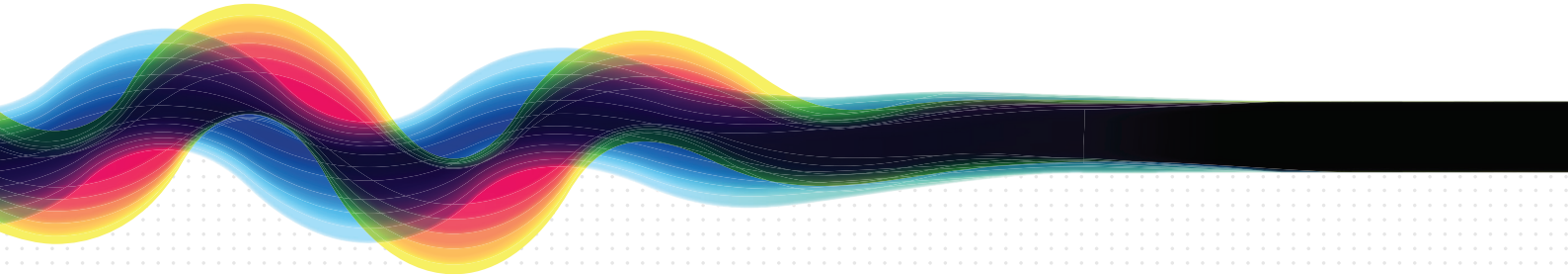


Extractive Industry Development Application & Licence

November 2022 | 22-336



We acknowledge the Whadjuk people of the Noongar nation as traditional owners of the land on which we live and work.

We acknowledge and respect their enduring culture, their contribution to the life of this city, and Elders, past and present.

Document ID: /Volumes/Graphics/2022/22-336 Ludlow, Lot 43 (546) Plantation Road/01 Indesign Report/01 Draft/00 InDesign/22-336 Ludlow Report F1/22-336 Ludlow, Lot 43 (No. 546) Plantation Road - Ludlow Holdings Pty Ltd Report F3 221109.indd

Issue	Date	Status	Prepared by	Approved by	Graphics	File
1	18.08.22	Final	Daniel Lewis	David Read	SEA	1
2	19.08.22	Final 2	Daniel Lewis	David Read	MS	2
3	09.11.22	Final 3	Daniel Lewis	David Read	MS	3

This report has been prepared for the exclusive use of the Client, in accordance with the agreement between the Client and Element Advisory Pty Ltd (**element**) ('Agreement').

element accepts no liability or responsibility whatsoever in respect of any use of or reliance upon this report by any person who is not a party to the Agreement or an intended recipient.

In particular, it should be noted that this report is a qualitative assessment only, based on the scope and timing of services defined by the Client and is based on information supplied by the Client and its agents.

element cannot be held accountable for information supplied by others and relied upon by **element**.

Copyright and any other Intellectual Property arising from the report and the provision of the services in accordance with the Agreement belongs exclusively to **element** unless otherwise agreed and may not be reproduced or disclosed to any person other than the Client without the express written authority of **element**.

Contents

1. Introduction	1	4.12 Proposed Vehicle Maintenance & Management	17
2. Site Description & Surrounds	3	4.13 Proposed Rehabilitation Management & Maintenance	17
2.1 Property Description, Ownership and Locality	3	5. Conclusion	19
2.2 Existing Site Topography	4	Appendix A	21
2.3 Geology, Soils and Groundwater Hydrology	4	Certificate Of Title	21
2.4 Acid Sulphate Soils (ASS)	5	Appendix B	23
2.5 Surface Water	5	Development Plans	23
2.6 Wetlands	5	Appendix C	25
2.7 Remnant Vegetation	6	Environmental Management Plan	25
2.8 Mining Tenement	6	Appendix D	27
3. Planning Framework	7	Dust Management Plan	27
3.1 Greater Bunbury Region Scheme	7	Appendix E	29
3.2 GBRS Strategic Minerals and Basic Raw Materials Resource Policy (2018)	8	Environmental Acoustic Report	29
3.3 Shire of Capel Local Planning Scheme No. 7	8	Appendix F	31
3.4 State Planning Policy 2.4 – Basic Raw Materials	9	Groundwater Monitoring Report	31
3.5 State Planning Policy 3.7 – Planning in Bushfire Prone Areas	11		
3.6 Shire of Capel Extractive Industries Local Law (2016)	11		
3.7 Separation Distances between Industrial and Sensitive Land Uses	12		
4. Development Proposal	13		
4.1 Overview	13		
4.2 Nature of Operations and Duration	13		
4.3 Stages of excavation	14		
4.4 Proposed depth of extraction	14		
4.5 Proposed Site Access and Movement	14		
4.6 Proposed hours of operation	14		
4.7 Proposed Dust management	14		
4.8 Proposed Noise management	15		
4.9 Proposed Stormwater Management	16		
4.10 Proposed Management of Dieback Risk	16		
4.11 Proposed Management of Visual Impacts	17		

1. Introduction

This Development Application has been prepared by **element** on behalf of the landowner for an Extractive Industry over a portion of Lot 43 (No.546) Plantation Road, Ludlow (“the subject site”). A copy of the Certificate of Title is attached at **Appendix A** and a copy of the proposed development plans are attached at **Appendix B**.

Lot 43 Plantation Road, Ludlow is a 27.13 Ha rural lot, previously used for equine training purposes with evidence of a trotting track located onsite. The property fronts Plantation Road and has regional access to Bussell Highway, approximately 3.3km west of the subject site via Hutton Road. The application for an extractive industry relates to only 6.79 Ha or 27%, of the subject site and is contained within the historically cleared and degraded portion of the site. Proposed extraction is anticipated to yield 117,682 tonnes of sand, with daily operations not anticipated to exceed 3,000 tonnes at any one time during peak haulage campaigns. Haulage is to utilise 19m trucks, exiting the site to travel to Bussell Highway via Hutton Road, servicing the region with sand, a basic raw material.

Post extraction, the sequential rehabilitation of the site will achieve a native rehabilitation outcome which is of a higher quality comprising a variety of native species enhancing the environmental outcome onsite and preserved in perpetuity. The balance of the extraction area is to be rehabilitated to pasture. This application was prepared by **element** in its capacity as the lead planning consultant, supported by the following specialist consultants:

MBS Environmental	Environmental Management Plan	Appendix C
	Dust Management Plan	Appendix D
Herring Storer	Environmental Acoustic Assessment	Appendix E
JDA	Groundwater Monitoring Report	Appendix F
Level Surveys	Feature Survey	
Harley Dykstra	Certified Feature Plan, Post Extraction Contours & Sand Volume Modelling	

Following lodgement of this Development Application with the regional JDAP, MBS Environmental are to lodge a clearing permit with DWER for concurrent assessment and determination following the determination of this DA.

2. Site Description & Surrounds

2.1 Property Description, Ownership and Locality

The subject site is situated approximately 4km south of the Capel Townsite and 18km northeast of the Busselton City Centre.

The proposed staged extraction area totals 6.79 ha of the 27.13Ha property and surrounds the existing dwelling which is to be retained as outlined within **Figure 1** below.

The property was historically cleared for agricultural purposes, with evidence of clearing outlined within **Figure 2 Historical Aerial image of Lot 43 (No. 546) Plantation Road, Ludlow (2003)**. Vegetation located within the proposed extraction boundary has naturally regenerated over the past 20 years and is predominantly of a degraded to completely degraded quality with only 0.07Ha classified as having a “Good” vegetation quality.

The subject site is surrounded by similar rural properties, with rural lots used for agricultural grazing to the south and east. North of the subject site, Iluka Resources historical mining operations and associated rehabilitation adjoins the Capel Nature Reserve while, the Busselton Rifle Club and Coolilup State Forrest are located west of the subject site, bordered by Bussell Highway. A recent extractive industry and licence was granted by the Shire of Capel for sand extraction within Lot 13 Plantation Road, Ludlow, east of the subject site. Extractive operations have since depleted the sand resource with rehabilitation to pasture, currently underway.

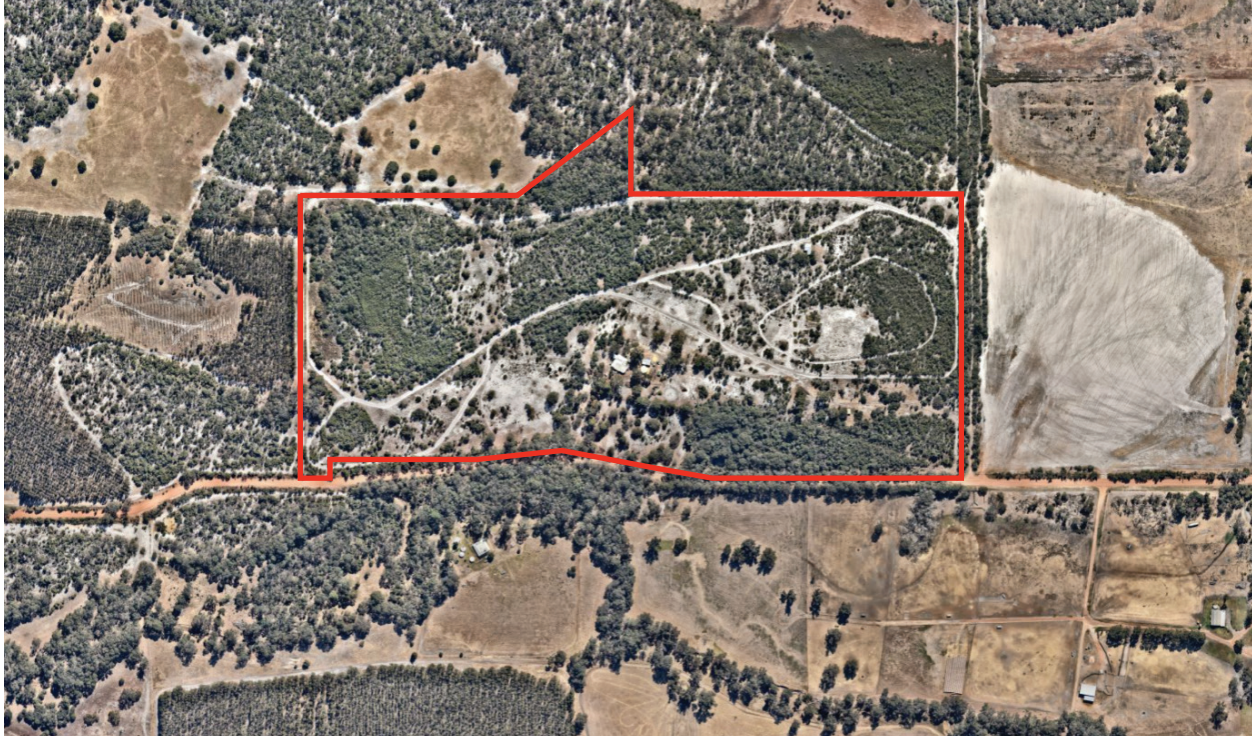


Figure 1. Aerial Image of Lot 43 (No. 546) Plantation Road, Ludlow



Figure 2. Historical Aerial image of Lot 43 (No. 546) Plantation Road, Ludlow (2003)

The property details applicable to the property are provided within **Table 1** below with a copy of the Certificate of Title attached at **Appendix A**.

Table 1 – Summary Of Land Details

Lot No.	Landowner	Area	Vol.	Folio	Plan No.
43	Ludlow Holdings PTY LTD	27.1307Ha	2771	694	DP69043

2.2 Existing Site Topography

The topography of Lot 43 is gently undulating, with two sandy peaks identified, one surrounding the existing dwelling and the other within the north-eastern portion of the site surrounding an existing shed. A small soak is located within the south-eastern portion of the site as identified by the feature survey as included on the site plan attached at **Appendix B**.

2.3 Geology, Soils and Groundwater Hydrology

The surface geology of the site is generally characterised by sands, with a significant area of peaty sand in the north west of the site. Regional groundwater flows are generally east to west towards the coast.

Long term groundwater monitoring has occurred in proximity to the subject site which shows the AAMGL (2010 to 2022) at 27.28m AHD with the MGL of 27.72m AHD was recorded on the 1st of October 2016. A copy of the groundwater analysis collected for the subject is outlined within the groundwater monitoring report attached at **Appendix F**.

Water levels identified onsite during the 2021 peak winter monitoring period were recorded and extrapolated by JDA to produce the groundwater contours outlined on the development plans attached at **Appendix B**. A copy of the JDA groundwater analysis completed for the site is included within **Figure 3 JDA Estimated Maximum Groundwater Level (MGL) Contours**.

Further detail on soil, geology and hydrology is included within the JDA Groundwater Monitoring report attached at **Appendix F**.

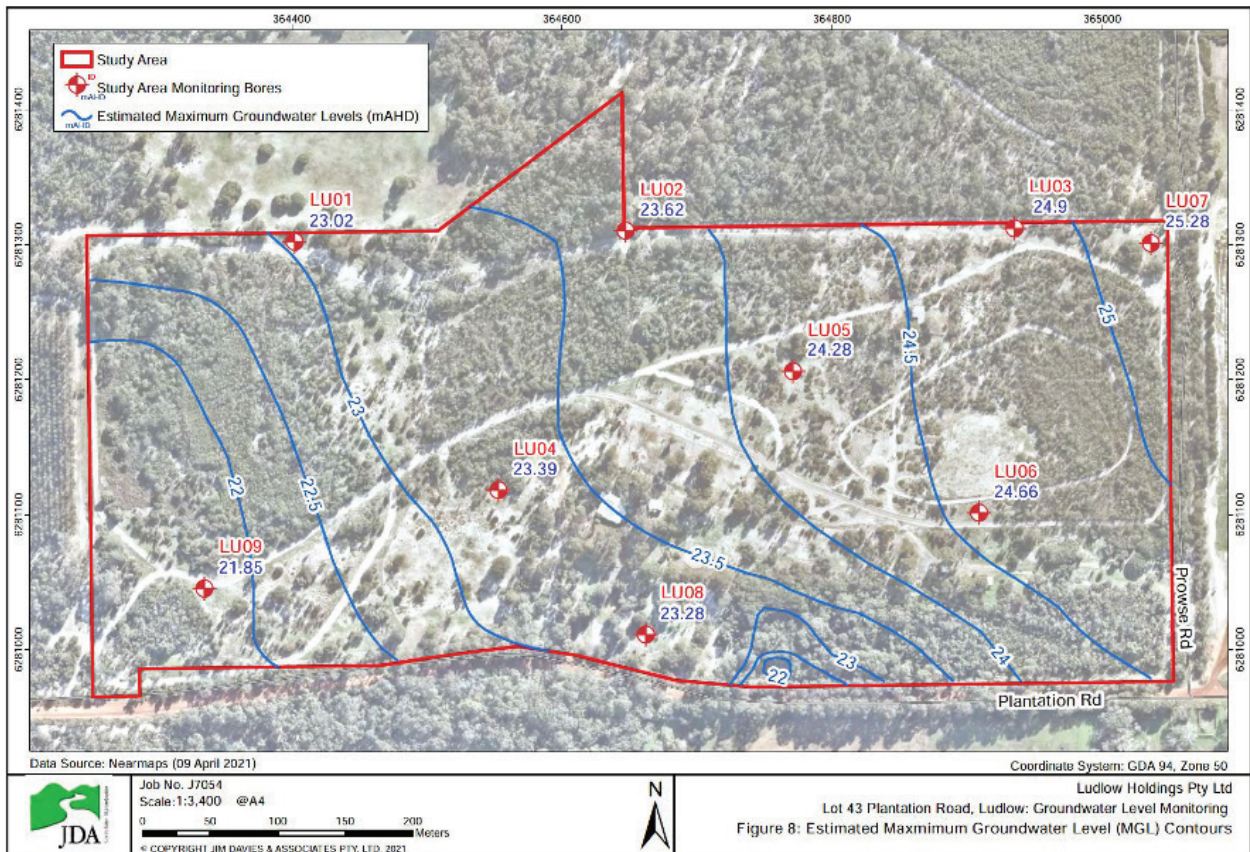


Figure 3. JDA Estimated Maximum Groundwater Level (MGL) Contours

2.4 Acid Sulphate Soils (ASS)

Department of Water and Environmental Regulation (DWER) Acid Sulphate Soil (ASS) risk mapping for the Swan Coastal Plain demonstrates that the subject site has the potential to contain ASS within 3m of the natural surface. However, due to no extraction of materials below the groundwater level the risk associated with disturbance of ASS is considered low for this proposal.

2.5 Surface Water

The site is well drained through highly permeable sandy soils allowing for all surface water to be contained onsite through onsite infiltration. Two small soaks exist on the property within the western and southern portion of the site as identified on the development plans at **Appendix B** and naturally retain surface water onsite.

2.6 Wetlands

The subject site is partially identified within a multiple use wetland as outlined within **Figure 4 Geomorphic Wetland Mapping of the Swan Coastal Plain (DWER)**. Multiple-use wetlands are wetlands that have few remaining important attributes, functions or values (Water and Rivers Commission 2001) and therefore, the proposed development will not significantly impact upon the continued preservation of the wetland. Further detail on the status of the wetlands onsite is contained within the environmental management plan attached at **Appendix C**.



Figure 4. Geomorphic Wetland Mapping of the Swan Coastal Plain (DWER)

2.7 Remnant Vegetation

An Environmental Management Plan (EMP) has been prepared by MBS Environmental in conjunction with this report with a copy of the EMP included at **Appendix D** of this report.

The report highlights that the portion of the lot to be used for the extractive industry is largely cleared of native vegetation. Of the proposed 6.79 Ha extraction area, only 1.89 ha of vegetation is proposed to be cleared. Vegetation that will be cleared consists of the following:

- 0.02 Ha of Vegetation Unit C (Degraded – Very Good)
- 0.05 Ha of Vegetation Unit D1 (Degraded – Good)
- 1.82 Ha of Vegetation Unit D2 (Completely degraded – Good)

The majority of the vegetation within the extractive site is considered to be in a ‘Degraded’ or ‘Completely Degraded’ condition, with only 0.07 Ha classified as having a “Good” vegetation quality.

Ecoedge was engaged to undertake a springtime significant flora survey, with 193 individual *Drakaea elastica* identified within Lot 43. The proposed extraction area is appropriately separated from these individual species by providing a 50m buffer from the edge of the extraction boundary to the nearest identified species.

The proposed extraction area contains no environmentally sensitive TEC’s and/or PEC’s, threatened Flora and no wetlands or watercourses of significant environmental value.

A native vegetation clearing permit will be required from the Department of Water and Environmental Regulation (DWER). A clearing permit is to be lodged by MBS Environmental with DWER following the lodgement of this application.

2.8 Mining Tenement

Iluka Midwest Limited Pty Ltd hold an active mining tenement over the subject site. Due to the nature of the proposed development for sand extraction which does not contain mineral sand deposits, there does not appear to be any conflict between the tenement holder and the applicant. It is anticipated that the application will be referred to the Department of Mines and Iluka Midwest Limited Pty Ltd for comment. Preliminary advice provided to the client indicated Iluka Midwest Limited do not have any concerns with the progression of this proposed EIL.

3. Planning Framework

3.1 Greater Bunbury Region Scheme

The Greater Bunbury Region Scheme zones the subject site as 'Rural' as outlined within **Figure 5** below.

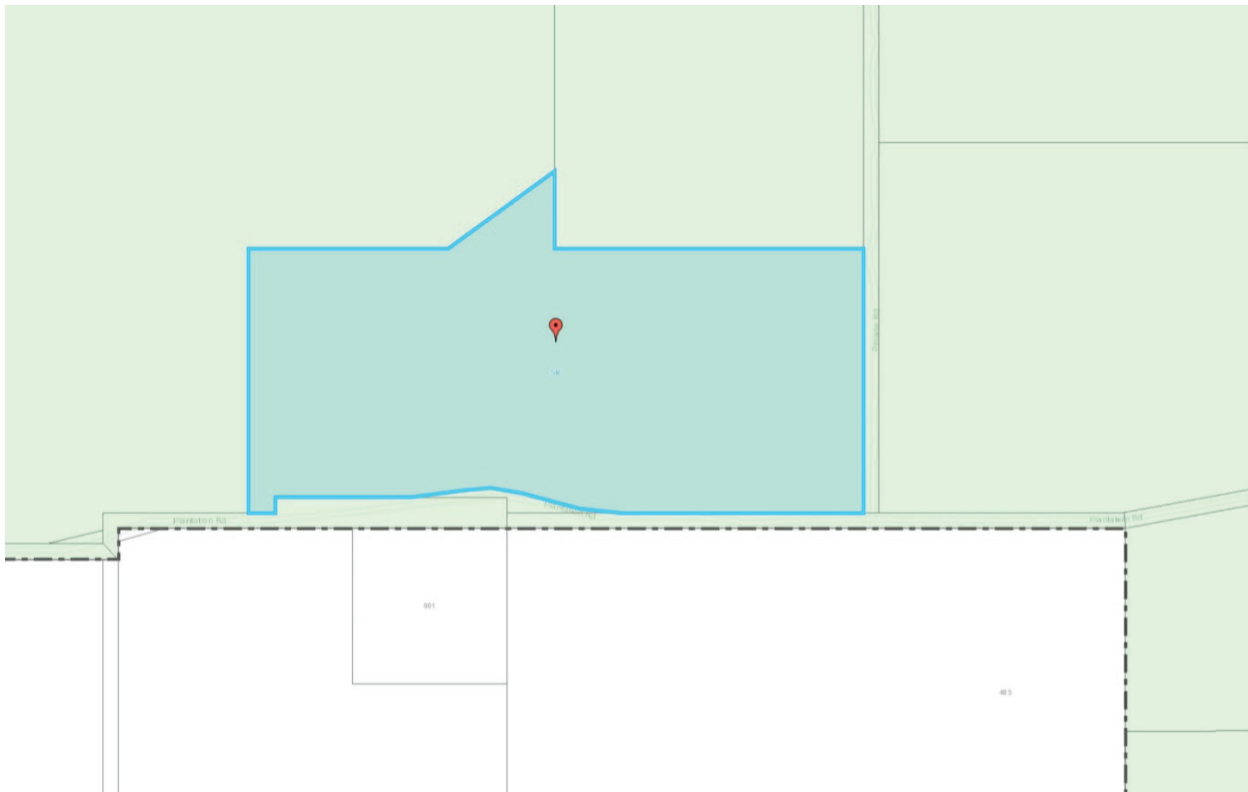


Figure 5. Greater Bunbury Region Scheme (GBRS)

The purpose of the 'Rural' zone is as follows:

“Rural – 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.”

The aims of the GBRS relevant to this proposal as are as follows:

The aims of the Scheme are to —

(A) Promote the sustainable development of land taking into account relevant environmental, social and economic factors;

(H) Protect strategic minerals and basic raw materials of State and regional importance and provide for the efficient and timely extraction of minerals and raw materials and subsequent rehabilitation of affected land.

The proposed development therefore seeks to promote the sustainable development of the land through the progressive extraction of basic raw materials prior to rehabilitation of a portion of the site to native vegetation to the satisfaction of DWER. The proposal is therefore in accordance with the purpose of the Rural zone and aims of the GBRS.

3.2 GBRs Strategic Minerals and Basic Raw Materials Resource Policy (2018)

The Greater Bunbury Region Scheme Strategic Minerals and Basic Raw Materials Policy, referred herein as “the policy” identifies significant geological supplies (SGS) within the Greater Bunbury Region Scheme (GBRS).

The principal purpose of the Policy is to ensure long-term security of access for minerals and basic raw materials as they are a major source of employment with significant flow-on effects to other sectors of the economy.

The Policy applies to the subject lot as outlined in **Figure 6** below, with a portion of Lot 43 identified as being within the Titanium-zircon mineralization deposit (shown red), while the balance of the Lot is within the 1000m buffer. The proposed operations are not considered to impact upon any titanium zircon mineral deposit and are of a nature which may co-locate within the designated buffer.

Therefore, the proposal meets the intent of the GBRS SGS Policy.

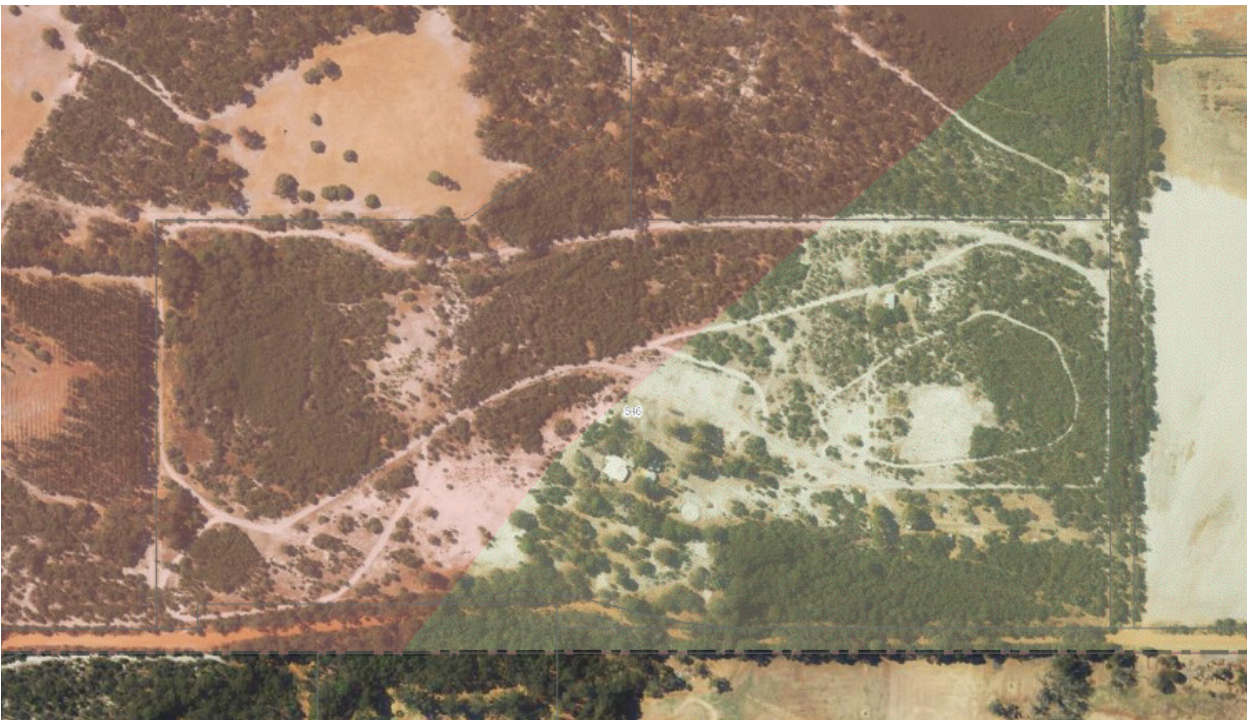


Figure 6. Strategic Minerals and Basic Raw Materials Resource Policy

3.3 Shire of Capel Local Planning Scheme No. 7

The property is currently zoned “Rural” under the Shire of Capel’s Local Planning Scheme No. 7 (LPS 7). An excerpt of the Shire of Capel’s LPS 7 mapping is provided as **Figure 7 – Local Planning Scheme No. 7 Zoning**.

The objective for the Rural zone is outlined as follows:

5.7 Rural Zone:

Council’s objective in the assessment of subdivision referrals and management of land uses in the Rural Zone is to preserve the character of the rural area, discourage the removal of prime agricultural land from agricultural production and prevent adverse effects on the continuation of established or potential agricultural industries.

The proposed extractive industry is in accordance with the objective of the Rural zone, given the proposal seeks to use land, which is of a poor vegetation and grazing quality, to extract the sand resource to leave a level and rehabilitated site which is able to support revegetation and ongoing grazing of pasture. The proposal therefore meets the objectives of the Rural zone.

An ‘Industry Extractive’ land use is defined by LPS 7 as:

Means an industry which involves:

*(a) the extraction of **sand**, gravel, clay, turf, soil, rock, stone, minerals, or similar substance from the land, and the storage, treatment or manufacture of products from those materials when the storage, treatment or manufacture is carried out on the land from which any of the materials so used is extracted or on land adjacent thereto; or*

(b) the production of salt by the evaporation of sea water

(Emphasis added)

Within the Rural zone, an Industry Extractive land use is an “A” use and may be considered by council, subject to the application being made public for community comment. Therefore, the proposed development is capable of approval in accordance with the land use permissibility of the Rural zone within LPS 7.

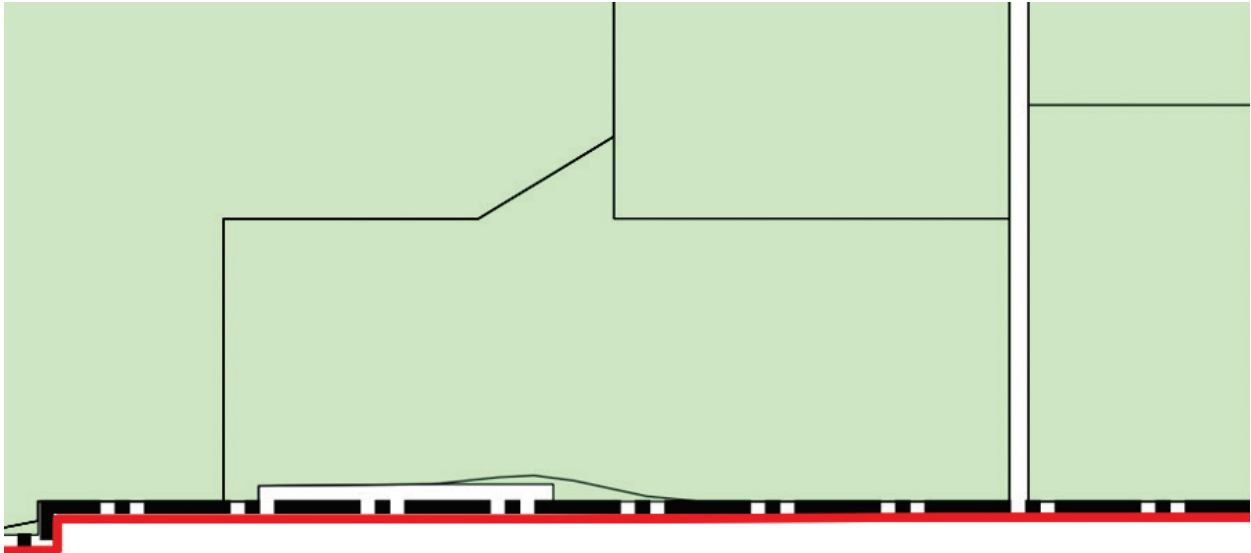


Figure 7. Local Planning Scheme No. 7 Zoning

3.4 State Planning Policy 2.4 – Basic Raw Materials

State Planning Policy 2.4 seeks to enable the responsible extraction of Basic Raw Materials (BRM) while ensuring the protection of people and the environment. The application of this Policy provides the foundation for land use planning to address the sustainable management of BRM in Western Australia. Applicable to this proposal, the following objectives of the Policy are as follows:

a) Provide guidance to facilitate the planning of BRM extraction from sites, where such extraction is considered appropriate on planning and environmental grounds;

(c) ensure considerations relating to the extraction of BRM and the regional importance of the materials are taken into account in the early stages of the planning process including scheme amendments, planning strategies and structure plans;

(e) prioritise the extraction and availability of BRM through the identification of sequential use sites and planned extraction and remediation as appropriate for the final intended land use;

(f) ensure that the use and development of land for extraction of BRM, during or after extraction, avoids, minimises and mitigates detrimental impacts on the community and environment, including water resources and biodiversity values, while allowing for future use, consistent with long term planning.

In light of the above Policy objectives, the proposed EIL seeks to meet the objectives of the Policy as follows:

- The proposed extractive industry seeks to extract a basic raw material in an appropriate manner which considers planning and environmental constraints onsite;
- The proposed rehabilitation onsite allows for the land to be rehabilitated to a greater vegetation condition compared to its current degraded state; and
- Due to the property’s location, it is appropriately separated from surrounding sensitive land uses due to the existing vegetation within plantation road allowing for appropriate screening of operations.

Demonstration of consistency with the assessment criteria detailed within SPP 2.4 is outlined within the following table:

SPP 2.4 Guidelines Part 4	Analysis of this Extractive Industry Application
(a) <i>the avoidance or mitigation of conflicts and detrimental effects on existing and future sensitive land uses and agricultural land in the surrounding areas (that is, noise, dust, vibration, blasting and vehicular traffic);</i>	The proposed extractive industry is appropriately located in proximity to surrounding rural and adjoining sensitive land uses.
(b) <i>having an effective consultation process with appropriate stakeholder engagement, including advertising as required;</i>	The development application is to be made available for public comment as part of the development application process with due regard given to any submissions made.
(c) <i>prioritisation of proposals within SGS areas aligned with DMIRS geoVIEW.WA mapping in Perth and Peel;</i>	Not applicable to this application.
(d) <i>if the resources is identified as a SGS area and/or local basic raw material demand;</i>	The site is not identified as an SGS for sand extraction.
(e) <i>the quantity and quality of resource and scale and duration of extraction;</i>	The proposed extractive industry is proposed to extract an estimated 123,440 tonnes of sand within a 5-year period.
(f) <i>management of finished ground levels for BRM extraction and site rehabilitation to:</i> i) <i>Maintain appropriate horizontal separation between extraction, water supply infrastructure and any other engineering requirements;</i> ii) <i>Avoid the exposure of groundwater and maintain the required vertical separation distances to groundwater for sequential land use;</i> iii) <i>Protect ground water and surface water quality.</i>	The proposed extractive industry will be consistent with SPP 2.4 Guidelines Part 4(f). The proposed extractive industry is adequately separated from water supply and engineering infrastructure. Further commentary regarding surface water and ground water is provided within this report. A separation distance to groundwater of +0.5m from the MGL is proposed and is considered sufficient to protect against potential interception of groundwater. Rehabilitation to native vegetation may proceed in accordance with vegetation types identified within the surrounding areas of the lot being within 0.5m from the MGL.
(g) <i>the site's potential for sequential land use and the ability to rehabilitate the land in a manner compatible with its long-term use identified by the Local Planning Scheme;</i>	Following extraction, the site is to be rehabilitated to native vegetation and pasture to appropriately reflect the sequential land use considerations.
(h) <i>the ability to stage the extraction operations to avoid conflicts with any adjacent land uses;</i>	The proposed development is staged to ensure sequential extraction avoids any adverse impacts on adjoining sensitive land uses. Appropriate management measures are to be implemented to ensure compliance and preventing adverse amenity impacts.
(i) <i>the effect of the proposed extractive industry on any adjacent agricultural land;</i>	The proposed extractive industry is not considered to negatively impact any agricultural land uses within proximity of the site.
(j) <i>the availability and suitability of road access;</i>	Road access is available and suitable for the proposed extractive industry with access to Bussell Highway as outlined within this report.
(k) <i>the effect of the proposed extractive industry on any native flora and fauna and general landscape values;</i>	Impacts on native flora and fauna, including landscape values is appropriately addressed within this report. The proposed extraction area represents clearing of only 7.95% (total clearing area of 2.18ha) of native vegetation onsite. Landscape values are maintained through the preservation of existing perimeter screening along the southern and eastern boundaries.
(l) <i>how all water resources will be protected during BRM extraction including a separation distance to the defined groundwater level plus other management measures to protect water resources during BRM extraction;</i>	Further justification for the proposal is outlined within this report. No water resources are to be negatively impacted by this proposal.
(m) <i>potential impacts on fragmentation and connectivity of remnant vegetation;</i>	No fragmentation is anticipated as part of this application.

SPP 2.4 Guidelines Part 4	Analysis of this Extractive Industry Application
(n) any requirements for an environmental offset;	Environmental offsets determined during the clearing permit process are to be determined onsite, with approximately 2.18 Ha proposed to be cleared, and 2.18Ha to be rehabilitated to native vegetation as determined by DWER.
(o) sites of cultural and historic significance on and near the land, having regard to how they are likely to be integrated with subsequent land uses; and	No applicable to this application.
(p) location and stability of excavations, stockpiles and overburden dumps.	No stockpiling is to occur onsite.

Therefore, the proposed development is designed in accordance with the provisions of SPP 2.3 – Basic Raw Materials and is capable of approval.

3.5 State Planning Policy 3.7 – Planning in Bushfire Prone Areas

The subject site is designated to be bushfire prone by DEFES with the provisions of SPP 3.7 and associated guidelines for Planning in Bushfire Prone Areas (V1.4).

Section 2.6 – Discretionary Decision-Making states the following applicable to this application:

Decision-makers can apply exemptions from the requirements of SPP 3.7 and these Guidelines where there is no intensification of land-use, and/or the proposal is not increasing the bushfire threat. Intensification of land use and/or development may include planning proposals that: a) result in an increase of visitors, residents or employees; or b) involve the occupation of employees on site for more than three hours at a time for multiple periods during a week.

An Extractive Industry is listed as a land use which may be considered exempt from compliance with the guidelines where no habitable buildings are proposed. Since the proposal does not contain any habitable buildings, and employees onsite are to be onsite for periods of haulage and loading only, the application is considered exempt from requiring a bushfire assessment at this stage.

3.6 Shire of Capel Extractive Industries Local Law (2016)

The Shire of Capel under the Local Government Act has prepared an Extractive Industry Local Law to outline the due process for determining Extractive Industry applications made within the Shire.

This proposed application seeks to meet the regulations as stipulated within the Local Law to allow for an appropriately staged and located development to operate in support of regionally significant infrastructure projects within the southwest.

In particular, the application seeks to comply in part with clause 6.1 – *Limits on excavation near boundary* as follows:

6.1 Limits on excavation

- (a) 20 metres of the boundary of any land on which the excavation site is located;
- (b) 20 metres of any land affected by a registered grant of easement;
- (c) 40 metres of any thoroughfare;
- (d) 50 metres of any bore, watercourse, wetland, swamp, or other water reserve; or
- (e) 2 metres of the estimated maximum groundwater level as determined from time to time by the Department of Water or otherwise as adopted by the local government.

The proposed extraction boundary as outlined within the excavation works plan attached at **Appendix B** and is located 20m from the western boundary and 20m from the Plantation Road reserve.

The following concessions to clause 6.1 of the Shire’s Extractive Industry Local law are proposed for consideration:

1. A reduction in the setback to a thoroughfare (Plantation Road) by 20m; and
2. Extraction to a depth no greater than +0.5m MGL.

Primary Street Setback:

The proposed setback to Plantation Road is proposed at 20m, as the existing native vegetation between the extractive industry boundary and road reserve provides sufficient screening of operations at either a 40m or 20m setback. No potential danger is posed to traffic along plantation road during operations and therefore a 20m setback is considered appropriate for this site.

Extraction Depth:

Depth of extraction within proximity of the maximum groundwater level (MGL) must consider the following constraints:

1. *The potential risk of intercepting groundwater; and*
2. *The post extraction use of the land.*

1. Risk of intercepting groundwater:

JDA Hydrologists have determined the MGL contours across the site based upon longitudinal data correlating peak winter monitoring data from bores onsite to the nearby DWER monitoring bore. Additional groundwater monitoring is currently being collected during the 2022 winter peak to further verify existing groundwater contours onsite inclusive of a correlation to long term monitoring by DWER.

The risk of intercepting the groundwater table is not considered likely, as the operator will maintain the required separation distance during the period of highest groundwater in accordance with a condition of the extractive industry licence (July – November). Non-compliance with this condition is a breach of approval and may be appropriately prosecuted.

To provide further confidence to the Shire and prevent any interception of groundwater, a calibrated machine control system may be imposed as a condition of Development Approval during the months of June – November, preventing any extraction below the post extraction contours identified on the development plans at **Appendix B**. Machine control systems are an industry standard to ensure extraction to a specified height.

2. Post Extraction Land Use:

The post extraction land use proposed onsite consists of 4.61Ha of pasture, and 2.18Ha of rehabilitation to native vegetation. Native vegetation proposed is to comprise species capable of establishment within 0.5m of the MGL in accordance with the EMP prepared by MBS attached at **Appendix C**. The final outcome of the composition of vegetation species is to be determined as part of the clearing permit process.

3.7 Separation Distances between Industrial and Sensitive Land Uses

The Environmental Protection Authority (EPA) has prepared a guiding document for assessment of environmental factors associated with the separation distances between sensitive land uses and Industrial land uses.

The proposed extractive industry is of a nature which reflects the 'Extractive Industry- Sand and Limestone' industry listed within Appendix 1. The relevant buffer distance is recommended to be 300-500m to sensitive land uses, depending on the size and nature of operations, with key impacts associated with operations being noise and dust.

The proposed development is located 121m from the nearest sensitive land use (closest point), separated and screened by existing vegetation within plantation road, a local gravel road. Management of Noise and Dust impacts on this sensitive land use are appropriately set out within this report to ensure no adverse impacts are posed by this development.

4. Development Proposal

4.1 Overview

The proposed extractive industry is restricted to only 6.79Ha of Lot 43, in a portion historically cleared for agricultural purposes. Extraction is to occur in 4 stages, operating sequentially east, around the dwelling. An aerial powerline which crosses the extraction area within stages 3 and 4 and is proposed to be retained.

Extraction of sand is to be completed by BCP, with haulage proposed to use as of right trucks up to 19m in length on Plantation Road to Hutton Road, before proceeding to the Bussell Highway to service the South West Region.

Following extraction, the site is to be recontoured with a bulldozer (or similar) to allow rehabilitation to pasture and native vegetation (where identified) to a standard which is self-sustaining as set out within the rehabilitation plan prepared by MBS. Rehabilitation proposed, seeks to provide a greater standard of vegetation within a portion of stage 3 and 4, while ensuring the balance of the land is returned to pasture for rural purposes.

4.2 Nature of Operations and Duration

The proposed daily operations onsite are outlined as follows.

Machinery located onsite during extraction works may include but are not limited to the following:

- A loader for the purpose of loading sand into haulage trucks;
- A bulldozer for the clearing of vegetation located within each proposed extraction stage and the sequential rehabilitation of each stage to respread topsoil;
- A mulcher for the processing of stockpiled vegetation to produce mulch for rehabilitation and application within a completed stage when required;
- An excavator for the stockpiling of vegetation, loading of the mulcher and topsoil spread where required;
- Haulage Trucks for transporting material off-site;
- A grader for road maintenance if required along plantation road in consultation with the shire; and
- A 15kl watercart onsite for dust suppression.

The duration of works onsite are anticipated to occur over a five-year period in accordance with a time limited extractive industry licence granted under the Shire's Extractive Industry Local Law (2016). It is anticipated that all material may be extracted within this period.

Rehabilitation and ongoing monitoring and maintenance of the rehabilitation to a self-sustaining status will require management over a period of 10 years following the completion of works onsite as required by a subsequent clearing permit.

The following activities are expected as part of the on-going operation of the site:

- Clearing - A bulldozer is to be used to undertake any clearing of areas for future extraction within the clearing permit area. Cleared vegetation is to be stockpiled in windrows on the property in an appropriate location for future processing by the mulcher.
- Removal and Stockpiling of Topsoil - Following clearing, the top 100mm of topsoil from the active extraction stage is to be removed and stockpiled. Stockpiles are to be constructed with a batter no greater than 1:3 to ensure minimal erosion of the stockpile during winter periods.
- Sand excavation - This activity involves excavation of the resource from the working face within the stage and loading of trucks for haulage offsite.
- Screening - Screening of excavated material may be required dependent upon the particle size of material and demand to remove debris and rock to produce a clean product. Should screening be undertaken onsite, a mobile screen is to be located onsite and operated in accordance with the environmental acoustic report attached at **Appendix E**. Material is to be loaded into the screen by front-end loader prior to the loading haulage trucks.

- Final contouring and topsoil respread - A combination of equipment may be used to undertake spreading and earthworks and includes but not limited to a bulldozer and tracked bobcat. Final batters are to be no greater than 1:6 and certified by a feature survey prior to rehabilitation.
- Site rehabilitation –Rehabilitation is to be completed in stages, following sand extraction, by a suitably qualified consultant, including annual reporting to the satisfaction of DWER.

4.3 Stages of excavation

Extraction of sand is proposed to occur within 4 separate stages as outlined within the Excavation Works Plan attached at **Appendix B**. Sequential extraction per stage is to occur in an orderly manner (1-4).

The total volume of material to be extracted is in the order of 117,682 tonnes.

4.4 Proposed depth of extraction

Depth of extraction is limited to a maximum of +0.5m MGL. Detailed post extraction contours are provided within the development plans provided at **Appendix B**. It is the operator's responsibility to not exceed this depth of extraction to prevent any risk of exposing groundwater within the site. Machine control guidance may be conditioned for extraction at +0.5m MGL to ensure protection of the groundwater level during periods of highest groundwater in the months of July – November.

4.5 Proposed Site Access and Movement

Access to the site is proposed via a new crossover to Plantation Road. Internal site access is to be generally in accordance with the development plans attached at **Appendix B**.

The proposed haulage route for the development is identified within **Figure 8 Proposed Haulage Route**.

During peak periods of operation, it is anticipated that 8 trucks are to enter and exit the site every hour with an anticipated extraction of 3,000 tonnes of sand per day. This is dependent upon the delivery destination and the number of haulage trucks operating on any given day. Heavy vehicle movements are to be largely reliant on market demand for material, with long periods of limited haulage activity, separated by short, intense haulage campaigns.

4.6 Proposed hours of operation

The proposed hours of operation are 7:00am to 7:00pm, Monday to Friday inclusive, and 7:00am to 4:00pm on Saturdays. No works are to occur on Sundays or Public Holidays.

4.7 Proposed Dust management

Dust generated onsite is to be managed in accordance with the Dust Management Plan (DMP) prepared by MBS Environmental with a copy of the plan attached at **Appendix D**.

As outlined within the DMP, dust will be managed onsite by:

- Visual monitoring of dust generation from the operations are to be undertaken onsite on an ongoing basis.
 - Should dust generation be observed and there is a risk of dust being blown out of the extraction area, additional watering of dust sources with the water cart will be organised.
 - Alternative dust controls, such as chemical dust suppressants (soil binding agents) and dust fencing will be implemented on a needs basis for any persistent sources of dust such as stockpiles or open areas waiting for extraction.
 - When weather conditions negate the effectiveness of dust prevention and mitigation measures and dust continues to be blown out of the extraction area, the dust generating activities will cease until conditions improve and compliance with this DMP can be achieved.
- During the drier months (typically November to April), visual monitoring will also be undertaken in bushland adjacent to the active extraction stage on a weekly basis to determine whether any dust accumulation is occurring (e.g. on leaves of plants). Records will be kept of this monitoring outside the extraction area and any mitigation measures undertaken.
 - If dust accumulation is observed outside the extraction area, the operations will be reviewed to determine ways to further minimise dust generation (e.g. soil binding agents). The most appropriate additional dust minimisation measures will be implemented. If dust accumulation continues despite the implemented measures, further measures will be trialled.

- If dust accumulation outside the extraction area cannot be resolved with the above measures, then instrumental dust monitoring with short-term alarms will be implemented to try and determine the exact source of dust. The short-term alarms (based e.g. on a 15 minute monitoring interval) will notify site operators when dust emissions are detected outside the extraction area so that the operations can be adjusted accordingly.

No dust is to cross the Lot boundary with the measures listed above considered appropriate to manage the potential of dust generation onsite.



Figure 8. Proposed Haulage Route

4.8 Proposed Noise management

An Acoustic report was prepared by Herring Storer and included as **Appendix E**, providing further modelling of anticipated noise impacts on the nearest sensitive land use within proximity of the development as outlined within **Figure 9**.

The acoustic report confirms that operations are capable of operating within the proposed extractive boundary without impacting upon the amenity of surrounding sensitive land uses. The modelled noise level during peak operation confirms compliance with the Environmental Protection (Noise) Regulations 1997 at 43dB(A). This assessable noise levels are determined including tonal characteristics and therefore, contains a +5 dB(A) penalty.

