed by excavation with side slopes no steeper than 2:1 (horizontal to vertical).
- Drains to have a constant fall from south to north.
- Drains to discharge into retention ponds.
- Drains to have capacity to transfer the 1% AEP peak flow from the adjacent stage with 150 mm freeboard.

The 1% AEP peak flow for the largest stage (stage 3: 0.53 m³/s) (Appendix 1). Either of the two options below for drain dimensions will satisfy the capacity requirements for all stages.

- V drain 500 mm depth below the natural ground surface with 2:1 (horizontal to vertical) side slopes (Figure 5).
- Additional stripping with removal of a minimum 350 mm overburden for at least 4 m to the east, with 2:1 (horizontal to vertical) side slope on the west side (Figure 6).

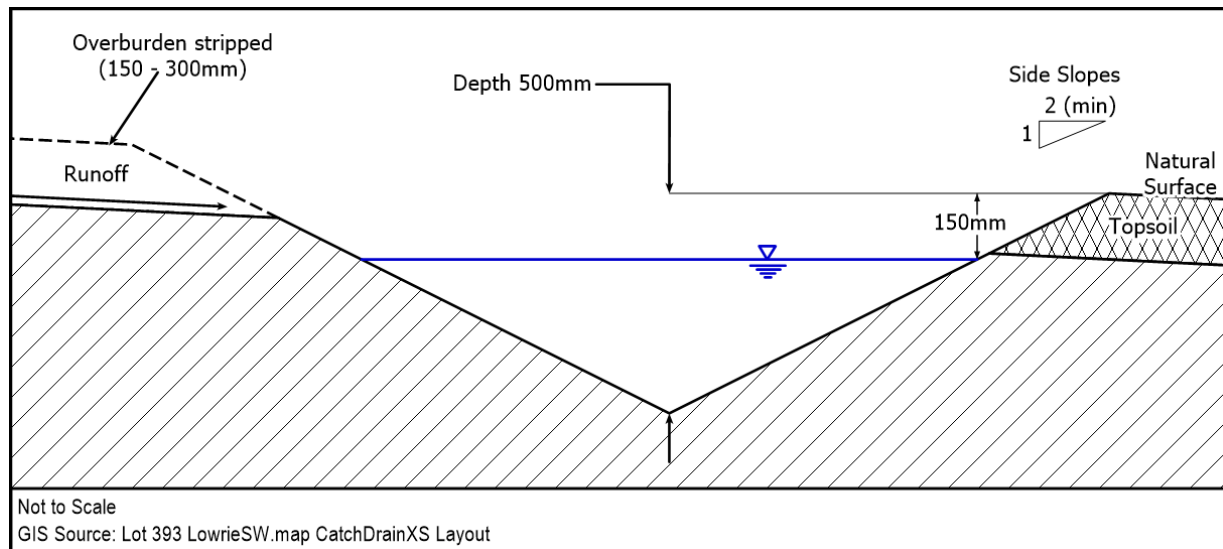


Figure 5: Catch Drain Design Cross-section — V Drain

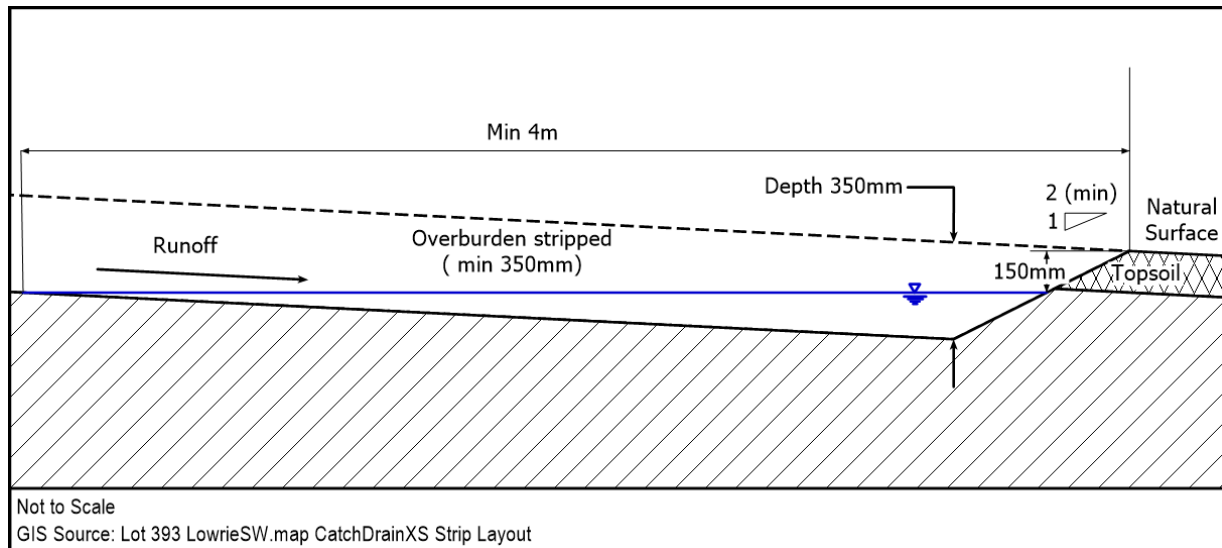


Figure 6: Catch Drain Design Cross-section — Additional Stripping

3.4 CONTOUR BANKS

To further manage runoff, increase infiltration, and reduce sediment movement post extraction, contour banks are to be constructed along the final landform contour at 100-m intervals. These are to be constructed during post mining rehabilitation works for each stage after completion of extraction.

Contour banks are to be constructed to the following specifications:

- Only clean material that is free of roots, stumps, or debris to be used.
- Minimum crest width – 0.5 m.
- Maximum bank grade – 2:1 (horizontal to vertical).
- Minimum height – 0.5 m.
- Aligned on the contour of the final landform.
- Joined to the final pit batters at each end.

Rehabilitation works for each stage will also include ripping along the contour to remove soil compaction and improve runoff infiltration and root penetration. Topsoil will be respread following ripping and vegetation established as described in the rehabilitation and decommissioning programs and the native vegetation rehabilitation plans for the properties.

4. MONITORING AND MAINTENANCE

All full inspection of stormwater management structures will be undertaken ahead of the commencement of seasonal autumn/winter rains and ahead of forecasted major out-of-season rainfall (e.g. summer rainfall due to cyclone activity). The purpose of these inspections is to check that everything is operational and to undertake maintenance as need be.

Catch drains and retention ponds will be inspected weekly during operations and within 24 hours after any runoff-producing rainfall events. Any slumps, bank damage, or loss of freeboard that would interfere with performance will be repaired to specification. Any fill material or sediment blocking the drain will be removed.

Following the occurrence of a rainfall event greater than the 10% AEP 2-hour duration (38.3 mm) or in the event of sediment laden runoff leaving the properties, a report will be made within 48 hours to the Shire of Capel detailing impacts and remediation actions (if any necessary).

5. ROLES AND RESPONSIBILITIES

Roles and responsibilities with respect to stormwater management are outline in Table 4.

Table 4: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	• Responsible for overall implementation of this plan. • Will provide information for site personnel on stormwater management objectives and measures to be undertaken on site. • Responsible for reporting to Shire of Capel.
All personnel	• Will be familiar with stormwater management objectives. • Will implement stormwater management measures as outlined in this plan. • Responsible for reporting stormwater management issues to EIL Licensee.

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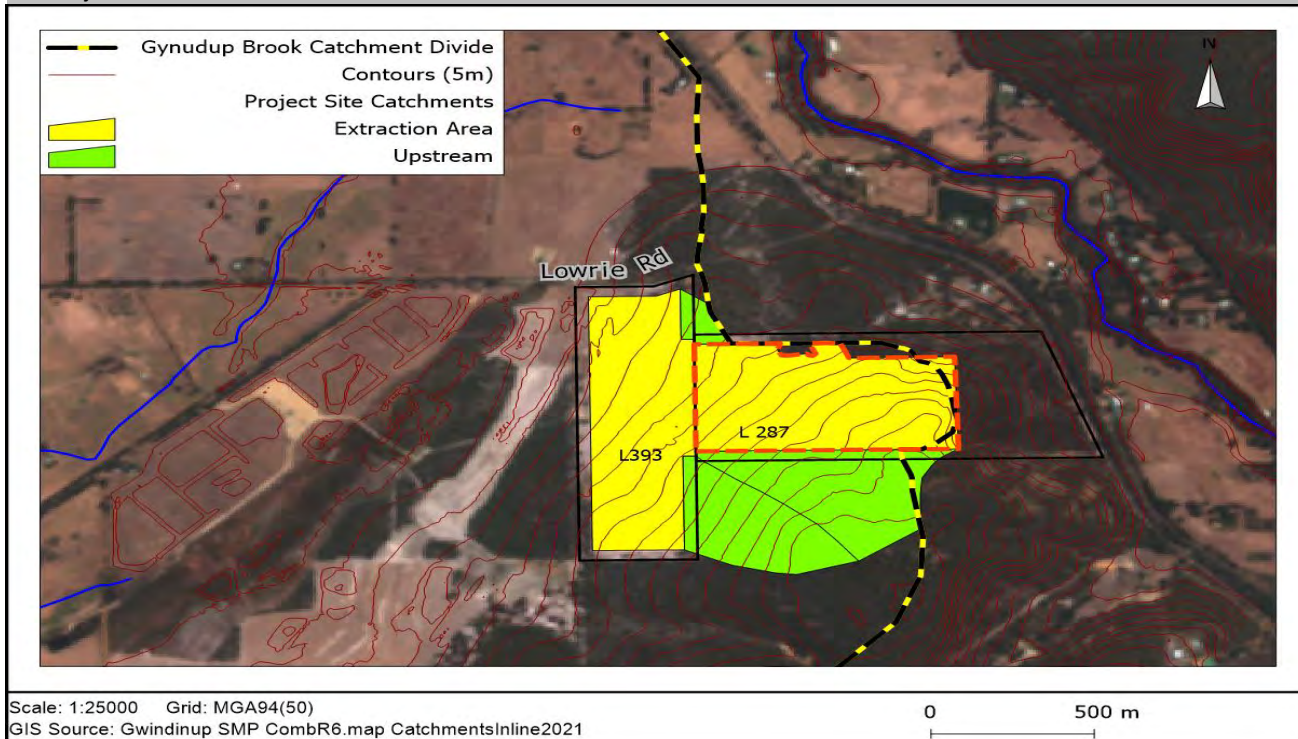
Department of Water and Environmental Regulation / Department of Primary Industries and Regional Development (DWER/DPIRD). 2024. *Lower Preston Catchment*. Healthy Estuaries WA. Accessed January 2024.

<https://estuaries.dwer.wa.gov.au/catchment/leschenault/lower-preston/>

APPENDICES

APPENDIX 1: HYDROLOGICAL CALCULATIONS — LOT 393 LOWRIE ROAD

A1.1 Project Site Location and Catchments



A1.2 Peak Flow Estimates for Vegetated Catchments (RFFE Method)

Peak Flow Estimate for Extraction Area (Stages 1 to 17) Lot 393 Lowrie Road

Results from ARR RFFE Model

<https://rffe.arr-software.org/>

Regional Flood Frequency Estimation Model for the 4th Edition of Australian Rainfall and Runoff

Input Data

Datetime: 2019-03-27 15:18

Region name: SW WA

Region code: 5

Site name: 393 Lowrie St 1-18

Latitude at catchment outlet (degree) = -33.5143

Longitude at catchment outlet (degree) = 115.731

Latitude at catchment centroid (degree) = -33.5193

Longitude at catchment centroid (degree) = 115.733

Distance of the nearest gauged catchment in the database (km) = 3.82

Catchment area (sq km) = 0.314

Design rainfall intensity, 1 in 2 AEP and 6 hr duration (mm/h): 6.248338

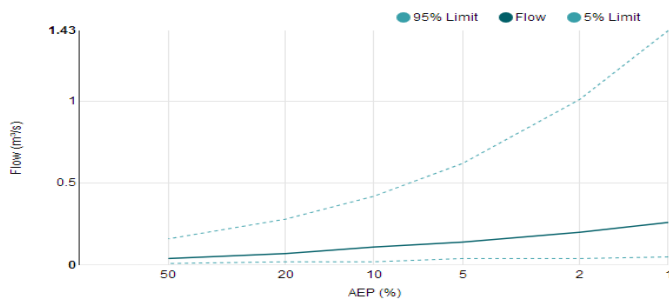
Design rainfall intensity, 1 in 50 AEP and 6 hr duration (mm/h): 13.147148

Shape factor of the ungauged catchment: 1.05

Catchment Location



Results



*The catchment is outside the recommended catchment size of 0.5 to 1,000 km². Results have lower accuracy and may not be directly applicable in practice.

AEP (%)	Discharge (m ³ /s)	Lower Confidence Limit (5%) (m ³ /s)	Upper Confidence Limit (95%) (m ³ /s)
50	0.04	0.01	0.16
20	0.07	0.02	0.28
10	0.11	0.02	0.42
5	0.14	0.04	0.62
2	0.2	0.04	1.01
1	0.26	0.05	1.43

Peak Flow Estimate for Upstream Catchment of Lot 393 Lowrie Road

Results from ARR RFFE Model

<https://rffe.arr-software.org/>

Regional Flood Frequency Estimation Model for the 4th Edition of Australian Rainfall and Runoff

Input Data

Datetime: 2021-02-11 18:55

Region name: SW WA

Region code: 5

Site name: Gwindinup Upstream Diversion

Latitude at catchment outlet (degree) = -33.5203

Longitude at catchment outlet (degree) = 115.7345

Latitude at catchment centroid (degree) = -33.5221

Longitude at catchment centroid (degree) = 115.7378

Distance of the nearest gauged catchment in the database (km) = 4.5

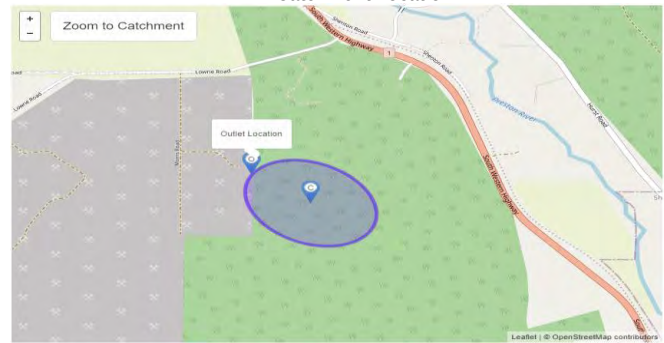
Catchment area (sq km) = 0.319

Design rainfall intensity, 1 in 2 AEP and 6 hr duration (mm/h): 6.248338

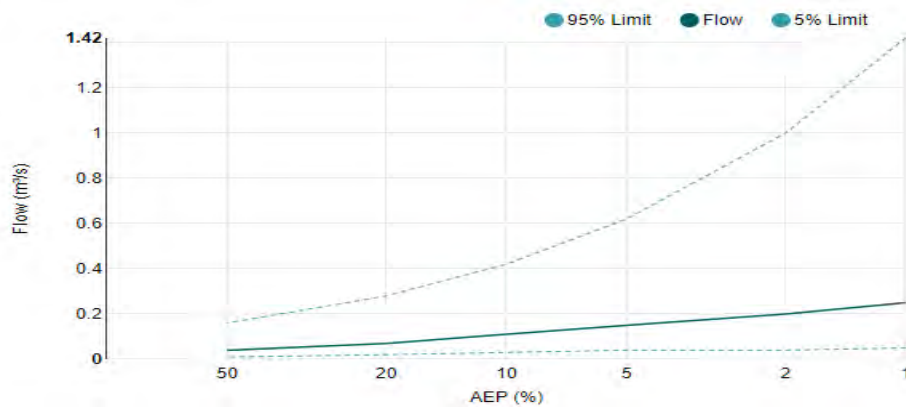
Design rainfall intensity, 1 in 50 AEP and 6 hr duration (mm/h): 13.147148

Shape factor of the ungauged catchment: 0.65

Catchment Location



Results



AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	0.04	0.01	0.16
20	0.07	0.02	0.28
10	0.11	0.03	0.42
5	0.15	0.04	0.62
2	0.2	0.04	1
1	0.25	0.05	1.42

A1.2 Peak Flow Estimate for Bare Catchments (Empirical Rational Method)

Methods

Calculation methods from Soil Conservation Guidelines for Queensland, Ch4 Empirical Version of Rational Method

The Rational Method design equation is:

$$QY = 0.278 \cdot C_Y \cdot I_{tc,Y} \cdot A$$

C10 based on catchment characteristics

Slope	5.7%	(Rolling - 2 to 10%)
Permeability	High	
Condition	3	(Bare)
C ₁₀	0.3	

Rational Method Frequency Factors (C_Y / C₁₀):

ARI (years)	2	5	10	20	50	100
Frequency Factor	0.6	0.8	1	1.2	1.5	1.8

Calculations and Results

Complete Excavation Area (bare ground)

Horton n	0.0275	(bare surface)
Total Distance	1019	
Overland	390	
Drain	700	
t overland	15.1	minutes
t channel (1m/s)	11.7	minutes
t _c	26.8	minutes
t _c	0.45	hr
A	0.314	km ²
C ₁₀	0.300	

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)		100
Annual Exceedance Probability		1%
Coefficient	C _Y	0.54
Time of Conc rainfall intensity	I _{tc}	89.33
Peak Discharge (Rational)	Q _Y (m ³ /s)	4.2

Stage 9 Large Pond (as constructed)

Horton n	0.0275	(bare surface)
Total Distance	570	
Overland	570	
Drain	0	
t overland	17.2	minutes
t channel (1m/s)	0.0	minutes
t _c	17.2	minutes
t _c	0.29	hr
A	0.150	km ²
C ₁₀	0.300	

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)		100
Annual Exceedance Probability		1%
Coefficient	C _Y	0.54
Time of Conc rainfall intensity	I _{tc}	105.00
Peak Discharge (Rational)	Q _Y (m ³ /s)	2.4

Stage 1 & 2 and 3 (bare ground)

Horton n	0.0275	bare surface
Total Distance	268	
Overland	268	
Drain	0	
t overland	13.3	
t channel (1m/s)	0.0	
t _c	13.3	minutes
t _c	0.25	hr
A	0.032	km ²
C ₁₀	0.300	
(Rainfall intensity based on ARR 2016)		

(rounded to 15min)

Average Recurrence Interval (years)	10	100
Annual Exceedance Probability	10%	1%
Coefficient	C _Y	0.30
Time of Conc rainfall intensity	Itc	72.00
Peak Discharge	Q _Y (m ³ /s)	0.19

Individual Stages (4 to 18)

Horton n	0.0275	bare surface
Total Distance	179	
Overland	179	
Drain	0	
t overland	11.7	
t channel (1m/s)	0.0	
t _c	11.7	minutes
t _c	0.25	hr
A	0.020	km ²
C ₁₀	0.300	
(Rainfall intensity based on ARR 2016)		

(rounded to 15min)

Average Recurrence Interval (years)	10	100
Annual Exceedance Probability	10%	1%
Coefficient	C _Y	0.30
Time of Conc rainfall intensity	Itc	90.00
Peak Discharge	Q _Y (m ³ /s)	0.15

L287 Complete Excavation Area (bare ground)

Horton n	0.0275	(bare surface)
Total Distance	500	
Overland	500	
Drain	0	
t overland	16.4	minutes
t channel (1m/s)	0.0	minutes
t _c	16.4	minutes
t _c	0.27	hr
A	0.184	km ²
C ₁₀	0.300	
(Rainfall intensity based on ARR 2016)		

Average Recurrence Interval (years)	100
Annual Exceedance Probability	1%
Coefficient	C _Y
Time of Conc rainfall intensity	Itc
Peak Discharge (Rational)	Q _Y (m ³ /s)

A1.3 Runoff Capacity Required for Retention Ponds

Runoff volume calculation for 10% AEP 2 hour duration event from bare ground for retention pond capacity.

Runoff based on WQPN 15 (DWER 2019) coefficient for gravel pits

P (mm)	38.3	10% AEP, 2 hour rainfall (mm)
Runoff Coefficient	0.80	
Runoff (mm)	30.6	

Runoff Volume for Catchments

Stage	Area (ha)	Runoff	Runoff Volume
		(mm)	(m ³)
1	1.5	30.6	459.6
2	1.7	30.6	520.9
3*	2.9	30.6	888.6
4	1.7	30.6	520.9
5	2.0	30.6	612.8
6	1.8	30.6	551.5
7	2.0	30.6	612.8
8	1.8	30.6	551.5
9	2.0	30.6	612.8
10	1.8	30.6	551.5
11	1.9	30.6	582.2
12	1.8	30.6	551.5
13	1.9	30.6	582.2
14	1.8	30.6	551.5
15	1.9	30.6	582.2
16	1.0	30.6	306.4
17	1.0	30.6	306.4
18	2.0	30.6	612.8
Total 1 to 18	32.5	30.6	9958.0
Stage 9 Large Pond**	15.0	30.6	4596.0

*3 includes some runoff from L287 Stage 8

** includes most of stages 1 to 9, excluding 3

A1.4 Hydraulic Flow Depth Calculations

Flood Levels for Peak Flows were estimated using Manning's Equation for an irregular channel.
Calculations were done with the HY-8 hydraulic analysis package version 7.6 (US Federal Highway Administration, 2019).

Diversion Banks

Channel bank 2:1 downstream, 20:1 upstream.
Slope 3.00% 0.03 m/m
Mannings n of 0.035 was used for the channel (natural channel, irregular, rough).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	1	0.02
2	2	0	0.02
3	22	1	0.02

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.25	0.16	0.16	0.948	49.881

Temporary Retention Pond Spillway

4m wide level spillway on natural terrain
Slope 5.00% 0.05 m/m
Mannings n of 0.02 was used (earth,uniform clean).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	0.3	0.02
2	10	0	0.02
3	14	0	0.02
4	24	0.3	0.02

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.53	0.06	0.06	1.431	30.037

Catch Drain (V drain)

Channel bank 2:1 downstream and upstream.

Slope 5.00% 0.05 m/m

Mannings n of 0.02 was used (earth,uniform clean).

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.53	0.33	0.33	2.422	97.264

Catch Drain (Additional Excavation)

Channel bank 2:1 downstream, 20:1 upstream.

Slope 3.00% 0.03 m/m

Mannings n of 0.02 was used (earth,uniform clean).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	1	0.02
2	2	0	0.02
3	20	1	0.02

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.53	0.18	0.18	1.702	51.897

Final Excavation Spillway

45m wide level spillway on natural terrain

Slope 5.00% 0.05 m/m

Mannings n of 0.02 was used (earth,uniform clean).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	49	0.02
2	8.5	48	0.02
3	53.5	48	0.02
4	78	49	0.02

Hy-8 Output

Flow	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1% AEP, Lot 393 only	4.20	48.06	0.06	1.622	27.63
1% AEP, Lot 393 and Lot 287	8.70	48.09	0.09	2.15	42.67

Stage 9 Large Pond Spillway

Trapezoidal drain on natural terrain

Slope 3.00% 0.03 m/m

Mannings n of 0.02 was used (earth,uniform clean).

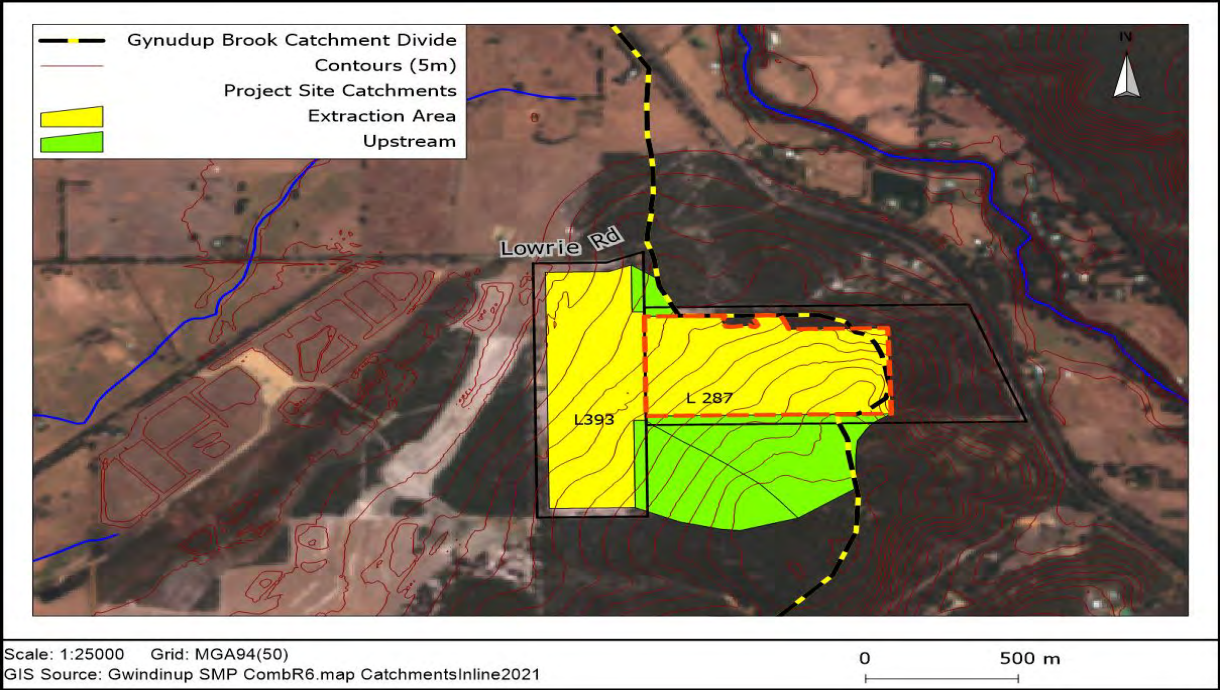
Channel Type:	Trapezoidal
Bottom Width:	2
Side Slope (H:V):	2.0:1

Hy-8 Output

Flow	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1% AEP, Stage 9 large pond	4.20	48.06	0.40	3.815	116

APPENDIX 2: HYDROLOGICAL CALCULATIONS — LOT 287 SOUTHWESTERN HIGHWAY

A2.1 Project Site Location and Catchments



A2.2 Peak Flow Estimate for Bare Catchments (Empirical Rational Method)

Methods

Calculation methods from Soil Conservation Guidelines for Queensland, Ch4 Empirical Version of Rational Method

The Rational Method design equation is:

$$QY=0.278 \cdot C_Y \cdot I_{tc} \cdot \gamma \cdot A$$

C10 based on catchment characteristics

Slope	5.7%	(Rolling - 2 to 10%)
Permeability	High	
Condition	3	(Bare)
C ₁₀	0.3	

Rational Method Frequency Factors (C_Y /C₁₀):

ARI (years)	2	5	10	20	50	100
Frequency Factor	0.6	0.8	1	1.2	1.5	1.8

Calculations and Results

L287 Excavation Area (bare ground)

	Main Pit	Stage 21	Stage 22
Horton n	0.0275	0.0275	0.0275
Total Distance (m)	980	300	100
Overland (m)	980	300	100
Drain (m)	0	0	0
t overland (min)	20.6	13.9	9.6
t channel (min)	0.0	0.0	0.0
t _c (min)	20.6	13.9	9.6
t _c (hr)	0.34	0.23	0.16
A (km ²)	0.326	0.018	0.005
C ₁₀	0.300	0.300	0.300

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)		100	100	100
Annual Exceedance Probability		1%	1%	1%
Coefficient	C _v	0.54	0.54	0.54
Time of Conc rainfall intensity	t _{tc}	91.60	110.80	138.00
Peak Discharge (Rational)	Q _v (m ³ /s)	4.5	0.3	0.1

A2.3 Runoff Capacity Required for Retention Ponds in L287

Runoff volume calculation for 10% AEP 2 hour duration event from bare ground for retention pond capacity.

Runoff based on WQPN 15 (DWER 2019) coefficient for gravel pits

P (mm)	38.3	10% AEP, 2 hour rainfall (mm)
Runoff Coefficient	0.80	
Runoff (mm)	30.6	

Runoff Volume

Stage	Area (ha)	Runoff	Runoff Volume
		(mm)	(m ³)
Stages 1 to 19 (draining west to main pond)	32.5	30.6	9,970
Stage 20 (NE Pond)	0.8	30.6	257
Stage 21 (SE Pond)	0.5	30.6	139
Total	33.8	30.6	10,367

A2.4 Hydraulic Flow Depth Calculations

Flood Levels for Peak Flows were estimated using Manning's Equation for an irregular channel. Calculations were done with the HY-8 hydraulic analysis package version 7.6 (US Federal Highway Administration, 2019).

Permanent Retention Pond Spillway

Trapezoidal drain on natural terrain

Slope 3.00% 0.03 m/m

Mannings n of 0.02 was used (earth, uniform clean).

Channel Type:	Trapezoidal
Bottom Width:	2
Side Slope (H:V):	2.0:1

Hy-8 Output

Flow	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1% AEP, Lot 287	4.50	69.51	0.51	3.44	150.35

APPENDIX 10: WEED AND DIEBACK MANAGEMENT PLAN

LOT 393 LOWRIE ROAD, GWINDINUP
SAND AND GRAVEL EXTRACTION

WEED AND DIEBACK MANAGEMENT PLAN

PREPARED FOR:

MARIO MICHELE GIACCI

FEBRUARY 2024

PREPARED BY:

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LOT 393 LOWRIE ROAD, GWINDINUP WEED AND DIEBACK MANAGEMENT PLAN

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APPENDICES

Appendix 1:	2017 Dieback Survey For Lot 393
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1. INTRODUCTION

1.1 PURPOSE

Mario Michele Giacci (the applicant) holds Development Approval (DA) and Extractive Industry License (EIL) on Lot 393 (Plan 159607) Lowrie Road in Gwindinup, Western Australia (the property) (Figure 1, Figure 2). This Weed and Dieback Management Plan (WDMP) has been prepared for the operations as supporting documentation to accompany a revised DA and EIL application to the Shire of Capel (the Shire).

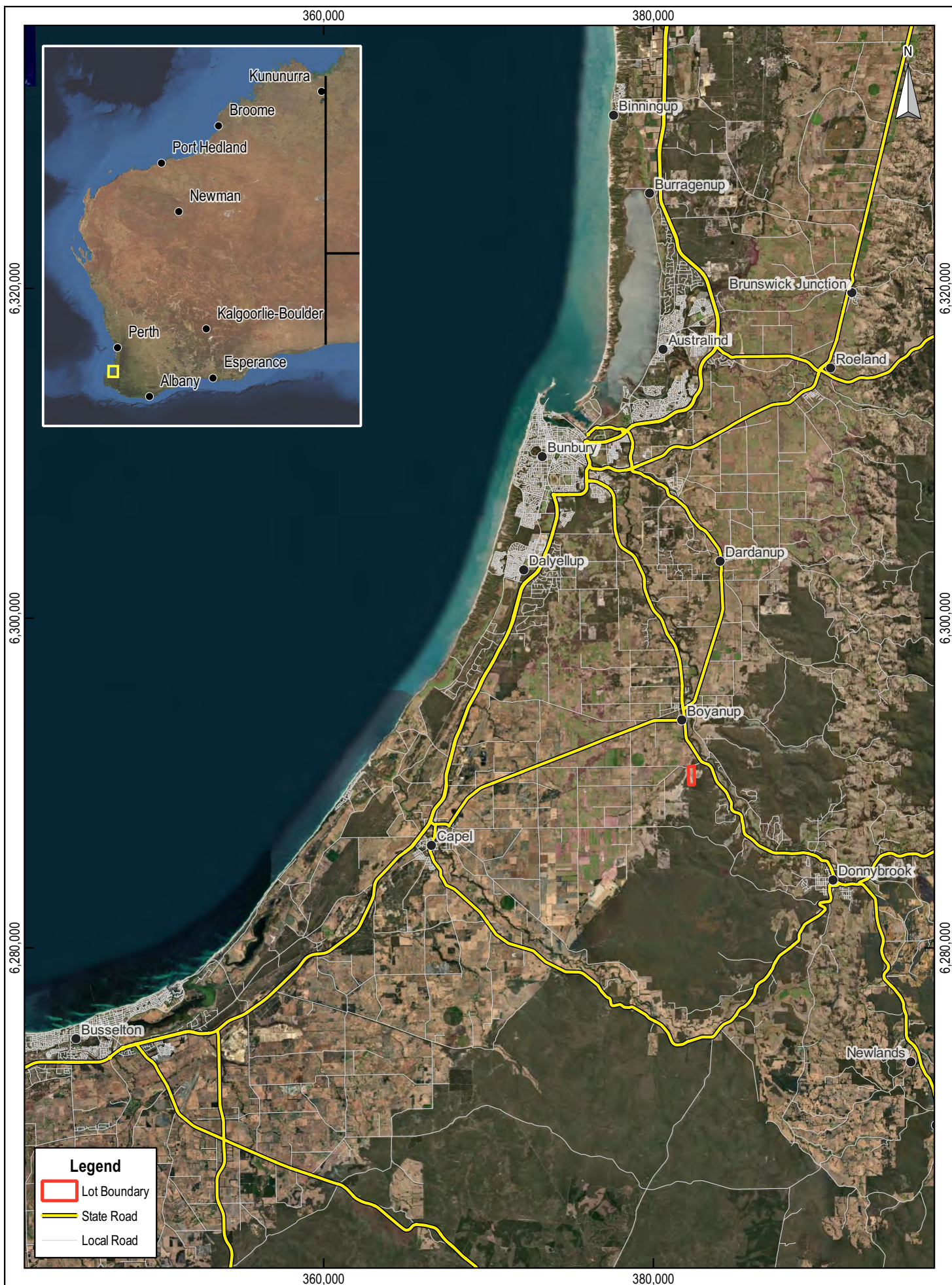
This WDMP is prepared in accordance with the *Biosecurity and Agriculture Management Act 2007* (BAM Act), the *Australian Weeds Strategy 2017–2027* developed by the Invasive Plants and Animals Committee, and the Dieback Working Group's (DWG 2021) Best Practice Guidelines for *Management of Phytophthora Dieback in Raw Material Industries* (the Guidelines). Consideration has also been given to the *Phytophthora Dieback Management Manual* (the Manual) produced by the Department of Biodiversity, Conservation and Attractions (DBCA 2020) and the *Dieback Hygiene Guidelines* by Southcoast Natural Resource Management (Southcoast NRM 2013).

1.2 SCOPE AND OBJECTIVE

This WDMP has been developed to provide details of the existing environment and guidance around best management practices for weeds and *Phytophthora cinnamomi* (dieback) with the objective to minimise the risk of introduction and spread of weeds and dieback during the extractive operations.

The scope of this WDMP includes the following:

- Describe the existing environment.
- Provide guidance to minimise spread of weeds and dieback within, to, and from Lot 393.



Scale: 1:300000
 Original Size: A4
 Image: ESRI World Imagery
 Grid: GDA94 / MGA zone 50

0 5 10 km

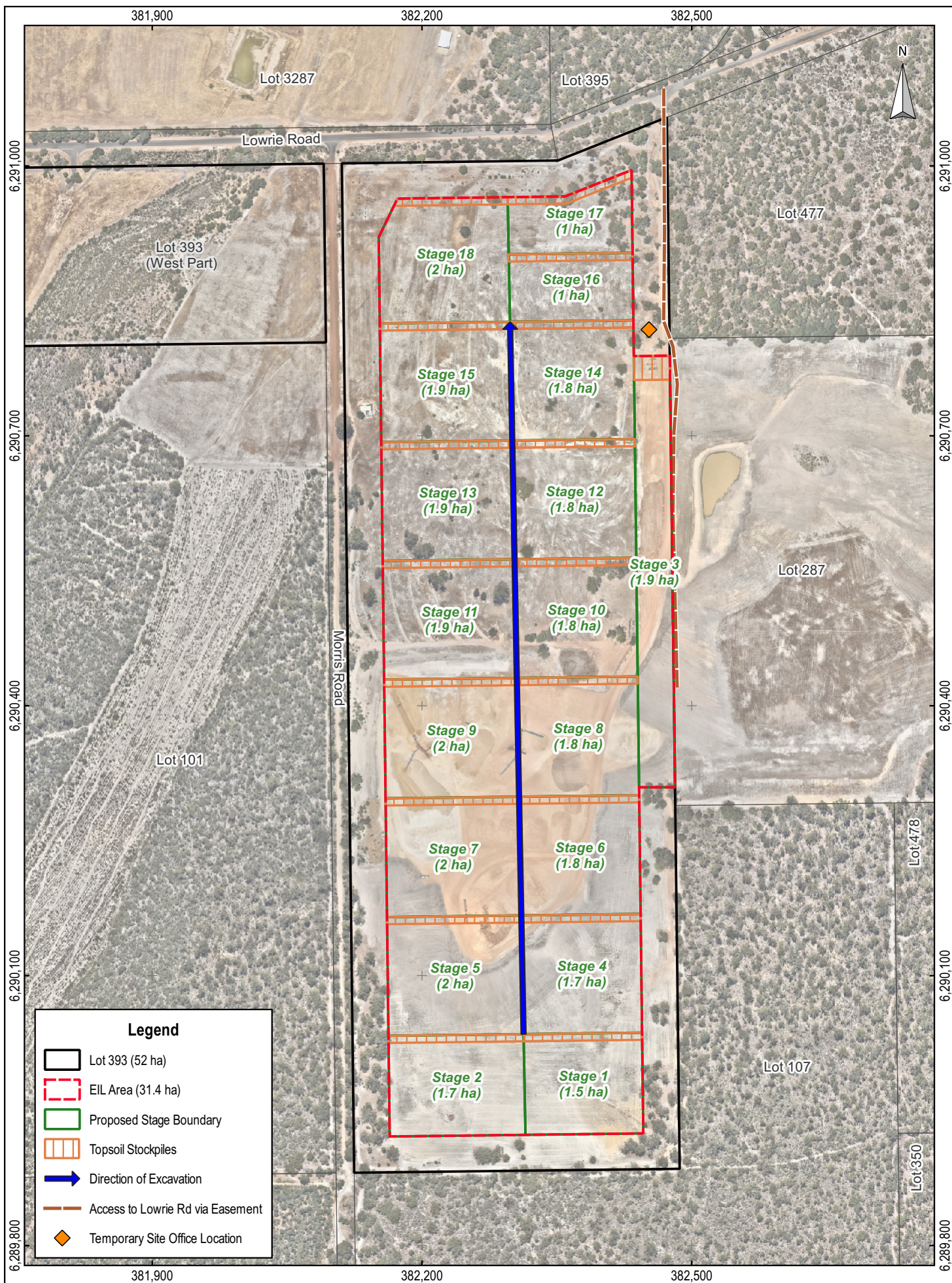
Mario Michele Giacci
 Lot 393 Lowrie Road, Gwindinup

Figure 1

Location

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Scale: 1: 5,500
 Original Size: A4
 Air Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

0 100 200 m

Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 2

Excavation Works Plan

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2. EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the project area is Mediterranean, with cool wet winters and hot dry summers. Bureau of Meteorology (BoM) long-term average climate data for the closest meteorological station (Donnybrook, 9 km southeast of the property) is shown in Figure 3. The average annual rainfall is 970.4 mm, mean minimum temperatures between 5 and 15°C and mean maximum temperatures between 16 and 31°C (BoM 2023).