Should the operator elect to use a screen onsite during stages 1 and 2, the screen is to only operate within a 3m bund on the southern side of the plant as outlined within the Acoustic Report.

Given these operating parameters, noise levels received at the nearest sensitive premises complies with the Environmental Protection (Noise) Regulations 1997 for the operating times as outlined within this report.

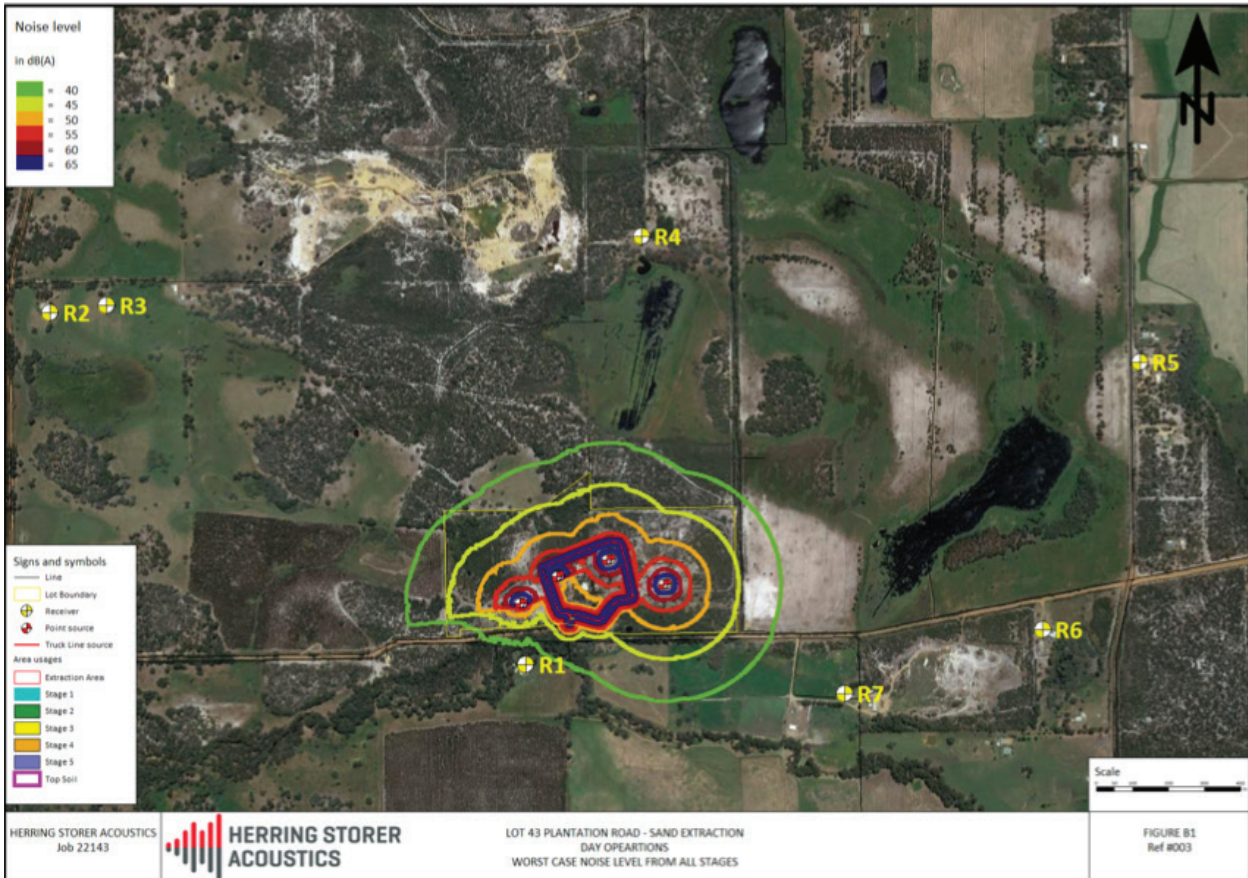


Figure 9. Modelled Acoustic Contours (Worst Case Scenario)

4.9 Proposed Stormwater Management

The objective of stormwater management for the site is for stormwater to be adequately managed in accordance with DWER Water Quality Protection Note No. 15 coefficient of runoff. All stormwater management for the balance of Lot 43 is to remain unchanged.

Recontouring of the site following excavation will ensure batter slopes are at a grade no greater than 1:6, ensuring no erosion or degradation of batters in perpetuity.

Stormwater retention will occur within the floor of the pit through onsite infiltration within each stage given the permeability of soils within each stage.

As a condition of development approval, a stormwater management plan may be prepared to the satisfaction of the Shire of Capel.

4.10 Proposed Management of Dieback Risk

No assessment of dieback risk has been completed onsite, with appropriate precautions to be implemented prevent the potential spread of dieback onsite by the operator during excavation. As a condition of development approval, a dieback management plan may be to the satisfaction of DWER.

Notwithstanding the above, the following measures are to be undertaken by the operator to minimise the spread of dieback:

- Educate all staff on the environmental impacts of dieback and provide training in how to clean earth-moving machinery, vehicles, equipment, and shoes of soil and vegetation prior to entering and leaving the site.
- Clean earth-moving machinery, vehicles, equipment, and shoes of soil and vegetation prior to entering and leaving the site.
- Trucks leaving the site will be required to have their load covered.
- Ensure that no known dieback affected soil, mulch, fill, or other material is brought on site.
- Restrict the movement of machines and other vehicles to the limits of the extraction area.

4.11 Proposed Management of Visual Impacts

Existing vegetation within the plantation road reserve and along the southern boundary of the subject site provide a natural visual screen and appropriately manage the visual impact of the Development from Plantation Road. No further screening works are required to manage visual impacts associated with the proposal.

4.12 Proposed Vehicle Maintenance & Management

All machinery onsite are to be serviced by an authorised service vehicle which is to arrive onsite when required and contains a hydrocarbon spill kit to prevent any potential contamination of the site. No hydrocarbons are to be stored onsite at any time, with the refuelling of machines to occur from an authorised service vehicle.

4.13 Proposed Rehabilitation Management & Maintenance

Following the extraction of material from each stage of development (1-4), the subject site is to be rehabilitated to pasture and native vegetation in accordance with the rehabilitation methodology outlined in the EMP attached at **Appendix C**.

The Post Extraction Plan proposes 2.18Ha to comprise native revegetation around the eastern portion of the site to replace degraded vegetation and enhance existing environmental values. The balance of the site (5.17Ha) is to be rehabilitated to pasture.

It is anticipated that as a condition of development approval, a Rehabilitation Implementation Plan (RIP) is to be prepared by a specialist consultant and approved by the Shire prior to the commencement of works. The RIP is to provide further guidance on industry best-practice to achieve the proposed completion criteria and environmental outcomes onsite.

5. Conclusion

Development Approval and consent to issue an Extractive Industry License by the Shire of Capel CEO is respectfully sought on behalf of the landowner of Lot 43 (No.546) Plantation Road, Ludlow.

The proposed Extractive Industry is justified as follows:

- This proposal seeks to extract a basic raw material, critical for local development projects and the south west economy;
- An Extractive Industry is a land use which may be considered within the Rural Zone under LPS No. 7;
- Excavation works onsite are to be appropriately conducted and sequentially implemented to minimise potential amenity impacts on surrounding sensitive land uses; and
- No adverse amenity impacts are anticipated to be caused following the implementation of management plans contained within this application.

On the basis of the description and rationale provided within this report, it is therefore respectfully requested that the Regional JDAP resolve to approve the proposed extractive industry at Lot 43 (No. 546) Plantation Road, Ludlow.

Appendix A

Certificate Of Title

WESTERN



AUSTRALIA

REGISTER NUMBER 43/DP69043	
DUPLICATE EDITION 1	DATE DUPLICATE ISSUED 25/11/2013

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

VOLUME 2771 FOLIO 694

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.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 43 ON DEPOSITED PLAN 69043

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

LUDLOW HOLDINGS PTY LTD OF 9A HAMELIN RETREAT GEOGRAPHE WA 6280
(T O706585) REGISTERED 19/4/2021

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

1. *O706586 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA REGISTERED 19/4/2021.

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: DP69043
PREVIOUS TITLE: 1934-549
PROPERTY STREET ADDRESS: 546 PLANTATION RD, LUDLOW.
LOCAL GOVERNMENT AUTHORITY: SHIRE OF CAPEL

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING O706586

Appendix B

Development Plans

LEGEND

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Monitoring Bore
-  Datum Mark (Spike or Peg)
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours (BCP Materials Pty Ltd)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

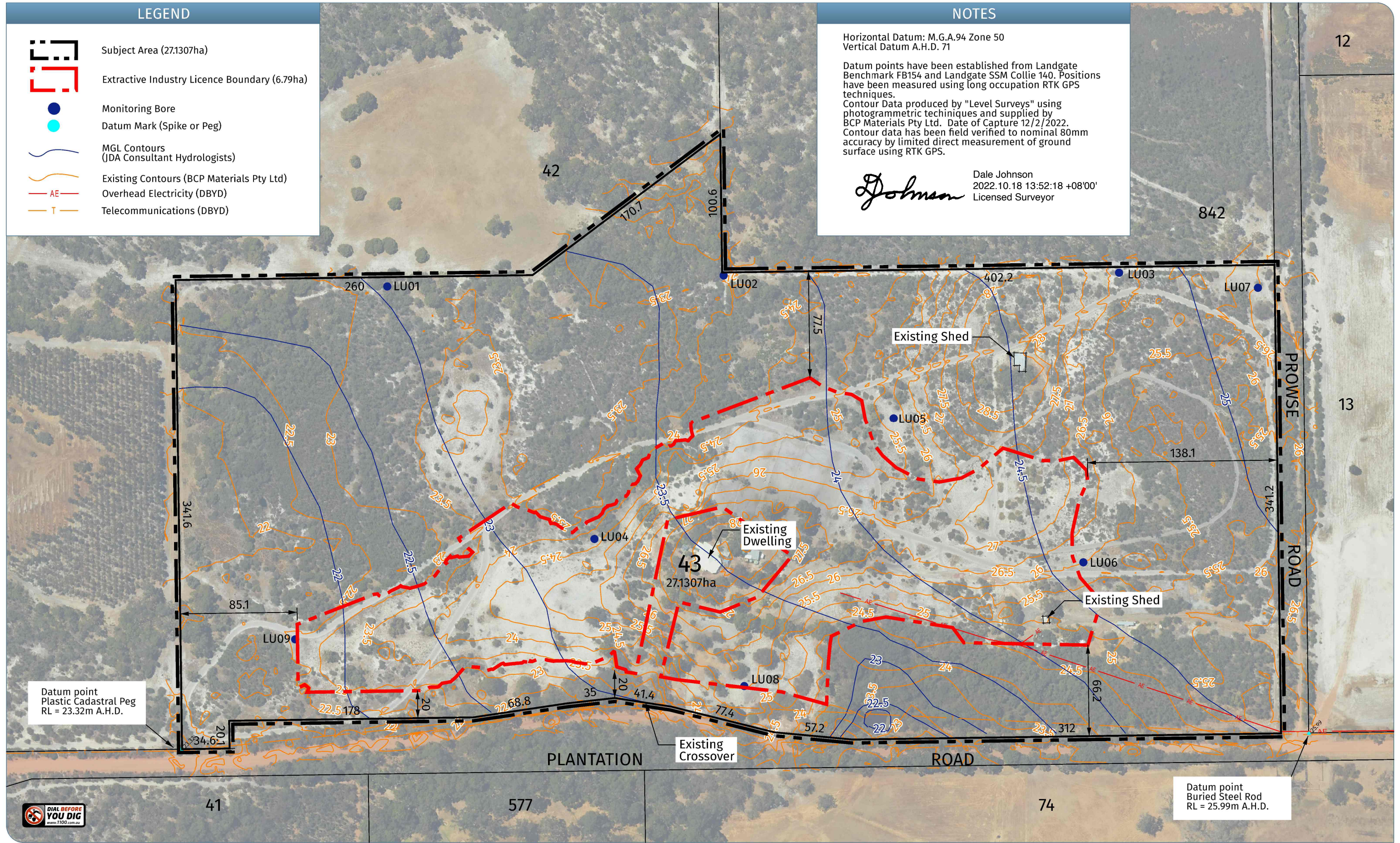
NOTES

Horizontal Datum: M.G.A.94 Zone 50
 Vertical Datum A.H.D. 71

Datum points have been established from Landgate Benchmark FB154 and Landgate SSM Collie 140. Positions have been measured using long occupation RTK GPS techniques.

Contour Data produced by "Level Surveys" using photogrammetric techniques and supplied by BCP Materials Pty Ltd. Date of Capture 12/2/2022. Contour data has been field verified to nominal 80mm accuracy by limited direct measurement of ground surface using RTK GPS.

D. Johnson Dale Johnson
 2022.10.18 13:52:18 +08'00'
 Licensed Surveyor



Datum point
 Plastic Cadastral Peg
 RL = 23.32m A.H.D.

Datum point
 Buried Steel Rod
 RL = 25.99m A.H.D.

FEATURE PLAN








Lot 43 (No. 546) Plantation Road,
 LUDLOW

Plan No. 22718-05	BUNBURY OFFICE: 21 Spencer Street, BUNBURY WA 6230 T: 08 9792 6000 E: bunbury@harleydykstra.com.au W: www.harleydykstra.com.au	COPYRIGHT: This document is and shall remain the property of HARLEY DYKSTRA. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.
Date 7/10/22	ALBANY BUNBURY BUSSELTON FORRESTDALE PERTH	
Drawn NP		
Checked DPJ		
Revision B		
Scale 1:2500@A3	0 20m 40m 60m	

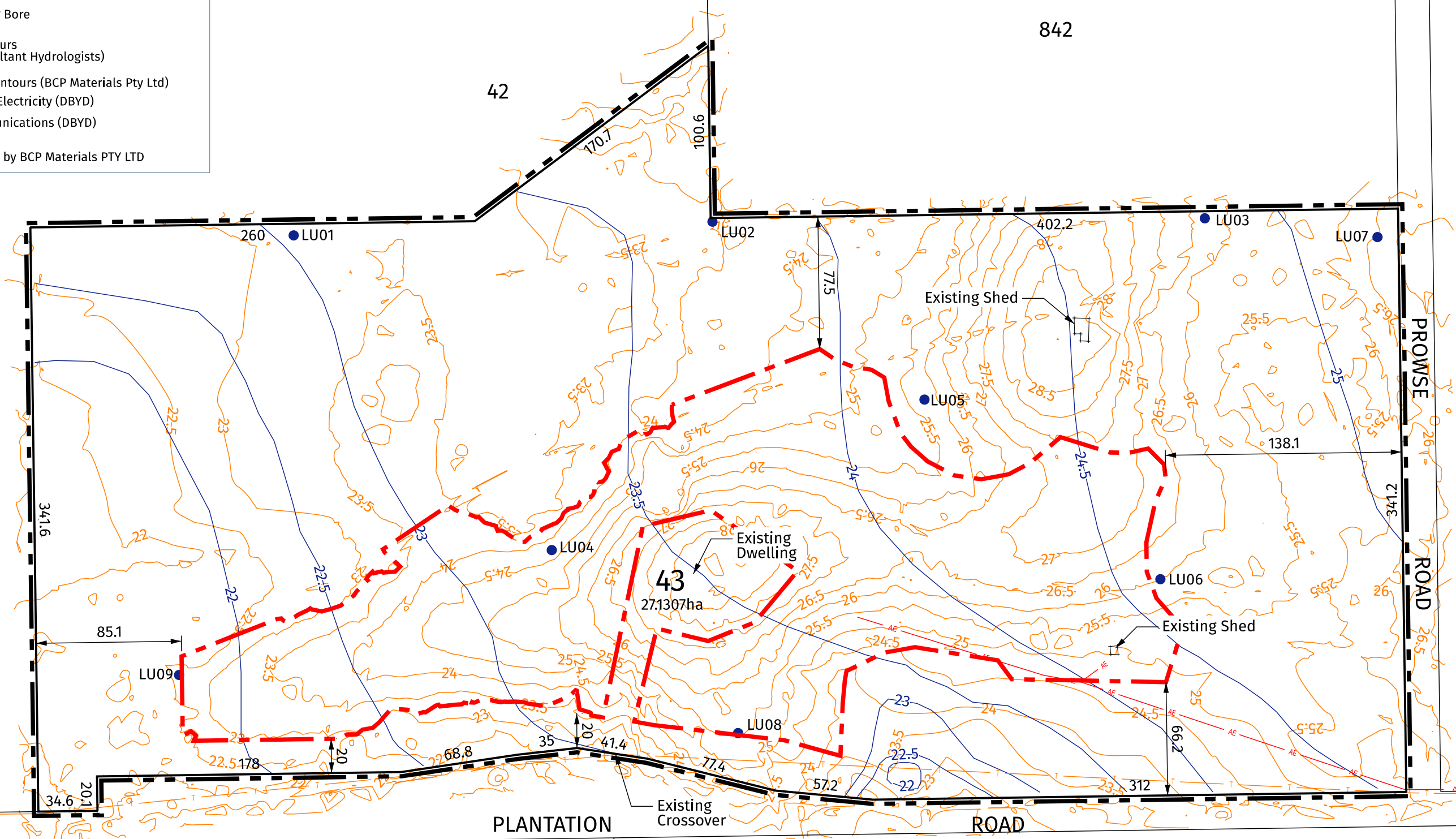


NOTE: This plan has been prepared for Volume purposes. Areas, Contours and Dimensions shown are subject to survey

LEGEND

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours (BCP Materials Pty Ltd)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

Contour data was provided by BCP Materials PTY LTD



41

577

Johnson

Dale Johnson
2022.10.18 15:49:30 +08'00'
Licensed Surveyor

74

SITE PLAN

Lot 43 (No. 546) Plantation Road,
LUDLOW

Plan No. | 22718-01
Date | 14/10/22
Drawn | NP
Checked | DPJ
Revision | H

BUNBURY OFFICE:
21 Spencer Street,
BUNBURY WA 6230
T: 08 9792 6000
E: bunbury@harleydykstra.com.au
W: www.harleydykstra.com.au

COPYRIGHT:
This document is and shall remain the property of HARLEY DYKSTRA. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Scale | 1:2500@A3



NOTE: This plan has been prepared for planning purposes. Areas, contours and Dimensions shown are subject to survey










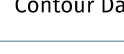

Harley Dykstra

PLANNING & SURVEY SOLUTIONS

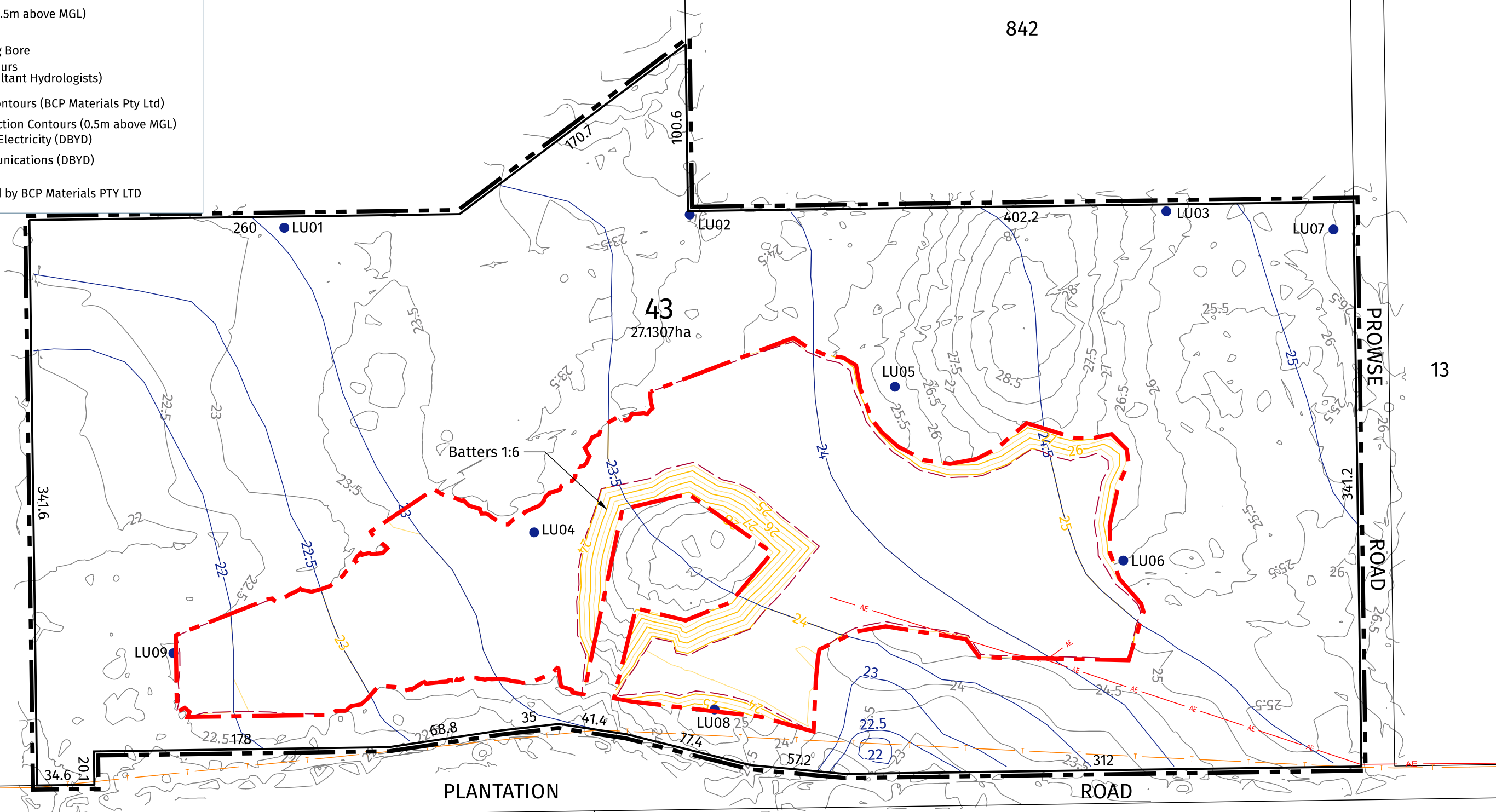
12

13

LEGEND

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Toe Line (0.5m above MGL)
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours (BCP Materials Pty Ltd)
-  Post Extraction Contours (0.5m above MGL)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

Contour Data was provided by BCP Materials PTY LTD



41

577

Johnson

Dale Johnson
2022.10.18 15:49:30 +08'00'
Licensed Surveyor

74

POST EXTRACTION PLAN

Lot 43 (No. 546) Plantation Road,
LUDLOW

Plan No. | 22718-04
Date | 01/11/22
Drawn | NP
Checked | DPJ
Revision | D

BUNBURY OFFICE:
21 Spencer Street,
BUNBURY WA 6230
T: 08 9792 6000
E: bunbury@harleydykstra.com.au
W: www.harleydykstra.com.au

COPYRIGHT:
This document is and shall remain the property of HARLEY DYKSTRA. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Scale | 1:2500@A3



NOTE: This plan has been prepared for Volume purposes. Areas, Contours and Dimensions shown are subject to survey










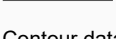

Harley Dykstra

PLANNING & SURVEY SOLUTIONS

12

13

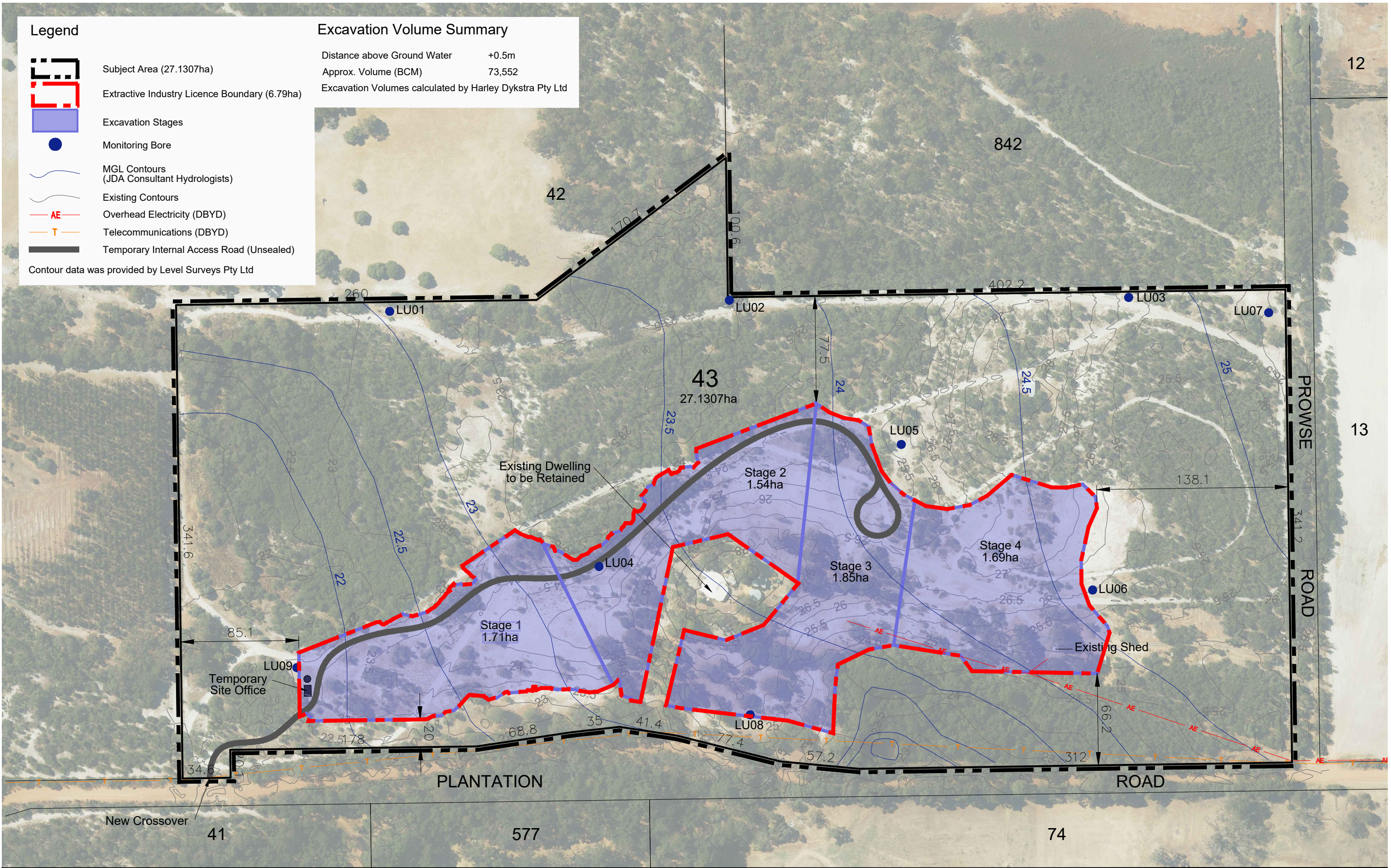
Legend

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Excavation Stages
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)
-  Temporary Internal Access Road (Unsealed)

Contour data was provided by Level Surveys Pty Ltd

Excavation Volume Summary

Distance above Ground Water	+0.5m
Approx. Volume (BCM)	73,552
Excavation Volumes calculated by Harley Dykstra Pty Ltd	



Excavation Works Plan
 Lot 43 (546) Plantation Road, Ludlow














Date: 9 Nov 2022 Scale: 1:2500 @ A3 File: 22-336 CP02B Staff: DL GW Checked: DL

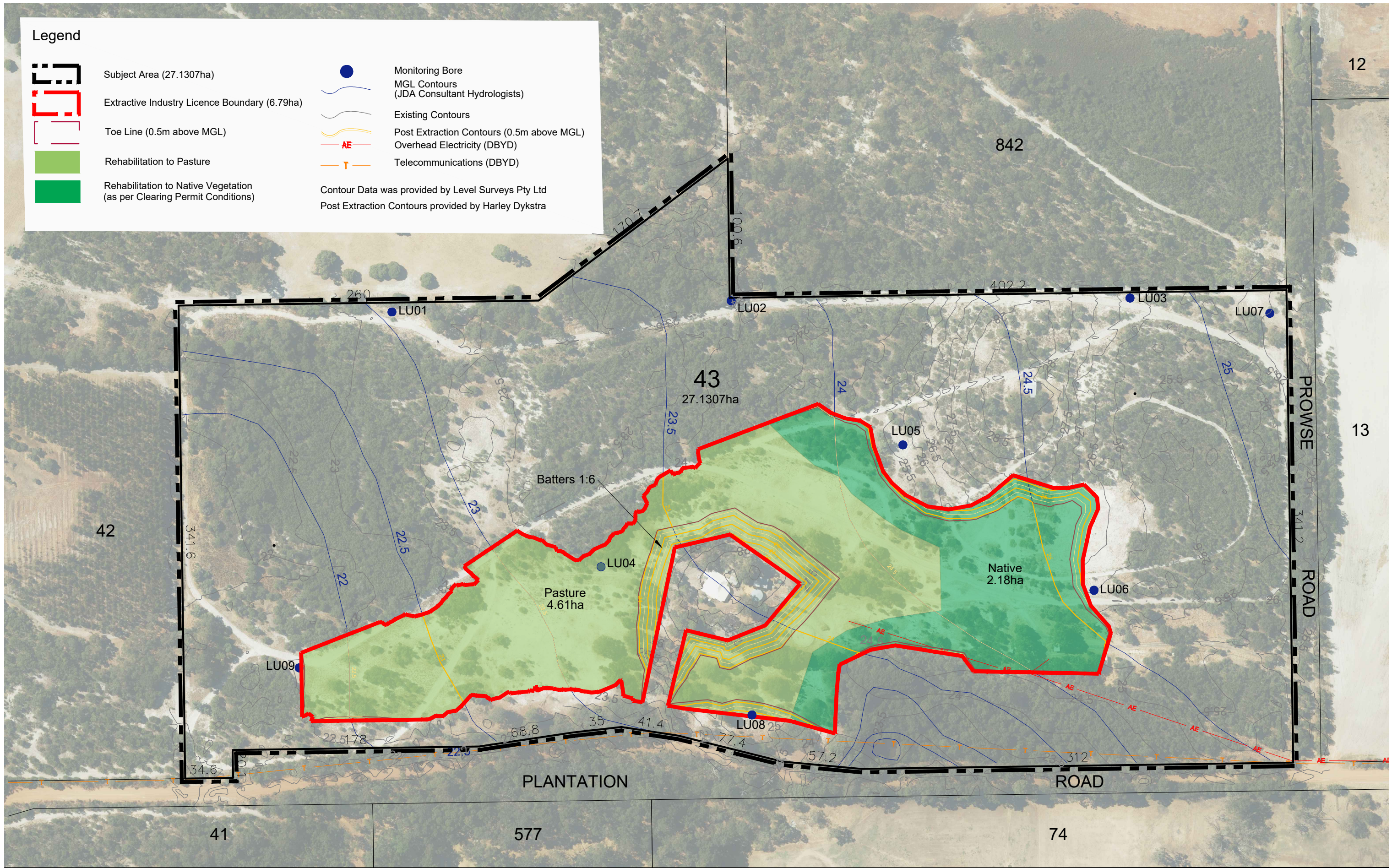
Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
 PO Box 7375 Cloisters Square, Perth Western Australia 6850.
 T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au

© Element Advisory WA Pty Ltd This concept has been prepared for the purpose of meeting client specifications. The drawing does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Although care has been taken in the compilation of this drawing by Element Advisory WA Pty Ltd, all parties associated with the proposed property development disclaim all responsibility for any errors or omissions. The right is reserved to change the plan at any time. Liability is expressly disclaimed by Element Advisory WA Pty Ltd for any loss or damage which may be sustained by any person acting on any visual impression gained from this drawing.

Legend

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Toe Line (0.5m above MGL)
-  Rehabilitation to Pasture
-  Rehabilitation to Native Vegetation (as per Clearing Permit Conditions)
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours
-  Post Extraction Contours (0.5m above MGL)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

Contour Data was provided by Level Surveys Pty Ltd
Post Extraction Contours provided by Harley Dykstra



Post Extraction Plan
Lot 43 (546) Plantation Road, Ludlow

Date: 9 Nov 2022 Scale: 1:2500 @ A3 File: 22-336 CP03B Staff: DL GW Checked: DL



Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
PO Box 7375 Cloisters Square, Perth Western Australia 6850.
T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au

Appendix C

Environmental Management Plan

**ENVIRONMENTAL MANAGEMENT PLAN
REVISION 1**

**SUPPORTING DOCUMENT FOR
EXTRACTIVE INDUSTRY LICENCE APPLICATION**

LOT 43 PLANTATION ROAD, LUDLOW

PREPARED FOR:

LUDLOW HOLDINGS PTY LTD

NOVEMBER 2022

PREPARED BY:

Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005
Ph: (08) 9226 3166
Email: info@mbsenvironmental.com.au
Web: www.mbsenvironmental.com.au

MBS
ENVIRONMENTAL

LOT 43 PLANTATION ROAD, LUDLOW ENVIRONMENTAL MANAGEMENT PLAN REV1

Distribution List:

Company	Contact name	Copies	Date
Ludlow Holdings Pty Ltd	Kelly Hillary, Director Kyle Jackson, Director	Electronic	8 November 2022
Emerge WA	Daniel Lewis, Planning Consultant	Electronic	8 November 2022

Document Control for Job Number: LHL43EA

Document Status	Prepared By	Authorised By	Date
Draft Report	Sharon Rose Kirsi Kauhanen	Susan Brand	13 July 2022
Final Report	Sharon Rose Kirsi Kauhanen	Susan Brand	11 August 2022
Draft Revision 1	Kirsi Kauhanen	Susan Brand	8 November 2022
Final Revision 1	Kirsi Kauhanen	Susan Brand	8 November 2022

Disclaimer, Confidentiality and Copyright Statement

This report is copyright. Ownership of the copyright remains with Martinick Bosch Sell Pty Ltd (MBS Environmental) and **Ludlow Holdings Pty Ltd**.

This report has been prepared for **Ludlow Holdings Pty Ltd** on the basis of instructions and information provided by **Ludlow Holdings Pty Ltd** and therefore may be subject to qualifications which are not expressed.

No other person other than those authorised in the distribution list may use or rely on this report without confirmation in writing from MBS Environmental. MBS Environmental has no liability to any other person who acts or relies upon any information contained in this report without confirmation.

This report has been checked and released for transmittal to **Ludlow Holdings Pty Ltd**.

These Technical Reports:

- Enjoy copyright protection and the copyright vests in MBS Environmental and **Ludlow Holdings Pty Ltd** unless otherwise agreed in writing.
- May not be reproduced or transmitted in any form or by any means whatsoever to any person without the written permission of the Copyright holder.

EXECUTIVE SUMMARY

Ludlow Holdings Pty Ltd is proposing to extract sand on Lot 43 (Plan 69043) Plantation Road in Ludlow, approximately 5 km south of the Capel town site in Shire of Capel. The purpose of this document is to provide supporting environmental information for the Development Application and the associated Extractive Industry Licence application that will be submitted to the local government authority, Shire of Capel. This document describes the environmental values of the site, potential environmental impacts and their management, and includes an indicative rehabilitation plan. This document should be read in conjunction with the DA application.

The proposed extraction area covers 6.79 ha, of which the majority has been cleared in the past. The main environmental impact of the project is the proposed clearing of 1.89 ha of native vegetation. This vegetation is largely native regrowth, of which approximately 96% is in Completely Degraded to Degraded condition. The proposed extraction area boundary has been delineated so that it focuses on the previously cleared and disturbed areas. Stockpiles and turnaround areas are proposed to be placed within the extraction area and therefore will require no further vegetation clearing.

The extraction area has been designed to avoid the identified population of Threatened *Drakaea elastica* (listed under both state and federal legislation) and maintain a 50 m separation distance from all recorded individuals of the species. No Threatened or Priority flora species or Threatened or Priority Ecological Communities will be directly impacted. There will be minor direct impact on three potentially significant flora species (one potential range extension species and two potential range end species), and this will be further defined as part of the Native Vegetation Clearing Permit (NVCP) process with the Department of Water and Environmental Regulation (DWER). Potential indirect impacts of the proposed operations on flora (e.g., dust) are expected to be effectively managed through the range of management measures described in this document.

While the fauna habitat value of the proposed extraction area is generally limited due to the mostly Degraded to Completely Degraded nature of the vegetation, the 1.89 ha of native vegetation proposed to be removed provides some suitable foraging and potential roosting habitat for Threatened Black Cockatoos, including 7 trees with a diameter at breast height of >50 cm (no hollows suitable for Black Cockatoo nesting). The vegetation proposed to be cleared also provides suitable habitat for the Threatened Western Ringtail Possum that was recorded on the property. Quenda (Priority 4) was recorded on the property but is likely to prefer the denser areas of understorey vegetation outside the proposed extraction area. Other significant fauna species were not recorded and while some have potential to occur on the property or visit it at times, they would be expected to mainly utilise the better quality habitat areas being retained on the property than the proposed extraction area.

Approximately 89% of the mapped extent of native vegetation will be retained. This vegetation will continue to provide suitable habitat for the significant flora and fauna and connectivity through the property during the operations. Further, a portion of the 6.79 ha extraction area will be revegetated back to native vegetation. At this stage, this portion is expected to be at least 2.18 ha, however this will be determined as part of the NVCP process with DWER.

The proposed sand extraction project has been designed to minimise environmental impacts and the majority of the potential impacts can be effectively managed through the measures detailed in this document. The significance of the impacts of the proposed clearing and the management/mitigation/offset measures required will be determined by the Department of Water and Environmental Regulation as part of the Native Vegetation Clearing Permit process. As part of this process, various measures to reduce, mitigate and offset impacts of the native vegetation clearing will be considered.

TABLE OF CONTENTS

1	INTRODUCTION	1
2	KEY LEGISLATION	5
2.1	ENVIRONMENTAL PROTECTION ACT 1986 (WA).....	5
2.2	BIODIVERSITY CONSERVATION ACT 2016 (WA).....	5
2.3	ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (CWLTH).....	5
3	EXISTING ENVIRONMENT	6
3.1	BIOREGIONAL CONTEXT.....	6
3.2	CLIMATE	6
3.3	CURRENT LAND USE	7
3.4	SOILS AND TOPOGRAPHY.....	7
3.5	GROUNDWATER	9
3.6	SURFACE WATER	9
3.7	ENVIRONMENTALLY SENSITIVE AREAS	9
3.8	FLORA AND VEGETATION	12
3.8.1	Regional Context.....	12
3.8.2	Vegetation Units.....	12
3.8.3	Threatened and Priority Ecological Communities.....	12
3.8.4	Flora Assemblage.....	19
3.8.5	Significant Flora.....	19
3.9	TERRESTRIAL FAUNA.....	19
3.9.1	Fauna Habitats	19
3.9.2	Significant Fauna.....	20
3.10	HERITAGE	24
3.10.1	Heritage Places	24
3.10.2	Aboriginal Heritage Sites.....	24
3.10.3	Native Title Claims.....	24
4	POTENTIAL IMPACTS AND MANAGEMENT	25
4.1	FLORA AND FAUNA	25
4.2	WEEDS	26
4.3	DIEBACK	26
4.4	LANDFORM AND SOILS.....	27
4.5	DUST	27
4.6	NOISE.....	27
4.7	VISUAL IMPACTS.....	27
4.8	GROUNDWATER	27
4.9	SURFACE WATER	28
4.10	DRAINAGE.....	28
4.11	ABORIGINAL HERITAGE.....	28
5	REHABILITATION	29
5.1	INDICATIVE REHABILITATION AREAS	29
5.2	INDICATIVE REHABILITATION MEASURES.....	29
5.2.1	Clearing and Handling of Native Vegetation.....	29
5.2.2	Soil Management and Earthworks.....	29
5.2.3	Revegetation	30
5.2.4	Weed Control.....	30
5.2.5	Grazing Control	30
5.2.6	Dieback Management.....	30
5.3	INDICATIVE COMPLETION CRITERIA	32

5.4	INDICATIVE MONITORING AND MITIGATION MEASURES	32
5.4.1	Final Landform.....	32
5.4.2	Pasture	33
5.4.3	Native Vegetation	33
6	CONCLUSIONS	35
7	REFERENCES	36

TABLES

Table 1:	Soil Landscape Units on Lot 43	7
Table 2:	Vegetation Units Within Lot 43	13
Table 3:	Vegetation Condition within Lot 43	14
Table 4:	Significant Flora on Lot 43 (Ecoedge 2022)	19
Table 5:	Habitat Types within Lot 43	20
Table 6:	Significant Fauna Summary.....	22
Table 7:	Indicative Completion Criteria.....	32
Table 8:	Monitoring and Mitigation Measures for Final Landform.....	33
Table 9:	Monitoring and Mitigation Measures for Pasture	33

FIGURES

Figure 1:	Location Plan.....	2
Figure 2:	Local Context.....	3
Figure 3:	Excavation Works Plan.....	4
Figure 4:	Landform and Soils.....	8
Figure 5:	Wetlands and Waterways	10
Figure 6:	Status of Wetlands	11
Figure 7:	Vegetation Complexes	15
Figure 8:	Vegetation Units and Significant Flora.....	16
Figure 9:	Vegetation Condition	17
Figure 10:	Clearing Extent in 2003	18
Figure 11:	Fauna Values	23
Figure 12:	Indicative Rehabilitation Areas	31

CHARTS

Chart 1:	Climate Statistics for Busselton Aero 2021 (BOM 2021)	6
----------	---	---

APPENDICES

Appendix 1: Flora and Vegetation Survey (Ecoedge 2022)

Appendix 2: Fauna Survey (Harewood 2022)

1 INTRODUCTION

Ludlow Holdings Pty Ltd (Ludlow Holdings) is proposing to extract sand on Lot 43 - Plan 69043 - Plantation Road in Ludlow (the property, Lot 43), approximately 5 km south of the Capel town site in Shire of Capel (Figure 1, Figure 2). The property totals 27.13 ha and the proposed extraction area covers 6.79 ha (Figure 3).

The purpose of this document is to provide supporting environmental information for the Development Application (DA) and the associated Extractive Industry Licence (EIL) application that will be submitted to the Shire of Capel. This document describes the environmental values of the site, potential environmental impacts and their management, and includes an indicative rehabilitation plan. This document should be read in conjunction with the DA application. The current excavation works plan is shown in Figure 3.

The project will require a Native Vegetation Clearing Permit (NVCP) from the Department of Water and Environmental Regulation (DWER) and therefore the project impacts and their management and mitigation will continue to be refined as part of the NVCP process.

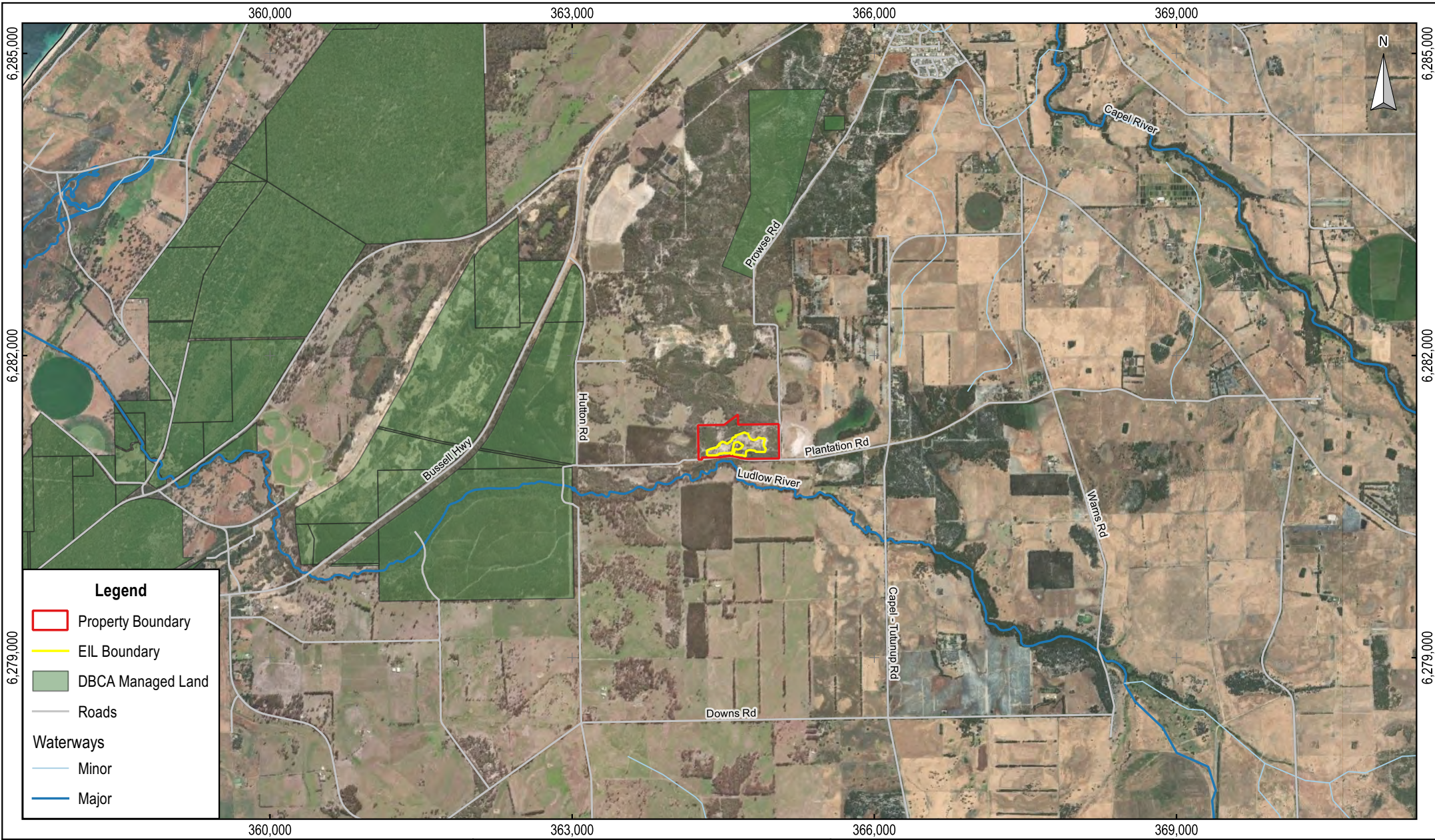


Scale: 1:125000
 Original Size: A4
 Image: Copernicus Sentinel Data 2020
 Grid: GDA94 / MGA zone 50

Ludlow Holdings
 Lot 43 Plantation Road,
 Ludlow

Figure 1
Location 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



Scale: 1: 50,000
 Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 0.5 1 1.5 2 km

Ludlow Holdings
 Lot 43 Plantation Road, Ludlow








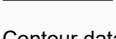

Figure 2

Local Context

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

MBS ENVIRONMENTAL

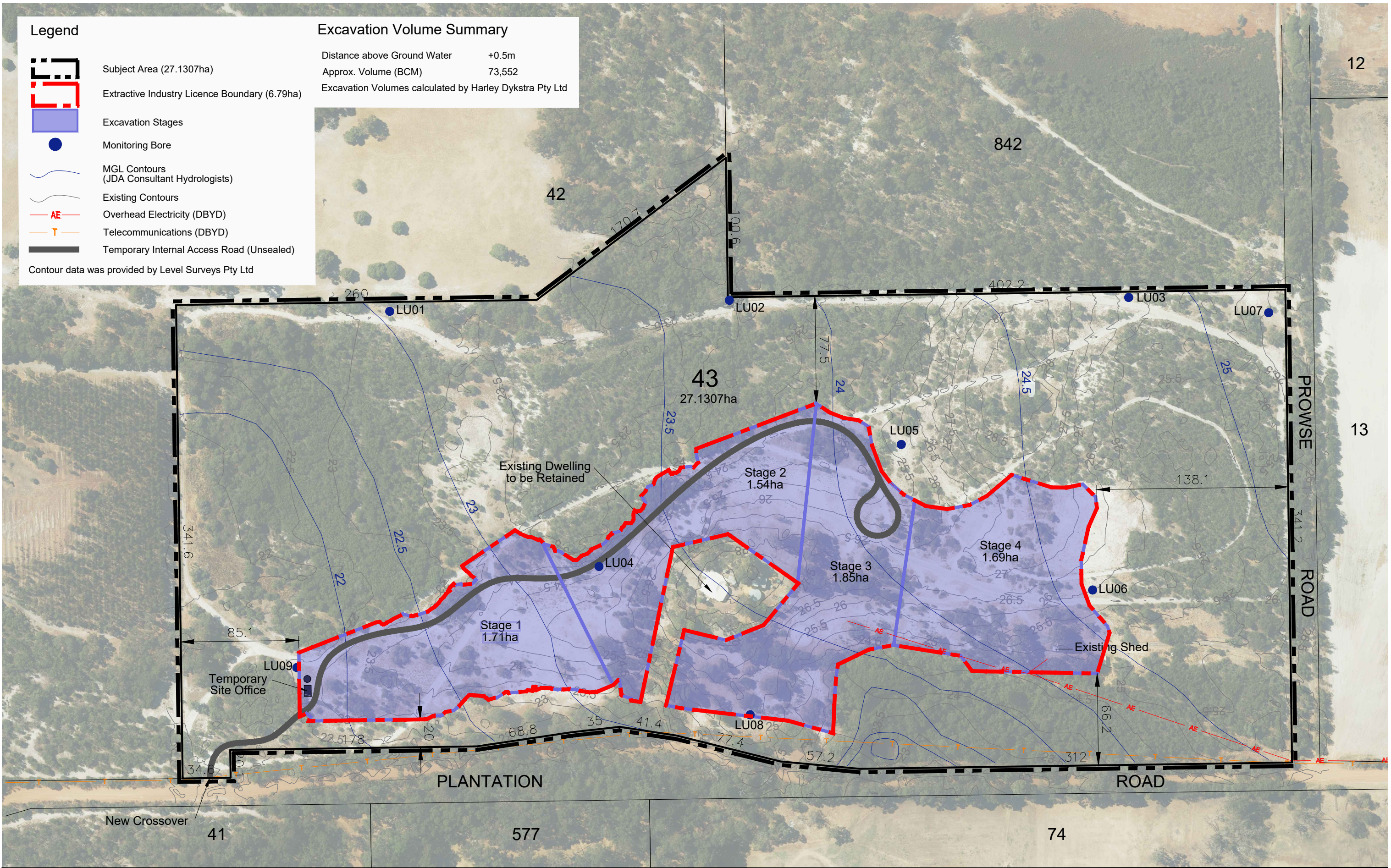
Legend

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Excavation Stages
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)
-  Temporary Internal Access Road (Unsealed)

Contour data was provided by Level Surveys Pty Ltd

Excavation Volume Summary

Distance above Ground Water	+0.5m
Approx. Volume (BCM)	73,552
Excavation Volumes calculated by Harley Dykstra Pty Ltd	



Excavation Works Plan
 Lot 43 (546) Plantation Road, Ludlow



Date: 9 Nov 2022 Scale: 1:2500 @ A3 File: 22-336 CP02B Staff: DL GW Checked: DL

Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
 PO Box 7375 Cloisters Square, Perth Western Australia 6850.
 T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au

© Element Advisory WA Pty Ltd This concept has been prepared for the purpose of meeting client specifications. The drawing does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Although care has been taken in the compilation of this drawing by Element Advisory WA Pty Ltd, all parties associated with the proposed property development disclaim all responsibility for any errors or omissions. The right is reserved to change the plan at any time. Liability is expressly disclaimed by Element Advisory WA Pty Ltd for any loss or damage which may be sustained by any person acting on any visual impression gained from this drawing.