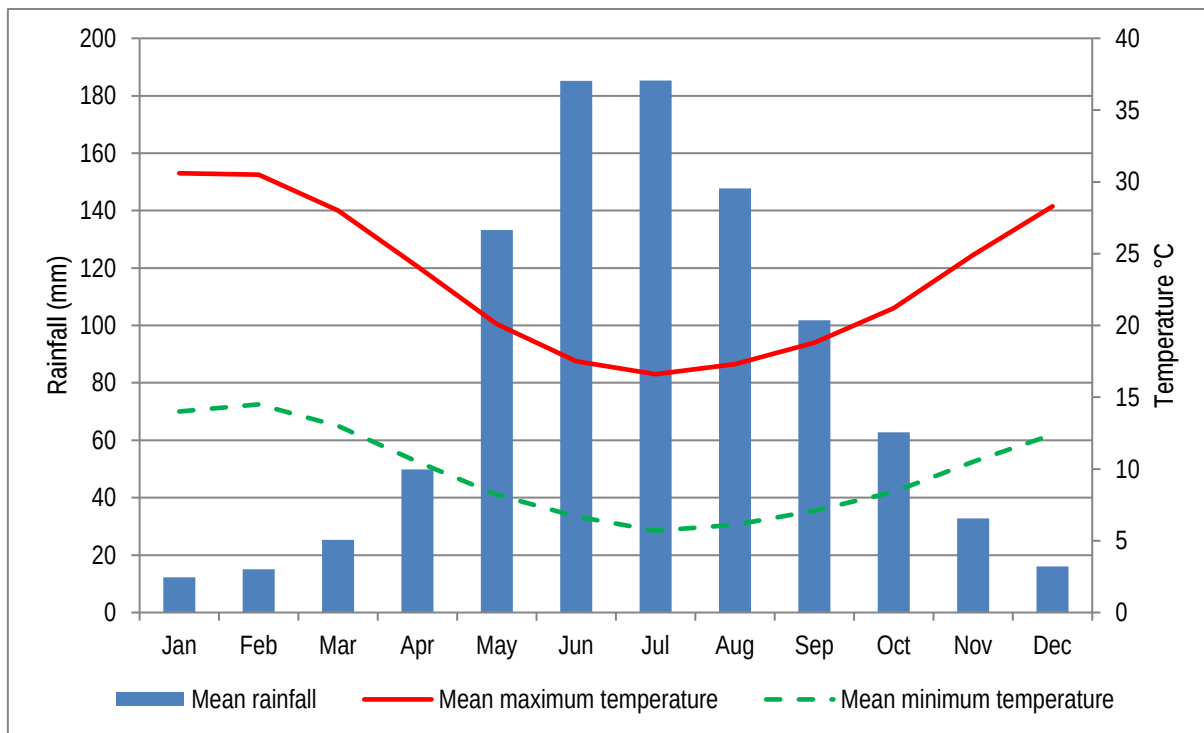


Figure 3: Climate Statistics (1900–2023) for BoM Station 9534

2.2 LANDFORM AND SOILS

The high point on Lot 393 is at 96 m Australian Height Datum (AHD), situated in the southeast corner of the property (Figure 4). From there the land slopes down at a near constant grade to a low point of 45 m AHD at the northwestern corner of the property.

Two soil and landform mapping systems are mapped within and surrounding the proposed extraction area (DPIRD-064):

- Whicher Scarp System: low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel, and non-saline wet soils. Jarrah-marri forest and woodland.
- Forrestfield System: undulating foot slopes of the Darling and Whicher Scarps. Duplex sandy gravels, pale deep sands, and grey deep sandy duplexes.

The majority of the property falls within the Whicher Scarp System with the northwestern corner in the Forrestfield System (Figure 4). Historical excavation along the western boundary of Lot 393 and recent extraction on southern parts of Lot 393 and neighbouring Lot 287 confirm the presence of gravel under a layer of sand of varying depth.

The extraction area on Lot 393 contains no wetlands or waterways. The Australian Soil Resource Information System maps the extraction area on Lot 393 as 'Extremely Low Probability/Low Confidence' for the risk of acid sulfate soil (CSIRO 2014).

2.3 VEGETATION

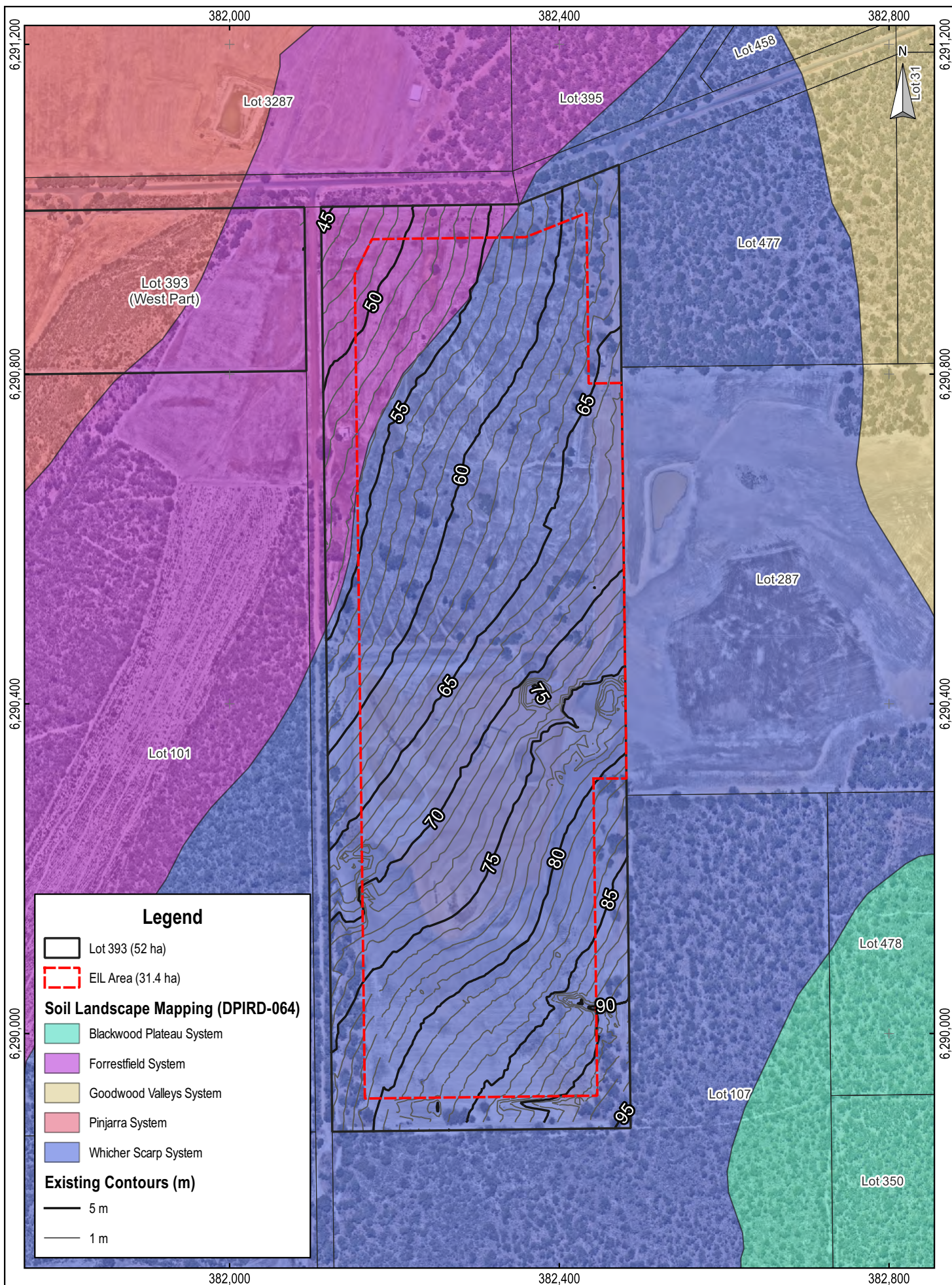
The property was previously covered in mostly blue gums that were harvested in 2018. There are some patches of remnant native vegetation and some sporadic individual native trees or shrubs comprising mainly *Corymbia calophylla*, *Eucalyptus marginata*, *Xylomelum occidentale*, *Agonis flexuosa*, and *Xanthorrhoea* sp.

According to the CPS 7171 decision report, vegetation condition on the property ranged from Completely Degraded to Degraded following Keighery (1994). This condition assessment was based on a site visit by the former Department of Environment Regulation in 2016 that also described the application area as comprising of mainly non-native Eucalyptus species with scattered native trees over weeds. A survey of Whicher Scarp in 2008 recorded that the application area did not retain remnant native vegetation (Keighery et al. 2008).

2.4 LAND USE

Lot 393 is zoned 'Rural' under the Shire's Local Planning Scheme (LPS) No.8 (2023) and is located within two Special Control Areas: (SCA) 6 — Strategic Minerals and Basic Raw Materials and SCA 8 — Regional Ecological Linkages. The property contains one shed with remnant patches of native vegetation and isolated native trees and shrubs. The 10.94 ha area of Lot 393 west of Morris Road and the northwestern corner of the property were previously part of mineral sand mining operations. These areas have been rehabilitated and signed off as completed by the Department of Mines, Industry Regulation and Safety.

The land surrounding Lot 393 is zoned either 'Rural', 'Priority Agriculture', 'State Forest', or 'Local Distributor Road'. There remains a Mineral Sands Caveat (in favour of Cristal Mining Limited) to protect mineral sand mining rights on the property. Sealed Lowrie Road runs along the northern property boundary and unsealed Morris Road runs between the western and eastern parts of Lot 393 (Figure 2).



Scale: 1: 6,000
 Original Size: A4
 Air Photo Date: Jan 2024
 Source: Extraction area contours from Thompson Surveying 2017
 Grid: GDA94 / MGA zone 50

0 100 200 m

Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 4

Landform and Soils

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 ENVIRONMENTAL

2.5 CURRENT WEED STATUS

A reconnaissance weed survey of the property was conducted by MBS Environmental in April 2022 and identified nine weed species. The list of weed species known to occur on the property is provided in Table 1. Most of the recorded weed species are very common in the general area, including surrounding properties, and because of their established position, eradication will not be feasible. However, appropriate weed management can minimise the spread of weeds as a result of the extractive operations and reduce the impacts of weeds on the proposed native revegetation. There are two identified priority weed species (Table 1) and more intensive control measures will be undertaken to manage them (see Section 3.2). It is noted additional common pasture grass species were observed during the site visit but have been omitted from this table.

Table 1: Known Weed Species on Lot 393 Lowrie Road

No.	Species Name	Common Name	Priority
1	<i>Arctotheca calendula</i>	Cape Weed	
2	<i>Conyza sp.</i>	Fleabane	
3	<i>Cucumis myriocarpus</i>	Paddy Melon	
4	<i>Dittrichia graveolens</i>	Stinkweed	
5	<i>Gomphocarpus fruticosus</i>	Narrow Leaf Cotton Bush	x
6	<i>Phytolacca octandra</i>	Ink Weed	
7	<i>Rumex sp.</i>	Dock	
8	<i>Solanum linnaeanum</i>	Apple of Sodom	x
9	<i>Solanum nigrum</i>	Blackberry Nightshade	

2.5.1 Declared Pests

Under the BAM Act, two of the known weeds are declared pests in Western Australia:

- *Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush).
- *Solanum linnaeanum* (Apple of Sodom).

The known infestations of these species on the property are located in different areas. Narrow Leaf Cotton Bush was found in small clusters in mid-section of the site where extractive is currently not occurring. Apple of Sodom was found in the southeast corner of the property, close to the bushland reserve. Both infestations have been treated following their identification.

These weeds have control methods and requirements associated with them as directed by the Agriculture and Food section of the Department of Primary Industries and Regional Development (DPIRD).

2.5.2 Local Weed Sources

The surrounding properties support a range of rural land uses, including pasture, sand extraction, residential dwellings, public purpose, recreation reserves, and bushland (Appendix 1). Many of these activities either involve weed species or they pose a significant risk for introducing and spreading weed species in the local area. Weed species in the local area can be spread by human activity but they can also be spread between properties by wind and by movement of local fauna (e.g. kangaroos and birds).

2.6 CURRENT DIEBACK STATUS

Dieback is present in locations around the globe that have a Mediterranean climate, including the southwest of Western Australia. There are over 140 species of *Phytophthora* worldwide, but the most commonly found and damaging species in the southwest is *Phytophthora cinnamomi*.

Dieback is predominantly spread through infected soil, commonly transported by fauna movement, surface water runoff, soil movement on sloping surfaces, and spores. The biggest cause of dieback spread is through human activity and movement, where contaminated soils are transported by vehicles, footwear, and equipment that introduces the pathogen to new areas. Additionally, the transport of infected soil as import or export material from a site can promote dieback spread. Various rural activities in the local area and recreational use of the reserves carry a risk of introducing and spreading dieback.

Dieback Public Map (Project Dieback 2024) indicates that all the native vegetation on Lot 287 and the adjacent properties is dieback infested with moderate confidence, based on an assessment in 2008. This mapping did not cover Lot 393 as it was considered already cleared. In November 2017, a dieback assessment was undertaken and subsequent management plan developed by Bark Environmental (Appendix 1). Due to high degree of historical disturbance to the site and paucity of native vegetation, the entire Lot 393 was assessed as 'Excluded' (presence or absence of dieback could not be determined).

Site specific dieback survey of neighbouring Lot 287 found that the majority of native vegetation on Lot 287 is dieback infested (approximately 15 ha) Bark Environmental (2020). Given the proximity of Lots 393 and 287, the extractive operations will be managed together to prevent spread of the pathogen outside of the operational footprint. For the purposes of this management plan, all of Lot 393 will be treated as potentially dieback infected.

3. WEED MANAGEMENT

Weeds can be spread or introduced to an area via a number of circumstances, such as wind borne seed, vehicle movements, rain runoff, fauna activity, movement of soil, dust, and introduction of soil from external sources. The applicant recognises the importance of effective management of weeds during extractive operations and subsequent revegetation. As the site already contains a range of common weed species and part of the property will be rehabilitated to pasture, weed management during the extractive operations will mainly aim to prevent the introduction of declared weed species, minimise spread of the more common weeds, and instigate the monitoring and control of weeds during rehabilitation.

3.1 WEED PREVENTION

The site operator will implement the following measures as part of the extractive operations to reduce weed spread and prevent, as far as practicable, the introduction of new weed species at Lot 393 and the export of weeds from the property:

- All vehicles, plant, and equipment entering or exiting Lot 393 will be clean and free of any weeds.
- Topsoil will be removed from the extraction area and stockpiled (gradually in stages).
- Following removal of topsoil, the movement of vehicles and machinery will be limited to the areas free of topsoil to limit the spread of any weeds.
- Exported quarry products will be free of weeds.
- Materials imported to site will be free of weeds.
- Weed control will be conducted in operational areas (e.g. trafficable areas and sand stockpiles) to ensure these areas remain weed free.
- Weed control of topsoil stockpiles will be undertaken to minimise seed set.
- During rehabilitation activities, weed control will be undertaken as necessary to minimise weed spread and prevent weeds from compromising the end land use.
- Weed presence and control will be monitored (Section 3.3).

Weed control will be tailored to cater for the specific needs of the weed species being managed and may involve chemical and/or manual control. In addition to broad spectrum herbicides, weed specific herbicides will be used where appropriate to target broadleaf, grass, geophyte, and woody weeds.

The requirements for rehabilitation and associated weed control are detailed in a separate rehabilitation plan. At this stage, it is anticipated that both pasture and native vegetation will be returned as part of rehabilitation. It is expected that rehabilitation weed control will, as a minimum, include control prior to planting/seeding once topsoil has been re-spread. This is typically undertaken in late autumn/early winter depending on commencement of seasonal rains. This will enable any weeds germinating from the soil seed bank to be targeted. Ongoing weed control following planting/seeding will also occur as need be to allow for the pasture and native species to become established.

3.2 WEED CONTROL GUIDANCE FOR PEST SPECIES

Apple of Sodom and Narrow Leaf Cotton Bush have been recorded on Lot 393 in the past. Control has been and will continue to be conducted as per the methods directed by the Agriculture and Food section of DPIRD (see Sections 3.2.1 and 3.2.2). Monitoring for these pest species will be ongoing (see Section 3.3) and further control will be undertaken if any individuals are observed.

3.2.1 Apple of Sodom

Apple of Sodom is categorised as a declared pest s22(2) with a control category of Exempt keeping category by the Western Australian Organism List (WAOL 2023a). Table 2 displays a recommended annual schedule for Apple of Sodom control (DPIRD 2020a). Identification photos for Apple of Sodom are provided in Figure 5, and Figure 6.

Table 2: Apple of Sodom Annual Schedule

Activity	Months	Notes
Germination	September to November	Most of the seed germinates in spring and late summer. Some seed may remain dormant in the soil for several years. Germination is greatly increased when the adult plant is removed.
Active growth	September to March	Grows about one to two metres high, but occasionally reaches five metres. The plant forms dense thickets which provide cover for rabbits and shade out pasture plants.
Flower	October to April	Flowers averaging about two centimetres across, and usually purple (occasionally white) with a yellow centre. Flowers have five petals joined to form a star.
Fruit	October to May	Produces round, tomato-like fruit, green and white at first, turning yellow, then brown and black as it ripens. The fruit is about 30 millimetres in diameter, containing numerous round flattened light brown seeds each about three millimetres across.
Monitor	January to December	Location of weed to be reported to management.
Manual control	January to December	Hand pull seedlings and young plants with gloves, removing roots. Collect all fruit from the infested area and burn isolated plants and all pulled plant material, including seedlings and fruit to reduce the spread of seed by birds (Southern Biosecurity Group 2023).
Chemical control	September to March - while actively growing	Perennial species, target during spring-summer.

Recommended herbicides for Apple of Sodom are Amitrole T®, Triclopyr, Glyphosate and Picloram + 2,4-D amine (DPIRD 2021). Information and herbicide concentration are as noted in Table 3.

Table 3: Herbicide Control of Apple of Sodom

Factor	Information
Amitrole T® (Group F)	
Active ingredient	250g/L amitrole + 220g/L ammonium thiocyanate.
Rate of product / 10 L water	100mL
Rate of Product / ha	Not recommended.
Wetting agent	1:600
Time of application	Almost any time of year — spring and summer preferred.
Notes	• Mature plants killed by single treatment, but follow-up needed when new seedlings emerge. • Grub and burn large plants: remove roots also. • Control of seedlings may be necessary for several years.

Factor	Information
	Brush off® (metsulfuron) at concentrations of 10-20g/100L effective in trials.
Triclopyr (Group I)	
Active ingredient	600g/L triclopyr (1) with 755g/L triclopyr available (2)
Rate of product / 10 L water	30 ml (1), 24 ml (2)
Rate of dilution for spot spraying	1:300
Wetting agent	1:400 plus summer spraying oil at a concentration of 1:400 may be used.
Time of application	When actively growing (spring - summer).
Notes	- Grub and burn large plants: ensure removal of roots. - Control of seedlings may be necessary for several years. - Brush off® (metsulfuron) at concentrations of 10-20g/100L effective in trials.
Glyphosate (Group M)	
Active ingredient	360, 490/500 and 540g/L, and 680g/kg glyphosate.
Rate of product / 10 L water	100mL for 360g/L formulation. 70mL for 490/500g/L formulation. 65mL for 540g/L formulation. 50g for 680g/kg formulation.
Rate of dilution for spot spraying	1:100 for 360g/L formulation.
Rate of Product / ha	Not recommended.
Time of application	When actively growing spring, summer.
Notes	- Not as effective as other treatments. - Addition of the wetting agent/penetrant Pulse® @ 1:500 may increase the effectiveness.
Picloram + 2,4-D amine (Group I)	
Active ingredient	75g/L picloram + 300g/L 2,4-D
Rate of product / 10 L water	30mL - 65mL
Rate of dilution for spot spraying	1:300 - 1:150
Wetting agent	1:400
Time of application	Flowering to early fruiting.
Notes	Residual effects of picloram will persist for one to two seasons, depending on rates, affecting legumes but not grasses.



Figure 5: Apple of Sodom Fruit (DAFWA 2023a)



Figure 6: Apple of Sodom Flower (DAFWA 2023b)

3.2.2 Narrow Leaf Cotton Bush

Narrow Leaf Cotton Bush is categorised as a declared pest s22(2) with a control category of C3 Management and Exempt keeping category by the Western Australian Organism List (WAOL 2023b). Table 4 displays a recommended annual schedule for Narrow Leaf Cotton Bush control (DPIRD 2020b). Identification photos for Narrow Leaf Cotton Bush are provided in Figure 7 and Figure 8.

Table 4: Narrow Leaf Cotton Bush Annual Schedule

Activity	Months	Notes
Germination	March to May and September to November - can germinate year round	Can be any time in warm, moist conditions.
Active growth	September to April and occasionally May	An erect slender short-lived shrub one to two metres high, with narrow opposite leaves, and bladder-like fruit. All parts of the plant exude a milky white sap when damaged. It reproduces by seed and suckers.
Flower	October to April and occasionally August and September	White or creamy with five fringed waxy lobes turned sharply outwards. They are formed in a loose drooping cluster of three to ten flowers in the leaf axils.
Fruit	February to November, occasionally December and January	Distinctive seed pods that are puffy, swan-shaped structures up to six centimetres long and 2.5 centimetres wide and covered in soft spines up to one centimetre long.
Monitor	January to December	Location of weed to be reported to management.
Manual control	March to May and September to November, can manually control year round	• Best during germination times. • Use Protective gear/gloves.
Chemical control	September to April	Best while actively growing.

Recommended herbicides for Narrow Leaf Cotton Bush are glyphosate and triclopyr (DPIRD 2018). Information and herbicide concentration are as noted in Table 5.

Table 5: Herbicide Control of Narrow Leaf Cotton Bush

Factor	Information
Triclopyr (Group I)	
Active ingredient	600g/L triclopyr. A 755g/L formulation also available.
Rate of product / 10 L water	30 ml.
Wetting agent	Use crop-oil such as Uptake® at concentrations of 500 mL 100 L, or DC-Trate at 1L/100L.
Time of application	Spring to December.
Notes	• Use in place of glyphosate when annual pastures are still growing to avoid damage to grasses. • Other products containing triclopyr and picloram are also reasonably effective but further work is required. • Dicamba is effective on seedlings.
Glyphosate (Group M)	
Active ingredient	100, 360, 450, 470-480, 490, 500, 517, 540, 570g/L; 680, 700, 840 and 875g/kg glyphosate.
Rate of product/ha	1:100 for 360 g/L formulation.
Rate of product/10 L water	• 100mL for 360g/L formulation. • 80mL for 450g/L formulation. • 70mL for 490/500g/L formulation. • 65mL for 540g/L formulation. • 50g for 680g/kg formulation.
Rate of product/ha	Not recommended.
Wetting agent	Wetting agent and/or summer spraying oil may be beneficial.
Time of application	Narrow Leaf Cotton bush can be sprayed at any time when actively growing: September-December is the most effective time to spray before fruit forms.
Notes	• Glyphosate is effective on mature bushes, regrowth and seedlings, provided good coverage is achieved. • Where low volume/low pressure pumps are being used the rates should be doubled. • Slash established bushes during winter, and burn, cultivate or grub seedlings and regrowth. • Roundup Biactive® or Razor® preferred treatment in wet areas or along water courses near shallow water. • The addition of 1g of metsulfuron/100L of water has also given improved control.

Factor	Information
Glyphosate (Group M)	
Active ingredient	Glyphosate 360 g/L.
Rate of product	1:2 parts with water. Apply directly to plant using a sponge glove. While this is a very selective method, it is slow to apply and slow to take effect. Retreatment will be necessary.



Figure 7: Flowering Narrow Leaf Cotton Bush (DAFWA 2023c)



Figure 8: Narrow Leaf Cotton Bush Flowers and Seeds (DAFWA 2023d)

3.3 MONITORING

3.3.1 Weed Status Monitoring

Weed status of the extraction area and immediate surrounds (10 m buffer) will be monitored biannually to determine whether introduction or spread of weeds is occurring and to identify required weed control. Monitoring should occur four to six weeks after the first significant autumn/early winter rains and in mid to late spring; however, opportunistic passive monitoring will also occur as a part of general operations and weed control organised if the need is identified.

Monitoring for pest species, Apple of Sodom and Narrow Leaf Cotton Bush, will be ongoing. Awareness raising of the pest species will be conducted for existing and new personnel, and any sightings of the pest species within the extraction area will be reported to management.

3.3.2 Weed Control Monitoring

Areas requiring weed control will be checked within two weeks before commencement of weed control (either as part of biannual monitoring or separately) and then six to eight weeks after weed control has been conducted to gauge effectiveness and determine if follow up control is required.

4. DIEBACK MANAGEMENT

Although the property was determined as uninterpretable for dieback, for the purposes of dieback management the extraction area will be considered as dieback infested. Dieback will be managed in accordance with the best practice guidelines and manuals (see Section 1.1), and will include the following measures:

- All earth-moving machinery will be cleaned of soil and vegetation prior to entering and leaving site.
- Soil will only be moved in dry conditions.
- No dieback affected material will be brought to site.
- Machinery and other vehicles will remain within the extraction area to minimise the risk of spreading disease.
- Drainage will be contained within the extraction area, with designated overflow pathways that minimise potential for disease spread. Direct surface water runoff from the extraction area to the surrounds will be avoided.
- Personnel will be informed that the site may be infested with dieback and that dieback can spread on vehicles, machinery, equipment, footwear, and tools, and instructed on clean down requirements.
- Topsoil will be stockpiled and respread as close to its source area as possible.
- Potential customers will be advised that the material exported from site cannot be considered dieback free.
- Entry to and exit from the site will be limited to designated locations.
- Trucks exporting sand from the site will be required to have their load properly covered.
- Ensure that, as far as can be known, any soil, mulch, fill, or other material brought on site is sourced responsibly and free of dieback.
- Topsoil will be removed and stockpiled from the extraction area (gradually in stages), and the subsequent movement of vehicles and machinery will be limited to the areas free of topsoil.
- Vegetation clearing and topsoil removal and stockpiling will only be undertaken in dry conditions.
- Existing and new personnel will be informed of dieback prevention measures and be required to meet them.
- Unauthorised access to the extraction site will be managed through fencing and lockable gates.
- Signage regarding unauthorised entry and 'clean on entry' requirements will be placed at the gates.
- Trafficable areas and material stockpiles areas will be maintained well-drained.

5. ROLES AND RESPONSIBILITIES

Roles and responsibilities with respect to weed and dieback management are outline in Table 6.

Table 6: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	• Responsible for overall implementation of this plan. • Will provide information for site personnel and truck drivers on weed and dieback management objectives and measures to be undertaken on site. • Responsible for organising monitoring and control of weeds. • Responsible for site access security and appropriate signage.
All personnel	• Will be familiar with weed and dieback management objectives. • Will implement measures to prevent spread and introduction of weeds and dieback as outlined in this plan. • Responsible for reporting any weed or dieback management issues to EIL Licensee.

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APPENDICES

APPENDIX 1: 2017 DIEBACK SURVEY FOR LOT 393

A Phytophthora Dieback Assessment and recommended Management Plan

for

Lot 393 Lowrie Road, Gwindinup, Shire of Capel



Phytophthora Dieback Assessment: Lot 393 Lowrie Road, Gwindinup, Shire of Capel

Introduction

A Phytophthora Dieback assessment was recently completed over Lot 393 (Plan 159607) Gwindinup in the Shire of Capel. The study area is 40.9ha in size and includes cleared areas, previously rated degraded-completely degraded native vegetation, blue gums in the north east and pasture in the north west corner where previous mineral sand mining occurred. The Shire has given approval for an extractive industry licence (EIL) subject to certain conditions, including undertaking a Phytophthora Dieback survey and preparing a management plan. The life of the pit is estimated at 19 years based on an extraction rate of 50,000m³/year but may vary depending on market demand for the resource. Extraction will be undertaken in stages of a few hectares each moving gradually from south to north.

This report provides background details on the study area available at the time of assessment, methodology, results and recommendations for managing Phytophthora Dieback during the proposed extraction activities.

Background information

Phytophthora cinnamomi

Phytophthora cinnamomi is a soil-borne water mould that has the capacity to invade and destroy the root system functions of susceptible plants and trees. Approximately 40 % of known flora in the south west of Western Australia can be impacted by the disease caused by *P. cinnamomi* known as Phytophthora Dieback. When bushland is infested with this disease it can result in permanent loss of one or more susceptible plants/trees, reduced biodiversity and ecosystem collapse in severe cases. *Phytophthora* spreads through the movement of spores within soil, plant material or water that contains its inoculum. Activities such as clearing bushland, mining, earthworks, vehicles, horse riding and bushwalking all present a risk of spreading this plant disease by transporting and depositing infected soil/plant material into vulnerable areas.

Study area background

No records of previous Phytophthora Dieback assessment were identified for this study area. MBS Environmental provided an extract from a Department of Water and Environment and Regulation preliminary report for a clearing permit application over this study area. Mattiske and Havel (1998) mapped two site vegetation complexes as occurring within the study area, Whicher and Cartis. The Department described site vegetation as “Degraded and Completely Degraded” according to the Keighery (1994) vegetation condition rating scale following their site inspection in 2016. No evidence of recent fire damage was observed during this November 2017 assessment. This study area falls within the “vulnerable zone” for Phytophthora disease to develop and according to the Bureau of Meteorology, the mean annual rainfall for the proximate Bunbury weather station is 728mm.

Methodology

Assessment was completed on 23 November 2017 with regard to guidelines and methodology employed by the Department of Biodiversity Conservation and Attractions (DPaW, 2015). No field demarcation with flagging tape or soil/plant sampling were required to complete this assessment. Informal transects were walked across the entire site to validate vegetation condition ratings and to observe and record any evidence of *Phytophthora* disease presence and absence. Waypoints were recorded with hand-held Garmin GPS and mapping was completed using GIS.

Results

Both vegetation complexes (Whicher and Cartis) are no longer intact within the study area. Despite the widely scattered occasional native plant/tree being present; for the purpose of Phytophthora Dieback assessment, the overall site vegetation condition was evaluated as “Degraded - Completely Degraded (ratings 5-6)” based on the Keighery scale (1994). The “Excluded” category applies to the entire study area extending across the EIL area due to the significant disturbance and paucity of native vegetation remaining to enable interpretation. The “Excluded” category also applies to the current access track situated along part of the north east boundary where vehicle and soil movement is currently occurring and no evidence of previous hygiene management is visible or can be deduced. On the attached Figure 1, the “Excluded” area is shown as uncoloured, having the same background colour as base data, but bordered by the proponent’s project study area boundary. Table 1 provides an area statement after determining the appropriate assessment categories on site.

Table 1. Area Statement – Lot 393 Lowrie Road

Primary Category	Area (ha)
Infested	0.0
Uninfested	0.0
Uninterpretable	0.0
Excluded	40.9
Protectable	0.0
Total Study Area	40.9

DPaW (2015) suggests that native vegetation within “Excluded” areas cannot be expected to recover autonomously (independently) within five years to a level that will enable interpretation. In the authors opinion, intervention such as revegetation with native plants/direct seeding and good top soil management would be necessary to enable some form of plant community to establish sooner than five years within this study area.

Given what appears to be a long history of disturbance within this study area, including sand mining, native vegetation clearing and plantation use; it is not considered as “Protectable” from Phytophthora Dieback. It is possible that the disease is already present, introduced during previous soil-moving activities, but as site native vegetation is highly disturbed with insufficient indicator plants remaining, the pathogen cannot be detected by observable factors.

Phytophthora Dieback Management for this site does not need to be complex. In this instance, it may be more practical for management to regard the entire study area as potentially “Phytophthora Dieback Infested” and place emphasis on managing site drainage and topsoil movement to minimise the spread of potentially infected material into Uninfested “Protectable” areas off-site. The following Management Plan is given to guide the proposed activities in the study area.



Previously cleared area in north west.



Blue gum plantation, understorey absent.

Phytophthora Dieback Management Plan

Table 2 lists management strategies and the rationale for their inclusion. Some of these actions will also compliment any weed management strategies for the study area.

Table 2. Phytophthora Dieback Management Plan – Lot 393 Lowrie Road, Gwindinup

Management Strategy	Rationale	Project Phase (Timing)
Contain surface water on-site including, pit drainage, EIL area and associated site access roads (address this in Stormwater MP)	Surface and sub-surface water are an efficient means for the spread of Phytophthora Dieback. Furthermore, increases in soil moisture can greatly increase the impact of the pathogen on surrounding native vegetation. Drainage should be designed to avoid any runoff into any adjacent external vegetated areas.	Planning
Install Signage	To inform personnel / contractors entering and leaving the site that it may be Infested with Phytophthora Dieback.	Initiation
Induct / Train site personnel	Inform personnel that: - The site may be infested with Phytophthora Dieback and how it can spread on their vehicles/machinery/equipment/footwear/tools. - To ensure the above items are thoroughly cleaned free of soil/organic material – Before entering any other sites determined as Dieback <u>Uninfested that require biosecurity-hygiene</u>. This could be done at a commercial wash-down facility, Shire approved depot facility or at the exit point of Lot 393 – should a cleandown area be established. For advice on establishing a cleandown area, contact BARK on 0400 208 582. - To maintain machinery/vehicle movements within the EIL area limits and not to enter adjacent bushland at any time.	Initiation
Maintain hard, well drained stockpile area and access road	Establishing hard surfaces on trafficable areas is less likely to result in soil/mud sticking to the undercarriage of vehicles.	Operational
Customer notification	Advise potential customers that the material may be Infested with Phytophthora Dieback and <u>cannot</u> be considered as free of the <i>Phytophthora</i> pathogen.	Operational
Topsoil management	Aim to stockpile and respread topsoil as close to its source area as possible.	Operational
Rehabilitate with non-susceptible plant species	Use of non-susceptible plant species in rehabilitation can increase success of rehabilitation within infested areas. Consult this URL for a list of WA resistant native plants: https://www.dwg.org.au/images/dieback_publications/Western_Australian_Natives_Resistant.pdf	

Legend

-  Lot 393 (study area)
-  EIL boundary (extraction area)
-  Excluded area (highly disturbed land where natural vegetation is unlikely to recover without intervention)



Figure 1: *Phytophthora* Dieback Occurrence - Map Lot 393

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DWG (no date). Management of Phytophthora Dieback in Extractive Industries.

Keighery, B. J. 1994. Bushland Plant Survey: A guide to plant community survey for the community. Wildflower Society of WA (Inc.).

Disclaimer and Limitations

This document is and shall remain the property of BARK Environmental Consulting and its client. BARK Environmental Consulting accepts no responsibility for other use of the data and edits or alterations to this report. This report presents the results from field Phytophthora dieback interpretation that may be supported by field sampling and available desktop information. Field observations provide site information relevant at the time of survey and natural and seasonal variability may occur, plus the pathogen may also spread autonomously or through uncontrolled vectors over time. This should be considered when reading this report. The data and advice provided herein relates only to the project study area and proposed activity described herein. It must be reviewed by a competent environmental practitioner before being used for any other purpose. Where reports, searches, any third party information, data, reference or similar work have been performed and recorded by others, the responsibility for the accuracy of such data remains entirely with the issuing authority, not in any form with BARK Environmental.

APPENDIX 11: TRANSPORT IMPACT STATEMENT 2023



Transport Impact Statement

MGM Bulk Pty Ltd Lot 393 Lowrie Road
Gwindinup

CW1200811_300306977

29 August 2023

Prepared for:

MGM Bulk Pty Ltd

Prepared by:

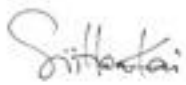
Stantec Australia Pty Ltd



Revision	DATE	Description	Author	Reviewed by	Approved by
A	03/08/2023	For Issue	SV	BS	SJL
B	29/08/2023	For Issue	SV	BS	SJL
C					



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Prepared by  _____
(signature)

Sai Vemula / Brian Sii

Reviewed by  _____
(signature)

Scott Lambie

Approved by  _____
(signature)

Ray Cook



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1.0 INTRODUCTION

1.1 BACKGROUND

Stantec has been commissioned by MGM Bulk Pty Ltd ('the Client') to undertake a Transport Impact Statement for a Sand & Gravel Extraction Site located at Lot 393 Lowrie Road within Gwindinup, Shire of Capel (the 'Site'). This report aims to assess the impact of the development on the adjacent road network and focus on access arrangements to and from the Site.

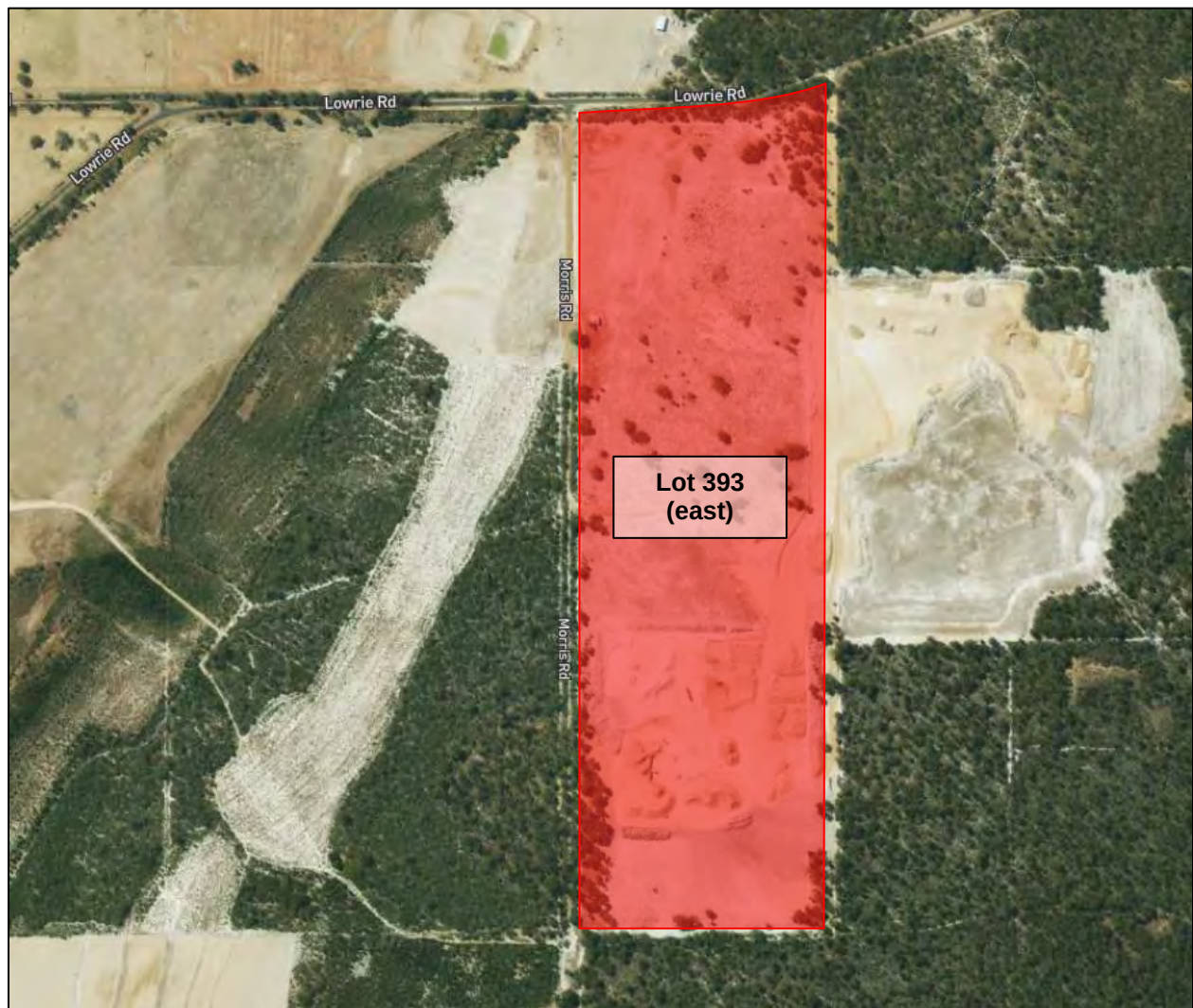
This report has been prepared following the *Western Australian Planning Commission (WAPC) Transport Impact Assessment Guidelines for Developments: Volume 4 – Individual Developments (2016)* and the checklist is included in **Appendix A**.



1.2 SITE LOCATION

The proposed development site Lot 393 (eastern portion) is located east of the intersection with Lowrie Road and Morris Road. The roads fronting the site are Lowrie Road and Morris Road as shown in **Figure 1-1**.