2 KEY LEGISLATION

2.1 ENVIRONMENTAL PROTECTION ACT 1986 (WA)

The *Environmental Protection Act 1986* (EP Act) is administered by the DWER and the Department of Biodiversity, Conservation and Attractions (DBCA). The EP Act provides for conservation, preservation, protection, enhancement and management of the environment, and for matters incidental to or connected with it. The EP Act establishes head powers to provide mechanisms for the development of Environmental Protection Policies, the referral and assessment of proposals (environmental impact assessment), the control of pollution, and enforcement. The EP Act also provides for an Environmental Protection Authority that is a statutory authority and is the primary provider of independent environmental advice to Government. DWER administers the clearing provisions of the EP Act. Applications for a NVCP are assessed and decisions are made to grant or refuse the application in accordance with the EP Act.

2.2 BIODIVERSITY CONSERVATION ACT 2016 (WA)

The *Biodiversity Conservation Act 2016* (BC Act) replaces the *Wildlife Conservation Act 1950* and provides for the ongoing protection of Western Australian flora, fauna, and ecological communities.

2.3 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (CWLTH)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. The EPBC Act aims to protect Matters of National Environmental Significance. Under the EPBC Act, the Commonwealth Department of Agriculture, Water and Environment (DAWE) lists, for example, Threatened species, Migratory species, and Threatened Ecological Communities. All development proposals are required to consider potential obligations under the EPBC Act.

3 EXISTING ENVIRONMENT

3.1 BIOREGIONAL CONTEXT

The property is located within the Swan Coastal Plain Bioregion classified by the Interim Biogeographic Regionalisation for Australia and described as a low lying coastal plain, mainly covered by Banksia or Tuart woodlands over sandy soils with paperbark prevalent in swampy areas (Thackway and Cresswell 1995).

The Swan Coastal Plain Bioregion is divided into two subregions, the Dandaragan Plateau (SWA01) and Perth (SWA02), of which the proposed EIL area is located within the Perth subregion. This subregion is comprised of colluvial and aeolian sands, alluvial river flats, and coastal limestone. Native vegetation varies from Heath and/or Tuart woodlands on limestone, Banksia and Jarrah woodlands on Quaternary marine dunes of various ages, and Marri on colluvial and alluvials. This subregion also includes a complex series of seasonal wetlands (Mitchell, Williams, and Desmond 2002). The primary land use associated with this subregion includes dry land agriculture, conservation, and crown reserve, as well as urban and rural residences (Mitchell, Williams, and Desmond 2002).

3.2 CLIMATE

The local area experiences a Mediterranean climate characterised by hot, dry summers and cool, wet winters. The closest Bureau of Meteorology (BoM) site recording long-term temperature and rainfall is Busselton Aero, station 009603 operating since 1997. The station is situated 11.3 km south of the proposed clearing area.

Monthly mean minimum temperatures range from 7.0°C to 14.7°C and monthly mean maximum temperatures range from 16.8°C to 30.2°C (Chart 1). The hottest month is January with a mean maximum temperature of 30.2°C and mean minimum temperature of 14.2°C, whilst July is the coldest month with average maximum and minimum temperatures of 16.8°C and 7.0°C, respectively (BoM 2021).

Mean annual rainfall is 685.4 mm (BoM 2021) with average rainfall peaking in July with an average of 133.8 mm (Chart 1). Annual precipitation falls predominantly in late autumn to early spring (May to September).

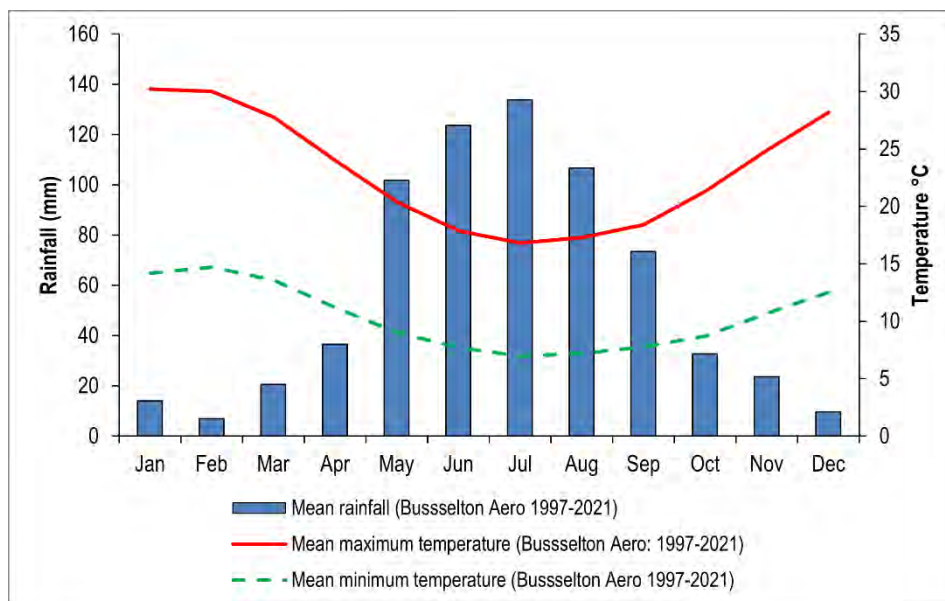


Chart 1: Climate Statistics for Busselton Aero 2021 (BOM 2021)

3.3 CURRENT LAND USE

Lot 43 is zoned as 'Rural' in the Shire of Capel Town Planning Scheme No. 7. Under the proposed Draft Local Planning Scheme No.8, the property is zoned 'Priority Agriculture' and is located in Special Control Area (6) - Basic Raw Materials (6.1 Resource Area) and Special Control Area (8) - Environment.

The property currently includes patches of remnant native vegetation, one residential dwelling, various outbuildings, and several horse-holding paddocks and a horse training track (Figure 3).

Surrounding properties are also zoned 'Rural' and support a range of rural land uses, including paddocks for grazing and hay production, timber plantations, a sand extraction site, and bushland (Figure 2). The sand extraction site to the east is currently undergoing rehabilitation to pasture. The closest residential dwelling outside Lot 43 is located approximately 138 m south of the proposed extraction area. Apart from this dwelling and the dwelling on Lot 43, no other residential dwellings are located within 500 m.

3.4 SOILS AND TOPOGRAPHY

The property is located on the Busselton Plain, which is a portion of the Swan Coastal Plain between Dunsborough and Capel River and is part of the larger Perth Basin. The majority of Lot 43 and all of the proposed extraction area is situated within the Bassendean System (212Bs) (DPIRD-064) as shown in Figure 4. The Bassendean System is characterised by sand dunes and sandplains with pale deep sand, semi-wet, and wet soil (DPIRD-064). The western and southern edges of Lot 43 intersect the Abba System (213Ab); however, this is outside the extraction area.

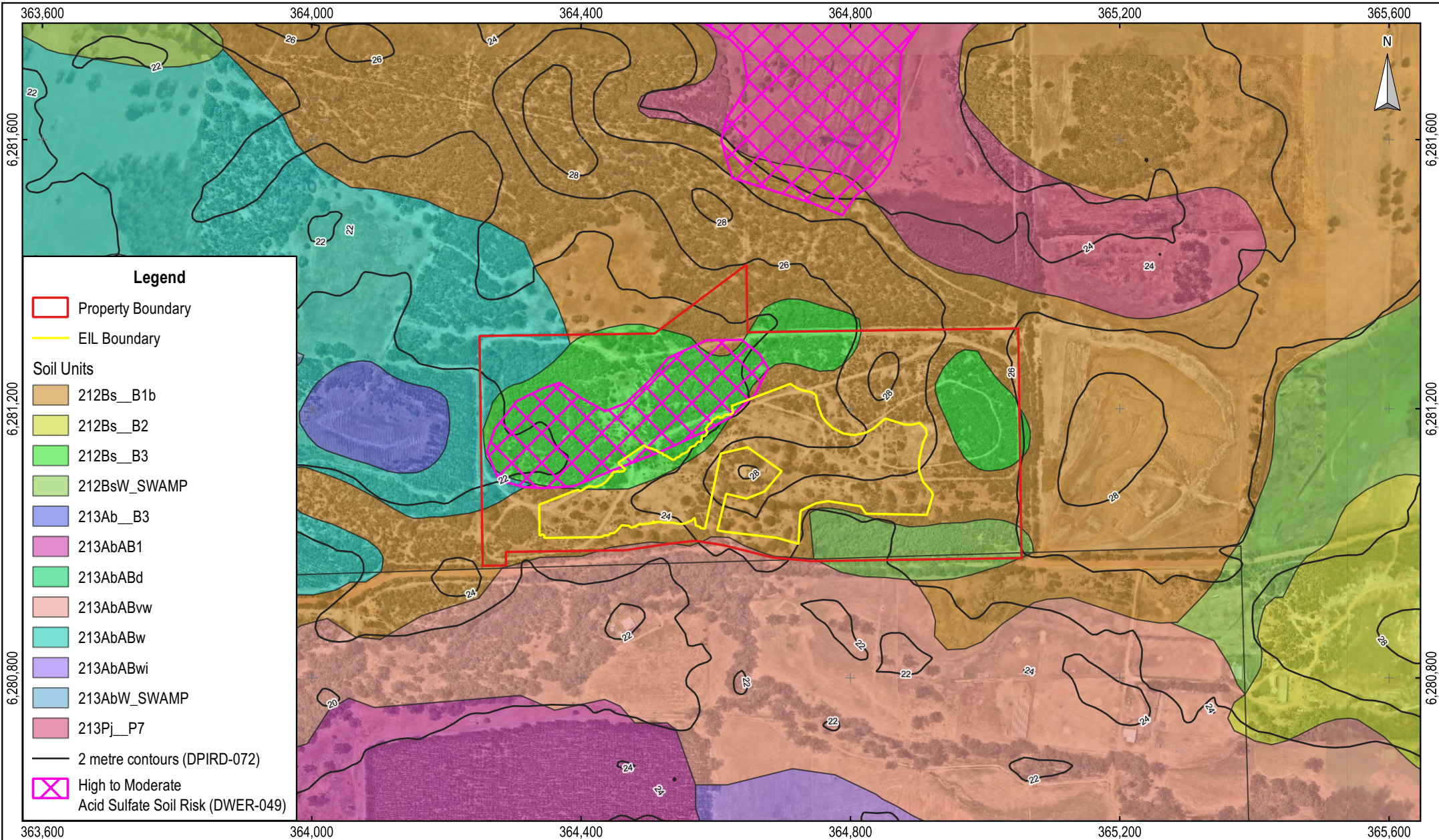
There are five soil landscape units within Lot 43 (Figure 4, Table 1, DPIRD-027), out of which the proposed extraction area intersects two Bassendean phases: B1b and B3. The majority of the proposed extraction area is located on phase B1b.

The elevation of the property ranges from 22 m to 28 m Australian Height Datum (AHD), with the highest elevation recorded on the sand ridge extending from the central part of Lot 43 north to the neighbouring property. The extraction area is positioned along this ridgeline between the two highest points and through the 26 to 24 m AHD area. (Figure 3, Figure 4).

The majority of the proposed extraction area is mapped as having a moderate to low risk of acid sulphate soils (ASS), while a small section of the property (of which less than 1 ha intersects with the proposed extraction area) is mapped as having high to moderate risk of ASS (DWER-055). The area of high to moderate risk of ASS partly coincides with phase B3 (Figure 4).

Table 1: Soil Landscape Units on Lot 43

Soil Type	Description	Within Extraction Area
Bassendean B1b Phase (212Bs_B1b)	Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.	Yes
Bassendean B3 Phase (212Bs_B3)	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Yes
Abba wet flats Phase (213AbABw)	Winter wet flats and slight depressions with sandy grey brown duplex (Abba) and gradational (Busselton) soils.	No
Abba wet vales Phase (213AbABvw)	Small narrow swampy depressions along drainage lines. Alluvial soils.	No
Sw - Swamp (Bassendean) (212Bs_Swamp)	Swamp	No



Scale: 1: 7,500
Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 100 200 m

Ludlow Holdings
Lot 43 Plantation Road, Ludlow

Figure 4

Landform and Soils

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



3.5 GROUNDWATER

Lot 43 lies within the Busselton-Capel Groundwater Area, proclaimed under the *Rights in Water and Irrigation Act 1914* (DWER-034). The unconfined 'Perth - Superficial Swan' aquifer overlies the more confined 'Perth - Leederville' aquifer and the deep 'Perth - Yarragadee South' aquifer (Department of Water 2022a).

Regional groundwater flow direction in the area is generally east to west (Commander 1984) and groundwater monitoring on site in 2021 (JDA 2021; JDA report is included in the DA application) indicated that this was the case for Lot 43. Maximum groundwater levels within Lot 43 were estimated to vary from 25 m AHD in the east to 22 m AHD in the west and south (JDA 2021). Based on JDA (2021) hydrology modelling, the maximum groundwater levels within the proposed extraction area vary from 24.5 m AHD in the east to 22 m AHD in the west.

3.6 SURFACE WATER

The property lies within the Busselton Coast Water Management Area and in the Ludlow River sub management area of the Vasse/Wonnerup Estuary Catchment (DWER-027; DWER-028; DWER-029; DWER-030). The property does not fall within a RIWI Surface Water Proclamation Area (DWER-037) and does not intersect a Public Drinking Water Source Area (DWER-033).

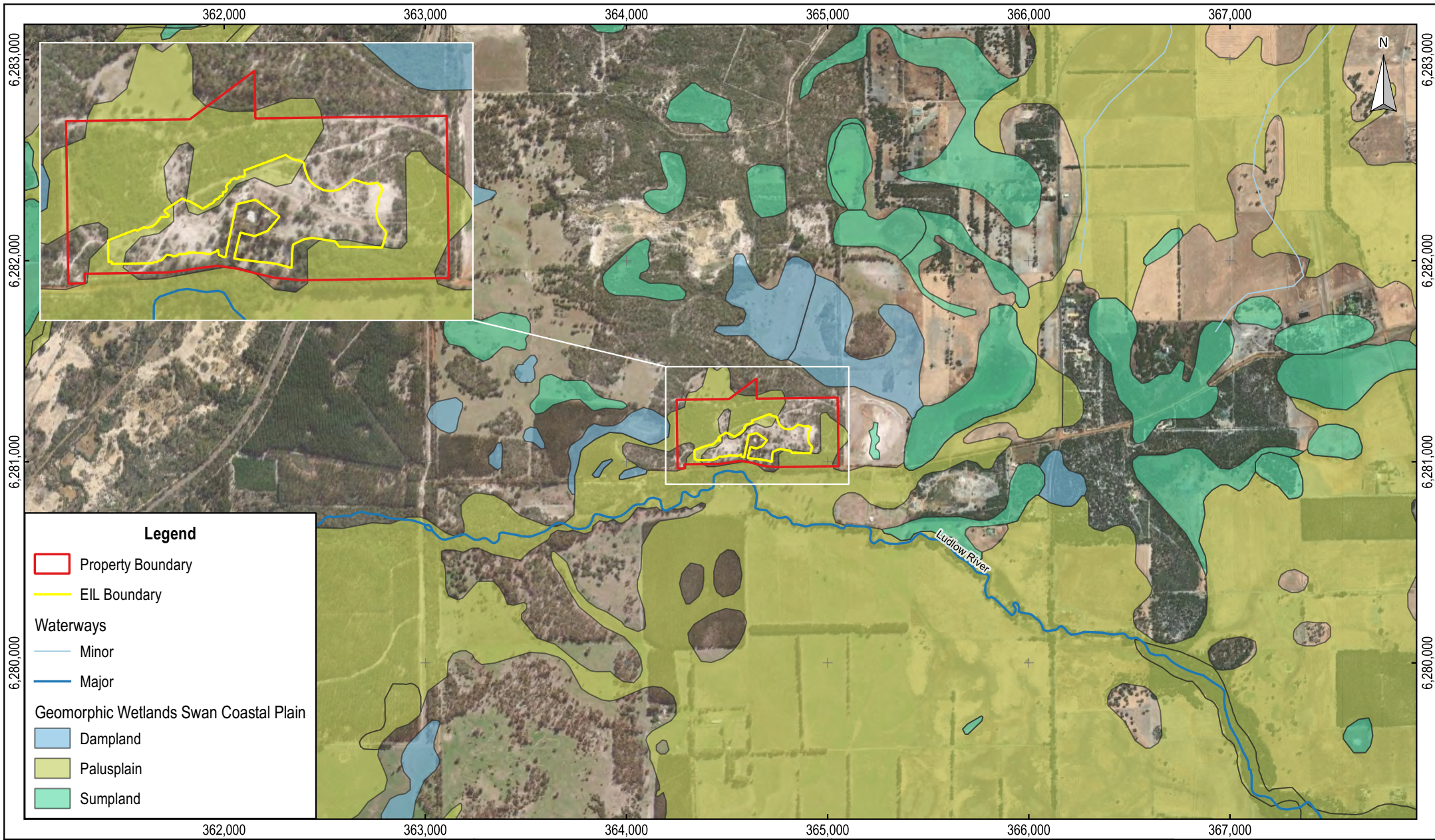
There are no watercourses or drainage lines within the property or the proposed extraction area. The closest watercourse is the Ludlow River, approximately 70 m to the south of the extraction area, on the southern side of the Plantation Road (Figure 5).

The property intersects an extensive Multiple Use palusplain wetland (Unique Feature ID 15809) that is a seasonally waterlogged flat covering over 42,000 ha in the southern Swan Coastal Plain (Figure 5, Figure 6, DBCA-019). The wetland has been largely cleared of native vegetation. The majority of the proposed extraction area is outside the mapped extent of this wetland, with approximately 1.26 ha being intersected. There are two small soaks on Lot 43 that are located within the wetland but outside the extraction area.

No Conservation category or Resource Enhancement category wetlands intersect the property, and none are present within 1 km of the proposed extraction area (Figure 6, DBCA-019). The closest Conservation category wetland is located approximately 1.3km north from the proposed extraction area.

3.7 ENVIRONMENTALLY SENSITIVE AREAS

Currently, there are no Environmentally Sensitive Areas (ESAs) mapped on the property (DWER-046). However, it is noted that there is confirmed presence of one species of Threatened flora outside of the extraction area, with their population buffer of 50 m expected to be considered an ESA. These plants have been excluded from the extraction area by a 50 m buffer. A Threatened Ecological Community has also been recorded on the property and is expected to be considered an ESA. This community has been excluded from the extraction area.

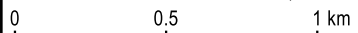


Legend

- Property Boundary
- EIL Boundary
- Waterways**
- Minor
- Major
- Geomorphic Wetlands Swan Coastal Plain**
- Dampland
- Palusplain
- Sumpland

Scale: 1: 25,000
Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)



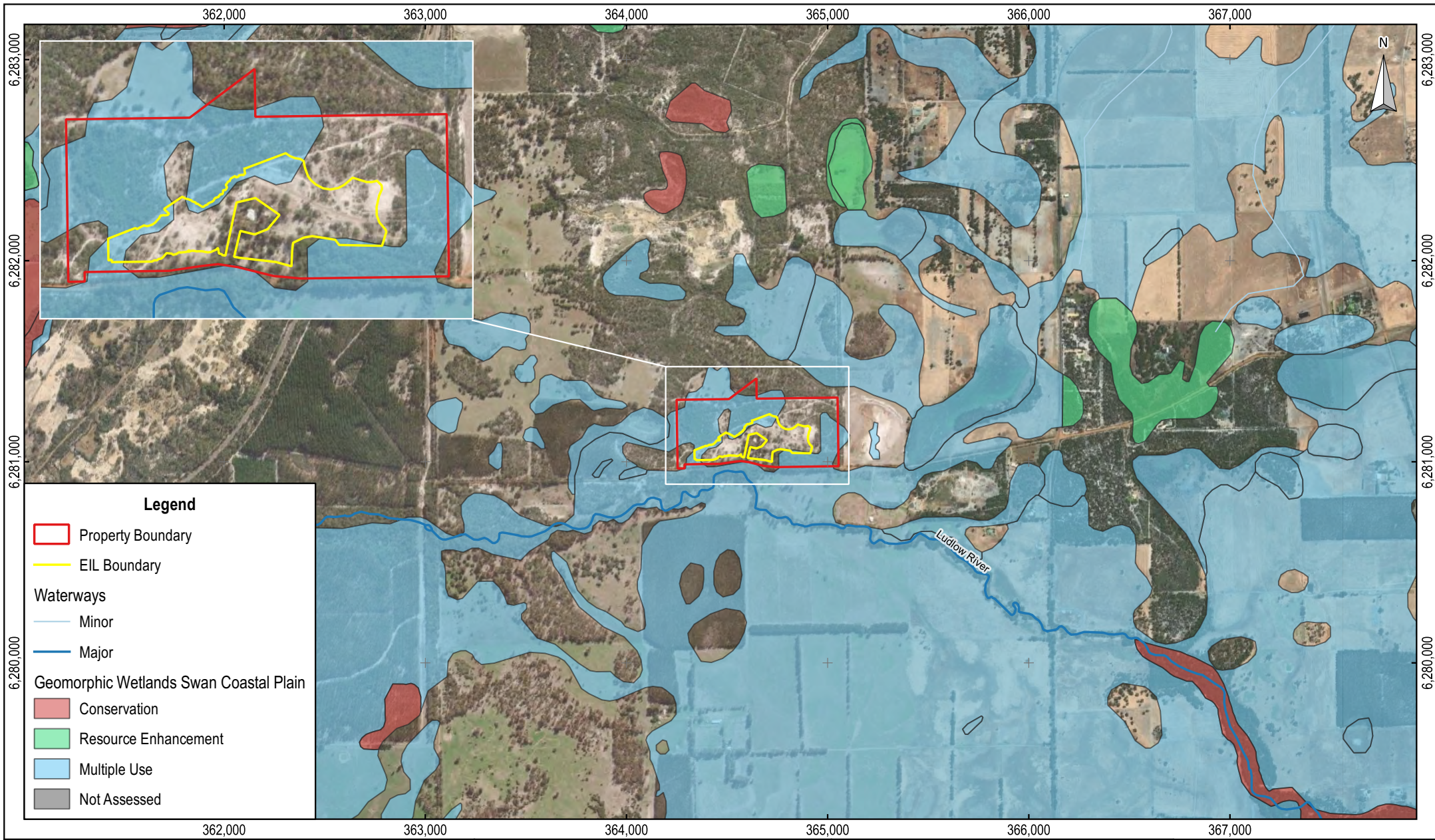
Ludlow Holdings
Lot 43 Plantation Road, Ludlow

Figure 5

Wetlands and Waterways

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





Scale: 1: 25,000
 Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 0.5 1 km

Ludlow Holdings
 Lot 43 Plantation Road, Ludlow

Figure 6
Status of Wetlands

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

MBS
 ENVIRONMENTAL

3.8 FLORA AND VEGETATION

3.8.1 Regional Context

There are two sets of broad scale (1:250,000) vegetation mapping available for this part of the southwest. The first set maps the entirety of Lot 43 including the proposed extraction area as Vegetation Association 1000 (Pre-European vegetation dataset DPIRD-006, Shepherd *et al.* 2002), described as Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (*Melaleuca* spp.). The second set maps the majority of the property including the proposed extraction area as Southern River Complex (Figure 7, DBCA-046, Heddle *et al.* 1980, Webb *et al.* 2016). This complex is described as: Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - *Banksia* species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark) along creek beds. The remainder of the property is mapped as Abba Complex.

3.8.2 Vegetation Units

A reconnaissance and targeted flora and vegetation survey was conducted by Ecoedge in spring (August - October) 2021 (Ecoedge 2022). Ecoedge recorded five native vegetation units, two of which included subunits (Table 2, Figure 8). Photos of the vegetation units are provided in the Ecoedge 2022 report (Appendix 1). In total approximately 17.8 ha of native vegetation remains on the property, of which approximately 52% is in Completely Degraded or Degraded condition, 30% is in Good condition, and the remainder is in Very Good and Excellent condition (Table 3, Figure 9).

Approximately a third of the property was mapped as cleared in 2021, however back in 2003 approximately 75% of the property was cleared (Figure 10). Vegetation communities B and D2, in particular, are largely regrowth.

The majority of the proposed extraction area was mapped as cleared (72%) by Ecoedge (2022) with the remaining native vegetation comprising mainly Unit D2 (Table 2). The proposed extractive operations are expected to require approximately 1.89 ha of native vegetation to be cleared (all vegetation within the proposed extraction area). This vegetation is largely in Completely Degraded and Degraded condition (96%), with only 0.07 ha of vegetation in Good condition (Table 3).

3.8.3 Threatened and Priority Ecological Communities

Ecoedge (2022) found one significant ecological community on Lot 43, namely 'Southern *Corymbia calophylla* woodlands on heavy soils' (FCT1b) (Figure 8) that is a state listed TEC (Vulnerable) but not listed federally. This community aligned with vegetation Units E1 and E2 (Table 2). The proposed extraction area does not intersect this ecological community. Other significant ecological communities known from records within 5 km of the site were not recorded on the property (Ecoedge 2022).

Table 2: Vegetation Units Within Lot 43

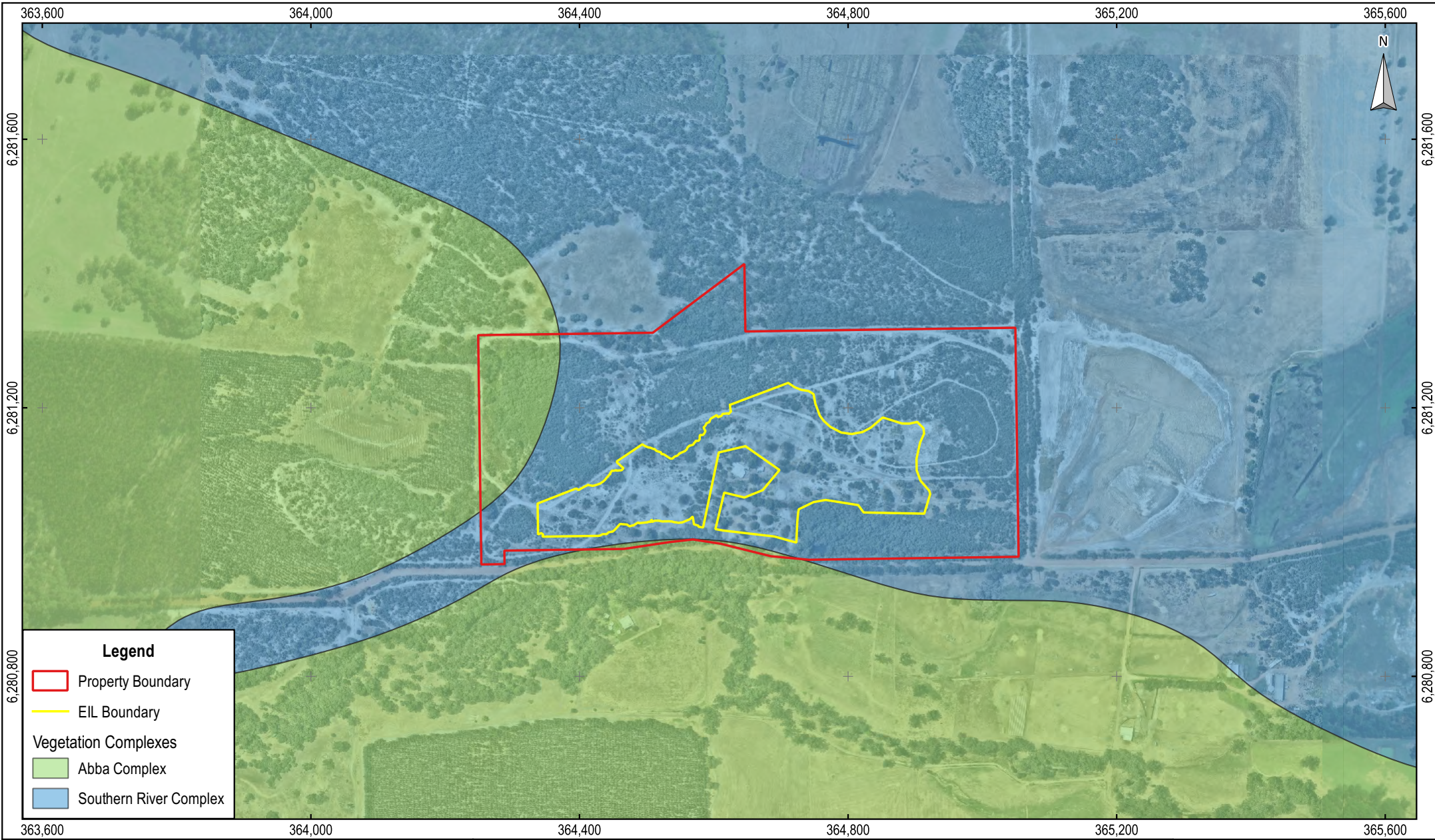
Vegetation Units	Description	Within Lot 43 (ha)*	Within Extraction Area (ha)
Unit A	Medium open forest of <i>Corymbia calophylla</i> over very open low woodland of <i>Xylomelum occidentale</i> over tall sparse shrubland of <i>Kunzea glabrescens</i> and <i>Xanthorrhoea brunonis</i> over <i>Pteridium esculentum</i> fernland or grassland of <i>Avena barbata</i> , <i>Briza maxima</i> and <i>Ehrharta longiflora</i> on grey sandy loam. [Condition mainly Degraded - Good].	0.85	None
Unit B	Open low woodland of <i>Melaleuca preissiana</i> over <i>Leptocarpus coangustatus</i> , <i>Lepidosperma longitudinale</i> sedgeland with patches of <i>Kunzea glabrescens</i> tall shrubland over <i>Hypocalymma angustifolium</i> low shrubland over open grassland/forbland of introduced taxa on grey sand (winter wet). [Condition mainly Degraded - Good].	0.63	0.002
Unit C	Very open medium woodland of <i>Corymbia calophylla</i> over medium woodland of <i>Melaleuca preissiana</i> over <i>Aotus gracillima</i> , <i>Astartea scoparia</i> , <i>Kunzea glabrescens</i> tall shrubland over <i>Hypocalymma angustifolium</i> low shrubland over open sedgeland of <i>Lepidosperma longitudinale</i> , <i>Pteridium esculentum</i> and <i>Schoenus efoliatus</i> open forbland on grey sand (winter damp). [Condition Degraded - Very Good].	1.16	0.02
Unit D1	Medium woodland of <i>Eucalyptus marginata</i> over open low woodland of <i>Banksia attenuata</i> and/or <i>Banksia ilicifolia</i> and <i>Nuytsia floribunda</i> over <i>Kunzea glabrescens</i> tall shrubland over shrubland of <i>Adenanthos meisneri</i> , <i>Brachyloma preissii</i> and <i>Melaleuca thymoides</i> over <i>Dasypogon bromeliifolius</i> low shrubland and <i>Phlebocarya ciliata</i> open forbland on grey sand. [Degraded-Good]	0.21	0.05
Unit D2	Medium very open woodland of <i>Agonis flexuosa</i> , <i>Banksia ilicifolia</i> or <i>Nuytsia floribunda</i> over tall shrubland of <i>Kunzea glabrescens</i> over low shrubland of <i>Acacia semitrullata</i> , <i>A. stenoptera</i> , <i>Adenanthos meisneri</i> , <i>Dasypogon bromeliifolius</i> , <i>Hypocalymma angustifolium</i> , <i>Melaleuca thymoides</i> and <i>Xanthorrhoea brunonis</i> over open forbland of <i>Patersonia occidentalis</i> , <i>Phlebocarya ciliata</i> on grey sand. [Condition mainly Completely Degraded-Good]	13.11	1.82
Unit E1	Medium woodland of <i>Corymbia calophylla</i> over very open medium shrubland of <i>Kingia australis</i> over low shrubland of <i>Acacia pulchella</i> , <i>Hardenbergia comptoniana</i> , <i>Leucopogon propinquus</i> , <i>Macrozamia riedlei</i> , <i>Pimelea angustifolia</i> , and <i>Xanthorrhoea brunonis</i> over open forbland of <i>Conostylis aculeata</i> , <i>Craspedia variabilis</i> and <i>Senecio quadridentatus</i> and very open sedgeland of <i>Schoenus grandiflorus</i> and <i>Tetralia octandra</i> and scattered <i>Microlaena stipoides</i> low grass on grey sandy loam. [Condition Very Good to Excellent]. (Southern <i>Corymbia calophylla</i> woodlands TEC).	1.09	None
Unit E2	Medium woodland of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over low woodland of <i>Agonis flexuosa</i> and <i>Melaleuca preissiana</i> over open medium shrubland of <i>Astartea scoparia</i> , <i>Acacia extensa</i> and <i>Grevillea manglesioides</i> over low sedgeland of <i>Anarthria prolifera</i> and <i>Lepidosperma longitudinale</i> and open forbland of <i>Burchardia multiflora</i> and <i>Opercularia hispidula</i> on grey-brown sandy loam or red-brown loam. [Condition ranges from Completely Degraded-Excellent]. (Southern <i>Corymbia calophylla</i> woodlands on heavy soils TEC).	0.80	None
	Existing Cleared Areas	9.55	4.90
	Total	27.41	6.79

*Includes the entire survey that was slightly larger than the property.

Table 3: Vegetation Condition within Lot 43

Vegetation Condition	Total within Lot 43 (ha)*	Within Extraction Area (ha)
Excellent	0.70	0.00
Very Good	2.46	0.00
Good	5.44	0.07
Degraded	6.68	0.56
Completely Degraded	2.58	1.26
Cleared	9.55	4.90
Total	27.41	6.79

**Includes the entire survey that was slightly larger than the property.*



Legend

- Property Boundary
- EIL Boundary

Vegetation Complexes

- Abba Complex
- Southern River Complex

Scale: 1: 7,500
 Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

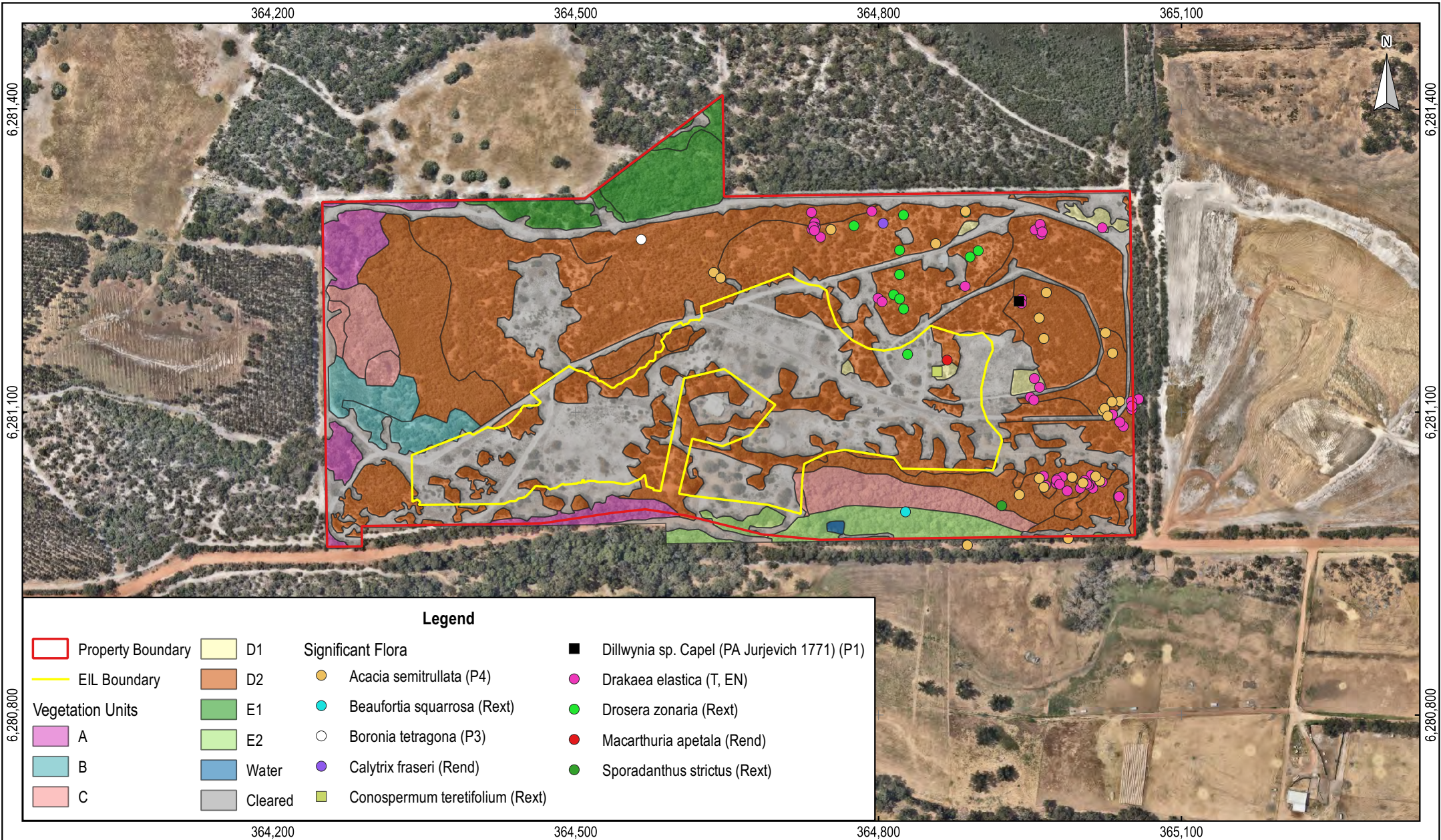
0 100 200 m

Ludlow Holdings
 Lot 43 Plantation Road, Ludlow

Figure 7
Vegetation Complexes

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





Legend

- | | | | |
|-------------------------|---------|--|---|
| Property Boundary | D1 | Significant Flora | <i>Dillwynia</i> sp. Capel (PA Jurjevich 1771) (P1) |
| EIL Boundary | D2 | <i>Acacia semitrullata</i> (P4) | <i>Drakaea elastica</i> (T, EN) |
| Vegetation Units | E1 | <i>Beaufortia squarrosa</i> (Rext) | <i>Drosera zonaria</i> (Rext) |
| A | E2 | <i>Boronia tetragona</i> (P3) | <i>Macarthuria apetala</i> (Rend) |
| B | Water | <i>Calytrix fraseri</i> (Rend) | <i>Sporadanthus strictus</i> (Rext) |
| C | Cleared | <i>Conospermum teretifolium</i> (Rext) | |

Scale: 1: 5,000
Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)
0 100 200 m

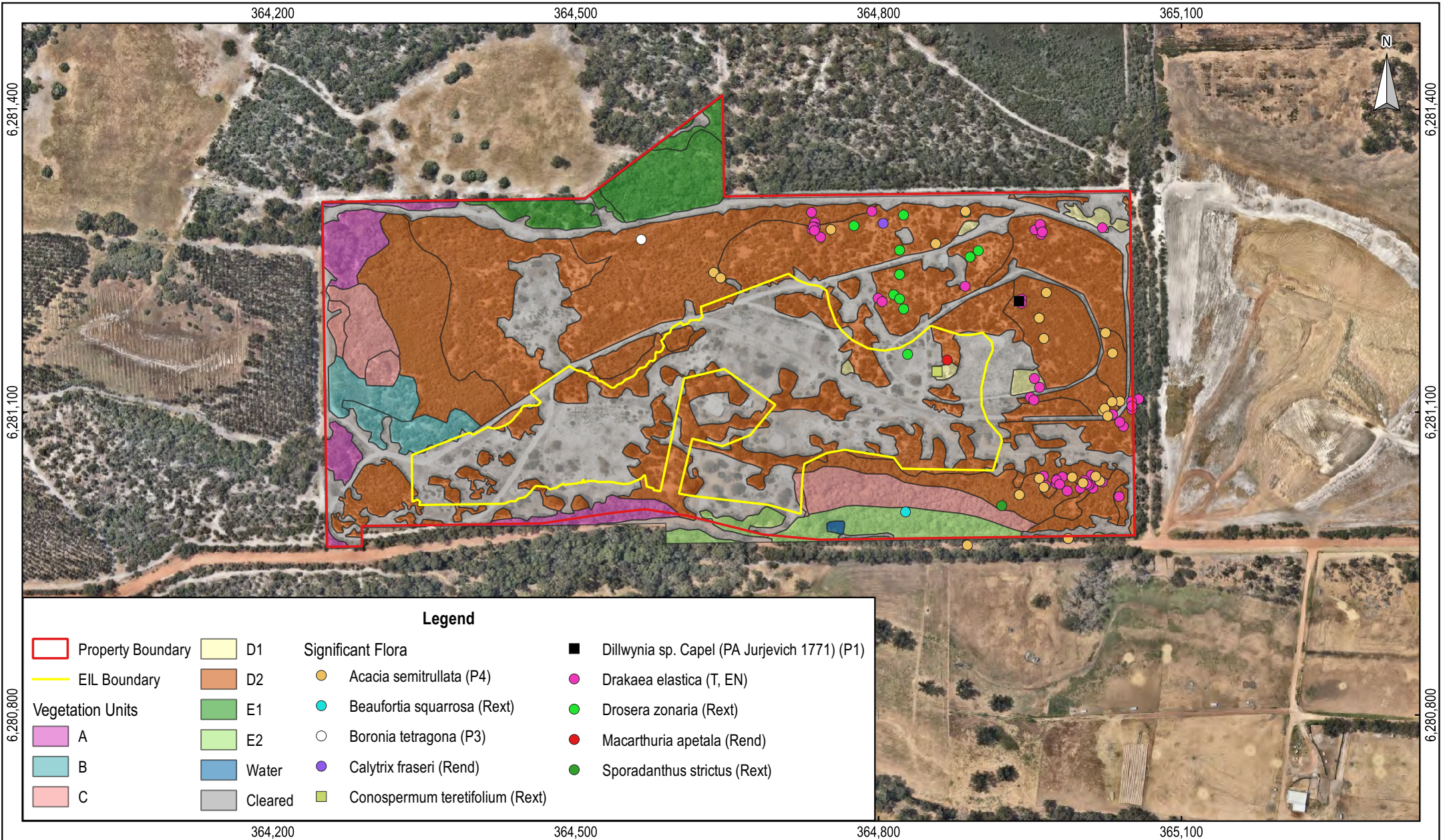
Ludlow Holdings
Lot 43 Plantation Road, Ludlow

Figure 8

Vegetation Units and Significant Flora

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





Legend

- | | | | |
|-------------------------|---------|--|---|
| Property Boundary | D1 | Significant Flora | <i>Dillwynia</i> sp. Capel (PA Jurjevich 1771) (P1) |
| EIL Boundary | D2 | <i>Acacia semitrullata</i> (P4) | <i>Drakaea elastica</i> (T, EN) |
| Vegetation Units | E1 | <i>Beaufortia squarrosa</i> (Rext) | <i>Drosera zonaria</i> (Rext) |
| A | E2 | <i>Boronia tetragona</i> (P3) | <i>Macarthuria apetala</i> (Rend) |
| B | Water | <i>Calytrix fraseri</i> (Rend) | <i>Sporadanthus strictus</i> (Rext) |
| C | Cleared | <i>Conospermum teretifolium</i> (Rext) | |

Scale: 1: 5,000
Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)
0 100 200 m

Ludlow Holdings
Lot 43 Plantation Road, Ludlow

Figure 8

Vegetation Units and Significant Flora

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





Figure 10: Clearing Extent in 2003

3.8.4 Flora Assemblage

Ecoedge (2022) identified 153 vascular flora taxa within Lot 43, of which twelve ($\approx 7.8\%$) were introduced taxa. Two Declared pest plants, *Asparagus asparagoides* (Bridal creeper) and *Zantedeschia aethiopica* (Arum Lily), were recorded on Lot 43, outside the proposed extraction area. The Bridal creeper is also a Weed of National Significance (WoNS).