Figure 1-1 Aerial Overview of the Site



Source: Metromap

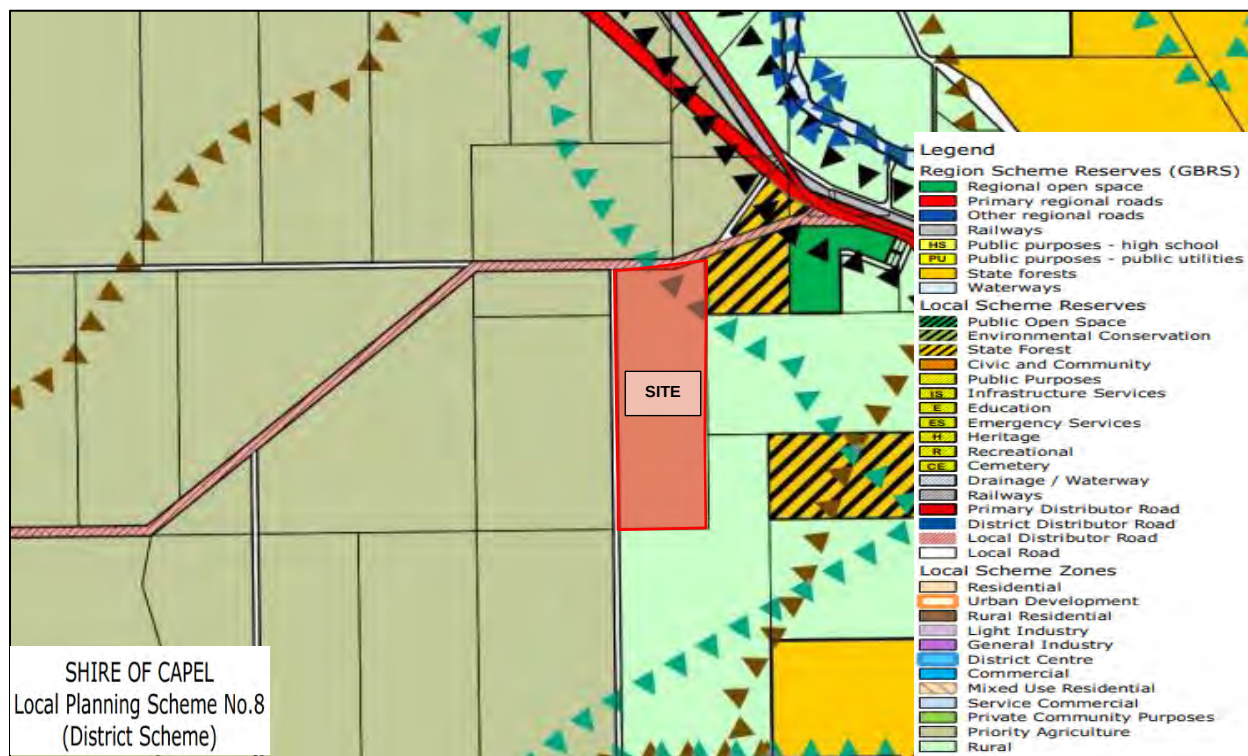


2.0 EXISTING SITUATION

2.1 EXISTING LAND USES

According to the *Shire of Capel's Local Planning Scheme No. 8*, the subject Site is zoned as a 'Rural' area as shown in **Figure 2-1**. The majority of the properties surrounding the Site are zoned as Priority agriculture and Rural areas whereas properties on North-East to the site are zoned for State forest and Regional open space.

Figure 2-1 Site Zoning Map



Source: Shire of Capel LPS No.8



2.2 EXISTING ROAD NETWORK

Road types are defined in the Main Roads Functional Hierarchy as follows:

- **Primary Distributors (Light blue):** These roads provide for the major regional and inter-regional traffic movement and carry large volumes of fast-moving traffic. Some are strategic freight routes, and all are State roads. They are managed by Main Roads.
- **Regional Distributors (Red):** These are the Roads that are not Primary Distributors but link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.
- **District Distributor A (Green):** These roads carry traffic between industrial, commercial, and residential areas and connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
- **District Distributor B (Dark blue):** These roads perform a similar function to District Distributor A but with reduced capacity due to flow restrictions from access to and roadside parking alongside the adjoining property. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and generally not through them, forming a grid that would ideally space them around 1.5 kilometres apart. They are managed by Local Government.
- **Local Distributors-Rural (Orange):** These roads connect to other Rural Distributors and to Rural Access Roads. These are Regional Distributors, but which are designed for efficient movement of people and goods within regional areas. They are managed by the Local government.
- **Access Roads (grey):** These roads provide access to abutting properties with amenity, safety, and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by the Local government.

The Site is accessed via Lowrie Road at the north-east corner of the Site. This access to Lowrie Road is used for all the vehicle movements to and from the Site, and provides a connection to South Western Highway. The surrounding road network is further characterised in **Table 2-1** and **Figure 2-2** shows the hierarchy as per Main Roads WA Road Information Mapping System.

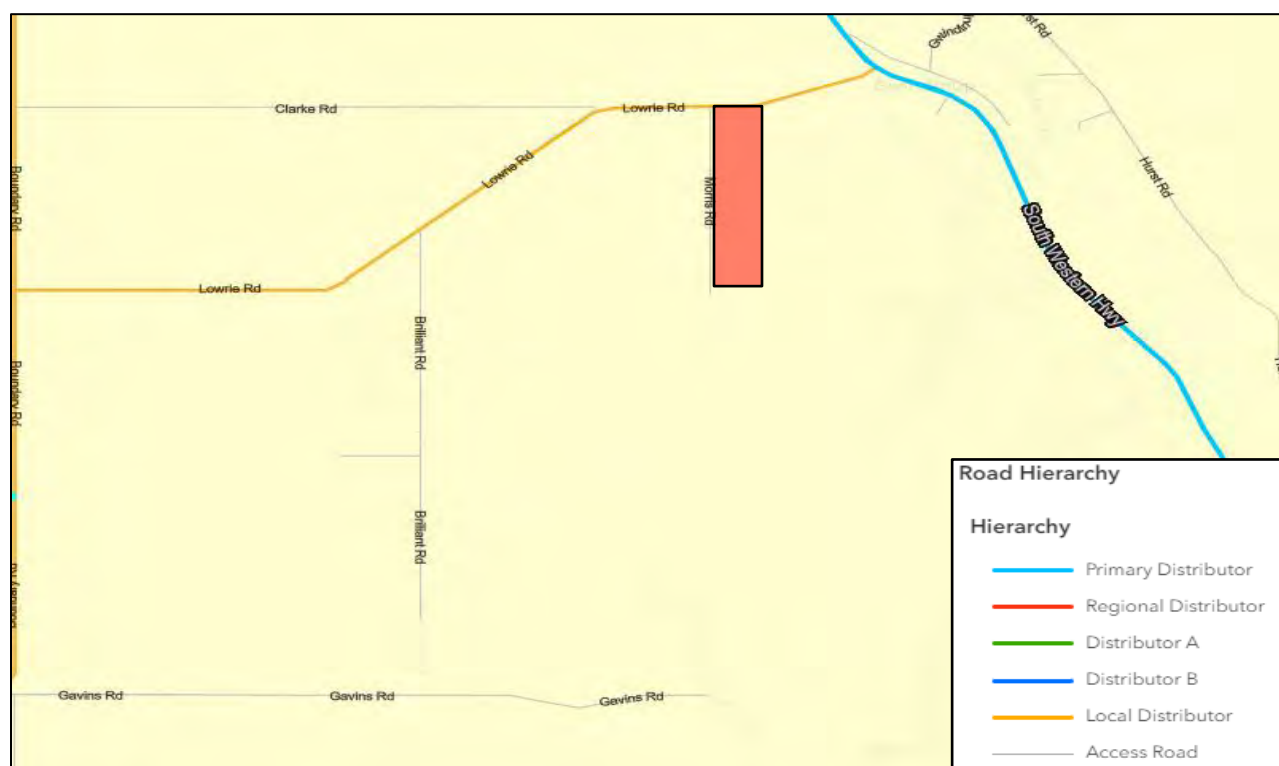


Table 2-1 Road Hierarchy and Characteristics

Road Name (Road ID)	Road Hierarchy			Road Characteristics		
	Road Hierarchy	Road Jurisdiction	No. of Lanes	No. of Footpaths	Road Width (m)	Posted Speed (km/h)
Lowrie Road (2060005)	Local Distributor	Local Government	2 <i>(two-way undivided)</i>	N/A	7.0	110
Clarke Road (2060010)	Access Road	Local Government	1 <i>(two-way undivided)</i>	N/A	4.0	110
South Western Highway (H009)	Primary Distributor	MRWA	2 <i>(one lane in each direction, undivided)</i>	N/A	12.0	110

Source: MRWA Road Information Mapping System

Figure 2-2 Road Hierarchy around the Site



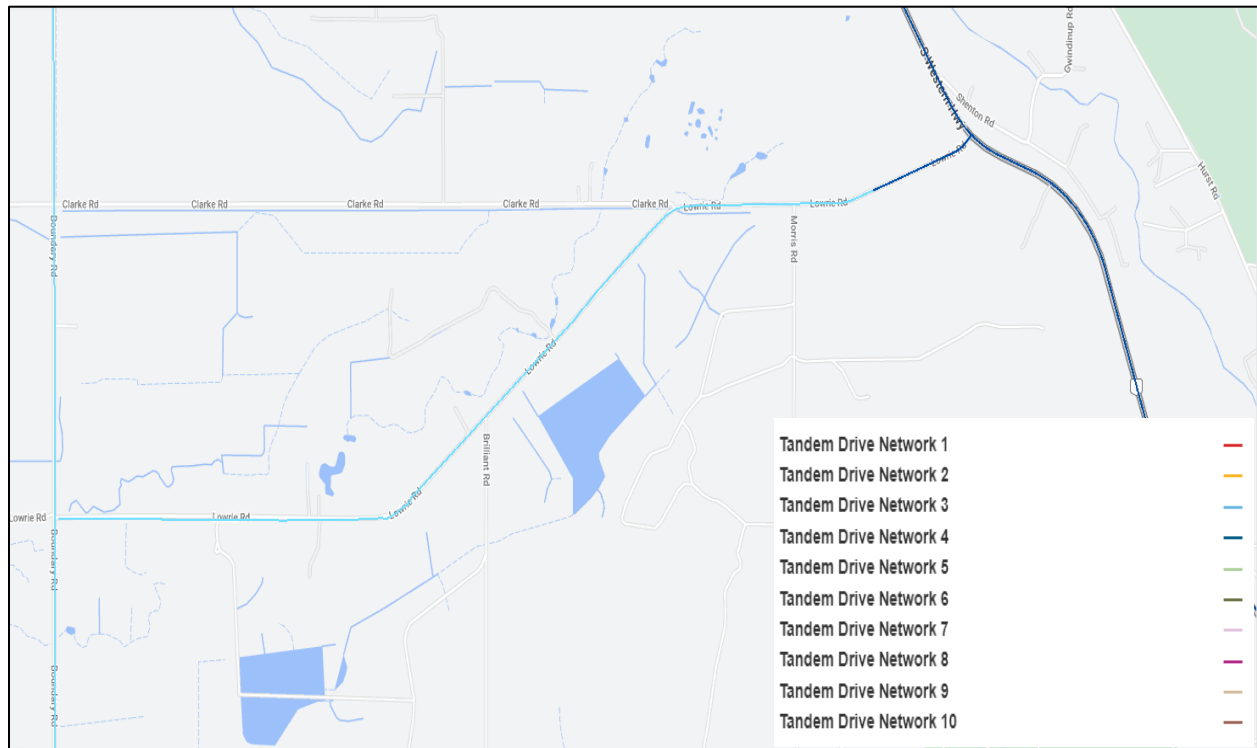
Source: MRWA Road Information Mapping System



2.3 EXISTING RESTRICTED ACCESS VEHICLE (RAV) NETWORK

Figure 2-3 shows the existing RAV network nearest to the Site. Currently, Lowrie Road has RAV 4 permit access that extends to the northeast edge of the Site till SLK 0.507 and RAV 3 permit access westwards connecting Lowrie Road (SLK 0.507) to Boundary Road.

Figure 2-3 Existing RAV Network



Source: MRWA HVS Network Map



2.4 EXISTING TRAFFIC VOLUMES

Existing traffic data were sourced from MRWA's Traffic Map and are summarised below in **Table 2-2**. The traffic volumes were collected relative to the location of the Site along with the hourly peak data for both of these sites during AM and PM.

Table 2-2 Traffic Volumes

Site No.	Road Name	Source	Year	Traffic Volume (% of Heavy Vehicles)	AM Hourly Peak	PM Hourly Peak
1	South Western Highway <i>South of Bridge St (SLK 170.55)</i> Site 15241	MRWA Traffic Map	2018/2019	7,796 (11.8%)	11AM 589 vehicles (308 N & 281 S)	3PM 683 vehicles (337 N & 346 S)
2	South Western Highway <i>South of Knights Rd (SLK 179.23)</i> Site 53535	MRWA Traffic Map	2021/2022	7,465 (16.2%)	11AM 591 vehicles (305 N & 286 S)	3PM 607 vehicles (278 N & 329 S)
3	Lowrie Road 100m East of Clarke Rd. SLK 1340	Shire of Capel	July 2015	237.4 (35.38%)	15.6 vehicles	24.7 vehicles
4	Lowrie Road 250m from South Western Hwy	Shire of Capel	July 2020	333 (35.4%)	33.2 vehicles	36.5 vehicles

Source: MRWA Traffic Map

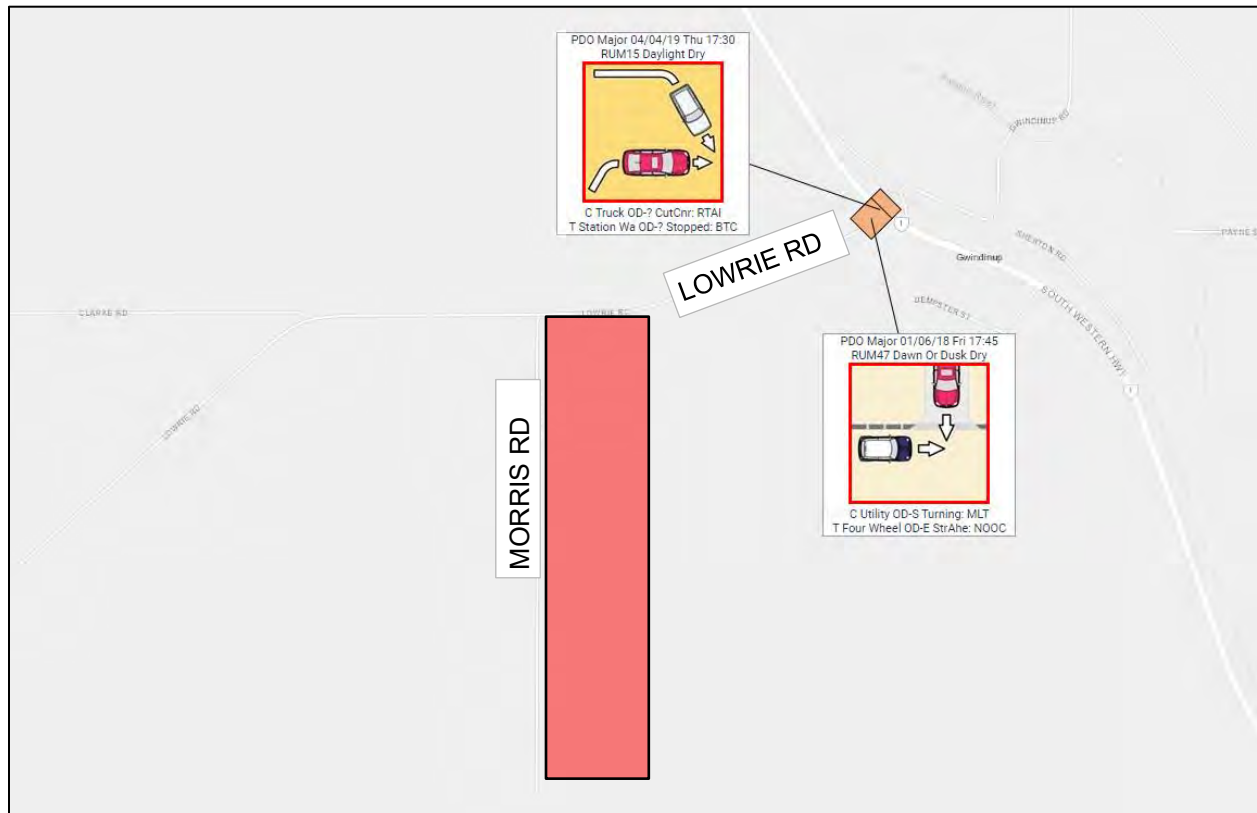
The traffic count data was also obtained from the Shire of Capel for the year 2015 and 2020 at two different sites located on Lowrie Road near the subject Site.



2.5 CRASH ASSESSMENT

Recorded crashes on the road network surrounding the Site were extracted from the available MRWA database between 2018 and 2022. Results of the crash assessment are presented in **Table 2-3**. **Figure 2-4** illustrates the location and severity of these crashes.

Figure 2-4 Crash Location



Source: MRWA Crash Reporting Centre

Table 2-3 Total Crashes

Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Right Angle	-	-	-	2	-	2
Total	-	-	-	2	-	2

From the assessment conducted, two (2) crash incidents were recorded along the surrounding road network; observations are summarised as follows:

- The two (2) recorded were all Right-Angle crashes at the intersection;
- Both crashes resulted in major property damage only;
- These incidents occurred along South Western Highway and Lowrie Road; and
- No crash incidents were recorded along Morris Road, Clarke Road, and Brilliant Road.

A history of similar type of crashes occurring within the same road section suggests further investigation should be undertaken to identify the underlying cause. It is noted that all the crashes occurred near the intersection of SWH and Lowrie Road. However, both crashes are Major Property Damage only with no casualty. The existing Basic right turn and the Auxiliary left turn lanes with good Safe Intersection Sight Distance (SISD) significantly reduces the risk of major crashes. As such, the additional truck movements in and out of this intersection may be less likely to contribute to additional crashes.

2.6 INTERSECTION ASSESSMENT

An intersection assessment has been carried out for the Lowrie Road and South Western Highway intersection as shown in **Figure 2-5**. For a robust assessment, the design speed of truck and car of 110 km/h and 120 km/h has been adopted from the Austroads Guide to Road Design. The minimum required safe intersection sight distance (SISD) for the trucks turning onto South Western Hwy from Lowrie Road is 302m for both north and south directions (for the design speed of 110 km/h). The minimum required safe intersection sight distance (SISD) for cars turning onto South Western Hwy from Lowrie Road is 341m for both north and south directions (for the design speed of 120 km/h). After carrying out the assessment, it is noted that the available SISD from both directions is as much as 500m, thus satisfying the Austroads minimum requirements.

Austroads Guide to Road Design Part4A Section A.10 was reviewed where it is suggested that an acceleration lane may be preferable where SISD is insufficient and/or traffic volumes on the road and the number of trucks entering are relatively high. According to the MRWA Standard Restricted Access Vehicle Route Assessment Guidelines, the required sight distance for posted speed limit of 100km/h for RAV is 252m, which can be achieved at this intersection. As the sight distance available on the through road is



good, it is relatively easy for through drivers to perceive the slow movement of these vehicles and to slow for them.

According to the historical traffic volume data, the through traffic in during the peak hours along South Western Highway is between 300-350vph in one direction. This would translate to approximately 6 vehicles per minute, or 1 car per 10 seconds in any direction.

This indicates that a turning vehicle/truck would have an average gap of 10 seconds, (approximately 300m on 110km/h posted speed). This gap is more than sufficient for through drivers to perceive the slow movement of these vehicles and to slow for them if required.