3.8.5 Significant Flora

Significant flora recorded by Ecoedge (2022) on Lot 43 are listed in Table 4 and shown in Figure 8. The significant flora included one Threatened species, three Priority species, three species that were potential range extensions and three potential range end species.

Table 4: Significant Flora on Lot 43 (Ecoedge 2022)

Species	Individuals within Lot 43	Individuals within Extraction Area
<i>Drakaea elastica</i> (T)	193	0
<i>Dillwynia</i> sp. Capel (P1)	1	0
<i>Boronia tetragona</i> (P3)	1	0
<i>Acacia semitrullata</i> (P4)	88	0
<i>Beaufortia squarrosa</i> (Range extension)	5	0
<i>Sporadanthus strictus</i> (Range extension)	3	0
<i>Drosera zonaria</i> (Range extension)	1140	100
<i>Calytrix fraseri</i> (Range end)	5	0
<i>Conospermum teretifolium</i> (Range end)	4	4
<i>Macarthuria apetala</i> (Range end)	1	1

3.9 TERRESTRIAL FAUNA

A fauna assessment of Lot 43 was completed by Greg Harewood (Harewood 2022, Appendix 2). It included a desktop assessment, a basic fauna assessment, and a targeted survey for Black Cockatoos and Western Ringtail Possums. A total of 32 native fauna species, mainly common birds, were recorded within the survey area.

3.9.1 Fauna Habitats

The survey by Harewood (2022) found that Lot 43 contained a mosaic of remnant native vegetation, regrowth, and cleared land around an array of existing infrastructure. A total of seven fauna habitat types were recorded, of which four are within the proposed extraction area (Table 5, Figure 11).

Table 5: Habitat Types within Lot 43

Habitat type	Description	Total within Lot 43 (ha)*	Within Extraction Area (ha)
Unit A	Medium open forest of marri over a very open low woodland over a tall sparse shrubland over a fernland or grassland on grey sandy loam.	0.85	None
Unit B	Open low woodland of paperbark over a sedgeland with patches of tall shrubland over a low shrubland over an open grassland/forbland on grey sand.	0.63	0.002
Unit C	Very open medium woodland of marri over medium woodland of paperbark over a tall shrubland over a low shrubland over an open sedgeland and open forbland on grey sand	1.16	0.02
Unit D	Tall shrubland with scattered emergent trees such as jarrah, peppermint, Banksia and Nuytsia on grey sand	13.32	1.87
Unit E	Medium woodland of marri and flooded gum over low woodland of peppermint and paperbark over open medium shrubland over a low sedgeland and open forbland on grey-brown sandy loam or red-brown loam.	1.89	None
Existing Cleared Areas		9.53	4.90
Artificial Dam (Soak)		0.02	None
Total		27.41	6.79

*Includes the entire survey (27.41 ha) that was slightly larger than the property (27.13 ha).

The fauna habitats on Lot 43 range from completely degraded (existing cleared areas) to very good (intact remnant native vegetation), however the majority is degraded, largely a consequence of historical clearing and livestock grazing (Harewood 2022). Given the degree of disturbance, the original fauna assemblage within the survey area is likely to be depauperate in many aspects, particularly the ground dwelling species that rely on dense native understorey (midstorey and ground cover) vegetation, which is absent/sparse in many areas on the property.

The areas of more consistent remnant vegetation were noted as likely to be utilised by a wider array of fauna species to some degree, with the majority fauna present being common bird species (Harewood 2022).

3.9.2 Significant Fauna

Evidence of four significant fauna species were recorded on Lot 43 in the fauna survey (Harewood 2022). Of the four significant species identified, three are threatened (T) - Baudin's Black Cockatoo, the Forest Red-tailed Black Cockatoo, and the Western Ringtail Possum - and one is Priority 4 (P4) - the Quenda. A further seven significant fauna species were assessed as 'possibly occurs' based on habitat and known records, however no evidence of their presence was recorded during the survey. Table 6 presents the significant fauna species recorded or possibly occurring within the survey area.

A total of 49 trees within the survey area were recorded as having a DBH of >50 cm (Figure 11, Harewood 2022). These trees are considered large enough to develop a hollow suitable for Black Cockatoo breeding at some future point. The majority of these trees (35) appeared to contain no hollows, and 13 trees contained apparent hollows that were assessed as unlikely to be suitable for nesting due to their small size, unsuitable orientation, or low height to ground level. One tree contained at least one hollow potentially suitable for Black Cockatoo nesting, however, no signs of use were recorded (Harewood 2022). Of the trees recorded as having a DBH > 50 cm (Harewood 2022), seven are located within the proposed extraction area, including one trees with hollows that are not suitable for Black Cockatoo breeding. The tree containing the potentially suitable hollow is located outside the proposed extraction area (Figure 11).

Evidence of Black Cockatoo foraging was observed in the survey area, in the form of chewed marri fruits, attributed to either the Forest Red-tailed Black Cockatoo or the Baudin's Black Cockatoo (Harewood 2022). No previously documented evidence of Black Cockatoo roosting was found within the survey area, nor were signs of roosting noted during the field assessment (Harewood 2022).

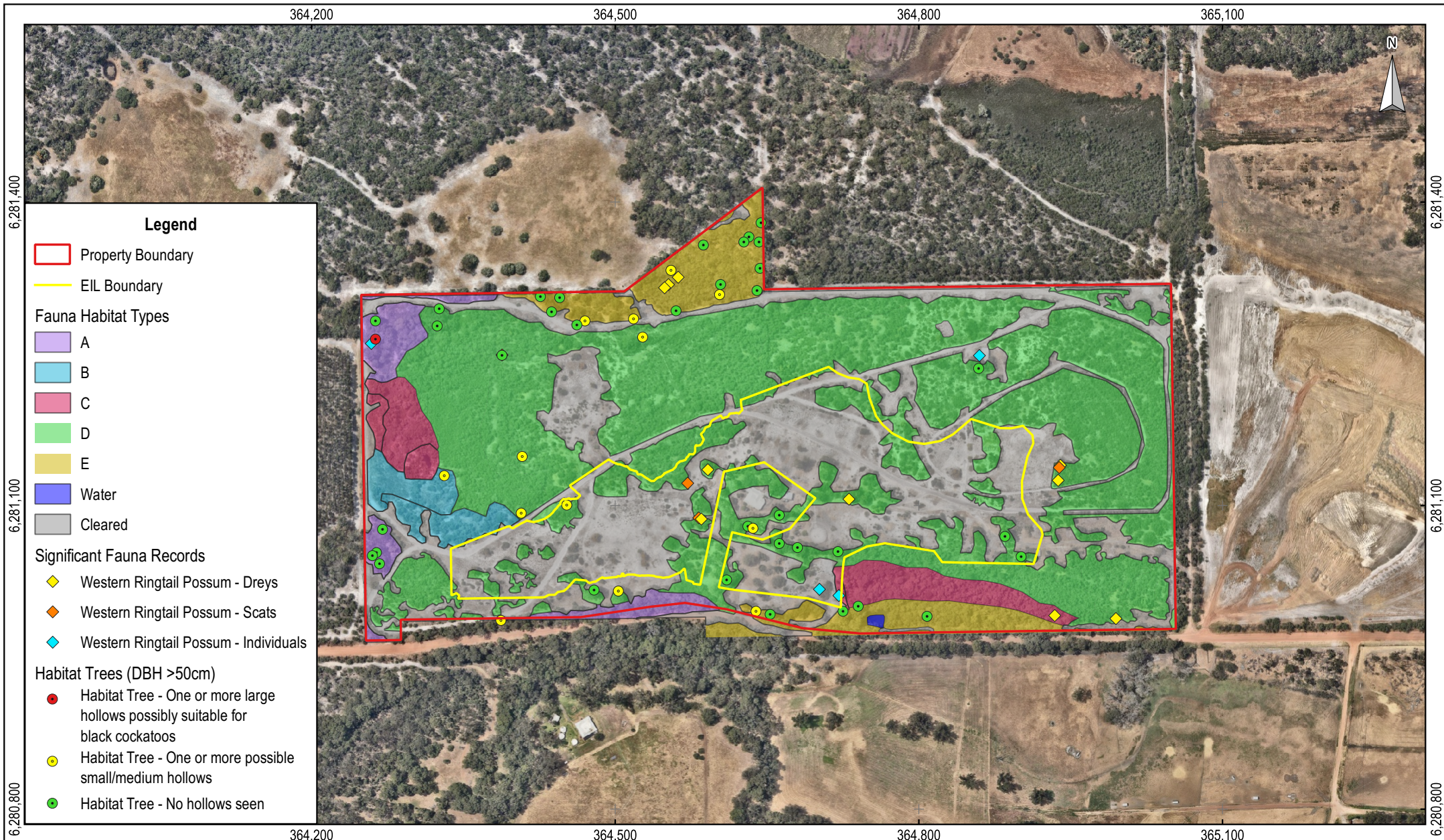
Evidence of Western Ringtail Possums was recorded during the daytime survey in the form of scats and dreys (Figure 11). In addition, some of the hollow bearing DBH > 50 cm trees recorded, were considered likely to provide suitable daytime refuge for the possum (Harewood 2022). A total of five individuals were observed during the nocturnal survey (Figure 11). The fauna habitat assessment also noted that most of the remnant vegetation present appeared to be suitable for Western Ringtail Possums, although occupancy within the survey area is likely varied, with favouritism for denser native woodland/low woodland habitat (and to an extent tall shrubland). It was noted that overall occupancy in the survey area is likely to be low.

Diggings attributed to the Quenda were observed within the survey area. It was noted that this species potentially utilises all areas with dense groundcover in the survey area.

Table 6: Significant Fauna Summary

Common Name (Species Name)	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence
	EPBC Act	BC Act/DBCA Priority			
Baudin's Black Cockatoo (<i>Calyptorhynchus baudinii</i>)	T(EN)	T(EN)	Mainly eucalypt forests where it feeds primarily on the marri seeds.	Yes	Known to Occur.
Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>)	T(EN)	T(EN)	Forests, woodlands, heathlands, farms; feeds on Banksia, Hakea and Marri.	Yes	Possibly Occurs.
Coastal Plains Skink <i>Ctenotus ora</i>	-	P3	Sandy substrates with low vegetation (including heath) in open Eucalyptus/Corymbia woodland over Banksia	Yes	Possibly Occurs
Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i>	T(VU)	T(VU)	Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble	Yes	Known to Occur.
Masked Owl (SW population) <i>Tyto n. novaehollandiae</i>	-	P3	Roosts and nests in heavy forest, hunts over open woodlands and farmlands.	Yes	Possibly Occurs.
Peregrine Falcon <i>Falco peregrinus</i>	-	OS	Diverse from rainforest to arid shrublands, from coastal heath to alpine. Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes.	Yes	Possibly Occurs.
Quenda <i>Isodon fusciventer</i>	-	P4	Dense scrubby, often swampy, vegetation with dense cover	Yes	Known To Occur
South-west Brush-tailed Phascogale <i>Phascogale tapoatafa wambenger</i>	-	CD	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover.	Yes	Possibly Occurs.
Swan Coastal Plain Shield-backed Trapdoor Spider <i>Idiosoma sigillatum</i>	-	P3	Burrows of this species usually found in Banksia woodland and heathland on sandy soils.	Yes/Marginal	Possibly Occurs.
Western Ringtail Possum <i>Pseudocheirus occidentalis</i>	T(CR)	T(CR)	Coastal peppermint, coastal peppermint-tuart, jarrah-marri associations, sheoak woodland, and eucalypt woodland and mallee.	Yes	Known To Occur
Western False Pipistrelle <i>Falsistrellus mackenziei</i>	-	P4	Wet sclerophyll forest dominated by karri and in high rainfall zones of the jarrah and marri forest.	Yes	Possibly Occurs.

CR = Critically Endangered, EN = Endangered, VU = Vulnerable, Mi = Migratory, Ma = Marine, CD = Conservation Dependent, P = Priority
T = Threatened, OS = Other Specially Protected Fauna



Scale: 1: 5,000
 Original Size: A4

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 100 200 m

Ludlow Holdings
 Lot 43 Plantation Road, Ludlow

Figure 11

Fauna Values

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

MBS
 ENVIRONMENTAL

3.10 HERITAGE

3.10.1 Heritage Places

Searches of the World, Commonwealth, National, State, and Shire heritage registers indicated that the property (inclusive of the proposed extraction area) does not contain any registered heritage places (DAWE 2022a, 2022b, DPLH 2022a, 2022b, Heritage Council 2022, Shire of Capel 2022b). The closest state heritage site (Lexden Park, 3022) is located 4.5 km to the northeast (Heritage Council 2022). The closest shire heritage site (Capel Rifle Range, 15058) is located approximately 2.2 km north of the property (Heritage Council 2022).

3.10.2 Aboriginal Heritage Sites

There are no Registered or Other Aboriginal Heritage Places, as listed by the Aboriginal Heritage Inquiry System (AHIS) within the property (DPLH 2022a). The closest Registered Aboriginal Heritage Site (Capel River, 20061) is located approximately 4 km to the north-east.

3.10.3 Native Title Claims

The property falls within the Southwest Native Title Settlement Area (Tribunal file number: WC2003/006; Federal Court file numbers: WAD6006/2003) (LGATE-005). This Native Title Claim was federally determined to exist in parts of its application area on 1 December 2021, however, the registration decision status was not accepted (National Native Title Tribunal 2021). The areas remaining for consideration for native title exist outside the property boundaries, approximately 340 kms to the north. This Native Title area does not preclude development from taking place on privately owned Lot 43.

4 POTENTIAL IMPACTS AND MANAGEMENT

4.1 FLORA AND FAUNA

The proposed extraction area covers 6.79 ha of which the majority has been cleared in the past. The main environmental impact of the project is the proposed clearing of 1.89 ha of native vegetation. This vegetation is largely native regrowth, of which approximately 96% is in Completely Degraded to Degraded condition. The proposed extraction area boundary has been delineated so that it focuses on the previously cleared and disturbed areas. Stockpiles and turnaround areas are proposed to be placed within the extraction area and therefore will require no further vegetation clearing.

The extraction area has been designed to avoid the identified population of Threatened *Drakaea elastica* and maintain a 50 m separation distance from all recorded individuals of the species. The extraction area avoids all recorded Priority flora species as well. No Threatened or Priority Ecological Communities will be directly impacted. There will be minor direct impact on three potentially significant flora species (one potential range extension species and two potential range end species), and this will be further defined as part of the NVCP process with DWER. Potential indirect impacts of the proposed operations on flora (e.g., dust) are expected to be effectively managed through the range of management measures described in this document.

While the fauna habitat value of the proposed extraction area is generally limited due to the mostly Degraded to Completely Degraded nature of the vegetation, the proposed clearing of 1.89 ha of native vegetation will result in the removal of:

- Some suitable foraging and potential roosting habitat for Black Cockatoos.
- Seven DBH trees with no hollows suitable for Black Cockatoo nesting, while retaining 42 DBH trees.
- Suitable habitat for the Threatened Western Ringtail Possum.
- Suitable habitat for Quenda (P4) and other significant fauna species with the potential to occur but not recorded (Carnaby's Black Cockatoo, South-west Brush-tailed Phascogale, Coastal Plains Skink, Masked Owl, Peregrine Falcon, Swan Coastal Plain Shield-backed Trapdoor Spider, Western False Pipistrelle) (Table 6).

Approximately 16 ha of native vegetation will be retained on Lot 43, which is 89% of the mapped extent. This vegetation will continue to provide suitable habitat for the significant flora and fauna and connectivity through the property during the operations. Further, a portion of the 6.79 ha extraction area will be revegetated back to native vegetation. This portion will be at least 2.18 ha.

The significance of the impacts of the proposed vegetation clearing and the management/mitigation/offset measures required to balance these will be determined by DWER as part of the NVCP process. As part of this process, various measures to reduce, mitigate, and offset impacts of the native vegetation clearing will be considered.

At a minimum, the following measures will be implemented during the operations to manage impacts on flora and fauna:

- Demarcating the extraction area and the proposed clearing area in the field prior to disturbance to avoid off site impacts.
- Undertaking vegetation clearing in stages corresponding to the extraction stages from west to east. Clearing of the next stage may start only once the extraction of the previous stage is nearing completion.
- Engaging a licenced and appropriately qualified fauna specialist to inspect the clearing area ahead of vegetation disturbance and be present to during the vegetation clearing to move along or capture and relocate fauna.

- Removing and stockpiling topsoil, retaining some logs and larger branches, and mulching vegetation for later use in rehabilitation.
- Implementing weed management measures as per Section 4.2.
- Implementing dieback management measures as per Section 4.3.
- Implementing dust management measures as per Section 4.5
- Implementing groundwater management measures as per Section 4.8
- Implementing drainage management as per Section 4.10.
- Implementing monitoring measures to avoid indirect impacts on *Drakaea elastica* (T).
- Implementing a rehabilitation plan as per Section 5.

4.2 WEEDS

Due to the disturbance history of the site, the extraction area supports a range of weed species, most of which are common in the local area. Declared pest plants Bridal creeper and Arum Lily were recorded on Lot 43, of which Bridal creeper is also a Weed of National Significance (WoNS).

The following measures will be undertaken to minimise the risk of introducing and spreading weeds:

- Clean earth-moving machinery of soil and vegetation prior to entering and leaving the site.
- Ensure that no known weed affected soil, mulch, fill, or other material is brought on site.
- Restrict the movement of machines and other vehicles to the limits of the extraction area.
- Undertake targeted control of Bridal creeper and Arum Lily prior to clearing of native vegetation.
- During extraction operations, undertake weed control within the extraction area to prevent the spread of weeds.
- During rehabilitation activities, undertake weed control as necessary to minimise weed spread and to prevent weeds from compromising the end land use.

4.3 DIEBACK

No formal dieback survey has been undertaken on the property, however the flora and vegetation survey by Ecoedge (2022) concluded that in addition to previous vegetation clearing, *Phytophthora* dieback was the likely reason for the death and absence of *Banksia* spp. in parts of the property where the species would be expected to occur. Large parts of the property, including the proposed extraction area, are likely to be formally uninterpretable for dieback due to the level of historical disturbance and the lack of indicator species.

As dieback is likely to be present, but its spread is unlikely to be able to be accurately determined, the management measures will focus on isolating the extraction area from the rest of the property to ensure the proposed operations will not exacerbate the spread of dieback in the area.

The following measures will be undertaken to minimise the risk of introducing and spreading dieback:

- Educate all staff on the environmental impacts of dieback and provide training in how to clean earth-moving machinery, vehicles, equipment, and shoes of soil and vegetation prior to entering and leaving the site.
- Clean earth-moving machinery, vehicles, equipment, and shoes of soil and vegetation prior to entering and leaving the site.
- Trucks leaving the site will be required to have their load covered.

- Ensure that no known dieback affected soil, mulch, fill, or other material is brought on site.
- Restrict the movement of machines and other vehicles to the limits of the extraction area.

4.4 LANDFORM AND SOILS

Based on 'soil landscape land quality' mapping (various DPIRD data layers - DPIRD 2019c), the main degradation risk on the soils within the proposed extraction area is wind erosion (DPIRD-016). This will be managed as follows:

- Clearing of native vegetation will be staged (up to 2 ha each), to minimise the area of bare ground open to the elements at any one point in time.
- Post-extraction rehabilitation will be undertaken gradually as extraction progresses to minimise the area of bare ground open to the elements at any time. In the native vegetation rehabilitation areas, mulch will be applied for a range of purposes, including to reduce wind erosion.
- A water truck will be available for dust suppression when required to minimise wind erosion.
- Soil binding agents or other dust control measures may be utilised if necessary to provide further reduction in wind erosion.

The proposed maximum final batter slopes of 1:6 (vertical : horizontal) are in line with naturally occurring slopes along the sand dune ridge and are also in accordance with approved final batter slopes for the other extractive sites in the local area. These slopes have been shown to be stable and are suitable for revegetation.

4.5 DUST

Extractive operations have potential to generate significant dust, however effective management measures are available to limit its generation. Please refer to the separate Dust Management Plan for further information on dust risks, their management and monitoring.

4.6 NOISE

Noise impacts on sensitive human receivers and their management are addressed separately in the DA. Considering the operations will be limited to standard noise regulation hours and, therefore, will not interfere with the typically quiet night time hours, the environmental impacts of the noise are expected to be minor. The noise impacts are also temporary in nature, ceasing once the extraction area has been rehabilitated.

4.7 VISUAL IMPACTS

The proposed operations are generally well screened by native vegetation from surrounding properties. Part of the operations may be visible from a small section of Plantation Road at the entrance to the site. Any visual impacts of the operations are expected to be minor and temporary in nature as the post-extraction landform and land use will blend into the surrounding area.

4.8 GROUNDWATER

The proposed operations are not expected to have significant impacts to groundwater levels or water quality due to the following:

- Separation distance to maximum groundwater level will remain at least 0.5 m.
- No groundwater abstraction or dewatering is proposed as part of the operations.
- The proposed vegetation clearing is limited to approximately 2.18 ha of largely degraded regrowth vegetation, with close to 88% of vegetation on the property being retained.

- No hydrocarbons or other chemicals will be stored on site. On-site refuelling of equipment will be from a mobile service vehicle carrying appropriate spill prevention and mitigation equipment. No major repairs or maintenance will take place on site.

4.9 SURFACE WATER

There are no signs of surface water (permanent or ephemeral) within the proposed extraction area. The closest surface water are the two small soaks on the property and Ludlow River on the southern side of Plantation Road. No indirect impacts on these are expected as long the groundwater management measures (Section 4.8) and drainage control measures (Section 4.10) are implemented.

The proposed sand extraction area intersects 1.26 ha of the mapped extent of the Multiple Use palusplain wetland. The majority of that is already cleared (0.83 ha) or in a Completely Degraded (0.15 ha) or Degraded (0.21 ha) condition, with only 0.06 ha in Good Condition. This 0.06 ha is vegetation unit D2 and is not wetland type vegetation. Considering the very small amount of clearing associated with the very large Multiple Use wetland, the proposed sand extraction is not expected to have a significant impact on wetlands.

4.10 DRAINAGE

Due to the free draining nature of the sandy soil and the gently sloping surface, stormwater is expected to percolate into the soil with nil to minimal runoff. The following drainage measures will be put in place to manage any runoff that might occur in major rainfall events:

- Clean stormwater from outside the project area will be diverted away from operational areas.
- Stormwater from the project area will initially be contained within the project area.
- Retention areas will be used to reduce turbidity.
- Overflow spillways and paths are designed to mitigate potential erosion and downstream water quality issues.
- Ripping along contour and revegetation of the project area will minimise future stormwater runoff and erosion.

4.11 ABORIGINAL HERITAGE

There are no registered Aboriginal heritage sites on the property. Should any potential artifacts or remains be discovered during operations, any works in the vicinity will stop immediately and the matter will be referred to the Department of Planning, Lands and Heritage. If bones are discovered, then the police will also be advised. The applicant notes that it is an offence under the WA *Aboriginal Heritage Act 1972* to interfere with any Aboriginal site unless written permission is obtained from the relevant Minister.

5 REHABILITATION

5.1 INDICATIVE REHABILITATION AREAS

It is expected that at least 2.18 ha area (more than the 1.89 ha clearing area) will be revegetated with native vegetation on site following sand extraction to mitigate/offset the impacts of vegetation clearing. The exact revegetation commitments will be determined as part of the NVCP assessment process with DWER and therefore only an indicative revegetation area (Area A) is shown in Figure 12. The mitigation/offset revegetation area will be covered by a conservation covenant that will limit future land uses.

The remaining portion of the extraction area (Area B, Figure 12) will cater for future rural/residential land uses and any such developments will be subject to separate approvals. This area will not be rehabilitated as a formal mitigation/offset measure and will not be covered by a conservation covenant. Following the completion of sand extraction, this area will be rehabilitated to pasture.

5.2 INDICATIVE REHABILITATION MEASURES

Sand extraction and rehabilitation will proceed gradually in stages. Once extraction of sand has been completed in a stage, it will be rehabilitated as extraction moves forward. The rehabilitation areas and measures will be determined in consultation with DWER as part of the NVCP process. Indicative revegetation measures are provided in the following sections. Some of these works will be undertaken prior to or during the extractive operations in preparation for rehabilitation. As part of decommissioning, any temporary site infrastructure (e.g., portable toilets) and waste/debris will be removed.

5.2.1 Clearing and Handling of Native Vegetation

Key measures relating to clearing and handling of native vegetation include the following:

- Clearing of native vegetation will be undertaken in stages.
- Some of the cleared vegetation, such as canopy material and smaller branches, will be mulched and stockpiled for later used in rehabilitation.
- Other plant matter, such as larger branches and some tree trunks removed from the clearing areas will be stockpiled and used in native revegetation areas to create microhabitats and assist with topsoil retention.

5.2.2 Soil Management and Earthworks

Key measures relating to soil management and earthworks include following:

- 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 into rehabilitation areas and spread across finalised land surfaces to avoid stockpiling, thus maximising seed and microbial benefits. When necessary, topsoil will be stockpiled for later use.
- Sand extraction will proceed in stages. As each stage of extraction phase is completed, the landform will be finalised in accordance with the latest approved development plan (maximum batter slopes of 1:6). The final contours shall be achieved and confirmed by way of digital survey.
- Prior to topsoil return, the pit floor will be deep ripped to remove any compaction that may have occurred during the sand extraction operations. Other areas of potential compaction will also be ripped. The removal of compaction is necessary to maximise plant root and water penetration into the soil during revegetation. Due to the sandy nature of the soils, the pit batter slopes are not expected to require deep ripping.
- The stockpiled topsoil will be re-spread across the extraction area to 50-100 mm deep. A thin layer of the stockpiled mulch will also be added to assist in erosion control and moisture retention.

- Following the return of topsoil and mulch, all areas will be shallow ripped along contour. This will create rip lines that will assist in stormwater retention and infiltration. In native revegetation areas, seedlings will be planted into these lines. The reason ripping is undertaken after spreading of topsoil and mulch is to avoid compacting and otherwise disturbing the rip lines while moving topsoil/mulch. Ripping will not occur in close vicinity to retained native trees to protect their root systems.

5.2.3 Revegetation

At this stage, the objective for Area A (Figure 12) is to establish self-sustaining native vegetation in at least Good condition to mitigate/offset the proposed vegetation clearing (Figure 12). The species mixture will be tailored to suit the post extraction landform and depth to groundwater and will comprise species currently occurring on the property (see Ecoedge 2022). The likely occurrence of Phytophthora dieback will be considered in the species selection. The revegetation will include species that provide habitat for the significant fauna currently utilising the area (e.g., Black Cockatoos and Western Ringtail Possum). Details of native revegetation will be further defined as part of the NVCP process.

Area B will be rehabilitated to pasture in order to stabilise the soil and cater for rural/residential land uses.

5.2.4 Weed Control

Weed control measures include those described for the operational stage (see Section 4.2) as well as the following specific to rehabilitation:

- Where necessary, weeds will be controlled prior to seeding/planting with a broad spectrum herbicide (or similar).
- Spot spraying with species selective herbicide will also be undertaken as necessary after seed germination and plant establishment.












5.2.5 Grazing Control

The key grazing control measure will be the installation of a fence around native revegetation areas that will minimise the potential for access by stock, kangaroos and rabbits.

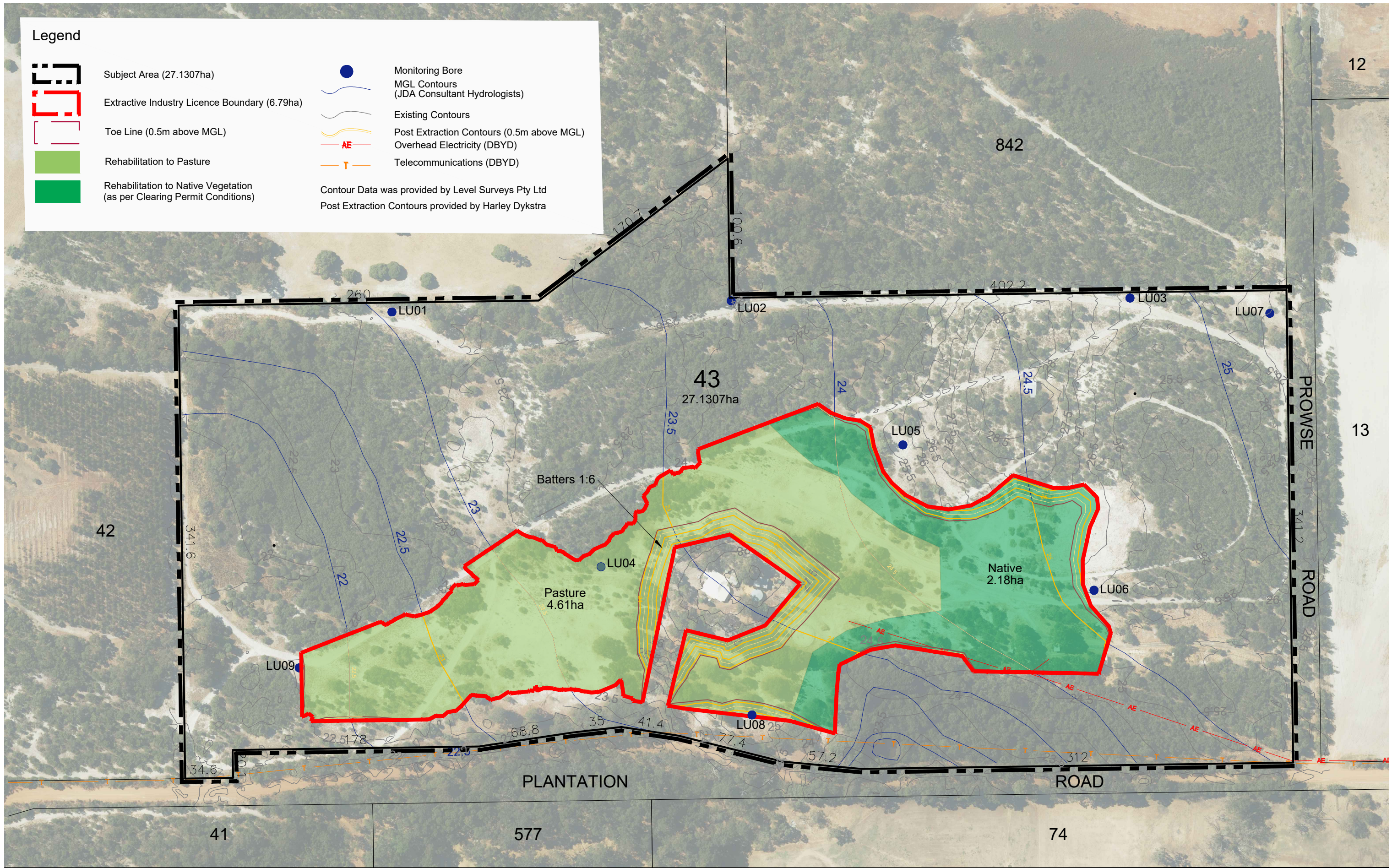
5.2.6 Dieback Management

Dieback management measures described in Section 4.3 also apply to rehabilitation.

Legend

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Toe Line (0.5m above MGL)
-  Rehabilitation to Pasture
-  Rehabilitation to Native Vegetation (as per Clearing Permit Conditions)
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours
-  Post Extraction Contours (0.5m above MGL)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

Contour Data was provided by Level Surveys Pty Ltd
Post Extraction Contours provided by Harley Dykstra



Post Extraction Plan
Lot 43 (546) Plantation Road, Ludlow



Date: 9 Nov 2022 Scale: 1:2500 @ A3 File: 22-336 CP03B Staff: DL GW Checked: DL

Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
PO Box 7375 Cloisters Square, Perth Western Australia 6850.
T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au

© Element Advisory WA Pty Ltd This concept has been prepared for the purpose of meeting client specifications. The drawing does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Although care has been taken in the compilation of this drawing by Element Advisory WA Pty Ltd, all parties associated with the proposed property development disclaim all responsibility for any errors or omissions. The right is reserved to change the plan at any time. Liability is expressly disclaimed by Element Advisory WA Pty Ltd for any loss or damage which may be sustained by any person acting on any visual impression gained from this drawing.

5.3 INDICATIVE COMPLETION CRITERIA

Indicative completion criteria are presented in Table 7. The completion criteria for native vegetation will be further developed as part of the NVCP process.

Table 7: Indicative Completion Criteria

Aspect	Completion Criteria
Landform	Final landform is in accordance with an approved post-extraction plan.
Soil Profile	Topsoil has been replaced in all rehabilitation areas.
Pasture - Cover (Area B only)	Pasture cover is sufficient to stabilise soil.
Vegetation – Species Composition (Area A only)	For each target revegetation type, the revegetation supports a minimum of 25 locally occurring native species.
Vegetation – Density (Area A only)	On average across the revegetation area, the stem densities of native flora are: <ul style="list-style-type: none"> • At least 600 trees per hectare • At least 2,000 shrubs per hectare • At least 2,400 herbs/grasses/climbers per hectare
Vegetation – Condition (Area A only)	Vegetation is self-sustaining.
Significant Weeds (Areas A and B)	No declared pest plants or Weeds of National Significance present.
Common Weeds (Area A only)	Weed cover less than 20%.
Bare Ground	No bare patches of ground more than 30 m ² in size.

5.4 INDICATIVE MONITORING AND MITIGATION MEASURES

Monitoring and mitigation measures have been broken down to those relating to final landform (Areas A and B), pasture (Area B) and native vegetation (Area A), and these are covered in the following sections.

5.4.1 Final Landform

Monitoring and mitigation measures relating to the final landform that will be undertaken in all rehabilitation areas are described in Table 8.

Table 8: Monitoring and Mitigation Measures for Final Landform

Item	Monitoring	Frequency	Mitigation
Landform	Licensed surveyor will confirm that the final landform is in accordance with the final contour plan.	Once per rehabilitation stage (typically an annual survey capturing new areas).	Corrective works as necessary.
Soil Profile	Photographic monitoring will be undertaken to show that topsoil has been respread.	Once per rehabilitation stage as part of vegetation monitoring.	Corrective works as necessary.
Erosion	Visual checks for landform stability and signs of erosion.	At least annually until completion criteria met.	Corrective works as necessary.

5.4.2 Pasture

Pasture monitoring and mitigation will be ongoing for the life of the extraction process and two years after the last seeding. Mitigation will be undertaken as necessary to address any issues identified through monitoring. The monitoring and mitigation of pasture as summarised in Table 9 will be undertaken by the proponent.

Table 9: Monitoring and Mitigation Measures for Pasture

Monitoring	Mitigation
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.

5.4.3 Native Vegetation

Formal revegetation monitoring will occur at least once per year in spring until the completion criteria have been met and maintained for two years. This monitoring will be undertaken by a suitably qualified and experienced environmental professional. Additional informal monitoring will be undertaken by the sand extraction project operators and landowners to identify and respond to any maintenance needs as quickly as possible and maximise progress towards completion criteria. Separate seedling survival checks may also be undertaken as need be in autumn in preparation for planting season.

Vegetation monitoring will comprise the following:

- Mixture of permanent and random quadrats (10 m by 10 m each, minimum one per hectare).
- Vegetation monitoring survey will be undertaken once per year in spring until completion criteria are met and maintained for two years.
- During each survey the following will be recorded for each quadrat:
 - Number of native plants present (planted, seeded, or naturally recruited).
 - Species of native plants (planted, seeded, or naturally recruited).
 - Maximum height for each native species.
 - Native vegetation structure.
 - Native vegetation % foliage cover.
 - Species of weeds.

- Estimated live % foliage cover of weeds.
- Vegetation condition (Keighery 1994).
- Signs of grazing, disease, pests, lack of moisture, erosion or other landform instability, or other factors adversely impacting on revegetation.
- Location coordinates and photographs.
- Boundary fence inspected to determine need for maintenance.
- Opportunistic traverses undertaken across the revegetation area when moving between monitoring locations. During these traverses, notes will be made of following:
 - Species of native plants (to obtain a record of species potentially not present in quadrats).
 - Species of weeds (particularly any significant weed species to be eradicated).
 - Signs and location of any grazing, disease, pests, lack of moisture, erosion or other landform instability, or other factors adversely impacting on revegetation.
 - Location of any bare patches larger than 30 m².

Monitoring results will be assessed against the completion criteria and mitigation measures will be implemented if necessary. These mitigation measures include but are not limited to following:

- Supplementary planting/seeding.
- Weed and/or pest control.
- Fence maintenance.

6 CONCLUSIONS

The proposed sand extraction project has been designed to manage and minimise environmental impacts through the measures detailed in this document. The significance of the impacts of the proposed native vegetation clearing and the management/mitigation/offset measures required to balance these will be determined by the DWER as part of the NVCP process.

7 REFERENCES

- Australian Government. (2022). *Environment Protection and Biodiversity Conservation Act 1999*. <https://www.legislation.gov.au/Details/C2016C00777> (accessed May 2022).
- Bureau of Meteorology. (2021). *Climate Data Online*. <http://www.bom.gov.au/climate/data/> (accessed June 2022).
- Commander, D.P. (1984). *The Bunbury Shallow-Drilling Groundwater Investigation*. Geological Survey of Western Australia, Report 12, 1 January 1984.
- Department of Agriculture, Water and the Environment. (2022a). *Australia's National Heritage list*. <http://www.environment.gov.au/heritage/places/national-heritage-list> (accessed June 2022). Canberra: DAWE.
- Department of Agriculture, Water and the Environment (DAWE). (2022b). *Australia's World Heritage List*. <http://www.environment.gov.au/heritage/places/world-heritage-list> (accessed June 2022). Canberra: DAWE.
- Department of Biodiversity, Conservation and Attractions (2021). *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*. <https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain> (accessed June 2022).
- Department of Planning, Lands and Heritage (2022a). *Aboriginal Heritage Inquiry System*. <https://www.wa.gov.au/organisation/department-of-planning-lands-and-heritage/aboriginal-heritage> (accessed June 2022).
- Department of Planning, Lands and Heritage (DPLH). (2022b). *ALT Estate (DPLH-003)*. <https://catalogue.data.wa.gov.au/dataset/alt-estate> (accessed June 2022).
- Department of Primary Industries and Regional Development. (2019a). *Pre-European Vegetation (DPIRD-006)*. <https://catalogue.data.wa.gov.au/dataset/pre-european-dpird-006> (accessed June 2022).
- Department of Primary Industries and Regional Development. (2019b). *Soil Landscape Mapping - Best Available (DPIRD-027)*. <https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available> (accessed May 2022).
- Department of Primary Industries and Regional Development (DPIRD). (2019c). *Soil landscape land quality (dataset series)*. <https://catalogue.data.wa.gov.au/dataset> (accessed June 2022).
- Department of Water (2022a). *Water Register*. <https://maps.water.wa.gov.au/#/webmap/register> (accessed June 2022).
- Department of Water and Environmental Regulation. (2018a). *Hydrographic Catchments - Basins (DWER-027)*. <https://catalogue.data.wa.gov.au/dataset/hydrographic-catchments-basins> (accessed May 2022).
- Department of Water and Environmental Regulation 2021a. *Clearing Regulations - Environmentally Sensitive Areas (DWER-046)*. <https://catalogue.data.wa.gov.au/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046> (accessed May 2022).
- Department of Water and Environmental Regulation. (2018b). *Hydrographic Catchments - Catchments (DWER-028)*. <https://catalogue.data.wa.gov.au/dataset/hydrographic-catchments-catchments> (accessed May 2022).
- Department of Water and Environmental Regulation. (2018c). *Hydrographic Catchments - Divisions (DWER-029)*. <https://catalogue.data.wa.gov.au/dataset/hydrographic-catchments-divisions> (accessed June 2022).

Department of Water and Environmental Regulation. (2018d). *Hydrographic Catchments - Subcatchments (DWER-030)*. <https://catalogue.data.wa.gov.au/dataset/hydrographic-catchments-subcatchments> (accessed May 2022).

Department of Water and Environmental Regulation. (2018e). *Public Drinking Water Source Areas (DWER-033)*. <https://catalogue.data.wa.gov.au/dataset/public-drinking-water-source-areas> (accessed May 2022).

Department of Water and Environmental Regulation. (2018f). *RIWI Act, Groundwater Areas (DWER-034)*. <https://catalogue.data.wa.gov.au/dataset/riwi-act-groundwater-areas> (accessed May 2022).

Department of Water and Environmental Regulation. (2018g). *RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)*. <https://catalogue.data.wa.gov.au/dataset/riwi-act-surface-water-areas-and-irrigation-districts> (accessed May 2022).

Department of Water and Environmental Regulation. (2017). *Acid Sulphate Soil Risk Map, Swan Coastal Plain (DWER-055)*. <https://catalogue.data.wa.gov.au/dataset/acid-sulphate-soil-risk-map-swan-coastal-plain-dwer-055> (accessed May 2022).

Ecoedge. (2022). *Flora and Vegetation Survey of Lot 43 Plantation Road Ludlow*. Unpublished report prepared for Ludlow Holdings Pty Ltd.

Government of Australia. (2022). Environment Protection and Biodiversity Conservation Act 1999. <https://www.legislation.gov.au/Details/C2022C00214> (accessed June 2022).

Government of Western Australia. (2022). *Biodiversity Conservation Act 2016*. <https://www.legislation.wa.gov.au/legislation/statutes.nsf/home.html> (accessed June 2022).

Government of Western Australia. (2022). *Environmental Protection Act 1986*. <https://www.legislation.wa.gov.au/legislation/statutes.nsf/home.html> (accessed June 2022).

Harewood. (2022). *Fauna Assessment of Lot 43 Plantation Road Ludlow*. Prepared for MBS Environmental Pty Ltd.

Hedde, E.M., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System. In: *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Western Australia.

Heritage Council WA. (2022). *Search Heritage Places*. <http://inherit.stateheritage.wa.gov.au/public> (accessed June 2022).

JDA Consultant Hydrologists (2022). *Groundwater Level Mapping, Lot 43 Plantation Road, Ludlow*. Unpublished report prepared for Ludlow Holdings Pty Ltd.

Keighery, B.J. (1994). *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc). Nedlands, Western Australia.

Landgate. (2022). *Native Title (Fed Court) (LGATE-005)*. <https://catalogue.data.wa.gov.au/dataset/native-title-fed-court-lgate-005> (accessed June 2022).

Mitchell, D., Williams, K. and Desmond, A. (2002). Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain Subregion). In *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Department of Conservation and Land Management. <https://www.dpaw.wa.gov.au/about-us/science-and-research/eoinformatics-research/117-a-biodiversity-audit-of-wa> (accessed June 2022).

National Native Title Tribunal. (2021). *Extract from Schedule of Native Title Applications: Anthony Bennell & Ors v State of Western Australia & Ors (Single Noongar Claim (Area 1))*.

http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/NTDA%20Extracts/WC2003_006/SNTAExtract_WC2003_006.pdf (accessed June 2022)

Shepherd, D., Beeston, G. and Hopkins, A. (2002). *Native Vegetation in Western Australia – Extent, Type and Status*. Department of Agriculture, Perth.

Shire of Capel (updated 2020). *Shire of Capel Local Planning Scheme No. 7*.
<https://www.wa.gov.au/government/document-collections/shire-of-capel-planning-information#local-planning-scheme> (accessed June 2022).

Shire of Capel. DRAFT - *Shire of Capel Local Planning Scheme No. 8*.
<https://www.capel.wa.gov.au/services/planning/strategy/> (accessed June 2022).

Shire of Capel (2018). *Shire of Capel Local Government Heritage Survey*.
<https://www.capel.wa.gov.au/services/planning/heritage/> (accessed July 2022).

Thackway, R. and Cresswell, I.D. 1995 (Eds). *An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves*, Version 4.0. Australian Nature Conservation Agency, Canberra.

Webb, A., Kinloch, J., Keighery, G. and Pitt, G. (2016). *The Extension of Vegetation Complex Mapping to Landform boundaries within the Swan Coastal Plain Landform and Forested Region of South West Western Australia*. Department of Parks and Wildlife, Bunbury, WA.

APPENDICES

APPENDIX 1: FLORA AND VEGETATION SURVEY (ECOEDGE 2022)

Reconnaissance and Targeted Flora and Vegetation Survey

Lot 43, Plantation Road, Capel



Prepared for Ludlow Holdings Pty Ltd
May 2022



PO Box 9179, Picton WA 6229
0484 771 825 | enquiries@ecoedge.com.au

Version	Origin	Review	Review date	Release approval	Issue date
V1	MBS	C. Spencer	4/05/22		
V2	R. Smith	C. Spencer	6/5/2022		
Final Draft	R. Smith	D. Brace	11/5/2022	Ecoedge	12/5/2022
Final	MBS	Ecoedge	12/7/2022	Ecoedge/MBS	20/7/2022

Executive summary

Ecoedge Environmental Services was engaged by MBS Environmental on behalf of client Ludlow Holdings Pty Ltd (the landowner) to undertake a targeted and reconnaissance flora and vegetation survey over Lot 43 Plantation Road, in the Shire of Capel.

The survey was required to identify key flora and vegetation values of the property to assist in scoping potential development opportunities and inform environmental impact assessment of a potential future development proposal.

The survey area was approximately 27.2 ha in size and comprised approximately 22 ha of remnant vegetation.

The survey was undertaken on 9 and 24 September 2020 and subsequently on 27 August and 3 September 2021 in accordance with the Environmental Protection Authority (EPA) (2016) Technical Guidance, Flora and Vegetation Surveys for Environmental Impact Assessment.

A total of one-hundred and fifty species were found during the survey.

The Threatened orchid *Drakaea elastica* (193 plants) was found at 45 locations, predominantly in the eastern most part of the survey area. This population size makes it one of the largest known for *D. elastica*.

One Priority 1 taxon *Dillwynia* sp. Capel (P.A. Jurjevich 1771) (one plant), one Priority 3 taxon *Boronia tetragona* (one plant), and eighty-seven plants of the Priority 4 flora species, *Acacia semitrullata*, were also recorded. The Priority 4 taxon *Eucalyptus rudis* subsp. *cratyantha* was also recorded in vegetation unit E2.

Several “range end” or disjunct taxa: *Beaufortia squarrosa*, *Calytrix fraseri*, *Conospermum teretifolium*, *Drosera zonaria*, *Macarthuria apetala*, *Sporadanthus strictus*, and *Taxandria fragrans* were also recorded growing in the survey area.

Two Pest Plants **Asparagus asparagoides* (Bridal creeper) and **Zantedeschia aethiopica* (Arum-lily), were recorded in the survey area.

Five vegetation units, A, B, C D1, D2, E1 and E2, were described for the survey area, with two of these units, D and E, being described and mapped as sub-units.

The two sub-units, E1 and E2, are considered to represent occurrences of the “Southern *Corymbia calophylla* woodlands on heavy soils”, a State-listed TEC.

While vegetation unit C does not correspond with any TEC or PEC, it comprises wetland vegetation of high conservation value because it contains several disjunct or “range end” taxa.

Vegetation types D1 and D2 are not occurrences of “Central *Banksia attenuata*-*Eucalyptus marginata* woodlands” (SWAFCT21a) or “Southern *Banksia attenuata* woodlands” (SWAFCT21b) or the associated “*Banksia* Woodlands of the Swan Coastal Plain” TEC/PEC

because there is either not enough Good quality vegetation (greater than 2ha) or complete absence of *Banksia attenuata* or *B. ilicifolia*.

Vegetation units B and C and sub-unit E2 are considered to represent wetland or riparian vegetation because of the presence of typical wetland species.

About one-third of the survey area is cleared, just over a third was classed as Degraded or Completely Degraded, and the remainder was Good to Excellent condition vegetation.

Two vegetation complexes are mapped to occur across the survey area: the Southern River complex and the Abba Complex, with the Southern River complex making up the bulk of the survey area. The vegetation units described for the survey are broadly representative of both described complexes. The Southern River Complex has less than 30% of its pre-European extent remaining. The Abba Complex has less than 10% remaining.

One of Beard's vegetation associations, Association 1000, is mapped across the survey area. This association is a reasonable match for survey area vegetation units. It has less than 30% of its pre-European extent remaining at all tiers of assessment.

Portions of the survey area are contiguous with vegetation linked to two formally mapped Regional ecological linkages that occur to the north of the survey area.

There are no environmentally sensitive areas within the survey area. The nearest is located approximately 830 m to the southwest of the survey area.

Contents

Executive summary.....	3
Statement of limitations	9
Reliance on data.....	9
Report for the benefit of the Client	9
1 Introduction.....	10
2 Scope and objectives	10
3 Methods.....	13
3.1 Desktop assessment.....	13
3.1.1 Significant flora likelihood of occurrence	13
3.2 Survey limitations.....	14
3.3 Field survey.....	15
4 Results desktop assessment.....	16
4.1 Biogeographic region and location	16
4.2 Landform and soils	17
4.3 Vegetation description according to pre-European mapping datasets.....	19
4.3.1 Vegetation complexes	19
4.3.2 Vegetation associations	20
4.3.3 Assessment of remaining extent against pre-European extent	22
4.4 Threatened and Priority ecological communities	24
4.5 Threatened and Priority flora.....	27
4.6 Wetlands	30
4.7 Watercourses	30
4.8 Regional ecological linkages.....	33
4.9 Environmentally Sensitive Areas.....	35
5 Field survey results	37
5.1 Flora.....	37
5.2 Post likelihood of occurrence.....	37
5.3 Threatened, Priority and other conservation significant flora	37
5.4 Pest plants	38
5.5 Vegetation Units.....	43
5.6 Vegetation condition.....	46

5.7	Conservation status of vegetation units	49
5.7.1	SWAFCT1b Southern <i>Corymbia calophylla</i> woodlands on heavy soils.....	49
5.7.2	Banksia woodlands of the SCP.....	49
5.7.3	Wetland units.....	49
6	Discussion and conclusions	52
6.1	Significance of the flora.....	52
6.2	Significance of the vegetation.....	53
6.3	Vegetation complexes and associations	53
6.4	Ecological linkages.....	54
6.5	Waterways and wetlands.....	54
6.6	Environmentally Sensitive Areas.....	54
7	References	55
	Appendix 1. Threatened and Priority flora likelihood of occurrence assessment rationale.	59
	Appendix 2. Vegetation condition scale (EPA, 2016).....	
	Appendix 3. Categories of Threatened and Priority ecological communities.	
	Appendix 4. Categories of Threatened ecological communities under the EPBC Act.....	
	Appendix 5. State Categories of Threatened and Priority list flora.....	
	Appendix 6. Categories of Threatened species under the EPBC Act.....	
	Appendix 7. Protected Matters Search Tool and NatureMap reports.	
	Appendix 8. Pre and post likelihood of occurrence.....	
	Appendix 9. Track log and relevé points.....	
	Appendix 10. List of vascular flora found within the survey area.	
	Appendix 11. Reporting forms for Threatened and Priority flora.	
	Appendix 12. Vegetation units and sub-units including photographs.	
	Appendix 13. Reporting forms for Threatened Ecological Communities.	

Table of Tables

Table 1. Limitations of the field survey with regard to assessment adequacy and accuracy.	14
Table 2. Soil mapping units occurring within the survey area (Tille & Lantzke 1990, DPIRD-027).	17
Table 3. Vegetation complexes mapped for the survey area (Webb et al., 2016).	19
Table 4. Vegetation complexes mapped within the survey area with regard to the Commonwealth retention targets (Government of Western Australia 2019a).	23
Table 5. Vegetation associations within the survey area with regard to the Commonwealth retention targets (Government of Western Australia 2019b).	23
Table 6. Threatened and Priority ecological communities occurring within assessment area (DAWE 2020, DAWE 2022, DBCA 2021a).	25
Table 7. Conservation significant flora likely to occur within the survey area.	28
Table 8. Likelihood of occurrence according to conservation status.	28
Table 9. Wetland types (adapted from Semeniuk & Semeniuk 1995).	30
Table 10. Definitions of and objectives for the different wetland management categories (EPA 2008).	30
Table 11. Linkage proximity values rating assigned to patches of remnant vegetation within a landscape (from Molloy et al., 2009).	33
Table 12. Vascular flora post-survey likelihood of occurrence according to conservation status.	37
Table 13. Description of vegetation units within the survey area.	43
Table 14. Area and percentage of the survey area in vegetation condition classes.	46
Table 15. Area and condition classes for the various vegetation unit within the survey area.	46

Table of Figures

Figure 1. Aerial photograph showing the location of the survey area.....	11
Figure 2. Aerial photograph showing the location of the survey and assessment area.	12
Figure 3. Land units mapped in and nearby the survey area (Tille & Lantzke 1990).	18
Figure 4. Vegetation complexes mapped in and nearby the survey area (Webb et al., 2016).	21
Figure 5. Threatened and Priority ecological communities within the assessment area (DBCA 2021a).	26
Figure 6. Threatened and Priority flora within the five km assessment area (DBCA 2021d)..	29
Figure 7. Geomorphic wetland type and waterways in proximity to the survey area (DBCA 2021e, Crossman & Li 2015).	31
Figure 8. Status of geomorphic wetlands in proximity to the survey area (DBCA 2021e, Crossman & Li 2015).	32
Figure 9. The survey area in relation to regional ecological linkages (Molloy et al. 2009).	34
Figure 10. ESAs within assessment area (DWER 2020).	36
Figure 11. Photographs of some of the significant taxa found within the survey area.	39
Figure 12. Significant flora within the survey area.	40
Figure 13. Location of Threatened flora (<i>Drakaea elastica</i>) within the survey area.....	41
Figure 14. Declared pest plants within the survey area.	42
Figure 15. Vegetation units within the survey area.....	45
Figure 16. Vegetation condition within the survey area.	48
Figure 17. Vegetation condition of the TEC within the survey area.....	51

Statement of limitations

Reliance on data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

Report for the benefit of the Client

The report has been prepared for the benefit of the Client and no other party. Ecoedge assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of Ecoedge or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

1 Introduction

Ecoedge Environmental Services (Ecoedge) was engaged by MBS Environmental (MBS) on behalf of Ludlow Holdings Pty Ltd (the landowner) in May 2021 to undertake a targeted and reconnaissance flora and vegetation survey over Lot 43 Plantation Road, Ludlow, within the Shire of Capel (survey area). The survey area is approximately 27.2 hectares (ha) in size and occurs within a rural setting approximately 5 kilometres (km) south-southwest of the Capel town centre **Figure 1** and **Figure 2**.

Ecoedge had previously surveyed the same area in the spring of 2020 for another client, but due to circumstances beyond Ecoedge's control, the results were not presented in a report. These 2020 results have been combined with outcomes of the late 2021 winter/early spring survey to produce a thorough assessment of the survey area.

The survey was required to identify key flora and vegetation values of the property to assist in scoping potential development opportunities and inform environmental impact assessment of a potential future development proposal.

This report compiles the findings of the surveys.

2 Scope and objectives

A desktop assessment was undertaken to identify relevant key features and constraints which were in or nearby the survey area, such as Threatened and Priority Flora, Threatened and Priority Ecological Communities (TEC and PECs), riparian vegetation, unusual soil/landscape systems, conservation estates, poorly represented vegetation associations and/or vegetation complexes and Environmentally Sensitive Areas (ESA's). The desktop assessment area encompassed a five-kilometre (km) buffer to the survey area (**Figure 2**).

The field survey was required to ground-truth the desktop assessment findings and delineate all significant flora and vegetation components within the survey area, including TECs and PECs and Threatened and Priority flora.

The survey and report were required to be undertaken in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) and to meet requirements of other relevant State and Commonwealth guidelines for threatened species and communities, such as approved conservation advice for *Environmental Protection and Biodiversity Act 1999* (EPBC Act 1999) threatened species and communities.



Figure 1. Aerial photograph showing the location of the survey area.

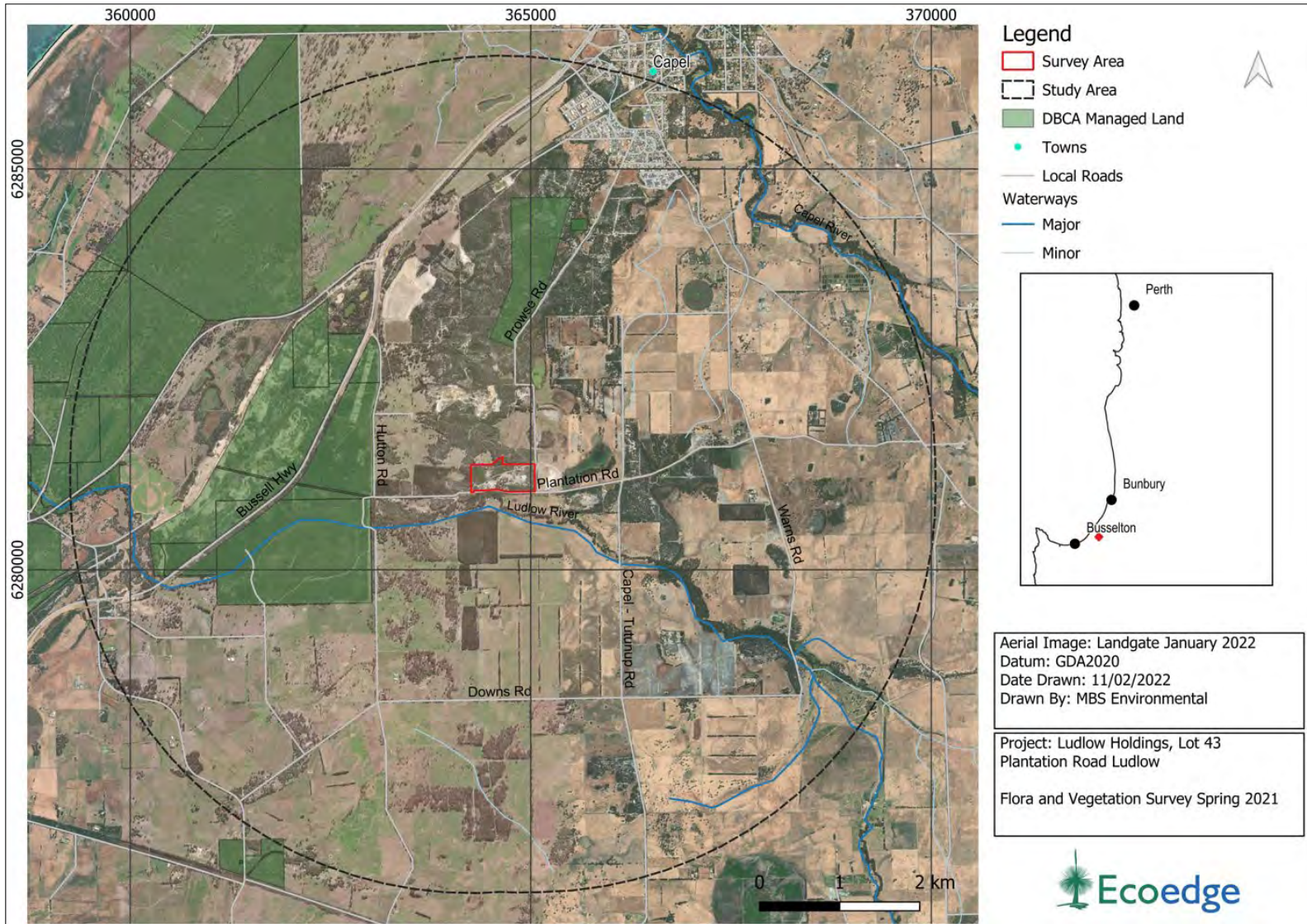


Figure 2. Aerial photograph showing the location of the survey and assessment area.

3 Methods

3.1 Desktop assessment

Prior to the field survey, a desktop assessment was undertaken to provide contextual information on the flora and vegetation within the survey area. The desktop studies included a review of the following information.

- Regional landscape and soil mapping – Busselton, Margaret River, Augusta: land capability study (Tille & Lantzke 1990) as digitally presented in the Soil Landscape Mapping – Best Available Data Set, DPIRD-027.
- Vegetation complex mapping of the South West Forest Region of Western Australia (Mattiske and Havel 1998) and the System 6 area (Hedde et al. 1980) as updated by Webb et al. (2016).
- Beard's Pre-European vegetation association mapping dataset (DPIRD-006) (Beard et al. 2013).
- WA Threatened and Priority Ecological Communities DBCA database extracts (DBCA 2021a) and TEC and PEC listings (DBCA 2018a, DBCA 2021b).
- Federal Protected Matters Search Tool results (DAWE 2020, DAWE 2022).
- Threatened and Priority flora Naturemap search results (DBCA 2020, DBCA 2021c).
- Extract from the Department's Threatened Flora database and the Western Australian Herbarium database (DBCA 2020d).
- Environmentally sensitive areas distribution maps data set, DWER-046 (DWER 2020).
- Geomorphic Wetlands, Swan Coastal Plain data set, DBCA-019 (DBCA 2021e)
- Directory of Important Wetlands in Australia – Western Australia data set, DBCA-045 (DBCA 2018c).
- Surface Hydrology Lines (National) (Crossman & Li 2015).
- The flora and vegetation of the Busselton Plain (Swan Coastal Plain): a report for the Department of Environment and Conservation as part of the Swan Bioplan Project. Department of Environment and Conservation, Perth, Western Australia. (Webb et al. 2009).

3.1.1 Significant flora likelihood of occurrence

Prior to undertaking the survey, an assessment of the likelihood of occurrence of Threatened and Priority flora occurring within the survey area was undertaken. The rationale for determining this pre and post likelihood of occurrence is provided in **Appendix 1**.

3.2 Survey limitations

Limitations with regards to the assessment are addressed in **Table 1**.

Table 1. Limitations of the field survey with regard to assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	Negligible	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Proportion of flora identified	Slight	The survey was carried out in late August and early-mid September, which is within the prime season for flowering in the south-west of Western Australia.
Climatic and seasonal effects	Minimal	Rainfall in the period May-September was 95% of the mean for that period in 2020 and 117% of the mean till the end of August 2021. Observations on growth and flowering indicated that it was good.
Availability of contextual information	Negligible	Comprehensive regional surveys of remnant vegetation, as well as more localised surveys, have been carried out on the southern Swan Coastal Plain.
Completeness of the survey	Negligible	The whole search area was covered on foot. Flowering was good.
Skill and knowledge of the botanists	Negligible	The senior field botanist conducting the survey has had extensive experience in botanical surveys in south-west Australia over a period of 25 years.

3.3 Field survey

The survey was carried out by Debbie Brace (flora permit FT61000764), Russell Smith (flora permit FB61000473) and Colin Spencer (flora permit FB62000169) according to the requirements of EPA (2016) on 9th and 24th September 2020 and on 27 August and 3 September 2021. Flora species not identified in the field were either photographed or collected for later identification. The time of the survey was within the optimum time for field identification of most of the Threatened and Priority flora identified as potentially occurring within the survey area. Taxonomy and conservation status were checked against the latest WA Herbarium census download (DBCA 2022).

A targeted survey for the Threatened orchid *Drakaea elastica* was carried out on 27 August and on 3 September 2021, when its distinctive leaf was clearly visible (DEC 2009).

Plant communities were described using data collected at 193 relevés or vegetation condition waypoints as well as recent aerial photography.

The relevé and quadrat information was used to identify and describe vegetation units using the NVIS system (Level 5; NVIS 2017).

Data collection points (vegetation condition assessment points and relevés) and survey track files were collected while on site.

Vegetation condition was assessed using the method of the EPA (2016) (**Appendix 2**).

4 Results desktop assessment

4.1 Biogeographic region and location

The survey area is located within the Swan Coastal Plain Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (IBRA) (Commonwealth of Australia 2016). It is characterised as a low lying coastal plain, mainly covered by Banksia or Tuart woodlands over sandy soils with paperbark prevalent in swampy areas (Thackway & Cresswell 1995).

The Swan Coastal Plain Bioregion is divided into two subregions, the Dandaragan Plateau (SWA01) and Perth (SWA02), of which the survey area is located within the Perth subregion. This subregion comprises colluvial and aeolian sands, alluvial river flats and coastal limestone. Native vegetation varies from heath and/or Tuart woodlands on limestone, Banksia and Jarrah woodlands on Quaternary marine dunes of various ages, and Marri on colluvial and alluvials. This subregion also includes a complex series of seasonal wetlands (Mitchell, Williams, and Desmond 2002).

4.2 Landform and soils

The survey area occurs near the boundary of the aeolian derived Bassendean System (212Bs) and predominantly alluvially derived Abba (213Ab) system of the southern Swan Coastal Plain, with most of the area comprising the Bassendean system.

The Abba system is a level to gently undulating, poorly drained plain characterised by wet soils and semi-wet soils, pale deep sands, pale sandy earths and grey deep sandy duplexes (Tille and Lantzke 1990).

These systems have been separated into landform-soil mapping units or "land units" based on landscape position and soil characteristics (Tille & Lantzke 1990). Five land units have been described for the survey area and are described in **Table 2** and **Figure 3**.

Table 2. Soil mapping units occurring within the survey area (Tille & Lantzke 1990, DPIRD-027).

System	Land units	Description
Bassendean system (212Bs)	212Bs__B1b	Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.
	212Bs__B3	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan or clay subsoil. Surfaces are dark grey sand or sandy loam.
	212BsW_SWAMP	Swamp
Abba system (213Ab)	213AbABw	Winter wet flats and slight depressions with sandy grey-brown duplex (Abba) and gradational (Busselton) soils.
	213AbABvw	Small narrow swampy depressions along drainage lines. Alluvial soils.

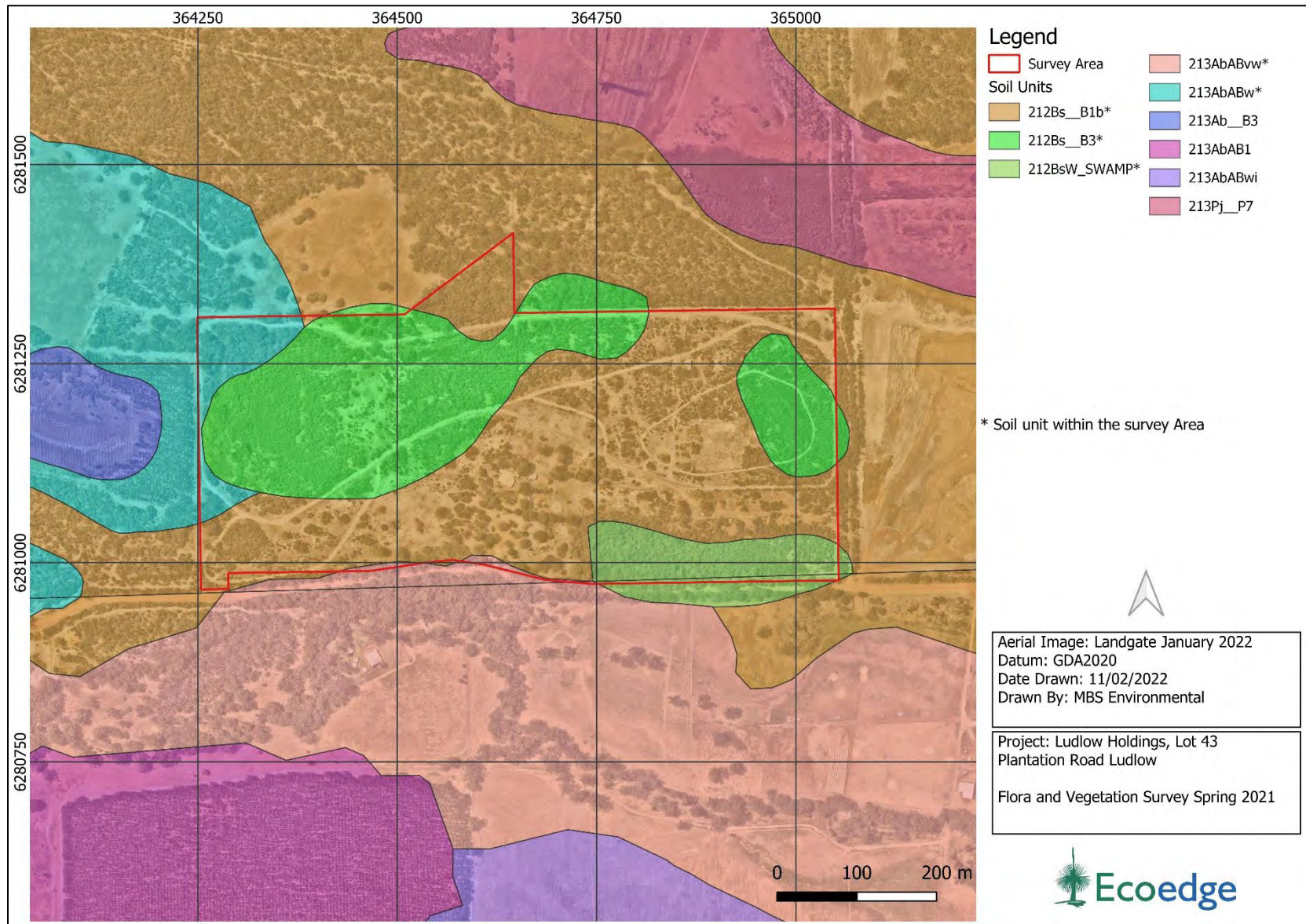


Figure 3. Land units mapped in and nearby the survey area (Tille & Lantzke 1990).

4.3 Vegetation description according to pre-European mapping datasets

4.3.1 Vegetation complexes

The comprehensive pre-1750 distribution of vegetation complexes¹ across the southwest of Western Australia is based on two main data sets, Heddle et al.'s 1980 1:250,000 scale vegetation complex mapping of the 'System 6' area comprising the greater Perth and Darling Range Region and Mattiske and Havel's 1998 1:50,000 scale mapping of forest vegetation covered by the Regional Forest Agreement 1999² (Webb et al. 2016). Both data sets were prepared in order to inform the adequacy of biodiversity conservation through state-managed reserves (EPA 1993, South West Regional Forest Agreement 1999). In 2016 these data sets were revised by DPaW (Webb et al. 2016) in order to fill data gaps and improve alignment and correlation between the data sets.

According to the vegetation complex mapping, as updated by Webb et al. in 2016, two vegetation complexes, the Southern River Complex and the Abba Complex, are mapped across the survey area. These are described in **Table 3** and shown in **Figure 4**. The Southern River Complex comprises the majority of the survey area.

Table 3. Vegetation complexes mapped for the survey area (Webb et al., 2016).

Vegetation Complex	Description
Southern River Complex	Open woodland of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Banksia</i> species with fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca raphiophylla</i> (Swamp Paperbark) along creek beds.
Abba Complex	A mixture of open forest of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Banksia</i> species and woodland of <i>Corymbia calophylla</i> (Marri) with minor occurrences of <i>Corymbia haematoxylon</i> (Mountain Marri). Woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca</i> species along creeks and on flood plains.

¹ Vegetation complex mapping is based on broadscale assessment of regional patterns of vegetation in relation to underlying landforms, soils and climatic trends.

² Mattiske and Havel's (1998) mapping also included an assessment of an area of the very southern portion of the Swan Coastal Plain landform (Webb et al. 2016).

4.3.2 Vegetation associations

A systematic survey of native vegetation in Western Australia was undertaken by J. S. Beard (along with others) during the 1970s, which described vegetation systems in the southwest of Western Australia at a scale of 1:250,000. Beard's vegetation maps attempted to depict the vegetation as it might have been prior to European settlement in terms of type and extent (Beeston et al. 2001). The Beard Vegetation Association dataset, also referred to as the pre-European native vegetation extent dataset, was digitised by Shepherd et al. (2002).

Beard vegetation associations have been described to a minimum standard of Level 3 "Broad Floristic Formation" for the National Vegetation Inventory System (NVIS) (state-wide to regional scale)³.

The survey area comprised only one Beard vegetation association: Association 1000 'Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; tea tree (*Melaleuca* spp.)'.

³ Beard's vegetation mapping units are referred to as 'associations' however these do not correspond to the NVIS Level 5 'Associations'. The NVIS system was developed long after Beard's work was completed, and while both classification systems use the same term, NVIS 'Associations' describe vegetation in more detail than do Beard's.

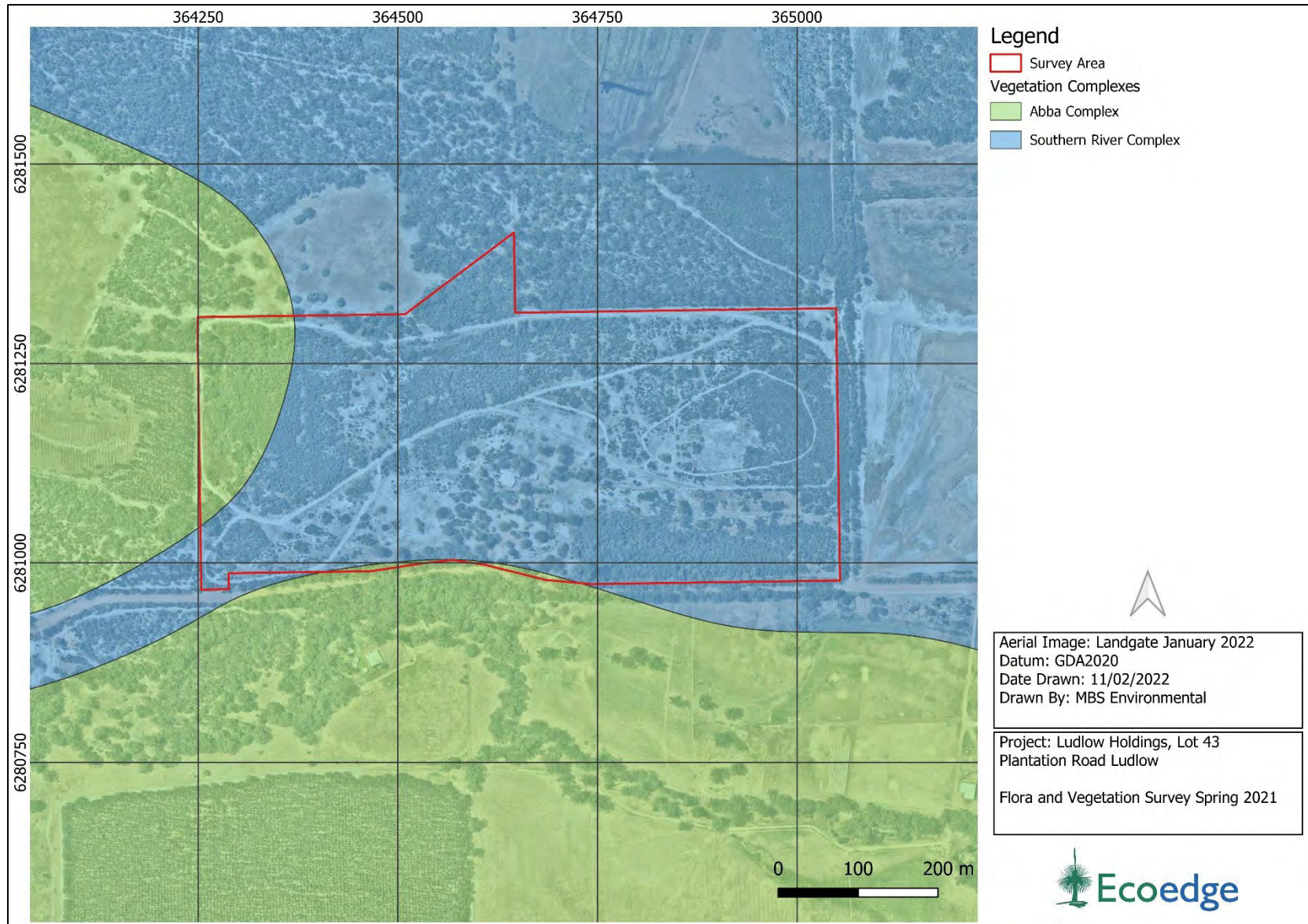


Figure 4. Vegetation complexes mapped in and nearby the survey area (Webb et al., 2016).

4.3.3 Assessment of remaining extent against pre-European extent

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia 2001).

In its report on the Statewide Vegetation Statistics incorporating the Comprehensive, Adequate and Representative (CAR) Reserve Analysis, the Government of Western Australia provides information on the pre-European and current extent of the ecological communities of Western Australia and reports on the status of the CAR reserve system for WA (Government of Western Australia 2019a). This system is also based on the National retention target of 30% overall. Only reserves managed by DBCA under the *Conservation and Land Management Act 1984* are considered for inclusion in the "CAR Reserve Analysis".

Table 4 presents the statistics as they relate to the percentage remaining of pre-European extent vegetation and the percentage of current extent in DBCA managed land of the two vegetation complexes identified within the survey area. The Southern River Complex, which makes up the bulk of the survey area, has less than 30% of its pre-European extent remaining. The Abba Complex has less than 10% remaining.

Table 5 presents the same statistics for the Beard vegetation association mapped across the survey area: Association 1000. This association has less than 30% of its pre-European extent remaining at all scales.

The red, orange and yellow shading in the tables indicates the status of the Commonwealth's 30% retention target.

Status of the commonwealth retention target	>30%	<30%	<10%
---	------	------	------

Table 4. Vegetation complexes mapped within the survey area with regard to the Commonwealth retention targets (Government of Western Australia 2019a).

Vegetation Complex	Pre-European (ha)	Current Extent (ha)	% Remaining	% remaining in DBCA reserves
Southern River Complex				
Swan Coastal Plain	58,781.48	10,832.18	18.43	1.60
Shire of Capel	7,876.12	1,794.33	22.78	N/A
Abba Complex				
Swan Coastal Plain	50,892.78	3,326.20	6.54	0.36
Shire of Capel	9,356.82	569.79	6.09	N/A

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

Table 5. Vegetation associations within the survey area with regard to the Commonwealth retention targets (Government of Western Australia 2019b).

Beard Vegetation Association	Pre-European (ha)	Current Extent (ha)	% Remaining	% remaining in DBCA Managed Land*
Association 1000 -				
State-wide	99,835.86	27,768.84	27.81	5.19
IBRA region: Swan Coastal Plain (SWA)	94,175.31	24,869.20	26.41	5.06
IBRA sub-region Perth (SWA02)	94,175.31	24,869.20	26.41	5.19
Shire of Capel	15,173.76	3,189.87	21.02	1.53

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

4.4 Threatened and Priority ecological communities

Ecological communities are defined by Western Australia's DBCA as "...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services." (DEC 2013).

Under Section 27 of the *Biodiversity Conservation Act 2016* (BC Act), the Western Australian Minister for Environment may list communities considered to be under significant threat as a TEC. These TECs can be listed under one of three conservation categories: Critically Endangered (CR), Endangered (EN), or Vulnerable (VU). The BC Act also provides for listing communities as collapsed ecological communities.

Possible TECs that do not meet survey criteria are added to the DBCA's Priority ecological community lists under Priorities 1, 2 or 3 (referred to as P1, P2, P3). Ecological communities that are adequately known, are rare but not Threatened, that meet criteria for near Threatened, or that have been recently removed from the Threatened list are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC 2013).

The current listing of Threatened and Priority ecological communities is specified in DBCA (2018a, 2021b). The conservation categories for these Threatened and Priority ecological communities are defined in **Appendix 3**.

TECs can also be listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There are three categories of TEC under the EPBC Act: Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) (Department of Agriculture, Water and the Environment) (DAWE 2020b). These are defined in **Appendix 4**.

The desktop assessment, which included a Protected Matters Search (DAWE 2020, DAWE 2022) and review of DBCA TEC and PEC database extracts (DBCA 2021a), found four EPBC Act, four BC Act listed TECs, and three State listed PECs within the 5 km assessment area.

The outcomes of these searches are presented in **Table 6**. The results of the DBCA records are shown in **Figure 5**.

Table 6. Threatened and Priority ecological communities occurring within assessment area (DAWE 2020, DAWE 2022, DBCA 2021a).

Community Name	Community Description	Status (WA)	Status (EPBC Act)
	<p>'Claypans of the Swan Coastal Plain' – a federally listed TEC consisting of four State-listed communities, three of which occur in the assessment area:</p> <ol style="list-style-type: none"> 1. SCP07: Herb rich saline shrublands in claypans 2. SCP08: Herb rich shrublands in claypans 3. SCP10a: Shrublands on dry clay flats 	<ol style="list-style-type: none"> 1. VU 2. VU 3. EN 	T (CR)
	SCP10b Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	CR	T (EN)
	Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain	P3	T (CR)
	SCP1b <i>Corymbia calophylla</i> woodlands on heavy soils of the southern Swan Coastal Plain	VU	-
	'Banksia Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed communities, including SCP21b Southern <i>Banksia attenuata</i> woodlands mapped separately in Figure 5 .	P3	T (EN)
	Wooded wetlands which support colonial waterbird nesting areas	P2	-

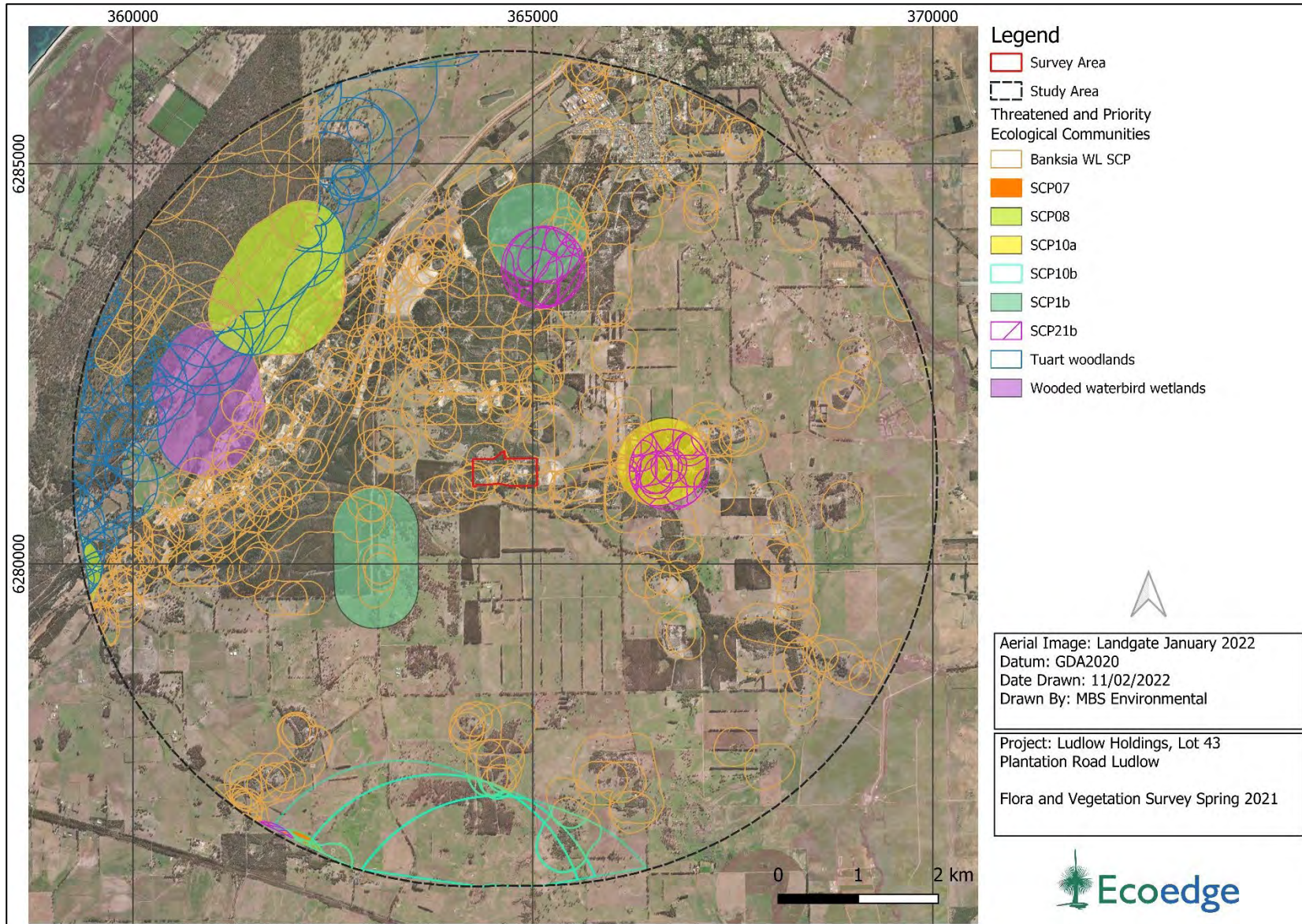


Figure 5. Threatened and Priority ecological communities within the assessment area (DBCA 2021a).

4.5 Threatened and Priority flora

Species of flora and fauna are defined as having a Threatened or Priority conservation status where their extant populations are restricted geographically and/or under threat of possible extinction. The DBCA recognises these threats and consequently applies regulations toward population and species protection.

Threatened extant flora species are listed under Section 19 of the BC Act and are ranked according to their level of threat using the International Union for Conservation of Nature (IUCN) Red List categories and criteria of; Critically Endangered (CR), Endangered (EN), Vulnerable (VU). It is an offence to “take” or damage Threatened flora without Ministerial approval. Section 5 of the Act defines “to take” as “... to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means”.

Priority flora is under consideration for future declaration as “Threatened flora”, dependent on more information. Species classified as Priority One to Three (referred to as P1, P2 and P3) need further survey to determine their status, while Priority Four (P4) species are adequately known rare or Threatened species that require regular monitoring.

Threatened flora lists are formally reviewed annually, whilst the Priority flora list is subject to a less formal ongoing review. The current listing of Threatened and Priority flora was updated on 5 December 2018 (DBCA 2018b).

Categories of Threatened and Priority flora as defined by the BC Act are presented in **Appendix 5**

Threatened flora may also be protected under the Commonwealth EPBC Act and be listed in one of six categories; the definitions of these categories are summarised in **Appendix 6** (DAWE 2020c).

Threatened or Priority flora occurring within 5 km of the survey area generated from a NatureMap search (DBCA 2020, DBCA 2021c) and a Protected Matters Search Tool query (DAWE 2020, DAWE 2022). DBCA and WA Herbarium Threatened and Priority flora data downloads (DBCA 2021d) are provided in **Appendix 7**.

Forty-one significant species were identified within this search area. Two species were considered Likely, thirty-two possible, and seven unlikely to occur within the survey area. The likely occurring species are listed in **Table 7**. There were no species recorded within the survey area according to the DBCA Threatened and Priority Flora data base download (DBCA 2021d). A summary breakdown of the likelihood of occurrence of all potential species according to conservation status is provided in **Table 8**, with the complete likelihood of occurrence assessment and post likelihood assessment provided in **Appendix 8**.

The locations of all Threatened and Priority Flora database flora are shown in **Figure 6** (DBCA 2021d).

Table 7. Conservation significant flora likely to occur within the survey area.

Species	Conservation Status
<i>Stylidium paludicola</i>	P3
<i>Verticordia attenuata</i>	P3

Table 8. Likelihood of occurrence according to conservation status.

Likelihood of occurrence	Total number	Priority 1	Priority 2	Priority 3	Priority 4	Threatened
Likely	2	0	0	2	0	0
Possible	32	0	4	12	12	4
Unlikely	7	0	0	4	0	3
Total	41	0	4	18	12	7

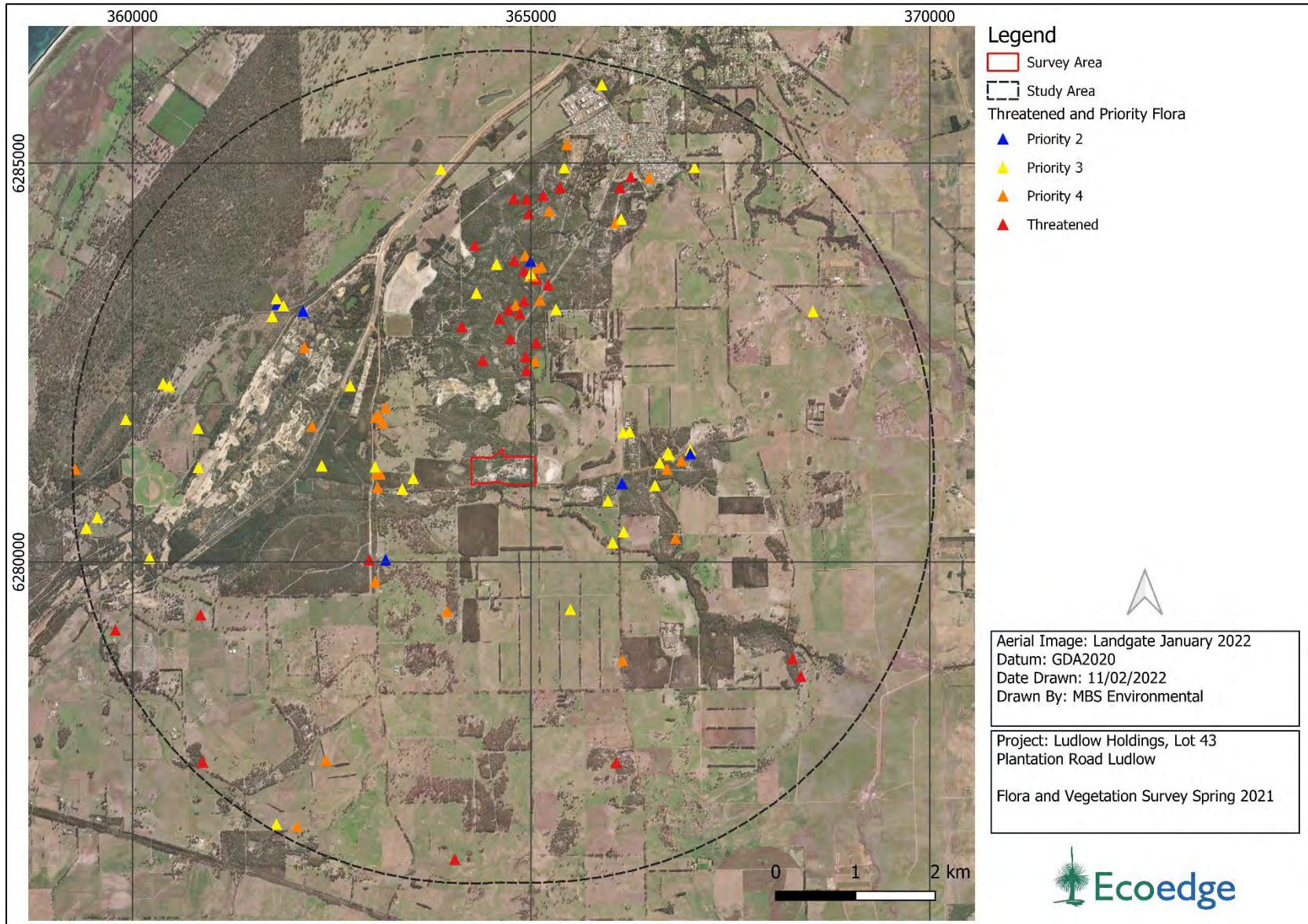


Figure 6. Threatened and Priority flora within the five km assessment area (DBCA 2021d)

4.6 Wetlands

Wetlands on the SCP have been classified into types using the geomorphic wetland classification system of Semeniuk & Semeniuk (1995), which is based on the characteristics of landform and water permanence, for example, lakes, palusplains and damplands. These are described in **Table 9**. The SCP wetlands have also been evaluated and assigned an appropriate management category and corresponding category objective, providing guidance on the nature of the management and protection the wetland should be afforded. These categories are described in **Table 10**.

Table 9. Wetland types (adapted from Semeniuk & Semeniuk 1995).

Management Category	Basin	Flat	Channel	Slope	Highland
Permanently inundated	Lake		River		
Seasonally inundated	Sumpland	Floodplain	Creek		
Intermittent inundation	Playa	Barlkarra	Wadi		
Seasonally waterlogged	Dampland	Palusplain	Trough	Paluslope	Palusmont

Table 10. Definitions of and objectives for the different wetland management categories (EPA 2008).

Management Category	Definition	Category Objective
Conservation	Wetlands with high conservation value for both natural or human use	To preserve wetland (natural) attributes and functions
Resource Enhancement	Wetlands with moderate natural and human use attributes that can be restored or enhanced	To restore wetlands through maintenance and enhancement of wetland functions and attributes
Multiple Use	Wetlands that score poorly on both natural and human use attributes	To use, develop and manage wetlands in the context of water, town and environmental planning

The survey area intersects a mapped occurrence of an extensive Multiple Use palusplain wetland (Unique Feature ID 15809) that covers over 42,000 ha in the southern Swan Coastal Plain (DBCA 2021e) **Figure 7**. No Conservation category or Resource Enhancement category wetlands intersect the survey area. The nearest Conservation category wetland and Resource Enhancement wetlands are both located approximately 920 metres to the north of the survey area **Figure 8**.

4.7 Watercourses

There are no permanent or ephemeral rivers, creeks or drainage lines within the survey area. The closest watercourse is Ludlow River, that at its closest point, runs approximately 30 m south of the survey area, as shown in **Figure 7** and **Figure 8** (Crossman & Li 2015).

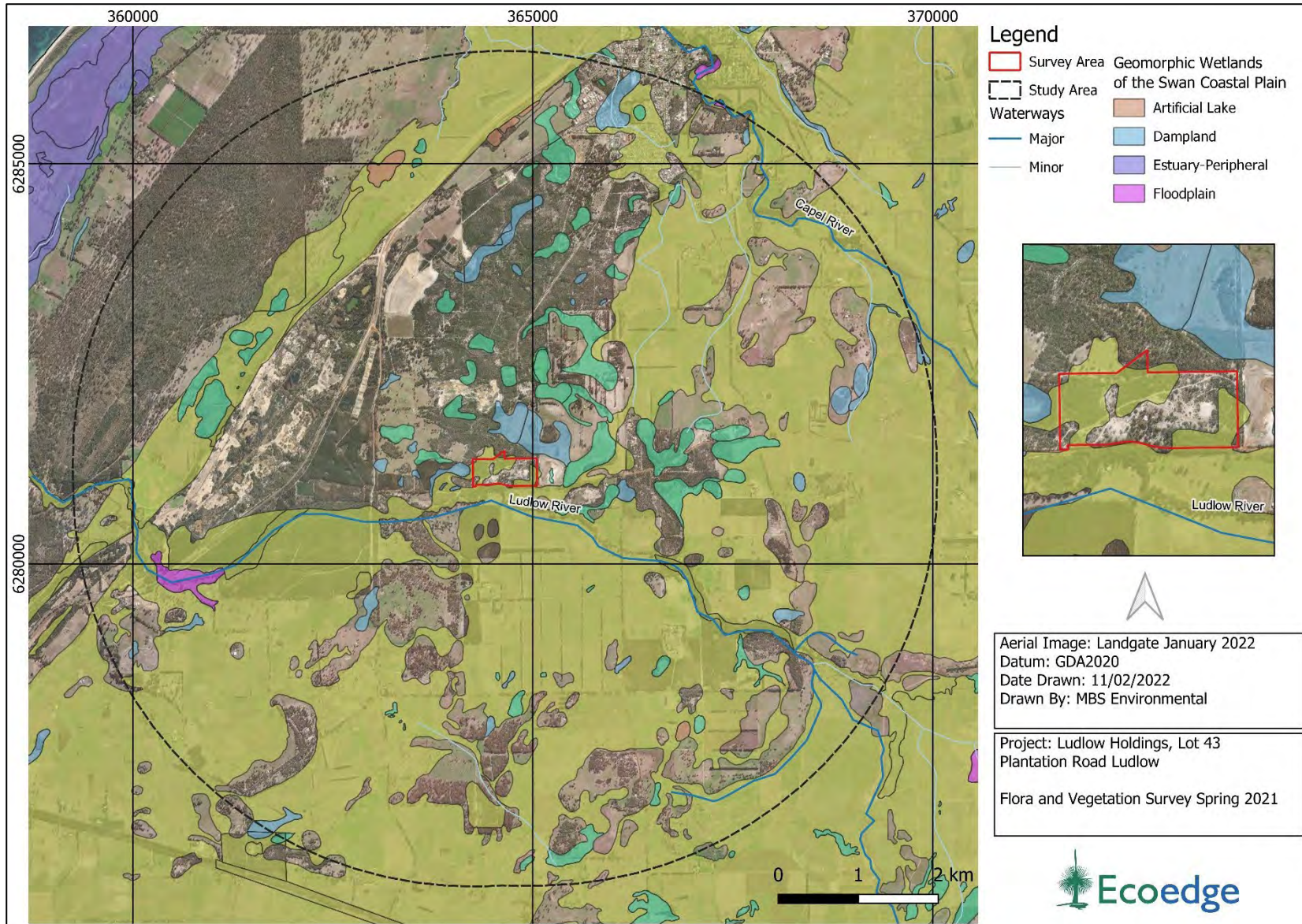


Figure 7. Geomorphic wetland type and waterways in proximity to the survey area (DBCA 2021e, Crossman & Li 2015).