Table 2-4 Sight Distance Requirements

Sight Distance Type	Vehicle Type	Design Speed (km/h)	Reaction Time (R _T)	Distance (m)
SISD	Truck	110	2.5 sec	302m (minimum)
SISD	Car	120	2.5 sec	341m (minimum)
ASD	Car	120	2.5 sec	241m (minimum)

Source: Guide to Road Design Part 4A



Figure 2-5 Lowrie Rd-South Western Hwy Intersection



Source: Metromap

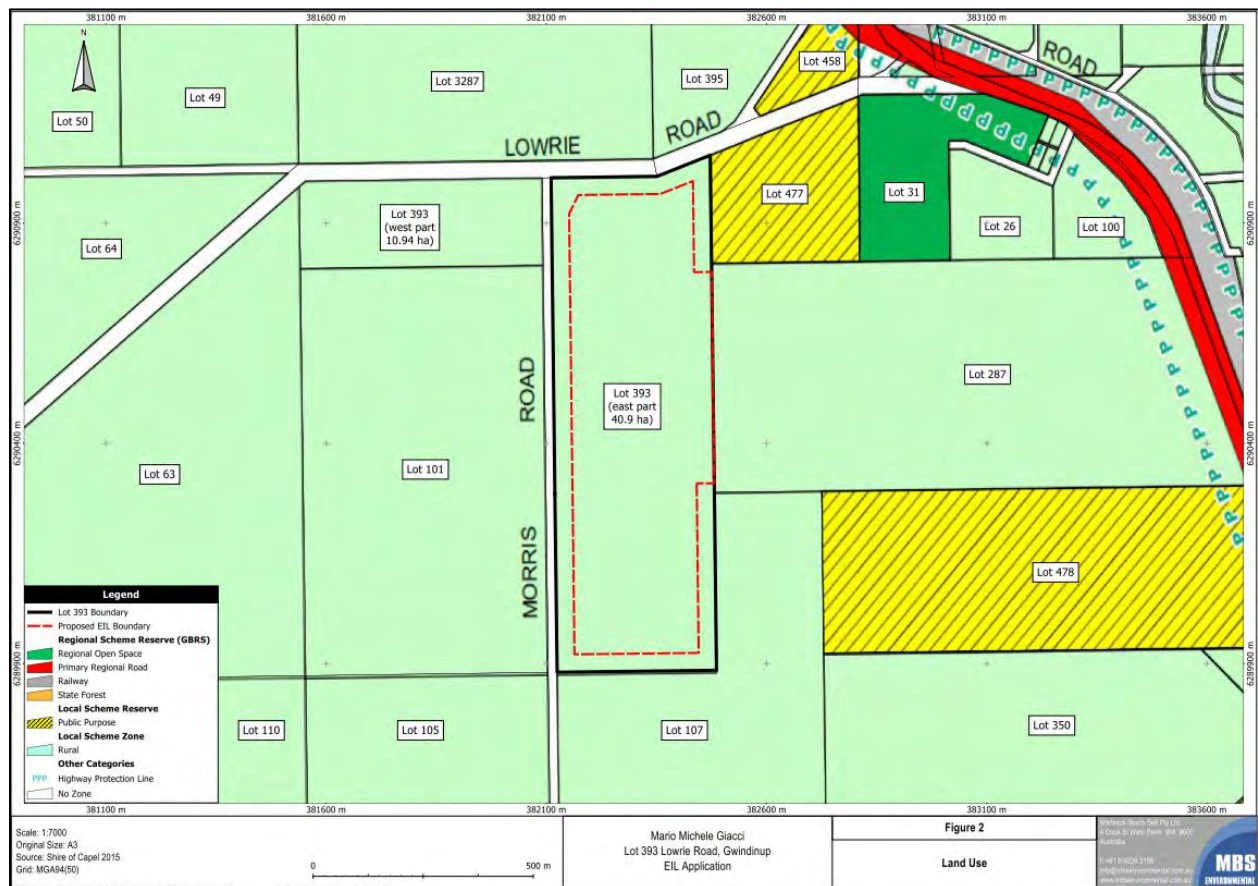
3.0 PROPOSED DEVELOPMENT

3.1 PROPOSED LAND USES

A portion of the Site Lot 393 is currently being used for the extraction of sand and gravel located to the eastern end of Lowrie Road. The indicative extraction area of the Site is 31.4 hectares, as shown in **Figure 3-1** (also provided in **Appendix B**).



Figure 3-1 Proposed Development Area



Source: MBS Environmental

3.2 ACCESS ARRANGEMENTS

Although the Site (Lot 393) can be accessed via Morris Road, the extractive operations will only utilise the access onto Lowrie Road at the North East corner of the site. This access is currently being used by both Lot 393 and the adjacent Lot 287 as illustrated in **Figure 3-2**.



Figure 3-2 Site Access Arrangement



Source: Metromap

3.3 PROPOSED HAULAGE ROUTE

Trucks leaving the Site drive in both directions on Lowrie Road, South Western Highway is only accessible with a RAV 4 permit (east) or RAV 3 permit (west). All hauling activities will be conducted by several truck configurations such as 6 wheelers, semi's, rigid trucks, dog trailers and semi-trailers up to 27.5m.



3.4 HOURS OF OPERATION

The proposed development site will operate between 7:00 am to 6:00 pm Monday to Friday and 7:00 am to 1:00 pm on Saturday. Days of operation will be from Monday to Saturday with an expected maximum movement of up to 150 truck trips per day (weekdays).



4.0 SWEPT PATH ANALYSIS

Swept path checks were conducted to assess the manoeuvrability of transport trucks along the haulage route of the proposed development. Swept path checks were conducted using the 27.5 RAV truck as design vehicles to emulate the trucks moving in and out of the proposed development.

4.1 SWEPT PATHS ON THE SITE ACCESS

Figure 4-1 Swept Path - Site Access

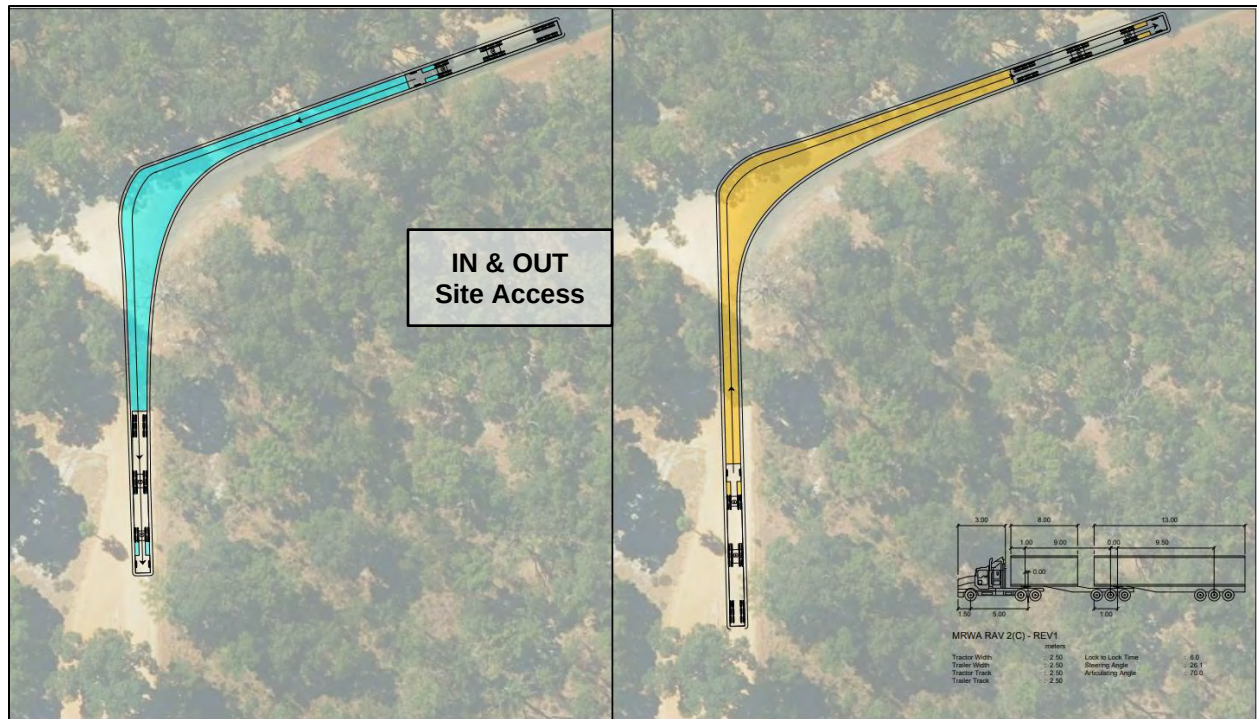


Figure 4-1 above shows the indicative swept path at the Site's access point, approximately 500m West of the intersection of Lowrie Road and South Western Highway. The crossover from Lowrie road to the site track is sealed and caters for road train truck configuration. Swept path analysis on the aerial image suggests that the existing access is adequate to accommodate one way movement only. A layby area has been provided approximately 65m south of the intersection, allowing for exiting vehicles to give way to entering vehicles if required.



5.0 TRIP GENERATION

5.1 ESTIMATED TRAFFIC GENERATION

For this assessment, a generated trip is defined by the ingress and egress movement of vehicles relative to the Site. If a vehicle is to enter and exit the Site on the same day, the vehicle is considered to generate 2 trips per day.

The maximum daily truck movements to and from the Site are proposed to be, 75 loaded trucks per day. Therefore, the Site is expected to generate up to 150 truck trips per day, which could be translated to approximately 14 truck trips/hour on average. **Table 5-1** provides a tabular summary of the estimated trips for the proposed development.

Table 5-1 Estimated Traffic Generation

Estimated Site-generated Trips	No. of Vehicles (11 hours of operation per day)	
	Daily	Hourly
Truck Trips	150	14 (7 IN & 7 OUT)

Note that the values above were based on maximum extraction. The actual number of trips generated by the development will vary based on time of day and extraction requirements through the life of the Site.

Based on the estimated site-generated trips, 14 hourly trips = approximately 1 truck per 5 minutes.

- Traffic management, such as the use of intercom, could be put in place to manage the inbound and outbound movements to minimise potential conflict at the access.
- Due to Low background traffic on Lowrie Road, additional truck traffic from the Site is unlikely to generate any significant delays to the existing traffic using the road.
- Existing intersection turning facilities (auxiliary lanes) minimise the delay for through traffic on South Western Highway even with the increased entering volumes. Some queueing may occur on Lowrie Road leg, but the delay is unlikely to significantly impact the overall operation of the intersection.



6.0 SUMMARY

This Transport Impact Statement outlines the transport aspects of the proposed development focusing on traffic operations and access. Included are discussions regarding traffic generation and potential issues.

This statement has been prepared following the *WAPC Transport Assessment Guidelines for Developments: Volume 4 – Individual Developments (2016)*.

The following conclusions are made for the proposed development:

- The proposed development is a Sand & Gravel extraction site located at the eastern end of Lowrie Road within Gwindinup, Shire of Capel;
- The proposed truck movements in and out of the Site are expected to be up to 150 daily truck movements in and out of the Site which translate to approximately 14 truck trips per hour on average.
- Two crashes over five years were recorded at the intersection of Lowrie Road and South Western Highway and both crashes are Major Property Damage only. The existing Basic right turn and the Auxiliary left turn lanes with good Safe Intersection Sight Distance (SISD) significantly reduces the risk of major crashes. Therefore, the additional truck movements in and out of this intersection are less likely to contribute to additional crashes.
- Swept path analysis of 27.5m trucks have been conducted for the assessment. The analysis suggests that 27.5m trucks could be accommodated to access the site from northeast corner of Lowrie road.

Overall, the traffic assessment has been conducted for the worst-case scenario for the Sand & Gravel extraction site- Lot 393 Lowrie Road Gwindinup. On normal days, the truck volumes are likely to be much lower than assessed and is unlikely to have a substantial long-term impact on traffic operations and the overall safety of the road network around it.



APPENDICES

APPENDIX A WAPC CHECKLIST

Item	Status	Comments/Proposals
Proposed Development		
Proposed Land Use	Section 3	
Existing Land Uses	Section 2	
Context with Surrounds	Section 2	
Vehicular Access and Parking		
Access Arrangements	Section 3	
Public, Private, and Disabled Parking Set Down / Pick-up	N/A	
Service Vehicles (non-residential)		
Access Arrangements	Section 3	
On/Off-site Loading Facilities	N/A	
Service Vehicles (residential)		
Rubbish Collection and Emergency Vehicle Access	N/A	
Hours of Operation (non-residential only)	Section 3	
Traffic Volumes		
Daily or Peak Traffic Volumes	Section 2	
Type of Vehicles (e.g., cars, trucks)	Section 2	
Traffic Management on Frontage Streets	N/A	
Public Transport Access		
Nearest Bus/Train Routes	N/A	
Nearest Bus Stops/Train Stations	N/A	
Pedestrian/Cycle Links to Bus Stops/Train Station	N/A	
Pedestrian Access/Facilities		
Existing Pedestrian Facilities Within The Development (If Any)	N/A	
Proposed Pedestrian Facilities Within Development	N/A	
Existing Pedestrian Facilities On Surrounding Roads	N/A	
Proposals To Improve Pedestrian Access	N/A	
Cycle Access/Facilities		
Existing Cycle Facilities Within The Development (If Any)	N/A	
Proposed Cycle Facilities Within The Development	N/A	
Existing Cycle Facilities On Surrounding Roads	N/A	
Proposals To Improve Cycle Access	N/A	
Site-specific Issues	N/A	
Safety Issues		
Identify Issues	N/A	
Remedial Measures	N/A	



APPENDIX B PROPOSED DEVELOPMENT AREA



Appendix 9

Existing Contours and Features
(Verified 1:2000 version of Figure 3)

Mario Michele Giacchi
Lot 393 Lowrie Road, Gwindinup
EIL Application

0100 m

Scale: 1:2000
Original Size: A1
Air Photo Date: November 2020 for southern part of
Lot 393 and Lot 287, January 2019 for rest.
Grid: MGA94(50)

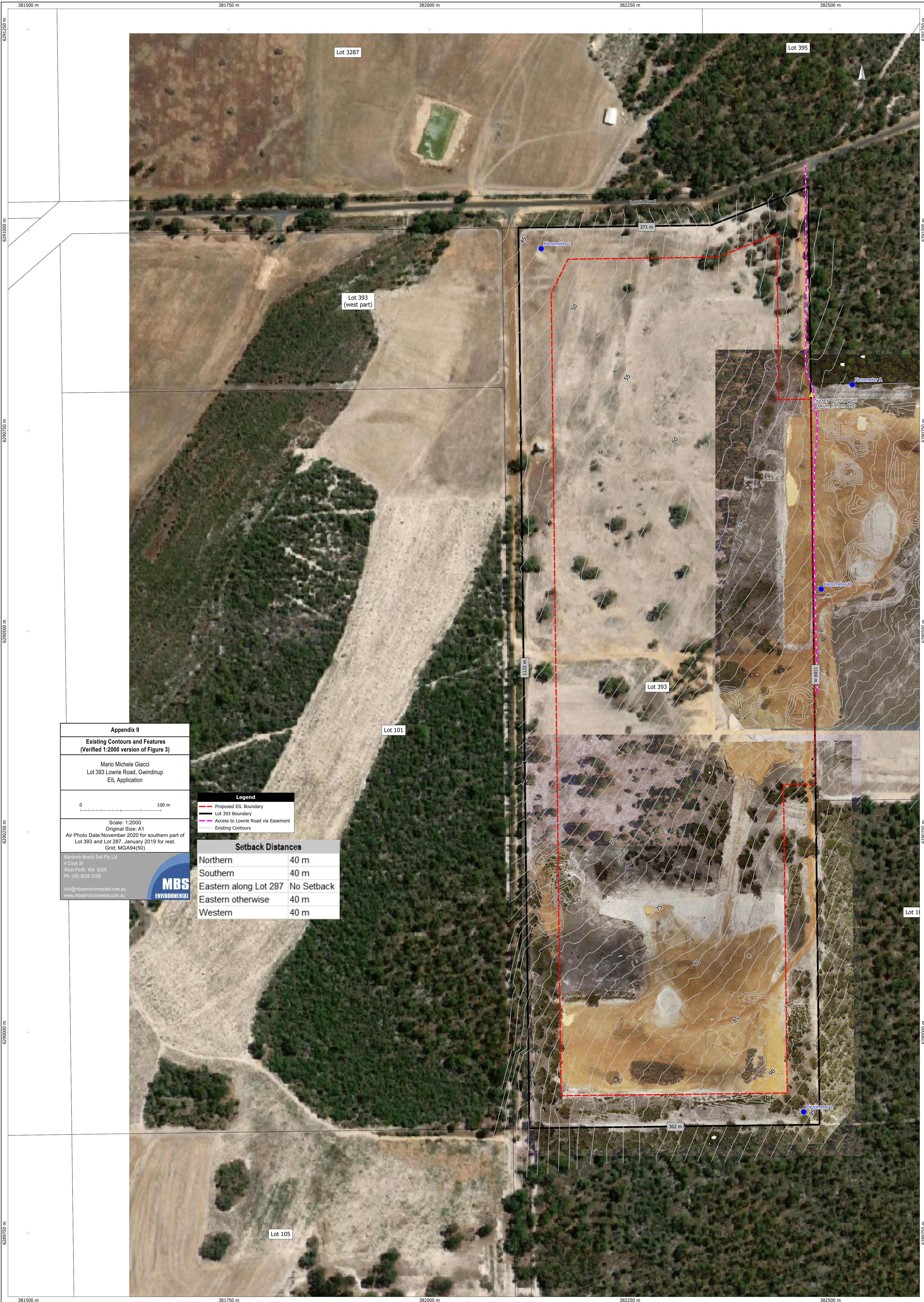
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MBS

ENVIRONMENTAL

- Legend
- Proposed EIL Boundary
 - Lot 393 Boundary
 - Access to Lowrie Road via Easement
 - Existing Contours

Setback Distances	
Northern	40 m
Southern	40 m
Eastern along Lot 287	No Setback
Eastern otherwise	40 m
Western	40 m



Appendix 10

Finished Development Plan

Mario Michele Giacci
Lot 393 Lowrie Road, Gwindinup
EIL Application

0100 m

Scale: 1:2000
Original Size: A1
Air Photo Date: November 2020 for southern part of
Lot 393 and Lot 287, January 2019 for rest.
Grid: MGA94(50)

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Legend

Lot 393 Boundary

Proposed EIL Boundary

Proposed Finished Surface Contours

Interval (m)

1

5

Permanent Retention Pond

Rehabilitation to Native Vegetation

Rehabilitation to Pasture



APPENDIX 12: NOISE MANAGEMENT PLAN

NOISE MANAGEMENT PLAN

LOT 393 LOWRIE ROAD, GWINDINUP

PREPARED FOR:

MARIO MICHELE GIACCI

MARCH 2024

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MBS
ENVIRONMENTAL



LOT 393 LOWRIE ROAD, GWINDINUP NOISE MANAGEMENT PLAN

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- Appendix 1: Wind Roses
- Appendix 2: Noise Complaint Form

1. INTRODUCTION

1.1 PURPOSE

Mario Michele Giacci (the applicant) has an existing Development Approval (DA) and Extractive Industry Licence (EIL) for the extraction of sand and gravel on Lot 393 Lowrie Road, Gwindinup (the property) within the Shire of Capel (Figure 1, Figure 2). This Noise Management Plan (NMP) has been prepared for the purposes of a 2024 DA/EIL application.

This NMP was prepared taking into consideration the Guidance for the Assessment of Environmental Factor No.3: *"Separation Distances between Industrial and Sensitive Land Uses"*, prepared by the Environmental Protection Authority (EPA 2005). This NMP should be read in conjunction with the DA EIL report.