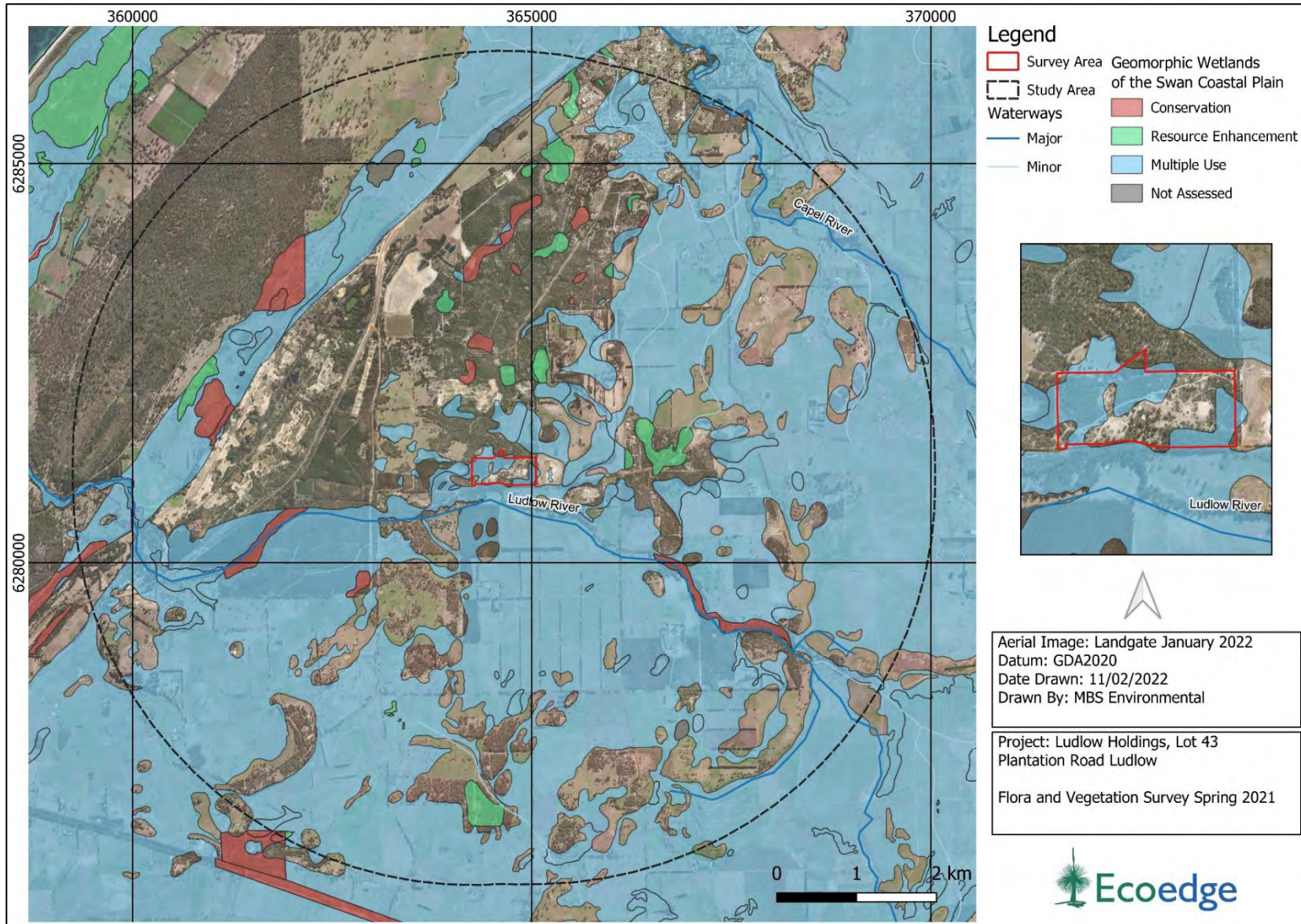


Figure 8. Status of geomorphic wetlands in proximity to the survey area (DBCA 2021e, Crossman & Li 2015).

4.8 Regional ecological linkages

Regional ecological linkages “link protected patches of regional significance by retaining the best (condition) patches available as steppingstones for flora and fauna between regionally significant areas” (Molloy et al., 2009).

Regional ecological linkages have been mapped by Molloy et al. (2009) across the SW of Western Australia in an area spanning between just north of Mandurah to Walpole in the south-east.

Molloy et al. (2009) assessed and assigned “proximity value” (pv) ratings to all patches of remnant native vegetation as a way of indicating the value of their connectivity with regional ecological linkages. This was based on their distance from the nearest mapped regional ecological linkage axis line and connected parcels of remnant vegetation (**Table 11**).

Table 11. Linkage proximity values rating assigned to patches of remnant vegetation within a landscape (from Molloy et al., 2009).

Proximity value	Description	
1a	with an edge touching or	< 100 m from a linkage
1b	with an edge touching or	< 100 m from a natural area selected in 1a
1c	with an edge touching or	< 100 m from a natural area selected in 1b
2a	with an edge touching or	< 500 m from a linkage
2b	with an edge touching or	< 500 m from a natural area selected in 2a
2c	with an edge touching or	< 500 m from a natural area selected in 2b
3a	with an edge touching or	< 1000 m from a linkage
3b	with an edge touching or	< 1000 m from a natural area selected in 3a
3c	with an edge touching or	< 1000 m from a natural area selected in 3b

Two regional ecological axis lines mapped by Molloy et al. (2009) meet to the north of the survey area **Figure 9**. These are the Capel - Boyanup Ecological Linkage and Wonnerup / Ludlow River / Gibson Forest Ecological Linkage. Parts of vegetation within the survey area have been mapped with the highest tier 1a, 1b and 1c proximity values due to their proximity to these linkages. The majority of the survey area has not been assigned a proximity value due to the extent of previous vegetation clearing and other disturbances.

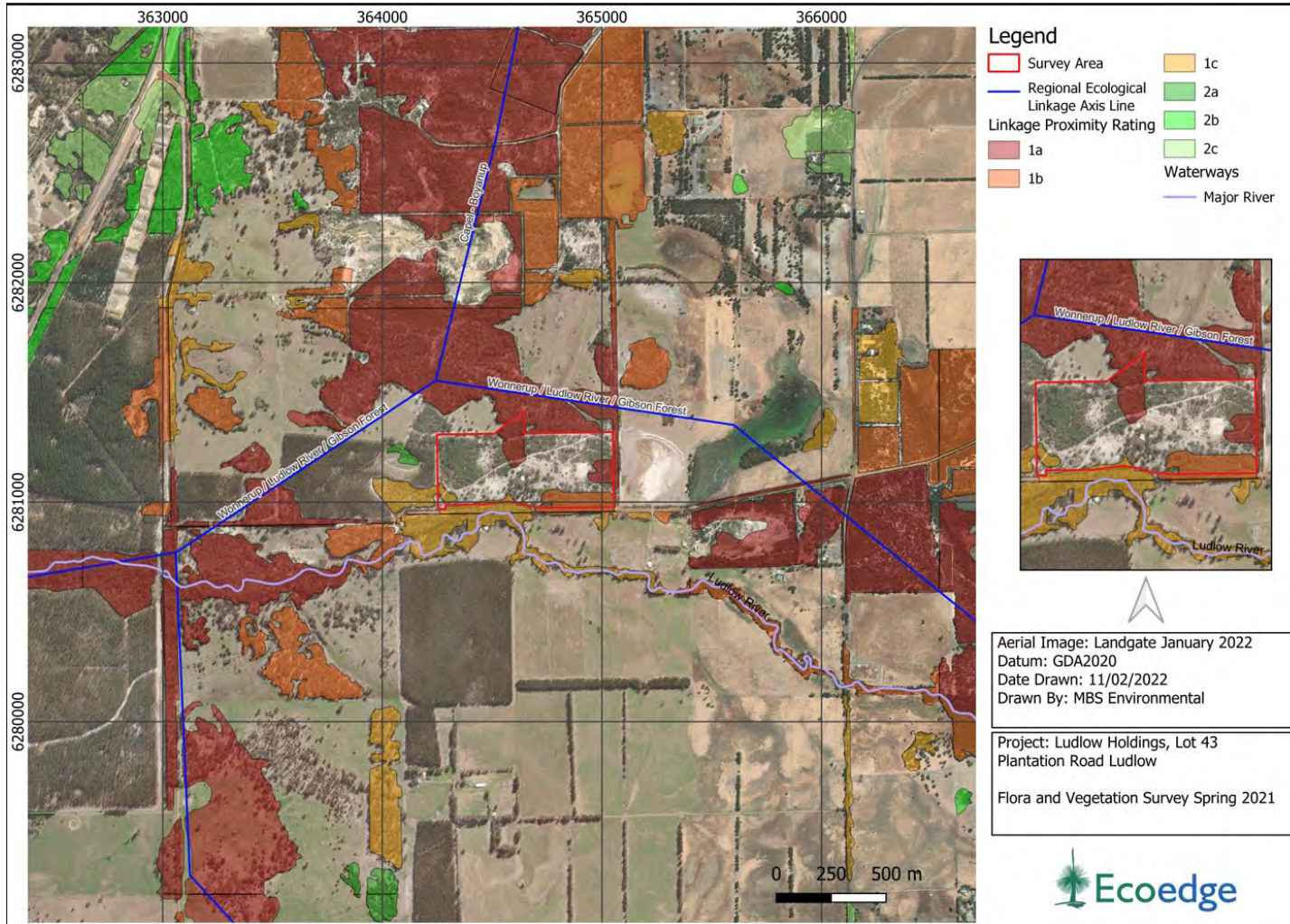


Figure 9. The survey area in relation to regional ecological linkages (Molloy et al. 2009).

4.9 Environmentally Sensitive Areas

ESAs are protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. They are selected for their environmental values at State or National levels (Government of Western Australia 2005). They include:

- Defined wetlands and riparian vegetation within 50 m
- Areas covered by Threatened ecological communities
- Area of vegetation within 50 m of Threatened flora
- Bush Forever sites
- Declared World Heritage property sites.

The survey area does not intersect a mapped ESA (DWER 2020), as shown in **Figure 10**. The nearest ESA is located approximately 830 m to the southwest of the survey area.

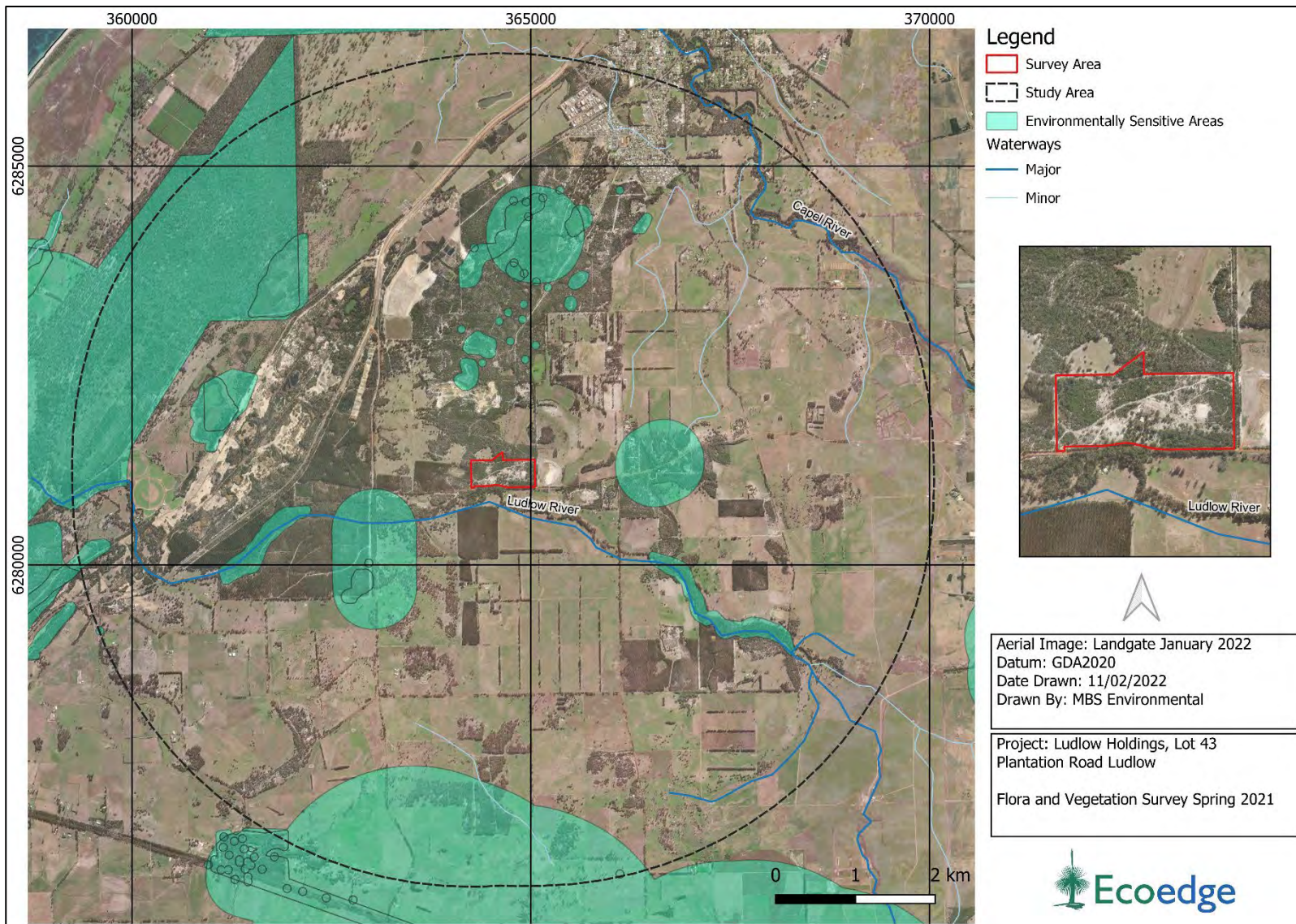


Figure 10. ESAs within assessment area (DWER 2020).

5 Field survey results

A map showing the location of data collection points (vegetation condition assessment points and relevés) and survey track files is provided in **Appendix 9**.

5.1 Flora

One hundred and fifty vascular flora taxa were identified within the survey area, of which twelve ($\approx 7.8\%$) were introduced taxa. The most common families were Myrtaceae (17 taxa), Fabaceae (15 taxa, incl. 1 non-native) and Orchidaceae (17 taxa).

The vascular flora recorded during the field survey is included in **Appendix 10**.

5.2 Post likelihood of occurrence

Thirty-eight of the forty-two Threatened or Priority taxa potentially occurring in the survey area were assigned a post-survey residual likelihood of “Unlikely” because for the bulk of them, even though potentially suitable habitat was present, they were not seen despite being thoroughly searched for at an appropriate time of year. The balance (4) of potentially occurring flora were recorded in the survey area.

A summary of the post-survey likelihood of occurrence according to conservation status is provided in **Table 12**.

Table 12. Vascular flora post-survey likelihood of occurrence according to conservation status.

Likelihood of occurrence	Total No.	Priority 1	Priority 2	Priority 3	Priority 4 ⁴	Threatened
Recorded	4	1	0	1	1	1
Unlikely	38	0	4	18	12	4
Possible	0	0	0	0	0	0
Total	42		4	19	13	5

5.3 Threatened, Priority and other conservation significant flora

The Threatened orchid *Drakaea elastica* (193 plants) was found at 45 locations, predominantly in the easternmost part of the survey area. Most plants were still in the leaf stage, though some had sent up their flowering stalks. Typical habitat for *D. elastica* in the survey area were thickets of *Kunzea glabrescens* over a leaf litter on grey sand.

⁴ The Priority 4 taxon *Eucalyptus rudis* subsp. *cratyantha* was also recorded in vegetation unit E2.

One plant of the Priority 1 taxon *Dillwynia* sp. Capel (PA Jurjevich 1771) (P1) was found within vegetation unit D1, in the northeast quadrant of the survey area, this was not included in the pre-survey likelihood table.

A single *Boronia tetragona* (P3) plant was found growing on grey sand with *Kunzea glabrescens* in the central, northern part of the survey area.

Eighty-seven plants of the P4 flora species, *Acacia semitrullata*, were recorded scattered through the eastern part of the survey area, mainly in *Kunzea glabrescens* tall shrubland.

Several “range end” or disjunct taxa: *Beaufortia squarrosa*, *Calytrix fraseri*, *Conospermum teretifolium*, *Drosera zonaria*, *Macarthuria apetala*, *Sporadanthus strictus* and *Taxandria fragrans*⁵, were also recorded growing in the survey area. *Calytrix fraseri*, *C. teretifolium*, *D. zonaria* and *M. apetala* were found in *Kunzea glabrescens* tall shrubland, whereas the other species were in wetland dominated by *Corymbia calophylla*, *Eucalyptus rudis* and *Melaleuca preissiana* in the southern part of the survey area.

The significance of the populations of this flora is discussed in **sub-section 6.1** below.

Photographs of this flora are shown in **Figure 11**, with their locations within the survey area shown in **Figure 12**. The occurrences of the Threatened *Drakaea elastica* are also shown by itself in **Figure 13**.

Copies of the completed Threatened and Priority Flora Report form for the confirmed occurrences of these species are provided in **Appendix 11**.

5.4 Pest plants

Two of the introduced species, **Asparagus asparagoides* (Bridal creeper) and **Zantedeschia aethiopica* (Arum-lily), are listed as Declared Pest Plants, but with no management requirements as no management category has been assigned to them under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). *A. asparagoides* was found in two locations and *Z. aethiopica* at one location (**Figure 14**).

⁵ See photo on report cover.



*Drakaea elastica*⁶



Boronia tetragona



Drosera zonaria



Beaufortia squarrosa



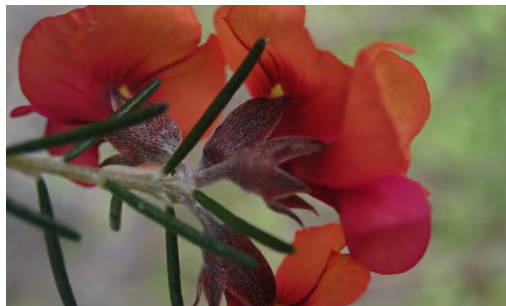
Macarthuria apetala



Conospermum teretifolium



Sporadanthus strictus



Dillwynia sp. Capel (PA Jurjevich 1771)

Figure 11. Photographs of some of the significant taxa found within the survey area.

⁶ The photo of *D. elastica* shows its bright green leaf next to *Drakaea glyptodon* grey leaf.

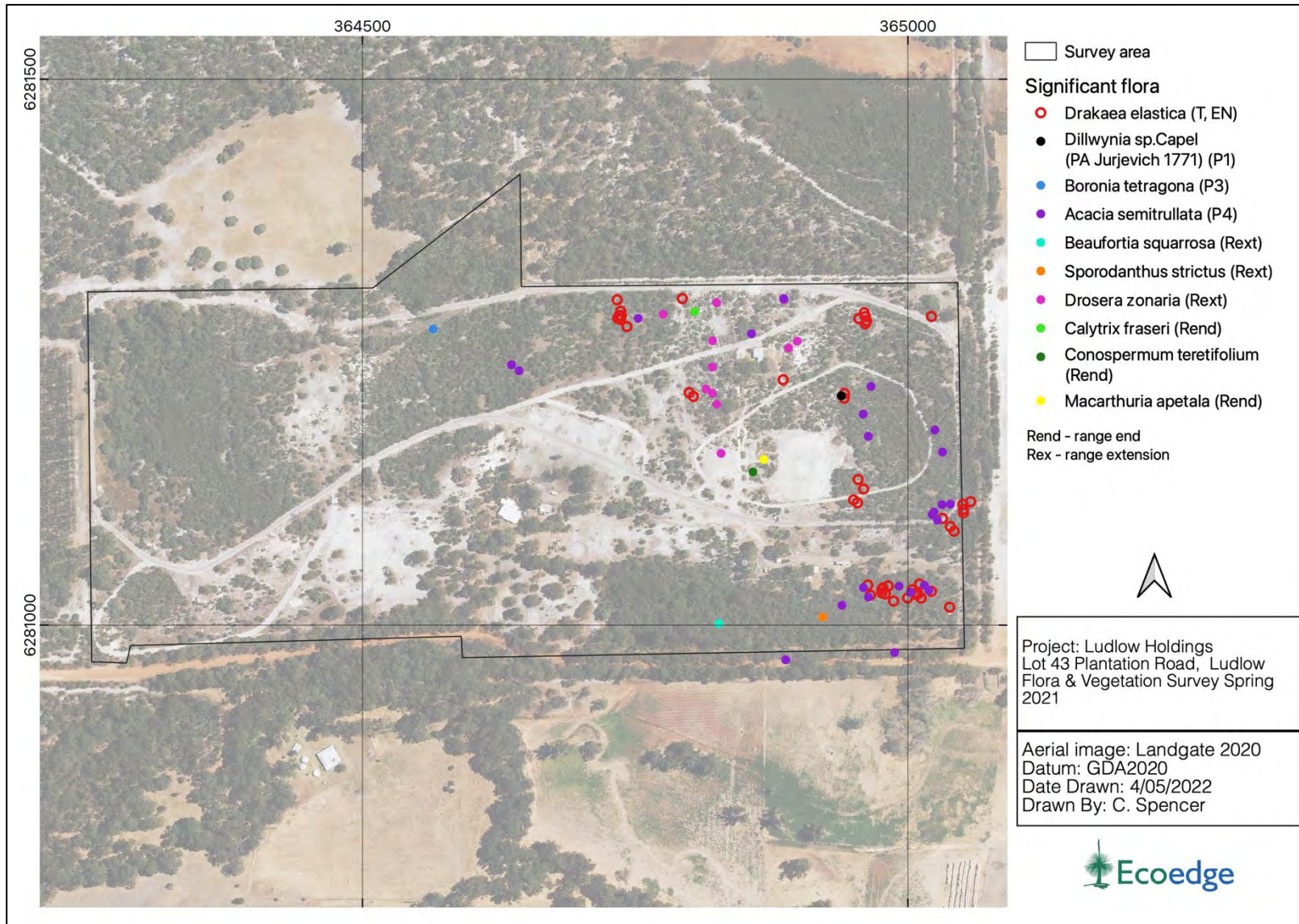


Figure 12. Significant flora within the survey area.

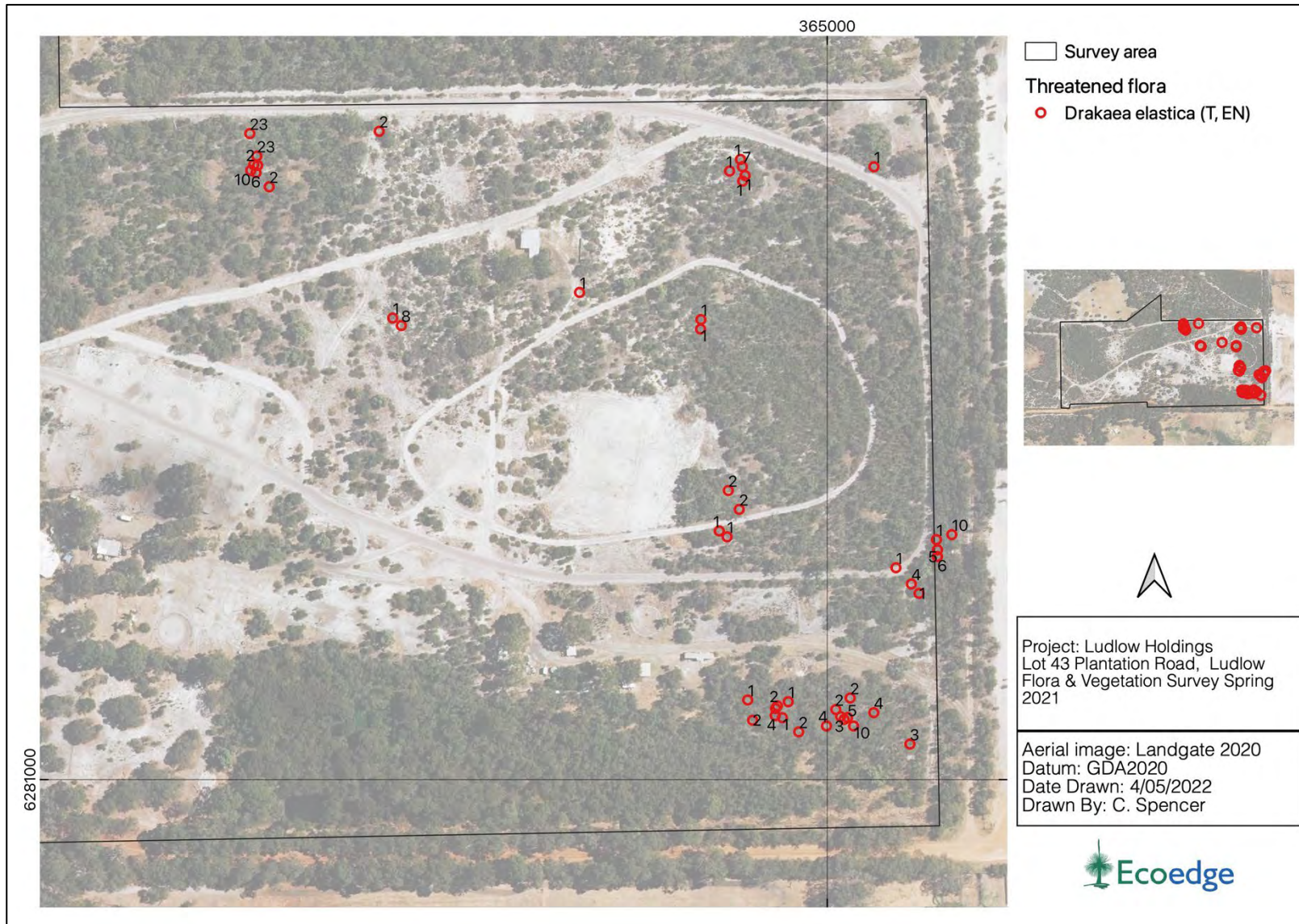


Figure 13. Location of Threatened flora (*Drakaea elastica*) within the survey area.

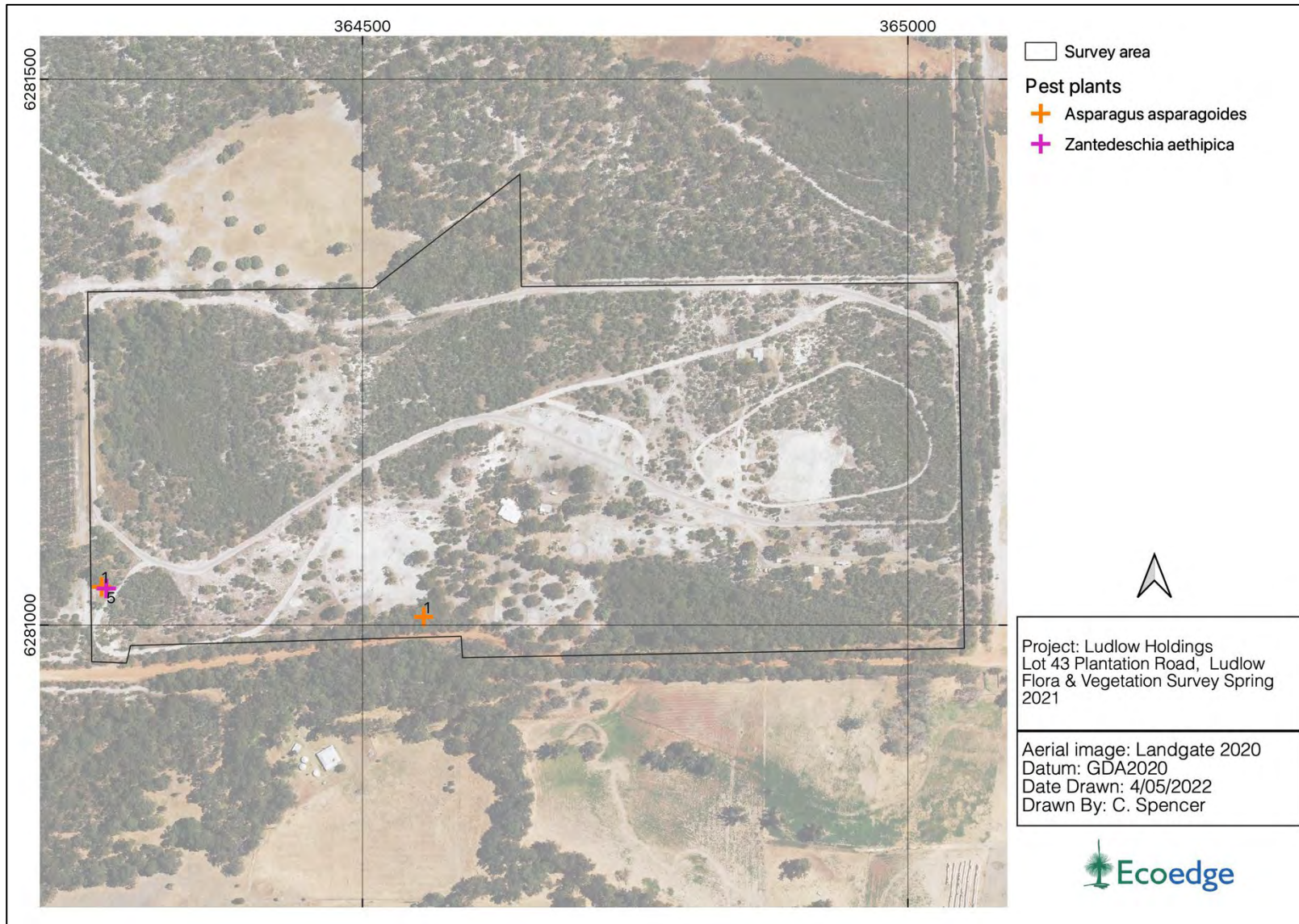


Figure 14. Declared pest plants within the survey area.

5.5 Vegetation Units

Five vegetation units were described for the survey area, with two of these units being described and mapped as sub-units. Vegetation unit D (comprised of sub-units D1 and D2) represents *Banksia* woodlands (in the case of D2, what was previously *Banksia*-dominated woodland) on sand. Unit E is comprised of *Corymbia calophylla*-dominated woodlands on loamy soils (sub-units E1 and E2).

These vegetation units and sub-units are described in **Table 13** and mapped in **Figure 15**. Photographs with accompanying descriptions are also provided in **Appendix 12**.

Aerial photography taken in 2004 shows that about 75% of the survey area had been cleared at that time. Since then, a large proportion of the cleared area has revegetated naturally to the extent that only 32% of the survey area has been mapped as cleared. The vegetation units dating from before the clearing are units A and C, sub-units E1 and E2 and a small portion of D1 and D2. Apart from the historical clearing, infestation by *Phytophthora cinnamomi* root-rot disease has caused major changes, particularly in vegetation unit D2, which is, in fact, a degraded form of D1 where all of the *Banksia attenuata* and *B. ilicifolia* have been removed by the disease.

Table 13. Description of vegetation units within the survey area.

Unit/Sub-unit	Description
A	Medium open forest of <i>Corymbia calophylla</i> over very open low woodland of <i>Xylomelum occidentale</i> over tall sparse shrubland of <i>Kunzea glabrescens</i> and <i>Xanthorrhoea brunonis</i> over <i>Pteridium esculentum</i> fernland or grassland of * <i>Avena barbata</i> , * <i>Briza maxima</i> and * <i>Ehrharta longiflora</i> on grey sandy loam. [Condition mainly Degraded - Good].
B	Open low woodland of <i>Melaleuca preissiana</i> over <i>Leptocarpus coangustatus</i> , <i>Lepidosperma longitudinale</i> sedgeland with patches of <i>Kunzea glabrescens</i> tall shrubland over <i>Hypocalymma angustifolium</i> low shrubland over open grassland/forbland of introduced taxa on grey sand (winter wet). [Condition mainly Degraded - Good].
C	Very open medium woodland of <i>Corymbia calophylla</i> over medium woodland of <i>Melaleuca preissiana</i> over <i>Aotus gracillima</i> , <i>Astartea scoparia</i> , <i>Kunzea glabrescens</i> tall shrubland over <i>Hypocalymma angustifolium</i> low shrubland over open sedgeland of <i>Lepidosperma longitudinale</i> , <i>Pteridium esculentum</i> and <i>Schoenus efoliatus</i> open forbland on grey sand (winter damp). [Condition Degraded - Very Good].
D1	Medium woodland of <i>Eucalyptus marginata</i> over open low woodland of <i>Banksia attenuata</i> and/or <i>Banksia ilicifolia</i> and <i>Nuytsia floribunda</i> over <i>Kunzea glabrescens</i> tall shrubland over shrubland of <i>Adenanthos meisneri</i> , <i>Brachyloma preissii</i> and <i>Melaleuca thymoides</i> over <i>Dasypogon bromeliifolius</i> low shrubland and <i>Phlebocarya ciliata</i> open forbland on grey sand. {Degraded-Good]
D2	Medium very open woodland of <i>Agonis flexuosa</i> , <i>Banksia ilicifolia</i> or <i>Nuytsia floribunda</i> over tall shrubland of <i>Kunzea glabrescens</i> over low shrubland of <i>Acacia semitrullata</i> , <i>A. stenoptera</i> , <i>Adenanthos meisneri</i> , <i>Dasypogon bromeliifolius</i> , <i>Hypocalymma angustifolium</i> , <i>Melaleuca thymoides</i> and

	<i>Xanthorrhoea brunonis</i> over open forbland of <i>Patersonia occidentalis</i> , <i>Phlebocarya ciliata</i> on grey sand. [Condition mainly Completely Degraded-Good]
E1	Medium woodland of <i>Corymbia calophylla</i> over very open medium shrubland of <i>Kingia australis</i> over low shrubland of <i>Acacia pulchella</i> , <i>Hardenbergia comptoniana</i> , <i>Leucopogon propinquus</i> , <i>Macrozamia riedlei</i> , <i>Pimelea angustifolia</i> , and <i>Xanthorrhoea brunonis</i> over open forbland of <i>Conostylis aculeata</i> , <i>Craspedia variabilis</i> and <i>Senecio quadridentatus</i> and very open sedgeland of <i>Schoenus grandiflorus</i> and <i>Tetraria octandra</i> and scattered <i>Microlaena stipoides</i> low grass on grey sandy loam. [Condition Very Good to Excellent]. (Southern <i>Corymbia calophylla</i> woodlands TEC).
E2	Medium woodland of <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> over low woodland of <i>Agonis flexuosa</i> and <i>Melaleuca preissiana</i> over open medium shrubland of <i>Astartea scoparia</i> , <i>Acacia extensa</i> and <i>Grevillea manglesioides</i> over low sedgeland of <i>Anarthria prolifera</i> and <i>Lepidosperma longitudinale</i> and open forbland of <i>Burchardia multiflora</i> and <i>Opercularia hispidula</i> on grey-brown sandy loam or red-brown loam. [Condition ranges from Completely Degraded-Excellent]. (Southern <i>Corymbia calophylla</i> woodlands on heavy soils TEC).

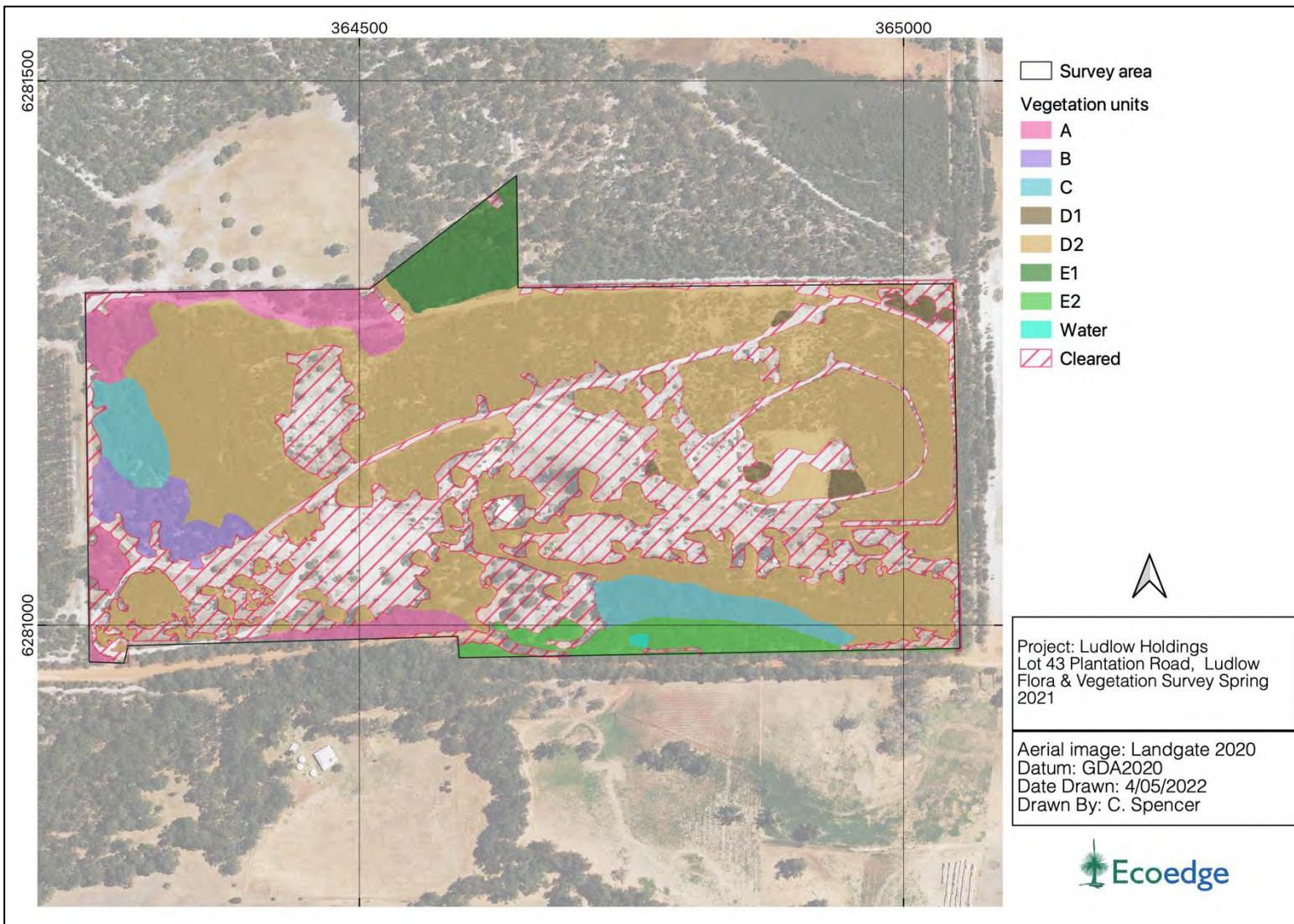


Figure 15. Vegetation units within the survey area.

5.6 Vegetation condition

Almost a third of the survey area (32%) was categorized as Cleared, with only scattered trees or shrubs. Another third of the survey area was in Good to Excellent condition. The Degraded and Completely Degraded areas represent areas that have only partly regenerated after the clearing 20-30 years ago.

A breakdown of the condition of the survey area vegetation is shown in (Table 14) and a breakdown of vegetation condition per unit is provided in Table 15. The distribution of vegetation condition in the survey area is mapped in Figure 16.

Table 14. Area and percentage of the survey area in vegetation condition classes.

Condition	Area (ha)	%
Excellent	0.70	3.93
Very Good	2.46	13.78
Good	5.44	30.45
Degraded	6.68	37.43
Completely Degraded	2.58	14.42
	17.86	100.00
Cleared	9.55	
Grand Total	27.41	

Table 15. Area and condition classes for the various vegetation unit within the survey area.

Vegetation Unit/Sub-unit	Cons Status	Condition	Area (ha)	%
A		Degraded	0.58	68.35
		Completely Degraded	0.27	31.65
		Total	0.85	100.00
B		Good	0.31	49.61
		Degraded	0.32	50.39
		Total	0.63	100.00
C		Very Good	0.96	82.50
		Good	0.07	6.29
		Degraded	0.10	8.53
		Completely Degraded	0.03	2.67
		Total	1.16	100.00
D1		Good	0.07	33.18
		Degraded	0.13	60.66
		Completely Degraded	0.01	6.16
		Total	0.21	100.00

Vegetation Unit/Sub-unit	Cons Status	Condition	Area (ha)	%
D2		Very Good	0.70	5.33
		Good	4.84	36.94
		Degraded	5.30	40.47
		Completely Degraded	2.26	17.26
		Total	13.11	100.00
E1	TEC (BC Act)	Excellent	0.70	64.19
	TEC (BC Act)	Good	0.14	12.64
	TEC (BC Act)	Degraded	0.25	23.17
		Total	1.09	100.00
E2	TEC (BC Act)	Very Good	0.80	100.00
		Total	0.80	100.00
		Total Remnant veg	17.86	
Water/Cleared			9.55	
		Grand Total	27.41	

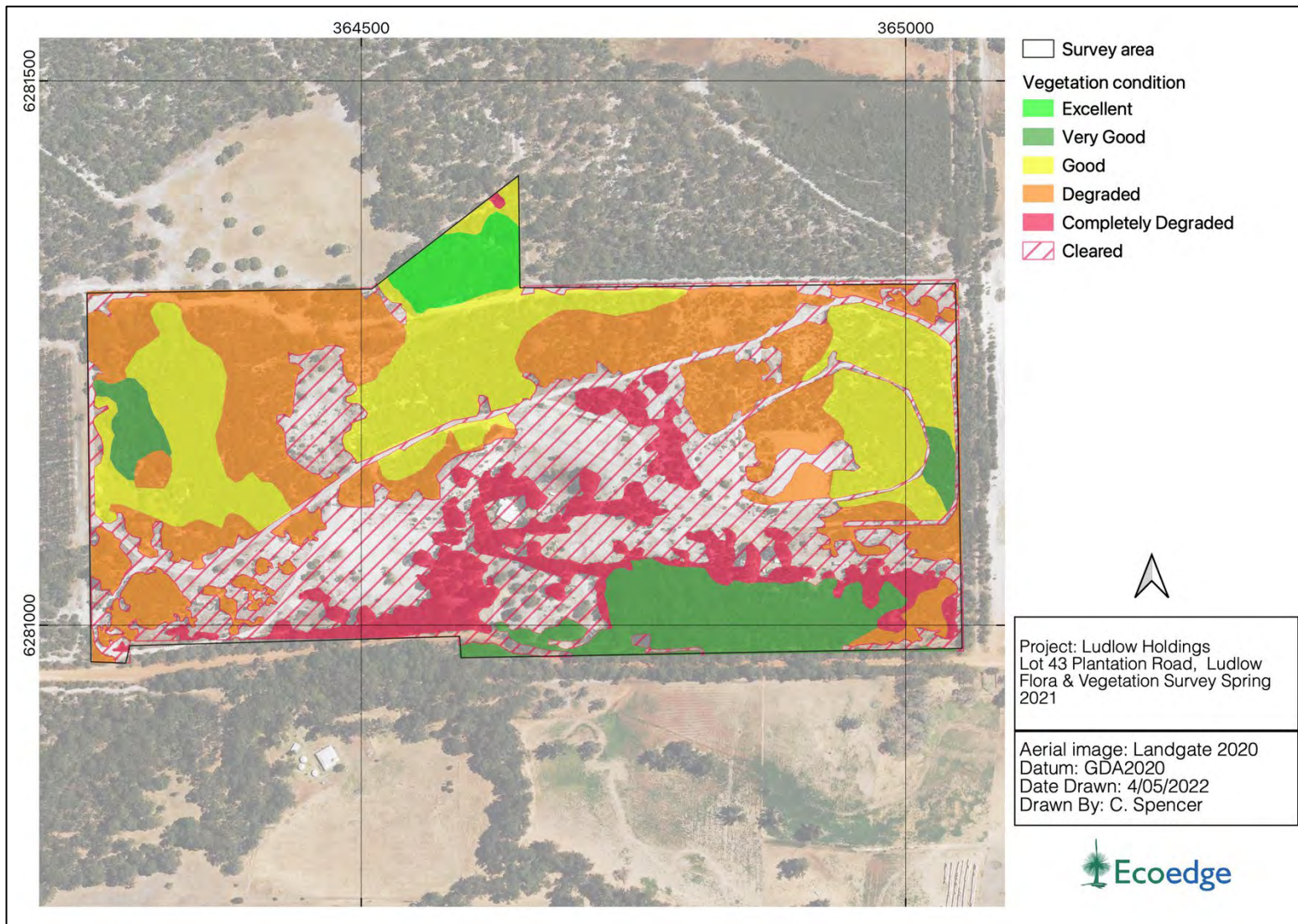


Figure 16. Vegetation condition within the survey area.

5.7 Conservation status of vegetation units

5.7.1 SWAFCT1b Southern *Corymbia calophylla* woodlands on heavy soils

Both sub-unit E1 and E2 (approximately 1.89 ha in total) resemble the State-listed TEC “Southern *Corymbia calophylla* woodlands on heavy soils” (SWAFCT1b) in that they are comprised of *C. calophylla* -dominated open forest on heavy soils, although they are quite different expressions of this floristic community type. Sub-unit E1 is a more typical variant of the community, with *Kingia australis* and *Xanthorrhoea brunonis* in the understorey and is on grey-brown sandy loam. Sub-unit E2, which has *Eucalyptus rudis* as a co-dominant, has some characteristics of the “water fringing communities” described in Webb et al. (2009). Indeed, the Ludlow River flows just to the south of the survey area. Nevertheless, sub-unit E2 is considered an occurrence of the State-listed TEC “Southern *Corymbia calophylla* woodlands on heavy soils”. The areas of the TEC are shown in **Figure 17**.

Vegetation unit A is comprised of *Corymbia calophylla* woodland or open forest on sandy soils. Originally it would have been superficially similar to sub-unit E1, although with more understorey species typical of sandy soils. However, most understorey species have now been replaced by introduced grasses and forbs, and it is now in Degraded to Completely Degraded condition. Because of the paucity of native understorey species and the sandiness of the soil, it is not regarded as an occurrence of the “Southern *Corymbia calophylla* woodlands on heavy soils” TEC (SWAFCT1b). The DBCA reporting form is supplied in **Appendix 13**.