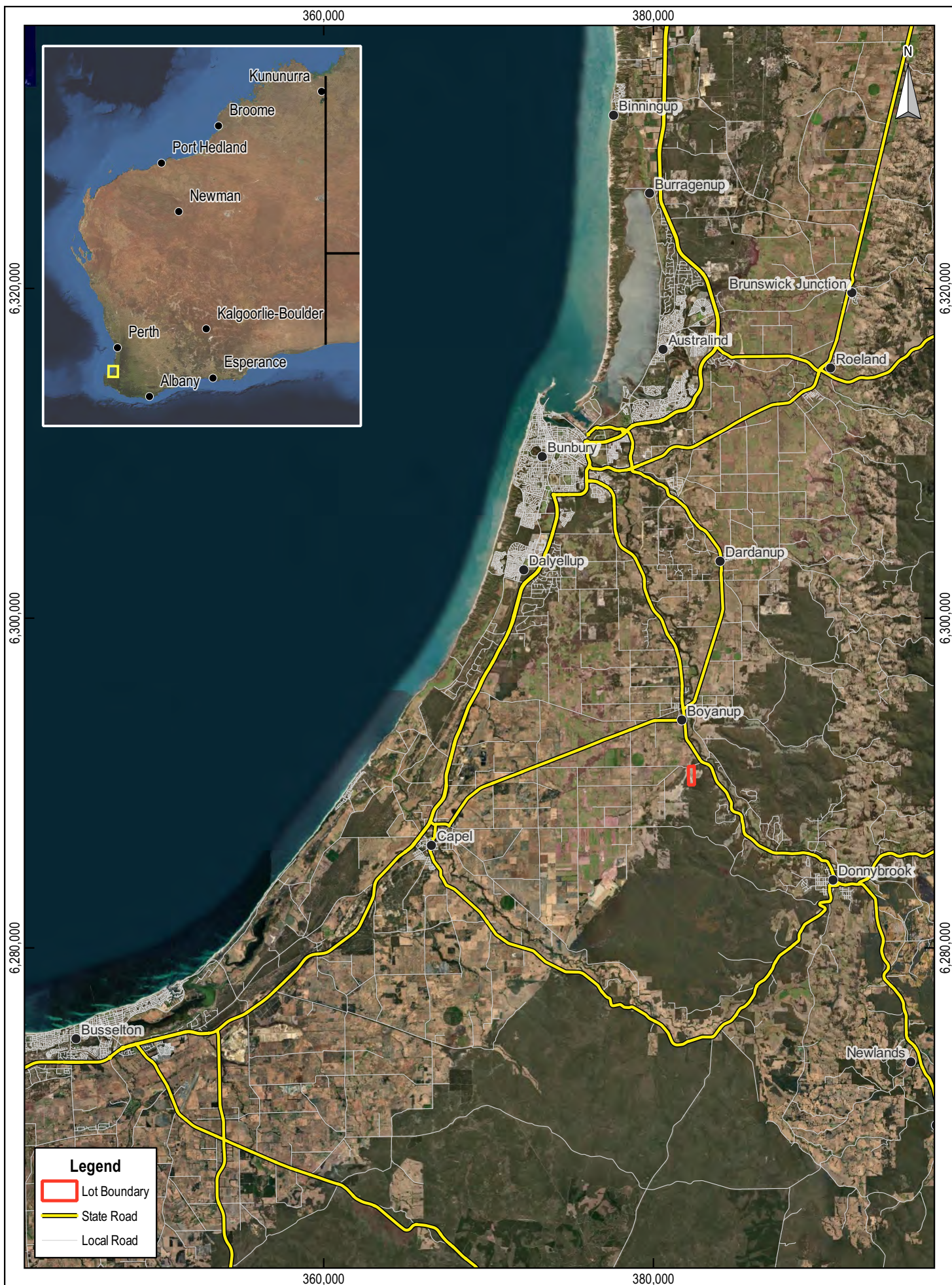
1.2 SCOPE

The scope of this NMP includes the following:

- Description of the existing environment and identification of sensitive receptors.
- Identification of potential sources of noise associated with the operations.
- A site risk assessment for noise.
- Description of appropriate noise prevention, monitoring, and mitigation measures.
- Identification of roles and responsibilities.
- A noise complaints process.

1.3 OBJECTIVE

The objective of this NMP is to minimise noise emissions generated by sand and gravel extraction operations on Lot 393.



Scale: 1:300000
 Original Size: A4
 Image: ESRI World Imagery
 Grid: GDA94 / MGA zone 50

0 5 10 km

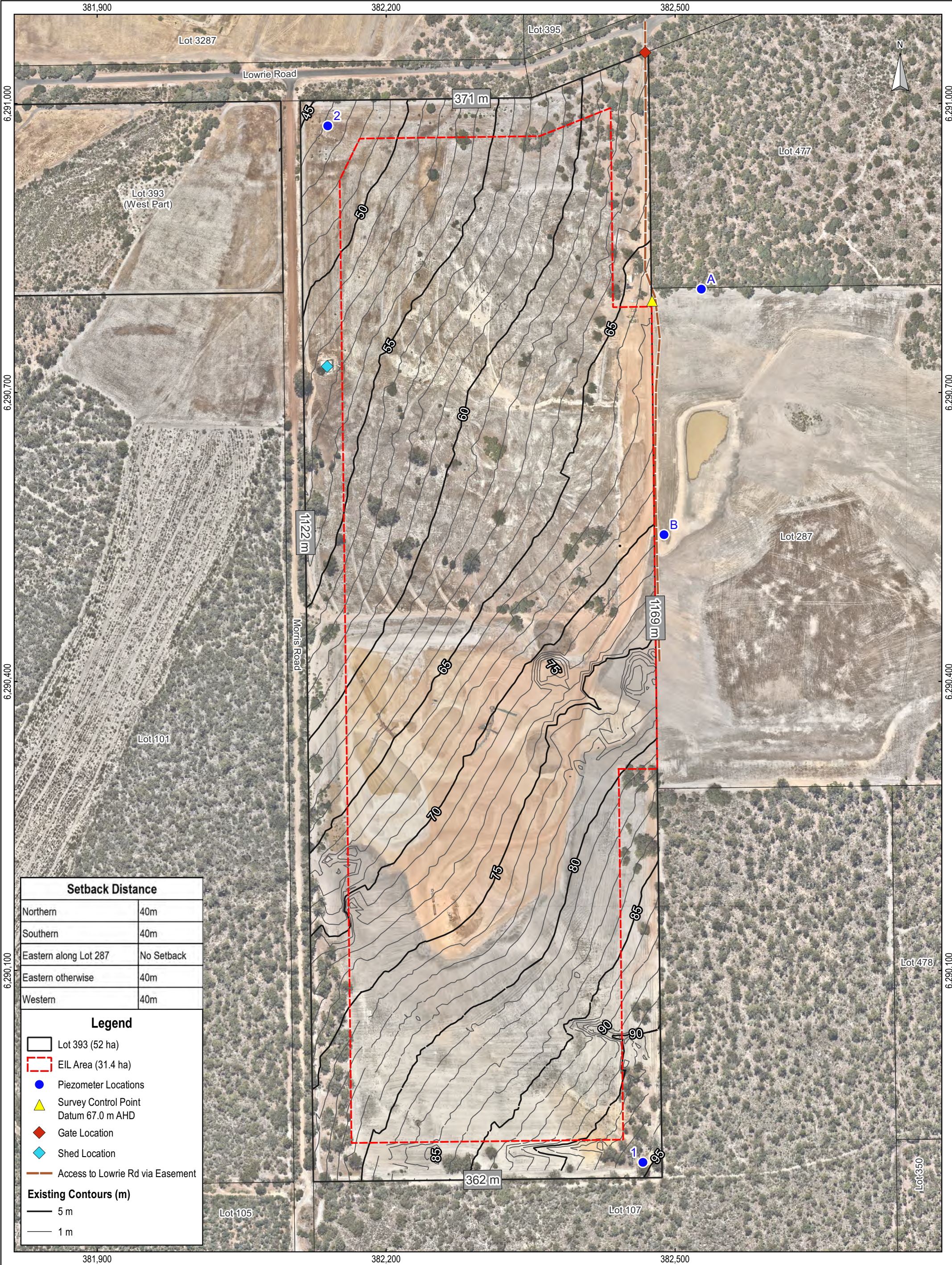
Mario Michele Giacci
 Lot 393 Lowrie Road, Gwindinup

Figure 1

Location

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Setback Distance	
Northern	40m
Southern	40m
Eastern along Lot 287	No Setback
Eastern otherwise	40m
Western	40m

Legend	
	Lot 393 (52 ha)
	EIL Area (31.4 ha)
	Piezometer Locations
	Survey Control Point Datum 67.0 m AHD
	Gate Location
	Shed Location
	Access to Lowrie Rd via Easement

Existing Contours (m)	
	5 m
	1 m

Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Source: Extraction area contours from Thompson Surveying 2017
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 75 150 m

Mario Michele Giacci
Lot 393 Lowrie Road, Gwindinup

Figure 2
Existing Contours and Features

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2. EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the project area is Mediterranean, with cool wet winters and hot dry summers. Bureau of Meteorology (BoM) long-term average climate data for the closest meteorological station (Donnybrook, 9 km southeast of the property) is shown in Figure 3. The average annual rainfall is 970.4 mm, mean minimum temperatures between 5°C and 15°C and mean maximum temperatures between 16°C and 31°C (BoM 2023).

Long-term wind roses for Donnybrook (BoM 2023) indicate prevailing winds comprise morning easterlies and afternoon westerlies (Appendix 1).

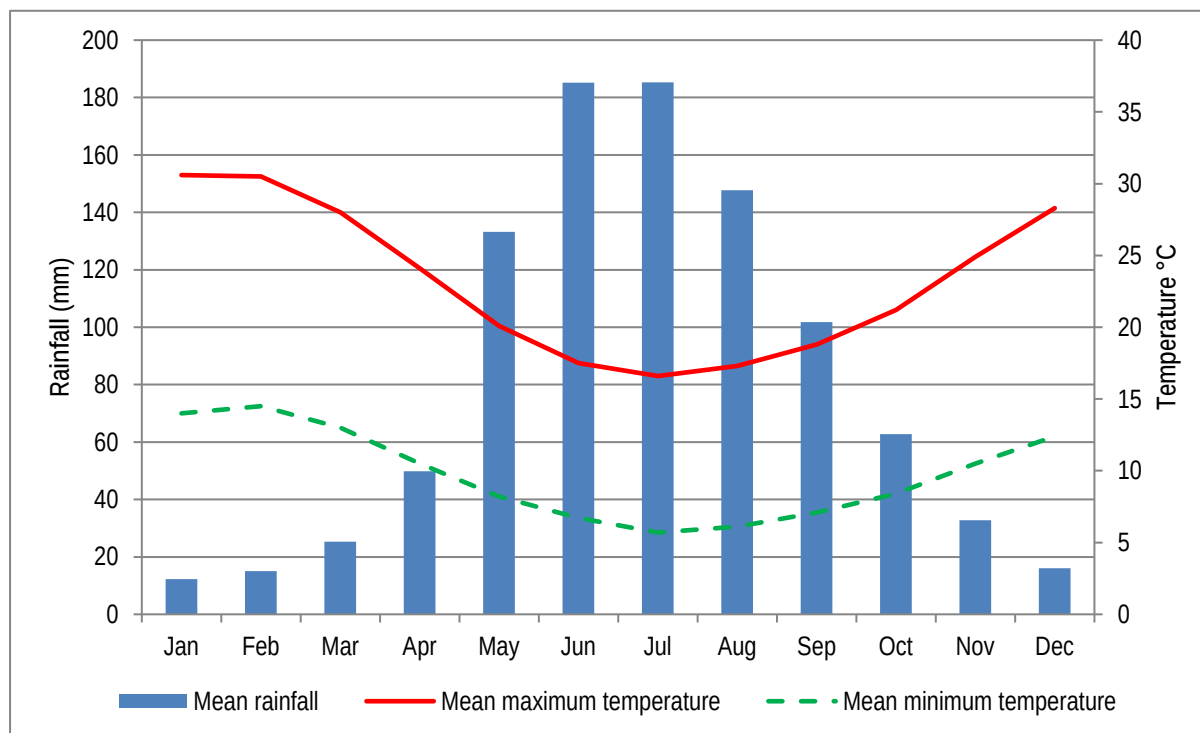


Figure 3: Climate Statistics (1900–2023) for BoM Station 9534

2.2 LAND USE

Lot 393 is located on Lowrie Road within the Shire of Capel, approximately 3.5 km south of Boyanup and approximately 26 km southeast of Bunbury (Figure 1). The property covers a total area of approximately 52 ha and is zoned Rural under the Shire of Capel Local Planning Scheme (LPS) No.8 and the Greater Bunbury Region Scheme (WA Gov 2014). LPS No.8 maps the property within two Special Control Areas (SCA): SCA6 — Strategic Minerals and Basic Raw Materials, and SCA8 — Regional Ecological Linkages (Shire of Capel 2023).

The property contains one shed (Figure 2) and was previously covered in mostly *Eucalyptus saligna* (blue gums), which were harvested in 2018. There are some remnant patches of native vegetation and isolated native trees and shrubs. The 10.94 ha area of Lot 393 west of Morris Road and the northwestern corner of the property were previously part of mineral sand mining operations. These areas have been rehabilitated and signed off as completed by the Department of Mines, Industry Regulation and Safety.

The land surrounding Lot 393 is zoned either Rural, Priority Agriculture, Reserve / State Forest or Local Distributor Road (South Western Highway). Existing sources of noise include the highway and other local roads, as well as a range of activities on rural properties, including the use of heavy machinery.

2.3 LANDFORM AND SOILS

The high point on Lot 393 is at 96 m Australian Height Datum (AHD), situated in the southeast corner of the property (Figure 2). From there the land slopes down at a near constant grade to a low point of 45 mAHd at the northwestern corner of the property.

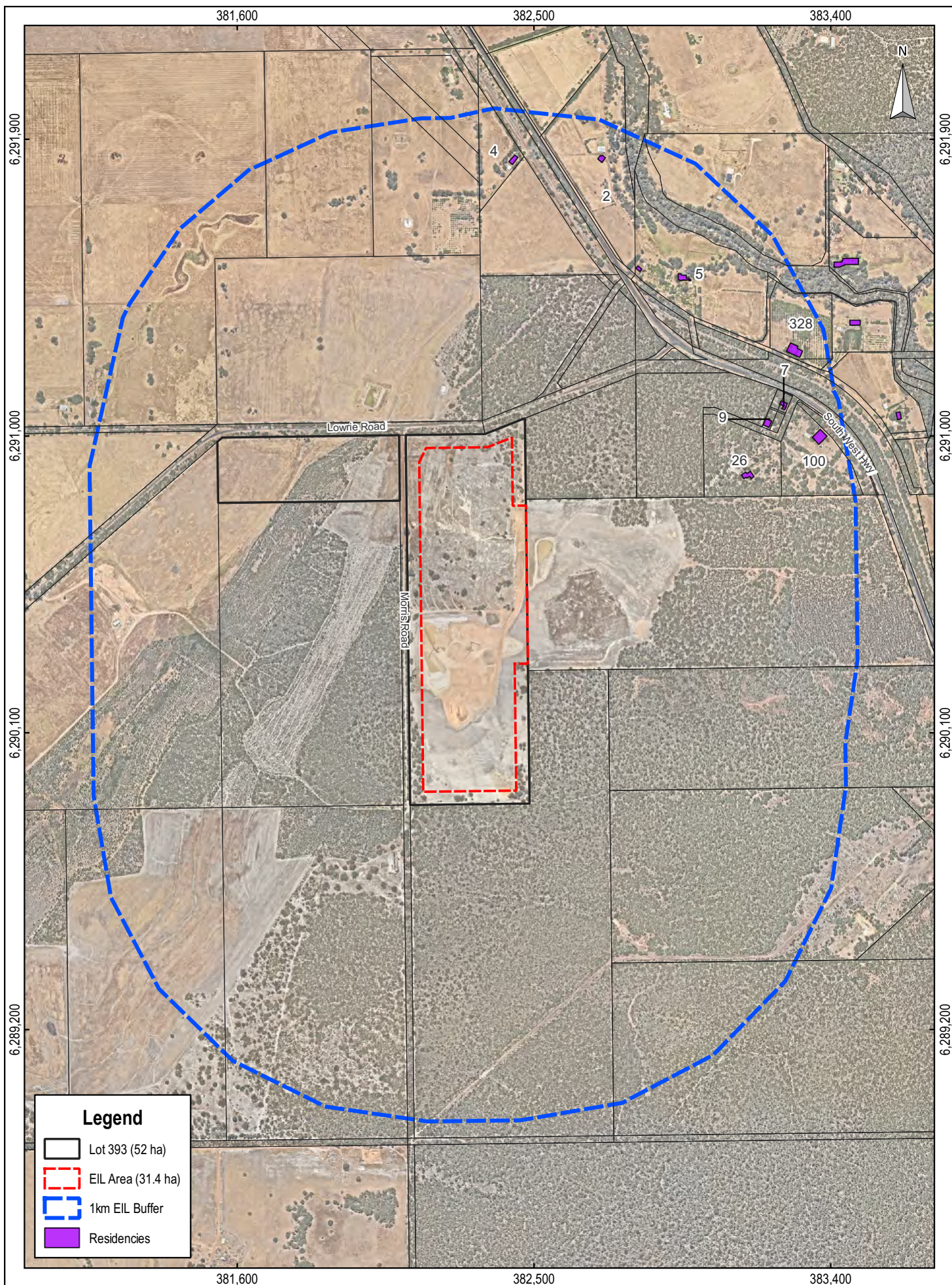
Two soil and landform systems are mapped within and surrounding the proposed extraction area (DPIRD-064):

- **Whicher Scarp System:** low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel, and non-saline wet soils. Jarrah-marri forest and woodland.
- **Forrestfield System:** undulating foot slopes of the Darling and Whicher Scarps.
- Duplex sandy gravels, pale deep sands, and grey deep sandy duplexes.

The majority of the property falls within the Whicher Scarp System with the northwestern corner in the Forrestfield System. Historical excavation along the western boundary of Lot 393 and recent extraction on southern parts of Lot 393 and neighbouring Lot 287 confirm the presence of gravel under a layer of sand of varying depth.

2.4 SENSITIVE RECEPTORS

For noise management purposes, the key sensitive receptors around an extractive industry site are residential dwellings. There are no residences within 500 m of Lot 393, therefore it is considered that there are no sensitive receptors within a notable distance (Figure 4). For residential dwellings beyond 500 m, there is ample vegetation screening them from operations on the property. The land surrounding Lot 393 is zoned either 'Rural' or 'Reserve' (Shire of Capel 2023). They include land uses of sand and gravel extraction, remnant bushland, rehabilitation projects from past mineral sand mining, and pasture (Figure 4).



Scale: 1: 15,000
 Original Size: A4
 Aerial Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

0 250 500 m

Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 4

Sensitive Receptors

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3. PROPOSED OPERATIONS AND NOISE

3.1 EXTRACTION OPERATIONS

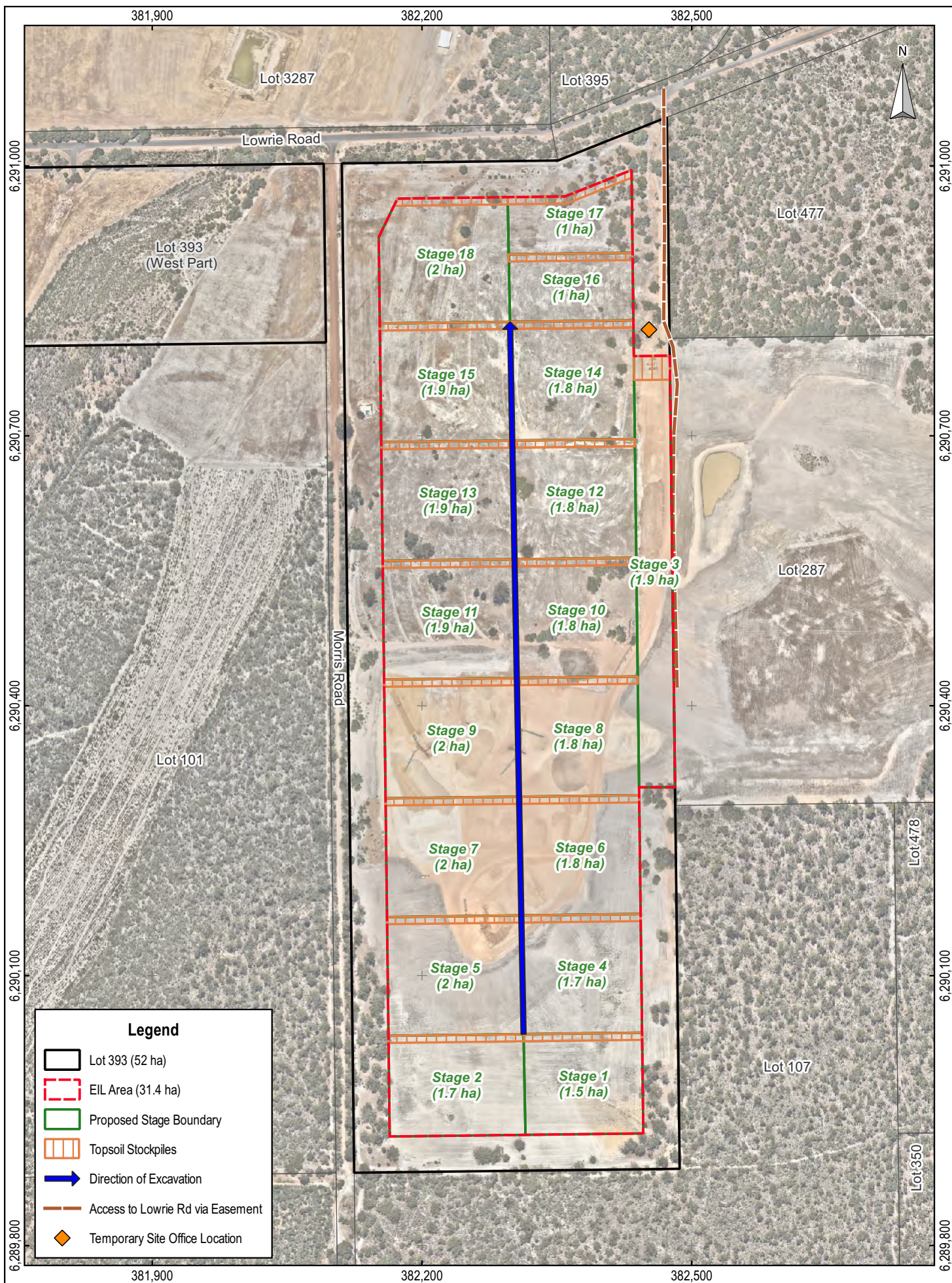
In summary, the extraction operations will proceed in stages and comprise of the following:

- Vegetation clearing (minimal) with a dozer or other heavy machinery.
- Remove and stockpile topsoil, litter, and any overburden with dozer and/or a loader.
- Extract sand and gravel material in 18 stages, with dozer and/or a loader.
- Crush and screen gravel with a mobile crusher.
- Load trucks and transport sand and gravel offsite.
- Form final landform with dozer and/or loader.
- Rip pit floor and replace topsoil and other overburden with dozer/loader, and rehabilitate to mixture of pasture and native vegetation.

The proposed project layout and extent of excavation are shown in the Works and Excavation Plan (Figure 5) and the Finished Development Plan (Figure 6). The pit is designed with maximum 1:6 final batter slopes extending to a maximum depth of approximately 5 m to cater for possible deeper gravel areas.

The operating hours of the site are proposed to be limited to between 7 am and 6 pm Monday to Friday and between 7 am to 1 pm on Saturdays, with no operations on Sundays or Public Holidays.

Key potential sources of noise for the sand and gravel extraction operations are the heavy vehicles and the crusher operating on the site and the haulage trucks.



Scale: 1: 5,500
 Original Size: A4
 Air Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

0 100 200 m

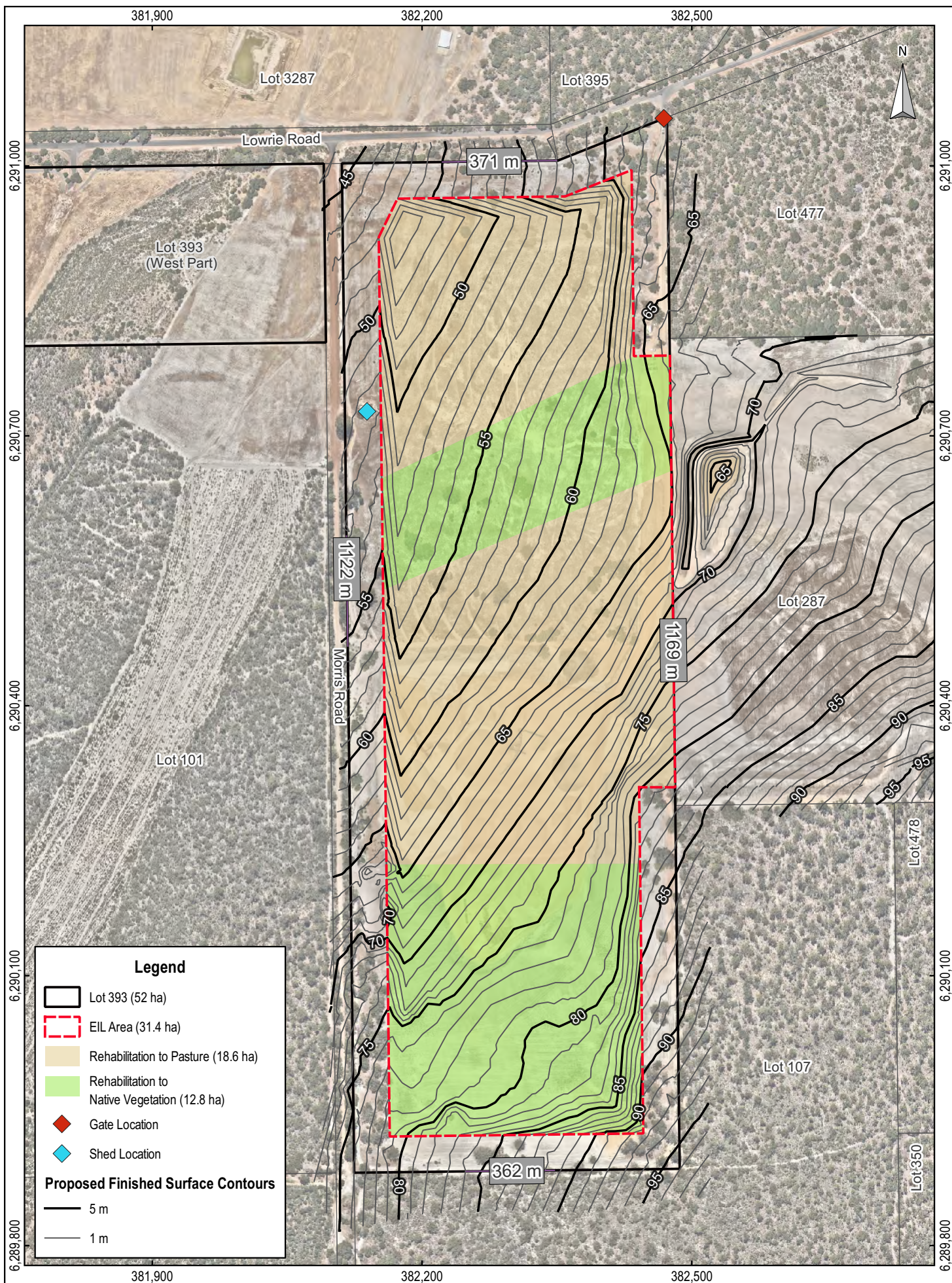
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Figure 5

Excavation Works Plan

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Scale: 1: 5,500
 Original Size: A4
 Air Photo Date: Jan 2024
 Grid: GDA94 / MGA zone 50

0 100 200 m

Mario Michele Giacci
 Lot 393 Lowrie Road,
 Gwindinup

Figure 6

Finished Development Plan

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3.2 SITE RISK ASSESSMENT

Guidance for the Assessment of Environmental Factors No.3: "*Separation Distances between Industrial and Sensitive Land Uses*" was prepared by the Environmental Protection Authority (EPA 2015). It sets generic separation distances for various types of industrial operations and sensitive land uses. For 'Extractive Industry — Sand and Limestone', the main potential impacts are identified as noise and dust and the generic separation distance to sensitive land uses is set at 300–500 m depending on the size of the operations.

The proposed extraction operations are at least 500 m from sensitive landuses with the closest residence located on Lot 5 to the northeast and situated 566 m from the proposed EIL boundary (Figure 4). Based on this, the operations are in line with the generic separation guidance and there is a lower risk of adverse impacts.

Additionally, a noise assessment was undertaken by Lloyd George Acoustics (2021) for the similar sand and gravel extraction operations on the adjoining property (Lot 287) where the closest residence is located 155 m away. The assessment found that extractive operations on Lot 287 could be undertaken in compliance with all applicable regulatory requirements subject to appropriate management measures being in place. The operations on Lot 393 are further removed from sensitive receptors than those on Lot 287, with no sensitive premises within 500 m of the operations on Lot 393. Therefore, it is expected that, with appropriate management measures in place, the operations on Lot 393 will remain in compliance with noise regulations.

4. NOISE MANAGEMENT ACTIONS

4.1 NOISE PREVENTION

The following noise management measures will be implemented on Lot 393 to reduce noise generation from the extractive operations:

- Operations will remain more than 500 m away from residences.
- Operational hours will be limited to between 7 am and 6 pm Monday to Friday and 7 am to 1 pm on Saturday.
- Dozer(s) will not operate at the same time as the mobile crusher.
- The mobile crusher will be set up on the pit floor behind the working face or behind material stockpiles.
- Topsoil and overburden will be stockpiled on the northern side of each stage and along the western boundary.
- The combination of pit floor depth to top of working face and/or bunding will be a minimum of 4 m in height.
- Heavy vehicles working on the property will be fitted with the less intrusive broadband-type ('croaker') reversing alarms rather than the tonal beepers.
- All vehicles and machinery on site will be regularly serviced to maintain good operating condition and minimise unnecessary noise.
- Speed limit on site will be 10 km/h.
- The importance of minimising noise on site will be communicated to all personnel and contractors.
- If noise complaints are received, these will be investigated promptly.

4.2 NOISE MONITORING AND MITIGATION

The following measures will be implemented to monitor and mitigate noise from site activities:

- Site personnel will monitor noise generation on an ongoing basis and if unusually high noise levels are observed, these will be proactively investigated and rectified.
- Site supervisor will undertake weekly checks to ensure appropriate bunding and stockpiles remain in place.
- Noise mitigation will be undertaken as necessary and may include e.g. engineering controls on machinery, relocation or redesign of bunding and/or stockpiles, relocation of crusher, change in machinery undertaking the work if feasible.

4.3 NOISE COMPLAINTS

The noise complaints process is as follows:

- A sign will be erected at the entrance to the extraction site advising the public on the appropriate contact in the event of a complaint.
- In the event of receiving a complaint, the EIL licensee will complete a Noise Complaint Form (Appendix 2) and undertake an initial investigation into the complaint within a day. Where possible, this initial investigation will resolve the matter, or alternatively the initial investigation will determine what further investigations and/or mitigation actions are to be undertaken. Any such further actions will be undertaken in a timely manner.
- A copy of the completed Noise Complaint Form will be forwarded to the Shire of Capel for their records.
- If required, a review of the NMP will be undertaken to refine noise prevention, monitoring, and mitigation measures.

5. ROLES AND RESPONSIBILITIES

Roles and responsibilities with respect to noise management are outlined in Table 1.

Table 1: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	• Will have overall responsibility for the noise management of the operations. • Will provide information for site operators and truck drivers on noise management objectives, and noise management measures to be undertaken on site (prevention, monitoring, and mitigation). • Will be responsible for resolving any persistent noise management issues. • Will be responsible for administering the noise complaints process.
All personnel	• Will be familiar with potential sources of noise associated with own role and how to minimise noise generation. • Will implement the noise prevention, monitoring and mitigation measures as described in this plan and as advised by the EIL Licensee. • Will be responsible for reporting any persistent noise management issues to the EIL Licensee.

6. REFERENCES

Bureau of Meteorology (BoM). 2023. *Climate Statistics for Australian Locations*. Bunbury Meteorological Station 9534. http://www.bom.gov.au/climate/averages/tables/cw_009534.shtml (accessed August 2023).

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Lloyd George Acoustics. 2021. *Environmental Noise Assessment Gravel Pit Expansion Lot 287 South Western Highway*.

Shire of Capel. 2023. *Local Planning Scheme No. 8*. Gazetted on 17 July 2023. <https://www.capel.wa.gov.au/local-planning-schemes.aspx> (accessed August 2023).

APPENDICES

APPENDIX 1: WIND ROSES

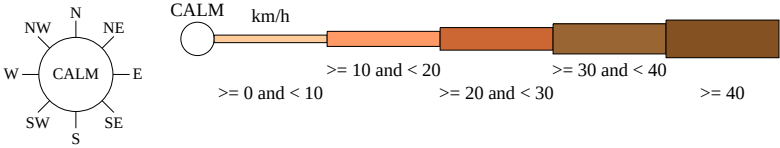
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 10 Aug 2023)

Custom times selected, refer to attached note for details

DONNYBROOK

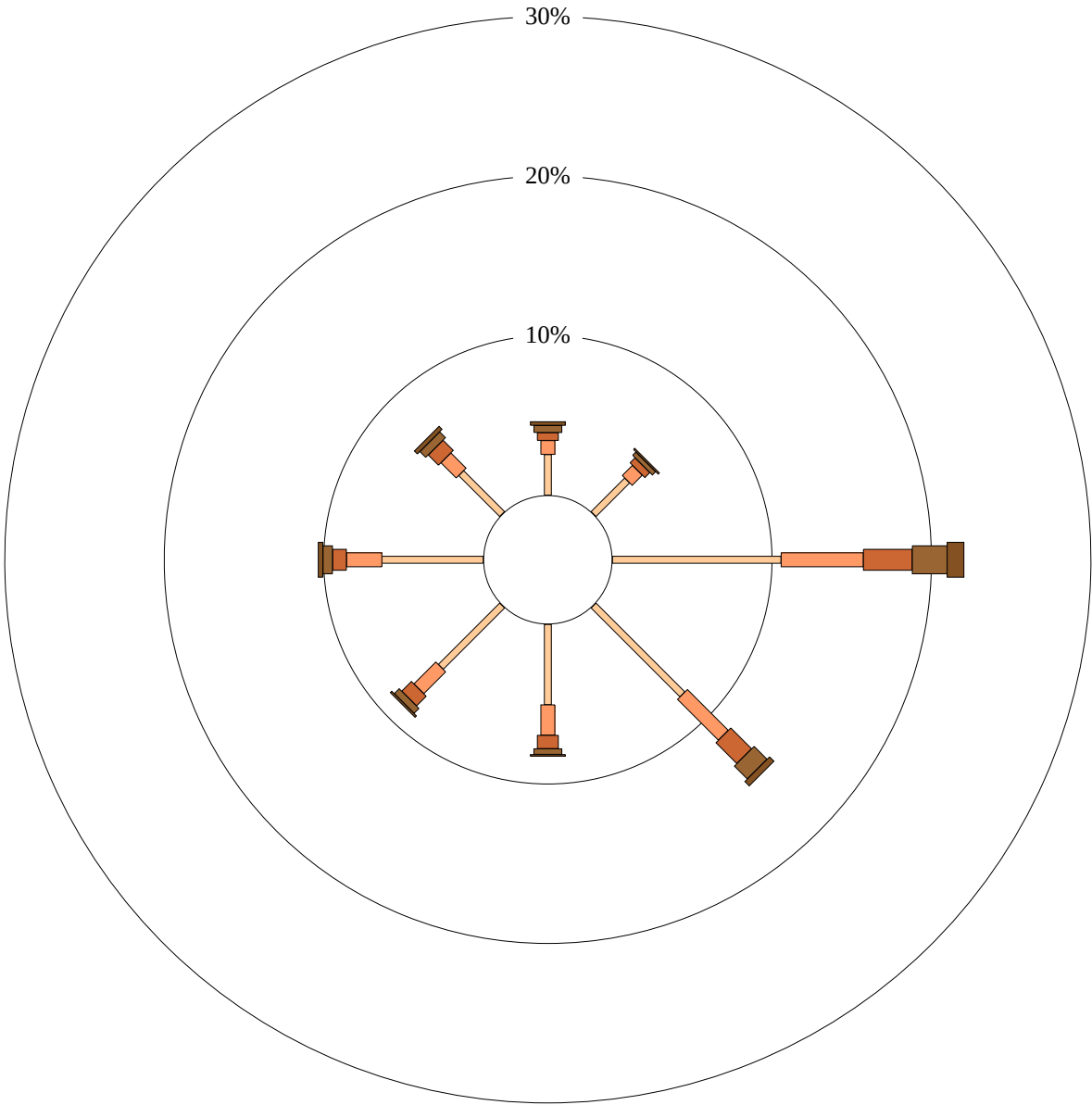
Site No: 009534 • Opened Jan 1900 • Still Open • Latitude: -33.5719° • Longitude: 115.8247° • Elevation 63m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
23300 Total Observations

Calm 20%



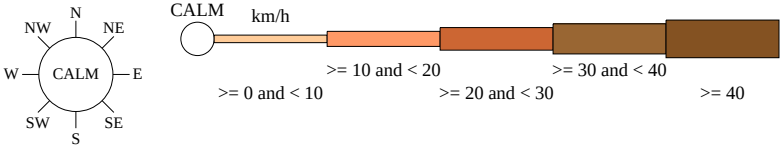
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 10 Aug 2023)

Custom times selected, refer to attached note for details

DONNYBROOK

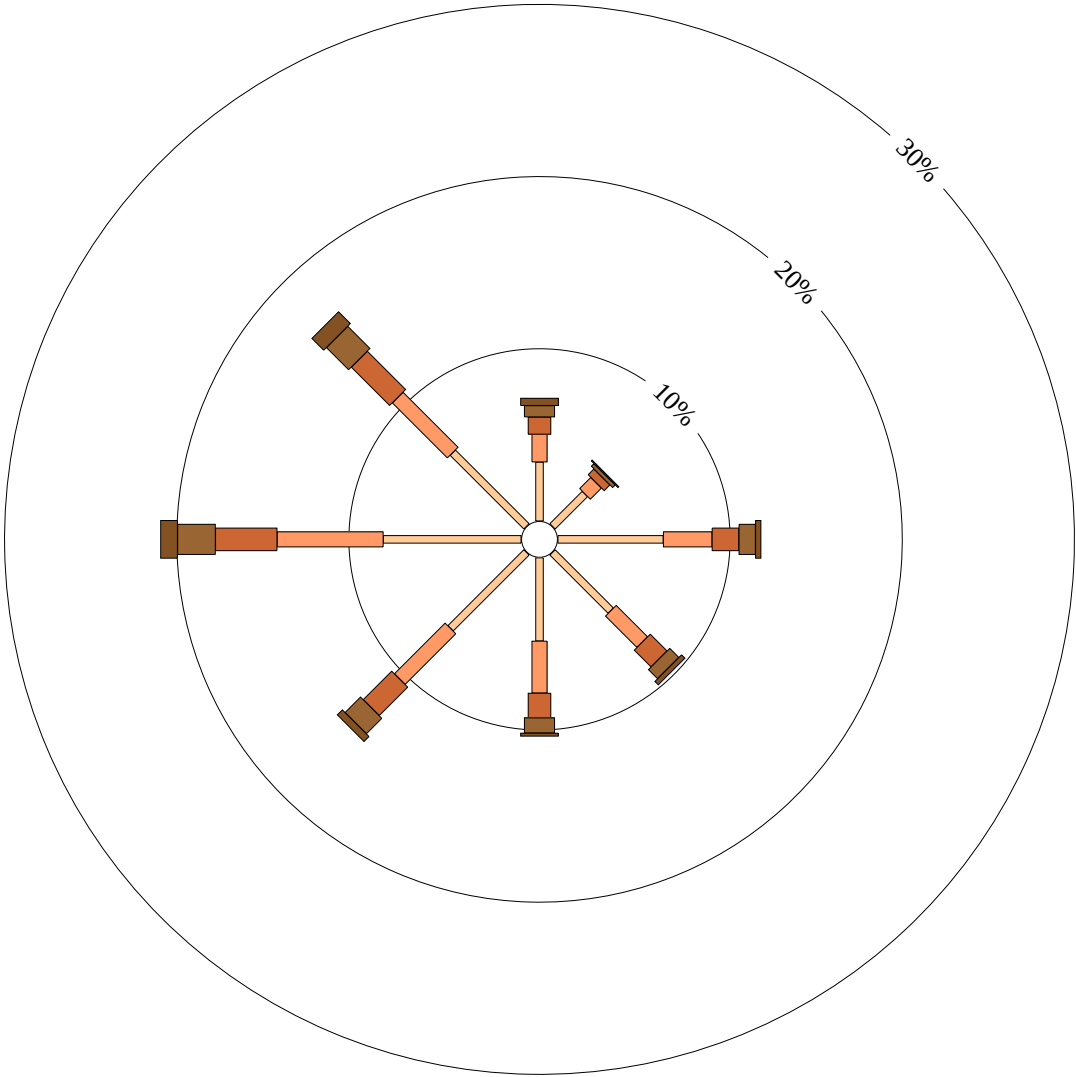
Site No: 009534 • Opened Jan 1900 • Still Open • Latitude: -33.5719° • Longitude: 115.8247° • Elevation 63m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
20359 Total Observations

Calm 5%



APPENDIX 2: NOISE COMPLAINT FORM

NOISE COMPLAINT FORM

Property: Lot 393 Lowrie Road, Gwindinup

Complaint date: _____

Complaint time: _____

Received by: _____

Complainant's Details

Name: _____

Telephone: _____

Affected address: _____

Complaint Details (attach report if insufficient space)

Action Taken (attach report if insufficient space)

Actions recorded by: _____

Date: _____

Copy to Shire of Capel: ☐ (tick)