5.7.2 Banksia woodlands of the SCP

Sub-unit D1, which occurs on deep pale sands, contains either *Banksia attenuata* or *B. ilicifolia*. Originally it was either “Central *Banksia attenuata*-*Eucalyptus marginata* woodlands” (SWAFCT21a) or “Southern *Banksia attenuata* woodlands” (SWAFCT21b), but there are not enough remaining understorey taxa to be certain which. It is not regarded as an occurrence of State-level PEC and Federally-listed TEC “Banksia Woodlands of the Swan Coastal Plain” because no patches exceed the 2-ha minimum extent for vegetation in Good condition to qualify (DotEE 2016).

Sub-unit D2, which also occurs on pale, deep sands, represents areas of what was previously *Banksia attenuata*-dominated woodland where the *Banksia* has been removed either by historical clearing or by Phytophthora dieback disease. Even though this sub-unit was mapped as Very Good condition in some places, it is not regarded as an occurrence of the Banksia Woodlands of the Swan Coastal Plain PEC/TEC because of the almost complete absence of *Banksia attenuata* or *B. ilicifolia* (DotEE 2016).

5.7.3 Wetland units

Unit B comprises open low woodland dominated by *Melaleuca preissiana* and sedgeland, some of which appear to have been affected by historical clearing. This vegetation unit is

similar to the “*Melaleuca preissiana* damplands” (SWAFCT04) unit of Gibson et al. (1994). It is not regarded as a PEC or TEC.

Unit C, which is wetland vegetation comprised mainly of *Melaleuca preissiana* woodland, with occasional emergent *C. calophylla*, is again similar to the “*Melaleuca preissiana* damplands” (SWAFCT04) unit of Gibson et al. (1994). However, particularly in the southern part of the survey area, it contains species such as *Beaufortia squarrosa*, *Grevillea manglesioides* and *Taxandria fragrans*, which are not typical of that floristic community type. It is likely that unit C, particularly that portion in the southern part of the survey area, is an example of the “relictual wetlands” mentioned in Webb et al. (2009) in their report on the flora and vegetation of the Busselton Plain. Therefore, even though it does not resemble a PEC or TEC, vegetation unit C is regarded as of high conservation value.

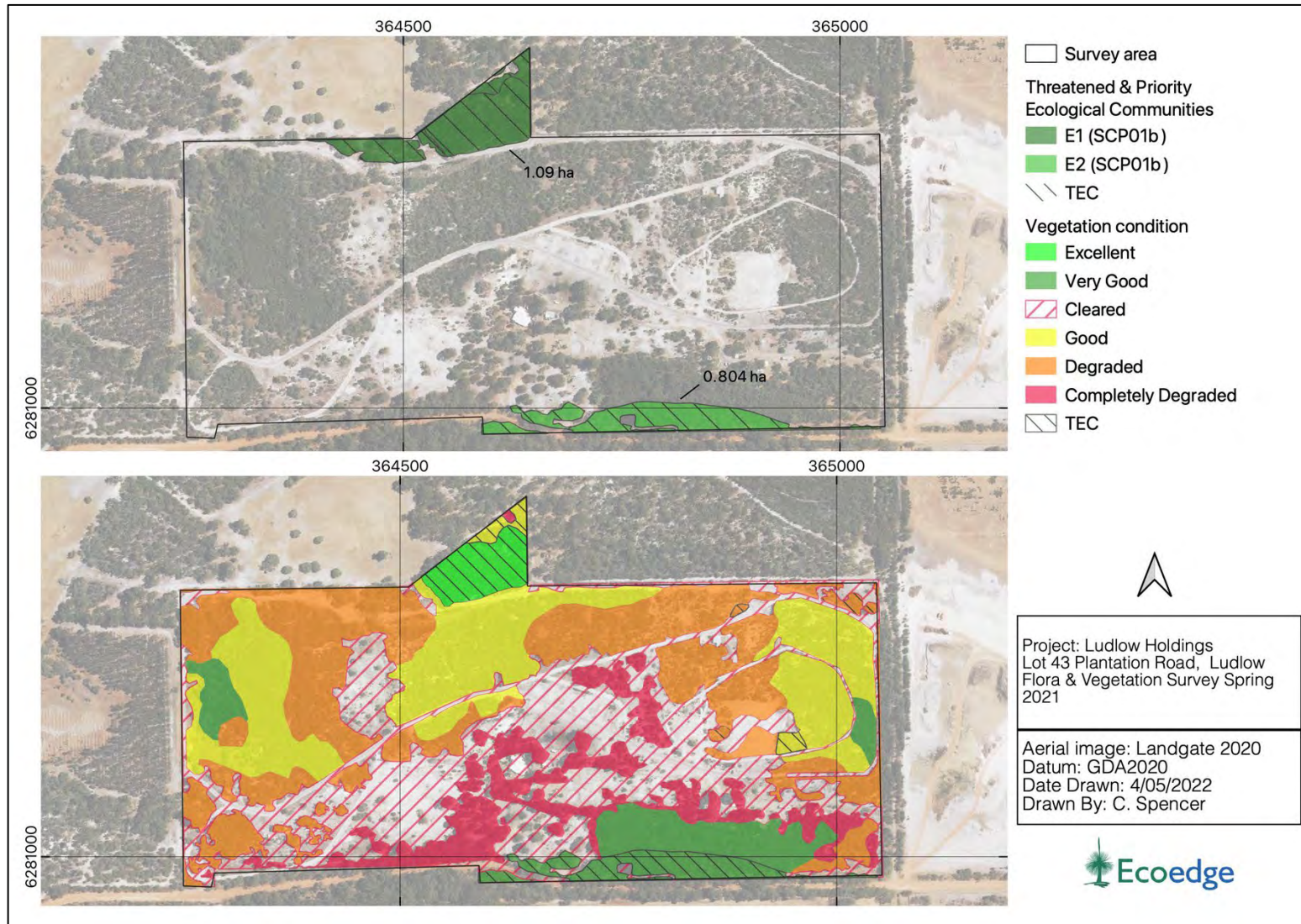


Figure 17. Vegetation condition of the TEC within the survey area.

6 Discussion and conclusions

6.1 Significance of the flora

Drakaea elastica is declared as Threatened flora under the Western Australian *BC Act* and is ranked as Critically Endangered (CR) under World Conservation Union (IUCN) criterion B2ab (ii,iii,iv,v) due to the severe fragmentation of populations and the continuing decline in the area, extent and quality of habitat and number of mature individuals (DEC, 2009). *D. elastica* is also listed as Endangered under the EPBC Act.

The main threats are land clearing, degradation and fragmentation of habitat, edge effects, density of ground-level vegetation, grazing, inappropriate disturbance, construction and maintenance work, rubbish dumping, weeds, disease, inappropriate fire regimes, poor recruitment, and salinity (DEC 2009).

The population of *D. elastica* within the survey area is one of the largest known (DEC 2009). As such, it is of particular importance for the conservation of this threatened species.

The priority 1 *Dillwynia* sp. Capel (PA Jurjevich 1771) is usually restricted to the Blackwood Plateau, and the occurrence in the survey area is one of the few known on the Swan Coastal Plain.

Boronia tetragona (priority 3) is found over a narrow range of about 40 km on the Swan Coastal Plain south of Bunbury and on the adjacent northern Blackwood Plateau. Many populations are in small reserves and native vegetation remnants on the coastal plain and therefore are vulnerable.

Acacia semitrullata, a priority 4 species, while not uncommon on the Swan Coastal Plain, is often restricted to road verges or remnant vegetation where the tenure is not secure for conservation purposes. Most of the *A. semitrullata* plants in the survey area occur in vegetation that is in Good or Very Good condition, and it is recommended that this vegetation, along with the Priority flora in it, is protected.

The priority 4 taxon *Eucalyptus rudis* subsp. *cratyantha*, which is found in the southern wetland (unit E), is restricted to the southern Swan Coastal Plain, south of Perth. Many populations consist only of “paddock” trees where there is no regeneration, so populations in native vegetation have particular value.

Several disjunct or “range end” taxa within the survey area, such as *Beaufortia squarrosa* and *Taxandria fragrans*, occur in vegetation unit C, which resembles the relictual wetland communities described by Webb et al. (2009). Range end species are at (or near) the limit of their distribution. As such, they may have genetic characteristics important in understanding the development and genetic diversity within a taxon.

A range extension species, *Drosera zonaria*, was found at several locations in vegetation unit D2. This species of taxon is normally found from just north of Perth through the Wheatbelt to the east of Esperance. Within its typical range, *D. zonaria* is common however, the population within the survey area is over 200 km from the nearest other known occurrences. As such, it is a significant outlier and possibly a genetic isolate.

The occurrence of *Conospermum teretifolium* within the survey area is one of the most northerly known, whereas the *Calytrix fraseri* in the survey area is one of the most southerly.

Macarthuria apetala occurs along the south coast and on the Swan Coastal Plain. The occurrence within the survey area would be one of the most southerly on the Swan Coastal Plain.

Sporadanthus strictus has a mainly south coast distribution from near Albany to Margaret River. The population in the survey area is one of the most northerly known and is therefore important in understanding the genetics of this taxon.

6.2 Significance of the vegetation

Both sub-units E1 and E2 are considered to represent occurrences of the “Southern *Corymbia calophylla* woodlands on heavy soils”, a State-listed TEC. The occurrences of this vegetation in the survey area are mainly in Very Good to Excellent condition. Consequently, they are protected under the BC Act. Area statements for these vegetation units are provided in **Table 14** above.

Unit C, which is mainly comprises of woodland dominated by *Melaleuca preissiana*, while not a PEC or TEC, is probably one of the relictual wetlands of the Busselton Plain mentioned in Webb et al. (1994). Several disjunct or “range end” taxa, including *Beaufortia squarrosa*, *Sporadanthus strictus* and *Taxandria fragrans* occur in this vegetation unit. It is recommended that this wetland vegetation is protected during any development within the survey area.

6.3 Vegetation complexes and associations

Two vegetation complexes are mapped to occur across the survey area: the Southern River complex and the Abba Complex, with the Southern River complex making up the bulk of the survey area. The vegetation units described for the survey are broadly representative of both described complexes. The Southern River Complex has less than 30% of its pre-European extent remaining. The Abba Complex has less than 10% remaining.

There is one of Beard’s vegetation associations mapped within the survey area: association 1000 ‘Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (*Melaleuca* spp.)’. This association is a reasonable match for survey area vegetation units. It

has less than the desired target of 30% of its pre-European extent remaining at all tiers of assessment.

6.4 Ecological linkages

Portions of the survey area are contiguous with vegetation linked to two formally mapped Regional ecological linkages which occur to the north of the survey area (Molloy et al. 2009). Accordingly, these areas have been assigned the highest tier proximity value ratings of 1a, 1b and 1c. Much of the area was not assigned a proximity value rating by Molloy et al. (2009) as, at the time of assessment, this was mostly cleared land. Should the site be reassessed, these formally cleared areas have regrown and would likely be assigned similarly high proximity value ratings.

There is no statutory basis for the protection of ecological linkages. However, in general, the importance of ecological linkages has been recognised as an environmental policy consideration in EPA and Planning policy (EPA 2008 and references therein).

6.5 Waterways and wetlands

There are no mapped Conservation category or Resource Enhancement wetlands within the boundary of the survey area (DBCA 2018). The nearest Conservation category and Resource Enhancement wetlands are both located approximately 920 m north-northeast of the survey area.

Vegetation units B and C and sub-unit E2, however, are considered to represent wetland or riparian vegetation because of the presence of typical wetland species such as the trees *Eucalyptus rudis* and *Melaleuca preissiana* and shrubs such as *Aotus gracillima* and *Astartea scoparia* and *Grevillea manglesioides*.

6.6 Environmentally Sensitive Areas

The survey area does not intersect a mapped ESA (DWER 2020). The nearest ESA is located approximately 830 m to the southwest of the survey area.

Exemptions for the need to obtain a clearing permit under the Environmental Protection (Clearing of Native Vegetation) Regulation 2004 do not apply within the boundary of ESAs.

As per the EP Act, ESA's which include threatened species should include a 50m buffer around the threatened species.

7 References

- Beard, J. S., Beeston, G.R., Harvey, J.M., Hopkins, A. J. M. and Shepherd, D. P. (2013). The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. Conservation Science Western Australia 9: 1-152.
- Beeston, G.R., Hopkins, A.J.M. and Shepherd, D.P. (eds) (2001). *Land-use and Vegetation, Western Australia*. Agriculture Western Australia, South Perth and National Land and Water Resources Audit, Canberra, from: <http://www.agriculture.gov.au/abares/aclump/Documents/WA%20Luse%201997%20Report.pdf>
- Commonwealth of Australia (2016). *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions)*. Department of the Environment and Energy. <https://data.gov.au/dataset/interim-biogeographic-regionalisation-for-australia-ibra-version-7>.
- Crossman, S., Li, O. (2015). Surface Hydrology Lines (National). Geoscience Australia, Canberra. <http://pid.geoscience.gov.au/dataset/ga/83130>
- Department of Agriculture, Water and the Environment (DAWE) (2020). *Protected Matters Search Tool query*. Generated 24 September 2020.
- Department of Agriculture, Water and the Environment (DAWE) (2022). *Protected Matters Search Tool query*. Generated 03 March 2022.
- Department of Agriculture, Water and the Environment (DAWE) (2020b). Categories of Threatened ecological communities under the EPBC Act. <http://www.environment.gov.au/biodiversity/threatened/communities/about#What is a threatened ecological community TEC>.
- Department of Agriculture, Water and the Environment (DAWE) (2020c). Categories of Threatened species under the EPBC Act. <https://www.environment.gov.au/biodiversity/threatened/species>.
- Department of Biodiversity, Conservation and Attractions (2018a). Threatened ecological communities endorsed by the Minister for the Environment (June 2018). https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_for_the_environment_june_2018.pdf.
- Department of Biodiversity, Conservation and Attractions (2018b). Threatened and Priority Flora list (5 December 2018). Department of Biodiversity Conservation and

Attractions. <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants>.

Department of Biodiversity, Conservation and Attractions (2018c) Directory of important Wetlands in Australia – Western Australia data set, DBCA-045 <https://catalogue.data.wa.gov.au/dataset/directory-of-important-wetlands-in-western-australia>

Department of Biodiversity, Conservation and Attractions (2020). *Naturemap, Western Australian Herbarium*. <http://naturemap.dpaw.wa.gov.au/default.aspx> accessed 24 September 2021.

Department of Biodiversity, Conservation and Attractions (2021a). *Extract from the Department's Threatened and Priority Ecological Community database*, DBCA Species and Communities Branch, 21 September 2021.

Department of Biodiversity, Conservation and Attractions (2021b). Priority ecological communities for Western Australia, Version 30. Species and Communities Program, Department of Biodiversity, Conservation and Attractions 21 July 2021. <https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority%20Ecological%20Communities%20list.pdf>

Department of Biodiversity, Conservation and Attractions (2021c). *Naturemap, Western Australian Herbarium*. <http://naturemap.dpaw.wa.gov.au/default.aspx> accessed 26 August 2021.

Department of Biodiversity, Conservation and Attractions (2021e). Geomorphic Wetlands, Swan Coastal Plain Data Set DBCA-019, last updated 18/10/21. <https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>

Department of Biodiversity, Conservation and Attractions (2022). Download from the WA Herbarium plant species database (7/04/2022).

Department of Environment and Conservation (2009). Glossy-leafed Hammer Orchid (*Drakaea elastica*) Recovery Plan. Department of Environment and Conservation, Western Australia.

Department of Environment and Conservation (DEC) (2013). *Definitions, categories and criteria for threatened and priority ecological communities*. Department of Environment and Conservation, Perth, Western Australia.

Department of the Environment and Energy (2016). Approved Conservation Advice (incorporating listing advice) for the *Banksia* Woodlands of the Swan Coastal Plain ecological community. Canberra.

- Department of Water Environment Regulation (DWER) (2020). Clearing Regulations - *Environmentally Sensitive Areas* (DWER046). <https://catalogue.data.wa.gov.au/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046>.
- Environment Australia (2001). National objectives and targets for biodiversity conservation 2001–2005. <http://www.environment.gov.au/resource/national-objectives-and-targets-biodiversity-conservation-2001%E2%80%932005>.
- Environmental Protection Authority (2008). Environmental Guidance for Planning and Development. Guidance Statement 33.
- Environmental Protection Authority of WA (2016). *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment*. EPA, Perth, Western Australia. http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA/Technical/Guidance/FloraandVegetationsurvey_Dec13.pdf
- Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). A floristic survey of the southern Swan Coastal Plain: report to Heritage Council of W.A. and Australian Heritage Commission. Department of Conservation and Land Management, Western Australia.
- Government of Western Australia (2005). Environmental Protection (Environmentally Sensitive Areas) Notice 2005 (Environmental Protection Act 1986). *Government Gazette, No.55*.
- Government of Western Australia (2019a). 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth. <https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics>
- Government of Western Australia. (2019b). 2018 South West Vegetation Complex Statistics. Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth, <https://catalogue.data.wa.gov.au/dataset/dbca>
- Hedde, E.M., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System. In: Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Western Australia.
- McArthur, W.M. and Bettenay, E. (1960). The development and distribution of the soils of the Swan Coastal Plain, Western Australia. Soil Publication No 16, CSIRO, Melbourne.
- Mattiske, E.M. and Havel, J.J. (1998). Vegetation Mapping in the South West of Western Australia and Regional Forest Agreement vegetation complexes. Map sheets for

- Pemberton, Collie, Pinjarra, Busselton-Margaret River, Mt Barker, and Perth, Western Australia. Scale 1:250,000. Department of Conservation and Land Management, Perth.
- Mitchell, D., Williams, K. and Desmond, A. (2002) Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) Subregional description and biodiversity values. Department of Conservation and Land Management.
- Molloy, S., O'Connor, T., Wood, J. and Wallrodt, S. (2009). South West Regional Ecological Linkages Technical Report. Western Australian Local Government Association (WALGA) and the Department of Environment and Conservation (DEC). West Perth.
- NVIS Technical Working Group (2017) Australian Vegetation Attribute Manual: National Vegetation Information System, Version 7.0. Department of the Environment and Energy, Canberra. Prep by Bolton, M.P., deLacey, C. and Bossard, K.B. (Eds).
- Semeniuk, C.A. and Semeniuk, V. (1995), A Geomorphic Approach to Global Classification for Inland Wetlands. *Vegetatio*, 118, 103-124.
- Shepherd, D., Beeston, G. and Hopkins, A. (2002). *Native Vegetation in Western Australia – Extent, Type and Status*. Department of Agriculture, Perth.
- Thackway, R. and Cresswell, I. (1995). An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program Version 4.0 Canberra : Australian Nature Conservation Agency, Reserve Systems Unit.
- Tille, P J, and Lantzke, N C. (1990). Busselton, Margaret River, Augusta: land capability study. Department of Primary Industries and Regional Development, Western Australia, Perth. Report 5.
- Webb, A, Keighery, B.J., Keighery, G.J., Longman, V. (2009). The flora and vegetation of the Busselton Plain (Swan Coastal Plain): a report for the Department of Environment and Conservation as part of the Swan Bioplan Project. Dept. of Environment and Conservation, Perth, Western Australia.
- Webb, A., Kinloch, J., Keighery, G. and Pitt, G. (2016). The Extension of Vegetation Complex Mapping to Landform boundaries within the Swan Coastal Plain Landform and Forested Region of South West Western Australia. Department of Parks and Wildlife, Bunbury, WA.

Appendix 1 Threatened and Priority flora Likelihood of occurrence assessment methodology.

Rating	Presurvey rationale	Post survey rationale
Recorded		Taxon was or has been recorded in the survey area.
Likely	Known to occur within one kilometre (km) of the survey area with suitable habitat known or predicted to occur within the survey area.	<p>The taxon is known to occur within one km of the survey area and very suitable habitat was present, but the taxon was not observed for one of the following reasons.</p> <ul style="list-style-type: none"> L1. The taxon was dormant at the time of survey and could therefore not be located. L2. The habitat was compromised, for example due to a recent fire. L3. The survey area is challenging to survey. The taxon is non- descript and difficult to find because, for example, it occurs in large areas of rocky granite outcrops, or within an expanse of open water.
Possible	Known to occur within a five-ten km of the survey area with suitable habitat known or predicted to occur within the survey area.	<p>The taxon is known from within a five to ten km radius of the survey area, and suitable habitat for the species was present, but despite a thorough search being carried out, the species was not observed. The taxon may however be present for any of the following reasons.</p> <ul style="list-style-type: none"> P1. The taxon was dormant at the time of survey and could therefore not be located. P2. The habitat was compromised, for example, due to a recent fire. P3. The survey area is challenging to survey. Te taxon is non- descript and difficult to find because, for example, it occurs in large areas of rocky granite outcrops, or within an expanse of open water.
Unlikely	Known or predicted to occur within ten km, but no suitable habitat is known or predicted to occur within the survey area.	<p>The taxon was not found and is unlikely to be present for one or more of the following reasons:</p> <ul style="list-style-type: none"> U1. No suitable habitat was observed, and the taxon is known to be restricted to a narrow and clearly defined habitat type. U2. Suitable or potential habitat was present and appropriately searched, but the taxon was not observed. U3. Suitable habitat present, but these areas were too degraded for the taxon to occur, for example, due to weed invasion and/or clearing.

Example of application of pre and post-survey likelihood of occurrence

Taxon	Cons Status	Flowering	Description	Pre survey likelihood	Post Survey Likelihood
<i>Drakaea elastica</i>	T (EN)	Oct-Nov	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red, green, yellow. White or grey sand. Low-lying situations adjoining winter-wet swamps.	Likely	Unlikely (U3)

Appendix 2. Vegetation condition scale (EPA 2016).

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Appendix 3. Categories of Threatened ecological communities under the EPBC Act.

Category	Definition
Critically endangered (CR)	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered (EN)	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable (VU)	If, at that time, an ecological, community is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future (indicative timeframe being the next 50 years).

Appendix 4. Categories of threatened and priority ecological communities under the BC Act.

Conservation code	Category
(T) Threatened ecological community pursuant to Sect 27 of the <i>Biodiversity Conservation Act 2016</i> .	
T	<p>(T) CR – Critically endangered</p> <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p>
	<p>(T) EN - Endangered</p> <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p>
	<p>(T) VU - Vulnerable</p> <p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p>
(P) Priority species – possible threatened communities.	
p1	<p>Poorly known communities</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>

Conservation code	Category
P2	<p>Poorly known communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
P3	<p>Poorly known communities</p> <ul style="list-style-type: none"> a) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: b) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; c) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
P4	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <ul style="list-style-type: none"> a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	<p>Conservation dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Appendix 5. Definitions of conservation codes for Threatened and Priority flora.

Conservation code	Category
(T) Threatened species pursuant to Sect 19 of the BC Act 2016.	
T	<p>(T) CR – Critically endangered</p> <p>Threatened species considered to be <i>“facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”</i>.</p>
	<p>(T) EN - Endangered</p> <p>Threatened species considered to be <i>“facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”</i>.</p>
	<p>(T) VU - Vulnerable</p> <p>Threatened species considered to be <i>“facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”</i>.</p>
(P) Priority species – possible Threatened species.	
P1	<p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>

Conservation code	Category
P3	<p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
P4	<p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Appendix 6. Categories of Threatened species under the EPBC Act.

Category	Definition
Extinct (Ex)	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (ExW)	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Appendix 7. Protected Matters Search Tool and NatureMap reports



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 26/08/21 18:21:07

[Summary](#)

[Details](#)

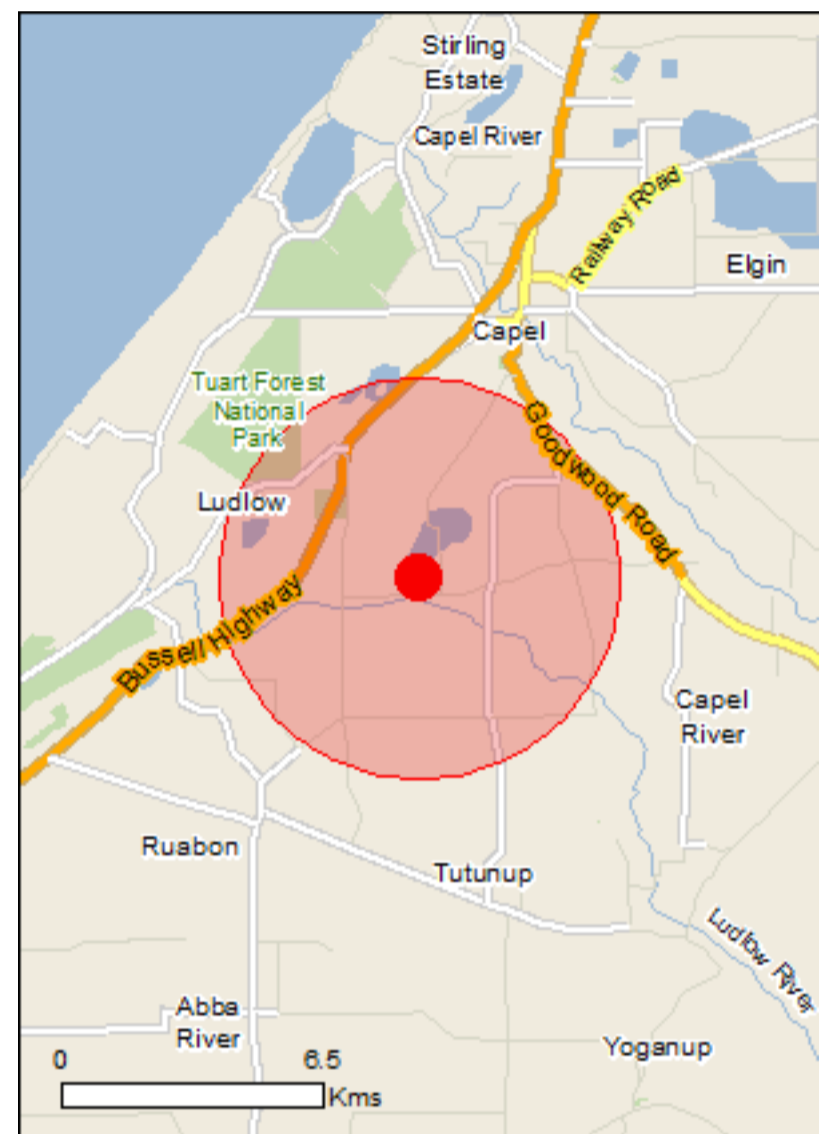
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

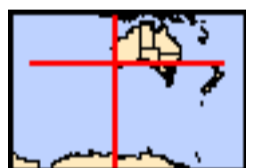
[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2015

[Coordinates](#)

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	33
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	25
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)

[\[Resource Information \]](#)

Name	Proximity
Vasse-wonnerup system	Within 10km of Ramsar

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area

Fish

Name	Status	Type of Presence
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroi Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat likely to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia busselliana Bussell's Spider-orchid [24369]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat known to occur within area
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea maccutcheonii McCutcheon's Grevillea [64522]	Endangered	Species or species habitat likely to occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat known to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat likely to occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Capel	WA
NTWA Bushland covenant (0175)	WA
Tuart Forest	WA
Unnamed WA50190	WA

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
------	--------	------------------

Birds

Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area

Mammals

Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Nationally Important Wetlands [\[Resource Information \]](#)

Name	State
McCarleys Swamp (Ludlow Swamp)	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.60071 115.54112

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

© Commonwealth of Australia

Department of Agriculture Water and the Environment

GPO Box 858

Canberra City ACT 2601 Australia

+61 2 6274 1111

Plantation Rd Significant flora NatureMap Report 5km

Created By Guest user on 26/08/2021

Kingdom Plantae

Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)

Current Names Only Yes

Core Datasets Only Yes

Method 'By Circle'

Centre 115° 32' 28" E, 33° 36' 03" S

Buffer 5km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	3339 <i>Acacia flagelliformis</i>		P4	
2.	3537 <i>Acacia semitrullata</i>		P4	
3.	43201 <i>Adelphacme minima</i>		P3	
4.	4586 <i>Amperea micrantha</i>		P2	
5.	7829 <i>Angianthus drummondii</i>		P3	
6.	141 <i>Aponogeton hexatepalus</i> (Stalked Water Ribbons)		P4	
7.	20026 <i>Blennospora doliiformis</i>		P3	
8.	16313 <i>Boronia anceps</i>		P3	
9.	17804 <i>Boronia tetragona</i>		P3	
10.	1596 <i>Caladenia huegelii</i> (Grand Spider Orchid)		T	
11.	13862 <i>Caladenia speciosa</i>		P4	
12.	1213 <i>Calectasia cyanea</i> (Blue Tinsel Lily)		T	
13.	35796 <i>Calothamnus quadrifidus</i> subsp. <i>teretifolius</i>		P4	
14.	19338 <i>Chamaescilla gibsonii</i>		P3	
15.	17686 <i>Chordifex gracilior</i>		P3	
16.	34765 <i>Darwinia whicherensis</i>		T	
17.	1639 <i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)		T	
18.	41803 <i>Eryngium</i> sp. <i>Ferox</i> (G.J. Keighery 16034)		P3	
19.	1945 <i>Franklandia triaristata</i> (Lanoline Bush)		P4	
20.	14011 <i>Grevillea brachystylis</i> subsp. <i>brachystylis</i>		P3	
21.	14526 <i>Grevillea elongata</i>		T	
22.	16522 <i>Isopogon formosus</i> subsp. <i>dasylepis</i>		P3	
23.	20462 <i>Jacksonia gracillima</i>		P3	
24.	29492 <i>Leucopogon</i> sp. <i>Busselton</i> (D. Cooper 243)		P2	
25.	13779 <i>Loxocarya magna</i>		P3	
26.	33742 <i>Microtis quadrata</i>		P4	
27.	2874 <i>Montia australasica</i>		P2	
28.	36200 <i>Ornduffia submersa</i>		P4	
29.	14085 <i>Petrophile latericola</i>		T	
30.	974 <i>Schoenus benthamii</i>		P3	
31.	999 <i>Schoenus loliaceus</i>		P2	
32.	1003 <i>Schoenus natans</i> (Floating Bog-rush)		P4	
33.	25800 <i>Stylidium paludicola</i>		P3	
34.	7803 <i>Stylidium striatum</i> (Fan-leaved Triggerplant)		P4	
35.	16769 <i>Synaphea hians</i>		P3	
36.	16862 <i>Synaphea petiolaris</i> subsp. <i>simplex</i>		P3	
37.	1033 <i>Tetralia australiensis</i>		T	
38.	1334 <i>Thysanotus glaucus</i>		P4	
39.	44444 <i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)		P4	
40.	12392 <i>Verticordia attenuata</i>		P3	
41.	12412 <i>Verticordia densiflora</i> var. <i>pedunculata</i>		T	
42.	14714 <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		P4	

Conservation Codes

T - Rare or likely to become extinct
 X - Presumed extinct
 IA - Protected under international agreement
 S - Other specially protected fauna
 1 - Priority 1
 2 - Priority 2
 3 - Priority 3
 4 - Priority 4

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
---------	--------------	-------------	-------------------	------------------------------------

5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 8. Pre and post likelihood of occurrence.

SPECIES	CATEGORY*	FLOWERING	DESCRIPTION AND HABITAT	Pre-likelihood	Post Survey Likelihood
<i>Dillwynia</i> sp. Capel (PA Jurjevich 1771)	P1	Sept - Octo	Erect, open, spreading shrub, to 2 m high. Fl. yellow & orange & red & pink, Sep to Oct. Littered grey loamy sand, rocky soils.	-	Recorded
<i>Amperea micrantha</i>	P2	Oct to Nov	Low, spreading, bushy perennial, herb, 0.1-0.3 m high. Fl. brown. Sandy soils.	Possible	Unlikely (U2)
<i>Leucopogon</i> sp. Busselton (D. Cooper 243)	P2	Aug- Sept	Slender, erect shrub to 70 cm; flowers white. <i>Pericalymma ellipticum</i> wet shrubland, Marri-Jarrah woodland.	Possible	Unlikely (U2)
<i>Montia australasica</i>	P2	Nov-Mar	Terrestrial or aquatic perennial herb, rooting from leaf nodes, terrestrial plants densely tufted and carpeting, aquatics loose and open. Fl. White - pale pink. Wet soil in permanent or winter wet swamps or aquatic in slow moving watercourses.	Possible	Unlikely (U2)
<i>Schoenus loliaceus</i>	P2	Aug to Nov	Annual, grass-like or herb (sedge), 0.03-0.06 m high. Fl. Sandy soils. Winter-wet depressions.	Possible	Unlikely (U2)
<i>Stylidium paludicola</i>	P3	Oct to Dec	Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. pink. Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Likely	Unlikely (U2)

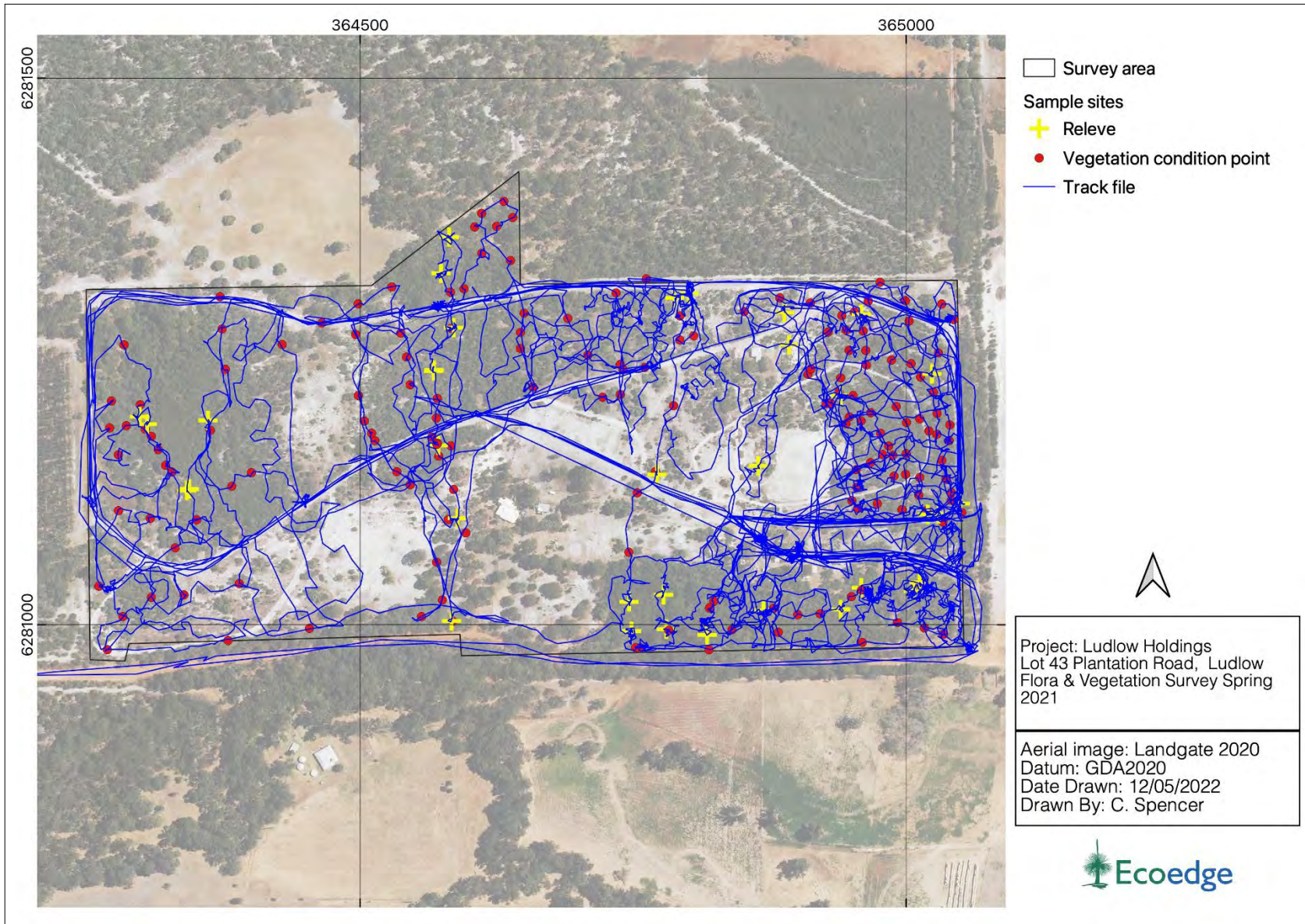
SPECIES	CATEGORY*	FLOWERING	DESCRIPTION AND HABITAT	Pre-likelihood	Post Survey Likelihood
<i>Verticordia attenuata</i>	P3	Dec or Jan to May	Shrub, 0.4-1 m high. Fl. pink. White or grey sand. Winter-wet depressions.	Likely	Unlikely (U2)
<i>Adelphacme minima</i>	P3		Erect annual, herb, 0.03-0.05m high. Fl. white. Grey sand, wet flats, swamps.	Possible	Unlikely (U2)
<i>Boronia anceps</i>	P3	Sep to Dec or Jan	Perennial, herb, 0.3-0.6 m high, lacking lignotuber, stem flattened and ancipitous when young. Fl. pink/pink-purple. White sand, gravelly laterite. Seasonally swampy heaths.	Possible	Unlikely (U2)
<i>Boronia tetragona</i>	P3	Oct to Dec	Perennial, herb, 0.3-0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink & red. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Possible	Recorded
<i>Grevillea brachystylis</i> subsp. <i>brachystylis</i>	P3	Sep to Dec or Jan	Prostrate or erect, non-lignotuberous shrub, 0.1-2 m high. Fl. red. Sand, sandy clay. Swampy situations, stream banks.	Possible	Unlikely (U2)
<i>Isopogon formosus</i> subsp. <i>dasylepis</i>	P3	Jun to Dec	Low, bushy or slender, upright, non-lignotuberous shrub, 0.2-2 m high. Fl. pink purple/red. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	Possible	Unlikely (U2)
<i>Jacksonia gracillima</i>	P3	Oct- Nov	Prostrate, spreading or scrambling, shrub, spindly shrub (broom-like), to 1(-1.5) m high. Fl. orange, yellow, rose pink. Sand, loam, clay. Flat, lower slopes, some winter wet.	Possible	Unlikely (U2)
<i>Loxocarya magna</i>	P3	Sep or Nov	Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Fl. ? Sand, loam, clay, ironstone. Seasonally inundated or damp habitats.	Possible	Unlikely (U2)

SPECIES	CATEGORY*	FLOWERING	DESCRIPTION AND HABITAT	Pre-likelihood	Post Survey Likelihood
<i>Olearia strigosa</i>	P3	Dec or Jan to May	Erect shrub, 0.5-1.5 m high. Fl. blue-purple. Sandy loam. Open forest	Possible	Unlikely (U2)
<i>Schoenus benthamii</i>	P3	Oct to Nov	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown, White, grey sand, sandy clay. Winter-wet flats, swamps.	Possible	Unlikely (U2)
<i>Synaphea hians</i>	P3	Jul or Sep to Nov	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. yellow. Sandy soils. Rises.	Possible	Unlikely (U2)
<i>Synaphea petiolaris</i> subsp. <i>simplex</i>	P3	Sep to Oct	Tufted shrub, 0.1-0.6 m high. Fl. yellow. Sandy soils. Flats, winter-wet areas.	Possible	Unlikely (U2)
<i>Chordifex gracilior</i>	P3	Sept to Dec	Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Fl. brown. Peaty sand. Swamps.	Possible	Unlikely (U2)
<i>Angianthus drummondii</i>	P3	Oct to Dec	Erect annual, herb, to 0.1 m high. Fl. yellow. Grey or brown clay soils, ironstone. Seasonally wet flats.	Unlikely	Unlikely (U1)
<i>Blennospora doliiformis</i>	P3	Oct to Nov	Erect annual, herb, to 0.15 m high. Fl. yellow. Grey or red clay soils over ironstone. Seasonally wet flats.	Unlikely	Unlikely (U2)
<i>Chamaescilla gibsonii</i>	P3	Sept	Clumped tuberous, herb. Fl. blue, Sep. Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	Unlikely	Unlikely (U2)
<i>Eryngium</i> sp. <i>Ferox</i> (G.J. Keighery 16034)	P3	Nov	Erect, open tuberous, herb, 0.1–0.3 m high. Fl. green. Grey to brown loamy to sandy clay, brown cracking clay. Winter-wet flats, swamps, dried claypans, ridges.	Unlikely	Unlikely (U2)
<i>Acacia flagelliformis</i>	P4	May-Sept	Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow. Sandy soils. Winter-wet areas.	Possible	Unlikely (U2)
<i>Acacia semitrullata</i>	P4	May to Oct	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream-white. White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Possible	Recorded

SPECIES	CATEGORY*	FLOWERING	DESCRIPTION AND HABITAT	Pre-likelihood	Post Survey Likelihood
<i>Aponogeton hexatepalus</i>	P4	Jul to Oct	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white. Mud. Freshwater: ponds, rivers, claypans.	Possible	Unlikely (U2)
<i>Caladenia speciosa</i>	P4	Sep to Oct	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white-pink. White, grey or black sand	Possible	Unlikely (U2)
<i>Calothamnus quadrifidus</i> subsp. <i>teretifolius</i>	P4	Sept to Dec	Tall woody erect shrub to 3 m, conifer like foliage, ornamental Fl. bright red. Sand, loam, clay, Winter-wet flats.	Possible	Unlikely (U2)
<i>Franklandia triaristata</i>	P4	Aug to Oct	Erect, lignotuberous shrub, 0.2-1 m high. Fl. white-cream-yellow/brown-purple. White or grey sand.	Possible	Unlikely (U2)
<i>Microtis quadrata</i>	P4	Dec-Jan	Slender erect annual herb, 0.3 - 0.8 m high, up to 100 yellowish-green flowers 2.5 - 3mm across. Clay based coastal flats.	Possible	Unlikely (U1)
<i>Ornduffia submersa</i>	P4	Sep to Oct	Tuberous emergent aquatic perennial dwarf shrub, height to 35 cm; flowers white; leaves floating on surface of water. Clay-based ponds and swamps (semi-aquatic)	Possible	Unlikely (U2)
<i>Schoenus natans</i>	P4	Oct	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown. Winter-wet depressions	Possible	Unlikely (U2)
<i>Thysanotus glaucus</i>	P4	Oct to Dec or Jan to Mar	Caespitose, glaucose perennial, herb, 0.1-0.2 m high. Fl. Purple. White, grey or yellow sand, sandy gravel.	Possible	Unlikely (U2)
<i>Tripterococcus</i> sp. <i>brachylobus</i> (A.S. George 14234)	P4	Nov-Dec or Feb	Erect perennial herb to 0.3-0.7 m high Fl. yellow. Grey/black sand. Winter wet depressions	Possible	Unlikely (U2)
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4	May or Nov to Dec or Jan	Erect shrub, 0.2-0.75 m high. Fl. Pink. Sand, sandy clay. Winter-wet depressions	Possible	Unlikely (U2)

SPECIES	CATEGORY*	FLOWERING	DESCRIPTION AND HABITAT	Pre-likelihood	Post Survey Likelihood
<i>Caladenia huegelii</i>	T (EN)	Sep to Oct	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red. Grey or brown sand, clay loam.	Possible	Unlikely (U2)
<i>Drakaea elastica</i>	T (EN)	Oct to Nov	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow. White or grey sand. Low-lying situations adjoining winter-wet swamps.	Possible	Recorded
<i>Verticordia densiflora</i> var. <i>pedunculata</i>	T (EN)	Dec or Jan	Erect to spreading shrub, 0.3-0.6 m high. Fl. pink/pink-white. Grey/yellow sand, sandy loam. Winter-wet low-lying areas.	Possible	Unlikely (U2)
<i>Darwinia whicherensis</i>	T (EN)	Oct to Nov	Erect shrub to 0.7 m high. Fl. green, red. Sand/clay over ironstone. Winter wet/damp.	Unlikely	Unlikely (U2)
<i>Petrophile latericola</i>	T (EN)	Nov	Multi-stemmed shrub, 0.4-1.5 m high. Fl. yellow, Red lateritic clay. Winter-wet flats	Unlikely	Unlikely (U2)
<i>Grevillea elongata</i>	T (VU)	Oct	Shrub, 1.5-2 m high. Fl. white-cream. Gravelly clay, sandy clay, sand. Road verges, swamps, creek banks.	Possible	Unlikely (U2)
<i>Morelotia australiensis</i>	T (VU)	Nov to Dec	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown. Sandy soils associated with heavy soils on the Pinjarra Plain.	Unlikely	Unlikely (U2)

Appendix 9. Track log and relevé points.



Appendix 10. List of vascular flora found within the survey area.

#	FAMILY_NAME	SPECIES	COMMENT	NATURALISED	CONSV_CODE
1	Aizoaceae	<i>Carpobrotus edulis</i>		*	
2	Anarthriaceae	<i>Anarthria prolifera</i>			
3	Anarthriaceae	<i>Lyginia imberbis</i>			
4	Apiaceae	<i>Xanthosia candida</i>			
5	Araceae	<i>Zantedeschia aethiopica</i>		*	
6	Asparagaceae	<i>Asparagus asparagoides</i>		*	
7	Asparagaceae	<i>Chamaescilla corymbosa</i>			
8	Asparagaceae	<i>Dichopogon preissii</i>			
9	Asparagaceae	<i>Lomandra preissii</i>			
10	Asparagaceae	<i>Thysanotus manglesianus</i>			
11	Asteraceae	<i>Arctotheca calendula</i>		*	
12	Asteraceae	<i>Craspedia variabilis</i>			
13	Asteraceae	<i>Hypochaeris glabra</i>		*	
14	Asteraceae	<i>Lagenophora huegelii</i>			
15	Asteraceae	<i>Quinetia urvillei</i>			
16	Asteraceae	<i>Senecio diaschides</i>			
17	Asteraceae	<i>Senecio quadridentatus</i>			
18	Asteraceae	<i>Ursinia anthemoides</i>		*	
19	Colchicaceae	<i>Burchardia congesta</i>			
20	Colchicaceae	<i>Burchardia multiflora</i>			
21	Commelinaceae	<i>Cartonema philydroides</i>			
22	Crassulaceae	<i>Crassula colorata</i>			
23	Cyperaceae	<i>Isolepis marginata</i>			
24	Cyperaceae	<i>Lepidosperma longitudinale</i>			
25	Cyperaceae	<i>Lepidosperma squamatum</i>			
26	Cyperaceae	<i>Mesomelaena tetragona</i>			
27	Cyperaceae	<i>Schoenus efoliatus</i>			
28	Cyperaceae	<i>Schoenus grandiflorus</i>			
29	Cyperaceae	<i>Tetraria octandra</i>			
30	Dasyogonaceae	<i>Dasyogon bromeliifolius</i>			
31	Dasyogonaceae	<i>Kingia australis</i>			
32	Dennstaedtiaceae	<i>Pteridium esculentum</i>			
33	Dilleniaceae	<i>Hibbertia cunninghamii</i>			
34	Dilleniaceae	<i>Hibbertia ferruginea</i>			
35	Dilleniaceae	<i>Hibbertia hypericoides</i>			
36	Dilleniaceae	<i>Hibbertia racemosa</i>			
37	Dilleniaceae	<i>Hibbertia vaginata</i>			
38	Droseraceae	<i>Drosera drummondii</i>			
39	Droseraceae	<i>Drosera enodes</i>			
40	Droseraceae	<i>Drosera erythrorhiza</i>			
41	Droseraceae	<i>Drosera glanduligera</i>			

#	FAMILY_NAME	SPECIES	COMMENT	NATURALISED	CONSV_CODE
42	Droseraceae	<i>Drosera macrantha</i>			
43	Droseraceae	<i>Drosera pallida</i>			
44	Droseraceae	<i>Drosera rosulata</i>			
45	Droseraceae	<i>Drosera zonaria</i>			
46	Ericaceae	<i>Andersonia caerulea</i>			
47	Ericaceae	<i>Brachyloma preissii</i>			
48	Ericaceae	<i>Conostephium pendulum</i>			
49	Ericaceae	<i>Leucopogon australis</i>			
50	Ericaceae	<i>Leucopogon conostephioides</i>			
51	Ericaceae	<i>Leucopogon glabellus</i>			
52	Ericaceae	<i>Leucopogon cordatus</i>	herb. spec.		
53	Ericaceae	<i>Sphenotoma gracilis</i>	sterile		
54	Ericaceae	<i>Styphelia conostephioides</i>			
55	Ericaceae	<i>Styphelia propinqua</i>			
56	Fabaceae	<i>Acacia extensa</i>			
57	Fabaceae	<i>Acacia huegelii</i>			
58	Fabaceae	<i>Acacia pulchella</i>			
59	Fabaceae	<i>Acacia semitrullata</i>			4
60	Fabaceae	<i>Acacia stenoptera</i>			
61	Fabaceae	<i>Aotus gracillima</i>			
62	Fabaceae	<i>Bossiaea eriocarpa</i>			
63	Fabaceae	<i>Daviesia divaricata</i> subsp. <i>divaricata</i>			
64	Fabaceae	<i>Dillwynia</i> sp. Capel (P.A. Jurjevich 1771)			1
65	Fabaceae	<i>Euchilopsis linearis</i>			
66	Fabaceae	<i>Gompholobium tomentosum</i>			
67	Fabaceae	<i>Hardenbergia comptoniana</i>			
68	Fabaceae	<i>Jacksonia horrida</i>			
69	Fabaceae	<i>Mirbelia dilatata</i>			
70	Fabaceae	<i>Ornithopus compressus</i>		*	
71	Goodeniaceae	<i>Dampiera pedunculata</i>			
72	Haemodoraceae	<i>Anigozanthos manglesii</i>			
73	Haemodoraceae	<i>Conostylis aculeata</i>			
74	Haemodoraceae	<i>Conostylis serrulata</i>			
75	Haemodoraceae	<i>Phlebocarya ciliata</i>			
76	Hemerocallidaceae	<i>Caesia micrantha</i>			
77	Hemerocallidaceae	<i>Johnsonia lupulina</i>			
78	Iridaceae	<i>Patersonia occidentalis</i>			
79	Iridaceae	<i>Romulea rosea</i>		*	
80	Juncaceae	<i>Juncus pallidus</i>			
81	Lamiaceae	<i>Hemiandra pungens</i>			
82	Loganiaceae	<i>Phyllangium paradoxum</i>			
83	Loranthaceae	<i>Nuytsia floribunda</i>			
84	Macarthuriaceae	<i>Macarthuria apetala</i>	cons. sig.		
85	Myrtaceae	<i>Agonis flexuosa</i>			

#	FAMILY_NAME	SPECIES	COMMENT	NATURALISED	CONSV_CODE
86	Myrtaceae	<i>Astartea scoparia</i>			
87	Myrtaceae	<i>Beaufortia squarrosa</i>			
88	Myrtaceae	<i>Calytrix fraseri</i>			
89	Myrtaceae	<i>Corymbia calophylla</i>			
90	Myrtaceae	<i>Eremaea pauciflora</i>			
91	Myrtaceae	<i>Eucalyptus marginata</i>			
92	Myrtaceae	<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i>			4
93	Myrtaceae	<i>Hypocalymma angustifolium</i>			
94	Myrtaceae	<i>Hypocalymma ericifolium</i>			
95	Myrtaceae	<i>Hypocalymma robustum</i>			
96	Myrtaceae	<i>Kunzea glabrescens</i>			
97	Myrtaceae	<i>Melaleuca preissiana</i>			
98	Myrtaceae	<i>Melaleuca raphiophylla</i>			
99	Myrtaceae	<i>Melaleuca thymoides</i>			
100	Myrtaceae	<i>Taxandria fragrans</i>			
101	Orchidaceae	<i>Caladenia flava</i>			
102	Orchidaceae	<i>Diuris corymbosa</i>			
103	Orchidaceae	<i>Diuris cruenta</i>			
104	Orchidaceae	<i>Drakaea elastica</i>			T
105	Orchidaceae	<i>Drakaea glyptodon</i>			
106	Orchidaceae	<i>Elythranthera brunonis</i>			
107	Orchidaceae	<i>Leporella fimbriata</i>			
108	Orchidaceae	<i>Paracaleana nigrita</i>			
109	Orchidaceae	<i>Pterostylis glebosa</i>			
110	Orchidaceae	<i>Pterostylis pyramidalis</i>			
111	Orchidaceae	<i>Pterostylis vittata</i>			
112	Orchidaceae	<i>Pterostylis</i> sp. Bloated snail orchid (W. Jackson BJ 486)			
113	Orchidaceae	<i>Pyrorchis nigricans</i>			
114	Orchidaceae	<i>Thelymitra antennifera</i>			
115	Orchidaceae	<i>Thelymitra crinita</i>			
116	Orchidaceae	<i>Thelymitra macrophylla</i>			
117	Orchidaceae	<i>Thelymitra vulgaris</i>			
118	Papaveraceae	<i>Fumaria capreolata</i>		*	
119	Poaceae	<i>Amphipogon turbinatus</i>			
120	Poaceae	<i>Anthoxanthum odoratum</i>		*	
121	Poaceae	<i>Austrostipa compressa</i>			
122	Poaceae	<i>Bromus diandrus</i>		*	
123	Poaceae	<i>Ehrharta longiflora</i>		*	
124	Poaceae	<i>Microlaena stipoides</i>			
125	Proteaceae	<i>Adenanthos meisneri</i>			
126	Proteaceae	<i>Adenanthos obovatus</i>			
127	Proteaceae	<i>Banksia attenuata</i>			
128	Proteaceae	<i>Banksia grandis</i>			
129	Proteaceae	<i>Banksia ilicifolia</i>			

#	FAMILY_NAME	SPECIES	COMMENT	NATURALISED	CONSV_CODE
130	Proteaceae	<i>Grevillea manglesioides</i> subsp. <i>manglesioides</i>			
131	Proteaceae	<i>Stirlingia latifolia</i>			
132	Restionaceae	<i>Chaetanthus aristatus</i>			
133	Restionaceae	<i>Chordifex laxus</i>			
134	Restionaceae	<i>Cytogonidium leptocarpoides</i>			
135	Restionaceae	<i>Desmocladus fasciculatus</i>			
136	Restionaceae	<i>Desmocladus flexuosus</i>			
137	Restionaceae	<i>Hypolaena exsulca</i>			
138	Restionaceae	<i>Hypolaena pubescens</i>			
139	Restionaceae	<i>Leptocarpus coangustatus</i>			
140	Restionaceae	<i>Sporadanthus strictus</i>	<i>cons. sig.</i>		
141	Rubiaceae	<i>Opercularia hispidula</i>			
142	Rutaceae	<i>Boronia crenulata</i> subsp. <i>pubescens</i>			
143	Rutaceae	<i>Boronia dichotoma</i>			
144	Rutaceae	<i>Boronia tetragona</i>			3
145	Rutaceae	<i>Philotheca spicata</i>			
146	Stylidiaceae	<i>Stylidium repens</i>			
147	Stylidiaceae	<i>Stylidium hesperium</i>			
148	Thymelaeaceae	<i>Pimelea angustifolia</i>			
149	Xanthorrhoeaceae	<i>Xanthorrhoea brunonis</i>			
150	Zamiaceae	<i>Macrozamia riedlei</i>			

Appendix 11. Reporting forms for Threatened and Priority flora.



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au> under Standard Report Forms

TAXON: <u>Drakaea elastica</u>		TPFL Pop. No.: _____	
OBSERVATION DATE: <u>3/09/2021</u>	CONSERVATION STATUS: <u>T</u>	New population <input checked="" type="checkbox"/>	
OBSERVER/S: <u>Russell Smith & Colin Spencer</u>		PHONE	<u>0447809124</u>
ROLE: <u>botanist</u>		ORGANISATION: <u>Ecoedge</u>	

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Lot 4499, Plantation Road, in the shire of Capel

Reserve No.: _____

DBC DISTRICT: _____	LGA: <u>Capel</u>	Land manager present: <input type="checkbox"/>	
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)	METHOD USED:	
GDA94 / MGA94 <input type="checkbox"/>	DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/>	GPS <input type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>	
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: <u>6281104</u>	No. satellites: _____	Map used: _____
WGS84 <input type="checkbox"/>	Long / Easting: <u>364997</u>	Boundary polygon captured: <input type="checkbox"/>	Map scale: _____
Unknown <input type="checkbox"/>	ZONE: <u>50</u>		
LAND TENURE:			
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input checked="" type="checkbox"/>	Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input type="checkbox"/>	MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/> SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input type="checkbox"/>	Area observed (m ²): _____
EFFORT: Time spent surveying (minutes): _____	No. of minutes spent / 100 m ² : _____
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>	Count method: _____ <small>(Refer to field manual for list)</small>
WHAT COUNTED: Plants <input type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>	
TOTAL POP'N STRUCTURE:	
	Area of pop (m ²): <u>5000</u>
Alive	
Dead	
QUADRATS PRESENT: No. _____ Size _____ Data attached <input type="checkbox"/> Total area of quadrats (m ²): _____	
Summary Quad. Totals: Alive	
REPRODUCTIVE STATE:	
Clonal <input type="checkbox"/> Vegetative <input checked="" type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input type="checkbox"/>	
Immature fruit <input type="checkbox"/> Fruit <input type="checkbox"/> Dehisced fruit <input type="checkbox"/> Percentage in flower: _____ %	

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information: <small>Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)</small>	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
• Potential clearing	N	E	M
•	---	---	---
•	---	---	---



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input checked="" type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
CONDITION OF SOIL:	Dry <input type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
 2. Open shrubland (Hibbertia sp., Acacia spp.);
 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Agonis flexuosa

2. Kunzea glabrescens

3. _____

4. _____

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Russell Smith Role: botanist Signed: Russell Smith Date: 07/02/2022

Please return completed form to **Species And Communities Branch DBCA**,
 Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.
 Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au> under Standard Report Forms

TAXON: <u>Boronia tetragona</u>	TPFL Pop. No.: _____
OBSERVATION DATE: <u>3/9/2021</u>	CONSERVATION STATUS: <u>P3</u> New population <input checked="" type="checkbox"/>
OBSERVER/S: <u>Colin Spencer</u>	PHONE: _____
ROLE: <u>botanist</u>	ORGANISATION: <u>Ecoedge</u>

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Lot 4499, Plantation Road, shire of Capel

Reserve No.: _____

DBC DISTRICT: _____	LGA: _____	Land manager present: <input type="checkbox"/>
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)	METHOD USED:
GDA94 / MGA94 <input type="checkbox"/>	DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM's <input type="checkbox"/>	GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: <u>6281270</u>	No. satellites: _____ Map used: _____
WGS84 <input type="checkbox"/>	Long / Easting: <u>364567</u>	Boundary polygon captured: <input type="checkbox"/> Map scale: _____
Unknown <input type="checkbox"/>	ZONE: <u>50</u>	
LAND TENURE:		
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input checked="" type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/> SLK/Pole _____ to _____
		Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>
		MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>
		Specify other: _____

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input checked="" type="checkbox"/>	Area observed (m ²): _____															
EFFORT: Time spent surveying (minutes): _____	No. of minutes spent / 100 m ² : _____															
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>	Count method: _____															
(Refer to field manual for list)																
WHAT COUNTED: Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>																
TOTAL POP'N STRUCTURE:																
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:25%;"></th> <th style="width:25%;">Mature:</th> <th style="width:25%;">Juveniles:</th> <th style="width:25%;">Seedlings:</th> <th style="width:25%;">Totals:</th> </tr> </thead> <tbody> <tr> <td>Alive</td> <td style="text-align: center;">1</td> <td></td> <td></td> <td style="text-align: center;">1</td> </tr> <tr> <td>Dead</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Mature:	Juveniles:	Seedlings:	Totals:	Alive	1			1	Dead				
	Mature:	Juveniles:	Seedlings:	Totals:												
Alive	1			1												
Dead																
	Area of pop (m ²): <u>1</u>															
	Note: Pls record count as numbers (not percentages) for database.															
QUADRATS PRESENT: No. _____ Size _____ Data attached <input type="checkbox"/>	Total area of quadrats (m ²): _____															
Summary Quad. Totals: Alive																
REPRODUCTIVE STATE: Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input checked="" type="checkbox"/>																
Immature fruit <input type="checkbox"/> Fruit <input type="checkbox"/> Dehisced fruit <input type="checkbox"/>	Percentage in flower: <u>100%</u>															

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
CONDITION OF SOIL:	Dry <input checked="" type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
 2. Open shrubland (Hibbertia sp., Acacia spp.);
 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Agonis flexuosa woodland

2. Kunzea glabrescens

3.

4.

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Russell Smith Role: botanist Signed: Russell Smith Date: 7/02/2022

Please return completed form to **Species And Communities Branch DBCA**,
 Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.
 Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au> under Standard Report Forms

TAXON: <u>Acacia semitrullata</u>		TPFL Pop. No.: _____	
OBSERVATION DATE: <u>07/09/2021</u>		CONSERVATION STATUS: <u>P4</u> <input checked="" type="checkbox"/> New population	
OBSERVER/S: <u>Russell Smith & Colin Spencer</u>		PHONE: <u>0447 809124</u>	
ROLE: <u>Botanists</u>		ORGANISATION: <u>Ecoedge</u>	

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Lot 4499, Plantation Road, shire of Capel

Reserve No.: _____

DBC DISTRICT: _____		LGA: <u>Capel</u>		Land manager present: <input type="checkbox"/>	
DATUM:		COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:	
GDA94 / MGA94 <input type="checkbox"/>		DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/>		GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>	
AGD84 / AMG84 <input type="checkbox"/>		Lat / Northing: <u>628 1133</u>		No. satellites: _____ Map used: _____	
WGS84 <input type="checkbox"/>		Long / Easting: <u>365008</u>		Boundary polygon captured: <input type="checkbox"/> Map scale: _____	
Unknown <input type="checkbox"/>		ZONE: <u>50</u>			
LAND TENURE:					
Nature reserve <input type="checkbox"/>		Timber reserve <input type="checkbox"/>		Private property <input type="checkbox"/>	
National park <input type="checkbox"/>		State forest <input type="checkbox"/>		Pastoral lease <input type="checkbox"/>	
Conservation park <input type="checkbox"/>		Water reserve <input type="checkbox"/>		UCL <input type="checkbox"/> SLK/Pole _____ to _____	
				Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>	
				MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>	
				Specify other: _____	

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input checked="" type="checkbox"/>		Area observed (m ²): _____	
EFFORT: Time spent surveying (minutes): _____		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>		Count method: _____	
(Refer to field manual for list)			
WHAT COUNTED:		Plants <input type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>	
TOTAL POP'N STRUCTURE:			
	Mature:	Juveniles:	Seedlings:
Alive	87		87
Dead			
		Area of pop (m ²): <u>5000</u>	
Note: Pls record count as numbers (not percentages) for database.			
QUADRATS PRESENT:		No. _____ Size _____ Data attached <input type="checkbox"/> Total area of quadrats (m ²): _____	
Summary Quad. Totals: Alive			
REPRODUCTIVE STATE:		Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input checked="" type="checkbox"/>	
Immature fruit <input type="checkbox"/> Fruit <input type="checkbox"/> Dehisced fruit <input type="checkbox"/>		Percentage in flower: <u>100%</u>	

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____

Please return completed form to **Species And Communities Branch DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.
Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input checked="" type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input checked="" type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input checked="" type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
CONDITION OF SOIL:	Dry <input type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
 2. Open shrubland (Hibbertia sp., Acacia spp.);
 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Kunzea glabrescens tall shrubland with occasional Banksia attenuata or B. ilicifolia.
2. _____
3. _____
4. _____

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Russell Smith Role: botanist Signed: Russell Smith Date: 07/02/2022

Please return completed form to **Species And Communities Branch DBCA**,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.
Record entered by: _____ Sheet No.: _____ Record Entered in Database

Appendix 12. Vegetation units and sub-units including photographs.

Unit A

Medium open forest of *Corymbia calophylla* over very open low woodland of *Xylomelum occidentale* over tall sparse shrubland of *Kunzea glabrescens* and *Xanthorrhoea brunonis* over *Pteridium esculentum* fernland or grassland of *Avena barbata*, *Briza maxima* and *Ehrharta longiflora* on grey sandy loam [Condition mainly Degraded].



Unit B

Open low woodland of *Melaleuca preissiana* over *Leptocarpus coangustatus*, *Lepidosperma longitudinale* sedgeland with patches of *Kunzea glabrescens* tall shrubland over *Hypocalymma angustifolium* low shrubland over open grassland/forbland of introduced taxa on grey sand (winter wet). [Condition mainly Degraded to Good].



Unit C

Very open medium woodland of *Corymbia calophylla* over medium woodland of *Melaleuca preissiana* over *Aotus gracillima*, *Astartea scoparia*, *Kunzea glabrescens* tall shrubland over *Hypocalymma angustifolium* low shrubland over open sedgeland of *Lepidosperma longitudinale*, *Pteridium esculentum* and *Schoenus efoliatus* open forbland on grey sand (winter damp). [Condition Degraded to Very Good].



Sub-unit D1

Medium woodland of *Eucalyptus marginata* over open low woodland of *Banksia attenuata* and/or *Banksia ilicifolia* and *Nuytsia floribunda* over *Kunzea glabrescens* tall shrubland over shrubland of *Adenanthos meisneri*, *Brachyloma preissii* and *Melaleuca thymoides* over *Dasypogon bromeliifolius* low shrubland and *Phlebocarya ciliata* open forbland on grey sand. [Condition Degraded to Very Good].



Sub-unit D2

Medium very open woodland of *Agonis flexuosa*, *Banksia ilicifolia* or *Nuytsia floribunda* over tall shrubland of *Kunzea glabrescens* over low shrubland of *Acacia semitrullata*, *A. stenoptera*, *Adenanthos meisneri*, *Dasyopogon bromeliifolius*, *Hypocalymma angustifolium*, *Melaleuca thymoides* and *Xanthorrhoea brunonis* over open forbland of *Patersonia occidentale*, *Phlebocarya ciliata* on grey sand. [Condition mainly Completely Degraded to Good]



Sub-unit E1

Medium woodland of *Corymbia calophylla* over very open medium shrubland of *Kingia australis* over low shrubland of *Acacia pulchella*, *Hardenbergia comptoniana*, *Leucopogon propinquus*, *Macrozamia riedlei*, *Pimelea angustifolia*, and *Xanthorrhoea brunonis* over open forbland of *Conostylis aculeata*, *Craspedia variabilis* and *Senecio quadridentatus* and very open sedgeland of *Schoenus grandiflorus* and *Tetraria octandra* and scattered *Microlaena stipoides* low grass on grey sandy loam. [Condition Very Good to Excellent].



Sub-unit E2

Medium woodland of *Corymbia calophylla* and *Eucalyptus rudis* subsp. *cratyantha* over low woodland of *Agonis flexuosa* and *Melaleuca preissiana* over open medium shrubland of *Astartea scoparia*, *Acacia extensa* and *Grevillea manglesioides* over low sedgeland of *Anarthria prolifera* and *Lepidosperma longitudinale* and open forbland of *Burchardia multiflora* and *Opercularia hispidula* on grey-brown sandy loam or red-brown loam. [Condition ranges from Completely Degraded to Excellent]. (Southern *Corymbia calophylla* woodlands TEC).



Appendix 13. Reporting forms for Threatened Ecological Communities.



Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

COMMUNITY: SWAFCT1b Southern Corymbia calophylla woodlands on heavy soils		OBSERVATION DATE: 29/09/2020
New occurrence <input type="checkbox"/>	Site ID: _____	CONS STATUS: _____
OBSERVER/S: Russell Smith & Colin Spencer		PHONE: 0447809124
ROLE: botanists	ORGANISATION: Ecoedge	
EMAIL: russell@ecoedge.com.au		

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
 Lot 4499, Plantation Road

Reserve No: _____

DISTRICT: _____ **LGA:** Capel **Land manager present:**

DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)	METHOD USED:
GDA94 / MGA94 <input checked="" type="checkbox"/>	DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM's <input checked="" type="checkbox"/>	GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: 6281330	No. satellites: _____ Map used: _____
WGS84 <input type="checkbox"/>	Long / Easting: 364600	Boundary polygon captured: <input checked="" type="checkbox"/> Map used: _____
Unknown <input type="checkbox"/>	Zone: 50	

LAND TENURE:

Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input checked="" type="checkbox"/>	Rail reserve <input type="checkbox"/>	Shire road reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input type="checkbox"/>	MRWA road reserve <input type="checkbox"/>	Other Crown reserve <input type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/>	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey Partial survey Full survey Area observed (m²): 9800

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

THREATS - type, and supporting information: e.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents.	Cause/Agent: e.g. weed type, grazing species, recreation type	Area affected	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			

*Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme

*Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)

CONDITION OF OCCURRENCE: (Bush Forever Scale) (estimate % of area in each)

Pristine <input type="checkbox"/> _____%	Very Good <input type="checkbox"/> _____%	Degraded <input type="checkbox"/> _____%
Excellent <input checked="" type="checkbox"/> 80%	Good <input checked="" type="checkbox"/> 20%	Completely Degraded <input type="checkbox"/> _____%

Please return form to:

communities.data@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by: _____ Date entered: _____ Database no: _____



Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

RECOMMENDED MANAGEMENT ACTIONS: e.g. roadside markers, weed control, etc.

ACTIONS IMPLEMENTED (include date):

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/> Hill <input type="checkbox"/> Ridge <input type="checkbox"/> Outcrop <input type="checkbox"/> Slope <input type="checkbox"/> Flat <input checked="" type="checkbox"/> Open depression <input type="checkbox"/> Drainage line <input type="checkbox"/> Closed depression <input type="checkbox"/> Wetland <input type="checkbox"/>	Granite <input type="checkbox"/> Dolerite <input type="checkbox"/> Laterite <input type="checkbox"/> Ironstone <input type="checkbox"/> Limestone <input type="checkbox"/> Quartz <input type="checkbox"/> Specify other:	(on soil surface; e.g. gravel, quartz fields) 0-10% <input checked="" type="checkbox"/> 10-30% <input type="checkbox"/> 30-50% <input type="checkbox"/> 50-100% <input type="checkbox"/>	Sand <input type="checkbox"/> Sandy loam <input type="checkbox"/> Loam <input checked="" type="checkbox"/> Clay loam <input type="checkbox"/> Light clay <input type="checkbox"/> Peat <input type="checkbox"/> Specify other:	Red <input type="checkbox"/> Brown <input checked="" type="checkbox"/> Yellow <input type="checkbox"/> White <input type="checkbox"/> Grey <input checked="" type="checkbox"/> Black <input type="checkbox"/> Specify other:	Well drained <input checked="" type="checkbox"/> Seasonally inundated <input type="checkbox"/> Permanently inundated <input type="checkbox"/> Tidal <input type="checkbox"/> Specify other:

Specific Landform Element: (Refer to field manual for additional values)

CONDITION OF SOIL:
 Dry Moist Waterlogged Inundated Cracked Saline Other:

VEGETATION CLASSIFICATION:

1. *Corymbia calophylla* medium woodland
2. *Kingia australis* over low shrubland of *Acacia pulchella*, *Hardenbergia comptoniana*, *Leucopogon proninuous*, *Macrozamia riedlei*, *Pimelea angustifolia* and *Xanthorrhoea brunonis*
3. open forbland of *Conostylis aculeata*, *Craspedia variabilis* and *Senecio quadridentatus* and very open sedgeland of *Schoenus grandiflorus* and *Tetraria octandra*
- 4.

FIRE HISTORY:

Last Fire: Season/Month: Year: **Fire Intensity:** High Medium Low No evidence of fire

Actual Occurrence Landuse:

Please return form to:

communities.data@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by: _____ Date entered: _____ Database no: _____

Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

Adjacent Landuse:

Associated Flora Species:

Associated Fauna Species:

OTHER COMMENTS:

ATTACHED: Map Mudmap Photo GIS data Field notes

Other:

COPY SENT TO: Regional Office District Office Other:

Submitter of record: Russell Smith **Role:** botanist

Signature: Russell Smith **Date submitted:** 19/01/2021

Please return form to:
communities.data@dpaw.wa.gov.au
or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

APPENDIX 2: FAUNA SURVEY (HAREWOOD 2022)

Fauna Assessment



Lot 43 Plantation Road

Ludlow

July 2022

V3

On behalf of:
MBS ENVIRONMENTAL
4 Cook Street
West Perth WA 6005

Prepared by:
Greg Harewood
Zoologist
PO Box 755
BUNBURY WA 6231
M: 0402 141 197
E: gharewood@iinet.net.au

TABLE OF CONTENTS

SUMMARY	
1.	INTRODUCTION 1
2.	SCOPE OF WORKS..... 1
3.	METHODS..... 2
3.1	LITERATURE REVIEW – FAUNA SPECIES OF CONSERVATION SIGNIFICANCE..... 2
3.2	FIELD SURVEYS..... 2
3.2.1	FAUNA HABITAT ASSESSMENT 2
3.2.2	FAUNA OBSERVATIONS..... 2
3.2.3	BLACK COCKATOO HABITAT ASSESSMENT 3
3.2.3.1	Breeding Habitat Assessment 3
3.2.3.2	Foraging Habitat Assessment 5
3.2.3.3	Night Roosting Habitat Assessment 5
3.2.4	WESTERN RINGTAIL POSSUM ASSESSMENT..... 5
3.2.4.1	Daytime Survey 5
3.2.4.2	Night Time Survey 5
3.2.4.3	Habitat Assessment..... 5
4.	SURVEY LIMITATIONS 5
5.	RESULTS 6
5.1	LITERATURE REVIEW – FAUNA SPECIES OF CONSERVATION SIGNIFICANCE..... 6
5.2	FIELD SURVEYS..... 8
5.2.1	FAUNA HABITAT ASSESSMENT 8
5.2.2	FAUNA OBSERVATIONS..... 11
5.2.3	BLACK COCKATOO HABITAT ASSESSMENT 11

5.2.3.1	Breeding Habitat Assessment	11
5.2.3.2	Foraging Habitat Assessment	12
5.2.3.3	Night Roosting Habitat Assessment	13
5.2.4	WESTERN RINGTAIL POSSUM ASSESSMENT.....	14
5.2.4.1	Daytime Survey	14
5.2.4.2	Night Time Survey	14
5.2.4.3	Habitat Assessment.....	14
6.	CONSERVATION SIGNIFICANT FAUNA SPECIES.....	14
7.	CONCLUSION.....	20
8.	REFERENCES	21

FIGURES

- FIGURE 1: Survey Area & Surrounds
- FIGURE 2: Survey Area – Aerial Photograph
- FIGURE 3: Fauna Habitats
- FIGURE 4: Habitat Trees (DBH >50cm)
- FIGURE 5: Possum Observations

TABLES

- TABLE 1: Conservation significant fauna previously recorded or potentially occurring within in the general vicinity of survey area
- TABLE 2: Example images of the fauna habitats within the survey area
- TABLE 3: Summary of habitat trees (DBH \geq 50cm) within the survey area
- TABLE 4: Likelihood of occurrence – fauna species of conservation significance

APPENDICES

APPENDIX A: Conservation Categories

APPENDIX B: NatureMap Database Search and Protected Matters Search Tool Results

APPENDIX C: Observed Fauna Listing

APPENDIX D: Habitat Tree Details

SUMMARY

This report details the results of a fauna assessment over Lot 43 Plantation Road, Ludlow in the Shire of Capel (the survey area). The landowners are proposing to clear sections of the survey area for the purpose of sand extraction and will be applying to the Department of Water and Environmental Regulation for a clearing permit pursuant to Section 51E of the *Environmental Protection Act 1986*.

The information presented here will be used by regulatory authorities to assess the potential impact of the proposal on fauna and fauna habitats at the site, during the project evaluation and clearing permit approval process.

The field component of the fauna assessment was carried out on 30 October and the 13 December 2021 by Greg Harewood (Zoologist) and consisted of a daytime reconnaissance survey and nocturnal spotlighting.

Key Findings

The survey area has a total extent of about 27 hectares (ha) and contains a mosaic of remnant native vegetation, regrowth and cleared land around an existing house and sheds.

About half of the vegetation present (~13 ha) consists of a *Kunzea* tall shrubland with scattered emergent trees including but not limited to jarrah, peppermint, *Banksia* spp. and *Nuytsia floribunda* on grey sand. A significant proportion of this vegetation appears to be regrowth from an historical clearing event the extent of which is evident on old air photos.

The balance of the site is either cleared (with bare sand/open grassland) or contains small areas of other vegetation types.

The fauna habitats present range from completely degraded (existing cleared areas) to very good (intact remnant native vegetation), however the majority is degraded, largely a consequence of historical clearing and livestock grazing. Given the degree of disturbance the original fauna assemblage within the survey area is likely to be depauperate in many aspects, in particular with respect to ground dwelling species which rely on dense native understory (midstorey and ground cover) vegetation, which is absent/sparse in many areas. Thirty two fauna species (mainly common bird species) were observed or secondary evidence of their presence recorded during the field survey.

A total of 49 potential black cockatoo breeding “habitat trees” were identified within the survey area. The vast majority of these trees (35) appeared to not contain hollows of any size. Thirteen (13) trees contained apparent or obvious hollows, all of which were assessed as being unlikely to be suitable for black cockatoos to currently use for nesting purposes, due to the hollows apparent small size, unsuitable orientation and/or low height above ground level. One tree (1) appeared to contain at least one hollow considered potentially suitable for black cockatoos to use for nesting purposes but this was not confirmed and no actual signs of use were noted.

Quality black cockatoo foraging habitat within the survey area can mainly be defined as the areas containing the densest areas of marri, jarrah and/or banksia vegetation. Marri woodland makes up about 3.2 ha of the survey area though the density of marri varies considerably. Jarrah and *banksia* are the dominant tree species in Unit C which makes up about 50% of the vegetation present however the density of these specific species is relatively low which reduces the overall quality rating of this unit. No evidence black cockatoos roosting within the survey area was noted.

Evidence of western ringtail possums were observed during the day and night survey in the form of scats and dreys during the day survey and five individuals during the spotlighting survey. Most of the remnant native vegetation (including advanced regrowth) present within the survey area appears to be suitable for western ringtail possums though the level of occupancy varies from area to area and appears overall to be generally low. The species is likely to be favouring the denser woodland/low woodland habitats with lower levels of occupancy within the areas of tall shrubland which make up about half of the survey area.

In summary four vertebrate fauna species of conservation significance (listed as State or Federal threatened/migratory species or as DBCA priority species) was positively identified as utilising the survey area for some purpose during the survey period, these being :

- Forest Red-tailed Black Cockatoo – Vulnerable (WA/Federal);
- Baudin's Black Cockatoo – Endangered (WA/Federal);
- Western Ringtail Possum – Critically Endangered (WA/Federal); and
- Quenda – Priority 4 (DBCA Priority Species).

Several other species of conservation significance may utilise the survey area for some purpose at times, but their status on-site and/or in the general area is difficult to determine because they were not sighted during the field survey, or evidence of use was not observed. These species are:

- Swan Coastal Plain Shield-backed Trapdoor Spider – Priority 3 (DBCA Priority Species);
- Coastal Plains Skink *Ctenotus ora* – Priority 3 (DBCA Priority Species);
- Peregrine Falcon – Schedule 7 (WA);
- Masked Owl – Priority 3 (DBCA Priority Species);
- Carnaby's Black Cockatoo – Endangered (WA/Federal);
- South-western Brush-tailed Phascogale - Schedule 6 (WA); and
- Western False Pipistrelle – Priority 4 (DBCA Priority Species).

The actual extent of proposed clearing within the survey area has not been finalised and therefore specific impacts on fauna species are difficult to predict. In this instance impacts are most likely to be related to the loss of habitat and the potential for some species to be killed or injured during clearing. Potential impacts on fauna should be reviewed as planning progresses.

1. INTRODUCTION

This report details the results of a fauna assessment over Lot 43 Plantation Road, Ludlow in the Shire of Capel (the survey area) (Figure 1). The survey area is approximately 27.0 hectares (ha) in size and contains a mosaic of remnant native vegetation, regrowth and cleared land (Figure 2). Parts of the survey area have up until recently been used for many years for the livestock grazing.

The landowners are proposing to clear sections of the survey area for the purpose of sand extraction and will be applying to the Department of Water and Environmental Regulation (DWER) for a clearing permit pursuant to Section 51E of the *Environmental Protection Act 1986*.

The information presented here will be used by regulatory authorities to assess the potential impact of the proposal on fauna and fauna habitats at the site, during the project evaluation and clearing permit approval process.

Information obtained as part of this fauna assessment report will also be used in conjunction with other environmental investigations to guide project planning and for the formulation of management plans, which will aim to minimise potential environmental impacts.

2. SCOPE OF WORKS

The scope of works was to conduct a “basic” fauna assessment and carry out a targeted survey for black cockatoo habitat and western ringtail possums. The assessment has therefore involved:

1. A basic (Level 1) Fauna Assessment (EPA 2020);
2. Targeted searches for black cockatoo habitat/site use (habitat trees, existing and potential nest hollows, foraging and roosting habitat);
3. Targeted western ringtail possum (WRP) survey; and
4. Report for summarising methods and 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 LITERATURE REVIEW – FAUNA SPECIES OF CONSERVATION SIGNIFICANCE

A list of conservation significant fauna recorded or likely to occur within the survey area has been compiled by a review of available databases and literature including, but not limited to the following data sources:

- Department of Biodiversity, Conservation and Attractions (DBCA) Threatened Fauna Database (NatureMap) (DBCA 2021). A 20 km buffer around the survey area was applied to capture previous fauna records within the immediate vicinity;
- *EPBC Act* Protected Matters database for fauna of national environmental significance (DAWE 2021). The minimum buffer (1 km) was applied to this search as the databases contains distribution data (areas) and not actual fauna records; and
- Literature search and review of other fauna surveys in the vicinity.

The conservation status of each species has been based on current lists produced under Federal and State Acts (EPBC Act and the *Biodiversity Conservation Act 2016 (BC Act)*), those species recognised under international treaties (CAMBA, JAMBA and the Bonn Convention) and Priority Fauna (as listed by the DBCA).

3.2 FIELD SURVEYS

The field component of the fauna assessment was carried out on 30 October and the 13 December 2021 by Greg Harewood (Zoologist) and consisted of a daytime reconnaissance survey and nocturnal spotlighting as described in the sections below.

3.2.1 FAUNA HABITAT ASSESSMENT

Vegetation units identified by Ecoedge (2022) have been used to define broad scale fauna habitats across the survey area. This information has been supplemented with observations made during the site reconnaissance survey.

The main objective of the assessment was to determine if it were likely that species of conservation significance would utilise the habitats identified as occurring within the survey area based on their documented habitat preference and current known distribution.

3.2.2 FAUNA OBSERVATIONS

Evidence of the presence or likely presence of fauna species of conservation significance (or suitable habitat) was searched for and recorded concurrent with other site surveys. Opportunistic observations of all fauna species were made during all field survey work and recorded where positive species identifications were made.

This aspect of the assessment included but was not limited to:

- Undertaking a series of transects across the survey area.
- Searching for evidence (i.e. individuals, tracks, scats, calls) of potential conservation significant species under logs, rocks and leaf litter.
- Observing bird species with binoculars.

3.2.3 BLACK COCKATOO HABITAT ASSESSMENT

The following methods were employed to comply with the defined scope of works and are based on Commonwealth of Australia (2012) guidelines which state 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.

The Commonwealth of Australia (2012) places habitats used by black cockatoos into the following three categories:

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

3.2.3.1 Breeding Habitat Assessment

The black cockatoo breeding habitat assessment identified all suitable breeding tree species within the survey area that have a diameter at breast height (DBH) equal to or greater than 50cm. The DBH of each tree was estimated using a pre-made "caliper".

Target tree species included marri, jarrah, tuart and flooded gum and any other *Corymbia/Eucalyptus* species of a suitable size that was present. Peppermints, *Banksia*, sheoak and *Melaleuca* tree species (for example) were not assessed as they typically do not develop hollows 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.

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

- Small = $\sim < 5$ cm diameter (i.e. entrance too small for a black cockatoo);
- Medium = ~ 5 cm-10cm diameter (i.e. entrance too small for a black cockatoo);
- Large = $\sim > 10$ cm diameter (entrance large enough for a black cockatoo but hollow appears unsuitable for nesting i.e. wrong orientation, appears too small, too low or too shallow); or
- Large (cockatoo) = $\sim > 10$ cm diameter (entrance and apparent hollow appears big enough and suitably sized/orientated for a black cockatoo to use for nesting).

Based on this assessment, trees present within the survey area were placed into one of four categories:

- Tree < 50 cm DBH or an unsuitable species (these were not assessed/recorded);
- Tree ≥ 50 cm DBH, no hollows seen;
- Tree ≥ 50 cm DBH, one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree ≥ 50 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 assessment, a tree containing a potential black cockatoo nest hollow was defined as:

Generally, any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) or possible hollows 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, were 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). Details recorded included hollow size, height, type, orientation, comments on suitability and any evidence of use

Trees with possible nest hollows were also scratched and raked with a large stick in attempt to flush any sitting birds from hollows and calls of chicks were listened for. Where the assessment was inconclusive, and if possible, trees identified as having potential nest hollows were subsequently examined and photographed using a drone (DJI Mavic Air).

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

3.2.3.2 Foraging Habitat Assessment

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. Foraging habitat is represented by plant species that are known to provide a food source for black cockatoos. This can be in the form of seeds, flowers and also boring grubs that are extracted from some plant species.

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.

3.2.3.3 Night Roosting Habitat Assessment

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

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

3.2.4 WESTERN RINGTAIL POSSUM ASSESSMENT

3.2.4.1 Daytime Survey

A day time survey to locate and record dreys, obvious tree hollows, scats and individual WRPs was carried out and involved a series of traverses on foot across the survey area.

3.2.4.2 Night Time Survey

A single night time survey to locate and record individual WRPs was carried out. This involved a series of transect across the survey area, on foot using a LED head torch to locate animals by way of eyeshine.

3.2.4.3 Habitat Assessment

Description and comments on the amount and quality of WRP habitat within the survey area are provided based on observations made during the site surveys.

4. SURVEY LIMITATIONS

No seasonal sampling was 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 be recognised that site conditions can change with time.

Lack of observational data on some species should also not necessarily be taken as an indication that a species is absent from the site or does not utilise it for some purpose at times.

During the survey, habitat 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.

The location of observations was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 metres, though it should be noted that in some circumstance the accuracy can increase or decrease beyond this range.

5. RESULTS

5.1 LITERATURE REVIEW – FAUNA SPECIES OF CONSERVATION SIGNIFICANCE

The literature review identified multiple fauna species of conservation significance as potentially occurring in the general area as listed in Table 1. The NatureMap (DBCA 2021) and Protected Matter Search Tool (DAWE 2021) results, used as a primary source for compiling this listing, are held within Appendix B. Because of the proximity of the survey area to the ocean a number of conservation significant marine species have appeared in database searches (Appendix B). These species have been excluded from the assessment as they would not, under normal circumstances, occur within the survey area.

Table 1: Conservation significant fauna previously recorded or potentially occurring within the general vicinity of survey area.

Species	Conservation Status ¹	
	BC Act/ DBCA Priority	EPBC Act
Carter's Freshwater Mussel <i>Westralunio carteri</i>	S3	VU
Swan Coastal Plain Shield-backed Trapdoor Spider <i>Idiosoma sigillatum</i>	P3	-
Pouched Lamprey <i>Geotria australis</i>	P3	-
Salamander Fish <i>Lepidogalaxias salamandroides</i>	S2	-
Coastal Plains Skink <i>Ctenotus ora</i>	P3	-
Lined Skink <i>Lerista lineata</i>	P3	-

¹ See Appendix A for conservation status codes

Species	Conservation Status ¹	
	BC Act/ DBCA Priority	EPBC Act
Australasian Bittern <i>Botaurus poiciloptilus</i>	S2	EN
Migratory Shorebirds/Wetland Species	Various	Various
Eastern Osprey <i>Pandion cristatus</i>	S5	Mig, Ma
Peregrine Falcon <i>Falco peregrinus</i>	S7	-
Grey Falcon <i>Falco hypoleucos</i>	S3	VU
Masked Owl <i>Tyto novaehollandiae novaehollandiae</i>	P3	-
Blue-billed Duck <i>Oxyura australis</i>	P4	-
Hooded Plover <i>Thinornis rubricollis</i>	P4	-
Carnaby`s Black Cockatoo <i>Zanda latirostris</i>	S2	EN
Baudin`s Black Cockatoo <i>Zanda baudinii</i>	S2	EN
Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksia naso</i>	S3	VU
Fork-tailed Swift <i>Apus pacificus</i>	S5	Mig
Grey Wagtail <i>Motacilla cinerea</i>	S5	Mig
Chuditch <i>Dasyurus geoffroii</i>	S3	VU
Quenda <i>Isoodon fusciventer</i>	P4	-
Bilby <i>Macrotis lagotis</i>	S3	VU
South-western Brush-tailed Phascogale <i>Phascogale tapoatafa wambenger</i>	S6	-
Western Ringtail Possum <i>Pseudocheirus occidentalis</i>	S1	CR
Quokka <i>Setonix brachyurus</i>	S3	VU
Woylie <i>Bettongia penicillata ogilbyi</i>	S1	EN
Western Brush Wallaby <i>Notamacropus irma</i>	P4	-
Water Rat <i>Hydromys chrysogaster</i>	P4	-
Western Mouse <i>Pseudomys occidentalis</i>	P4	-
Western False Pipistrelle <i>Falsistrellus mackenziei</i>	P4	-

5.2 FIELD SURVEYS

5.2.1 FAUNA HABITAT ASSESSMENT



The survey area has a total extent of about 27 ha and contains a mosaic of remnant native vegetation, regrowth and cleared land around an existing house and sheds.




About half of the vegetation present (~13 ha) consists of a *Kunzea* tall shrubland with scattered emergent trees including but not limited to jarrah, peppermint, *Banksia* spp. and *Nuytsia floribunda* on grey sand. A significant proportion of this vegetation appears to be regrowth from an historical clearing event the extent of which is evident on old air photos.



The balance of the site is either cleared (with bare sand/open grassland) or contains small areas of other vegetation types. To put the area of native remnant vegetation remaining within the survey area into perspective there is approximately 11,000 ha of remnant native vegetation within 12 km of the survey area (DPIRD 2021).

Example images of the various fauna habitats present are provided in Table 2.

Table 2: Example images of the fauna habitats within the survey area

Fauna Habitat Description	Example Image
<p>Unit A: Medium open forest of marri over a very open low woodland over a tall sparse shrubland over a fernland or grassland on grey sandy loam.</p> <p>Area – 0.85 ha (3.1%)</p>	
<p>Unit B: Open low woodland of paperbark over a sedgeland with patches of tall shrubland over a low shrubland over an open grassland/forbland on grey sand (winter wet).</p> <p>Area – 0.63 ha (2.3%)</p>	

Fauna Habitat Description	Example Image
<p>Unit C: Very open medium woodland of marri over medium woodland of paperbark over a tall shrubland over a low shrubland over an open sedgeland and open forbland on grey sand (winter damp).</p> <p>Area – 1.16 ha (4.2%)</p>	
<p>Unit D: Tall shrubland with scattered emergent trees such as jarrah, peppermint, <i>Banksia</i> and <i>Nuytsia</i> on grey sand.</p> <p>Area – 13.31 ha (48.6%)</p>	
<p>Unit E: Medium woodland of marri and flooded gum over low woodland of peppermint and paperbark over open medium shrubland over a low sedgeland and open forbland on grey-brown sandy loam or red-brown loam.</p> <p>Area – 1.89 ha (6.9%)</p>	

Fauna Habitat Description	Example Image
<p>Existing Cleared Areas. Area – 9.53 ha (34.8%)</p>	
<p>Manmade dam. Area – 0.02 ha (0.1%)</p>	

The fauna habitats present range from completely degraded (existing cleared areas) to very good (intact remnant native vegetation), however the majority is degraded, largely a consequence of historical clearing and livestock grazing. Given the degree of disturbance the original fauna assemblage within the survey area is likely to be depauperate in many aspects, in particular with respect to ground dwelling species which rely on dense native understory (midstorey and ground cover) vegetation, which is absent/sparse in many areas.

Despite the history of disturbance, the areas of more coherent remnant vegetation are still likely to be utilised in some fashion by a reasonably wide range of species though most would be relatively common and widespread bird species. Exceptions to this generalised statement include black cockatoos, which utilise sections of the area as habitat (see section 5.2.3). Most of the natural habitat present also appears to be suitable for western ringtail possums though the level of occupancy varies from area to area and appears to be generally low (see section 5.2.4).

5.2.2 FAUNA OBSERVATIONS

Thirty two fauna species (mainly common bird species) were observed or secondary evidence of their presence recorded during the field survey. A full listing of the species observed is held on Appendix C.

Evidence of four fauna species of conservation significance was recorded, these being Baudin’s black cockatoo (endangered), the forest red-tailed black cockatoo (vulnerable), the western ringtail possum (critically endangered) and quenda (priority 4).

No evidence of any other fauna species of conservation significance was observed. However, this does not eliminate the potential for some species to still occur, if only infrequently.

5.2.3 BLACK COCKATOO HABITAT ASSESSMENT

5.2.3.1 Breeding Habitat Assessment

Trees considered potentially suitable for black cockatoos to use as nesting habitat (subject to a suitable hollow being present and other factors) found within the survey area comprised the following species:

- Marri – *Corymbia calophylla*;
- Jarrah – *Eucalyptus marginata*;
- Flooded Gum - *Eucalyptus rudis*;
- Tuart - *Eucalyptus gomphocephala* (planted);
- Dead Unidentified - *Eucalyptus* spp.; and
- Non-endemic eucalypts (planted - various unidentified species) - *Eucalyptus* spp.

A summary of the habitat trees observed is provided in Table 3. The locations of habitat trees are shown in Figure 4.

Table 3: Summary of potential habitat trees (DBH \geq 50cm) within the survey area

Total Number of Habitat Trees Recorded	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</u> Suitable for Nesting Black Cockatoos	Tree Species					
				Marri	Jarrah	Non-endemic Eucalypt	Flooded Gum	Dead Unknown	Tuart
49	35	13	1	26	14	4	2	2	1

The assessment identified 49 trees within the survey area with a DBH of ≥ 50 cm. The vast majority of these trees (35) appeared to not contain hollows of any size. Thirteen (13) trees contained apparent or obvious hollows, all of which were assessed as being unlikely to be suitable for black cockatoos to currently use for nesting purposes, due to the hollows apparent small size, unsuitable orientation and/or low height above ground level. One tree (1) appeared to contain at least one hollow considered potentially suitable for black cockatoos to use for nesting purposes but this was not confirmed and no actual signs of use were noted.

Additional details on each habitat tree observed can be found in Appendix D.

Based on available mapping, there is approximately 11,000 ha of remnant native vegetation within 12 km of the survey area (DPIRD 2021). Much of this is likely to contain “potential” breeding habitat as defined by DAWE (i.e. suitable tree species with a DBH ≥ 50 cm).

5.2.3.2 Foraging Habitat Assessment



The following flora species, known to be or potentially used as a direct food source (e.g. seeds, flowers, nectar, bark or grubs) by one or more species of black cockatoo were recorded within the survey area:

- Marri – *Corymbia calophylla*;
- Jarrah – *Eucalyptus marginata*;
- Flooded Gum - *Eucalyptus rudis*;
- Tuart - *Eucalyptus gomphocephala*;
- Non-endemic eucalypts (planted - various unidentified species) - *Eucalyptus* spp.;
- Banksia – various *Banksia* species;
- Grey Stinkwood - *Jacksonia furcellata*; and
- Peppermint – *Agonis flexuosa*.

It should be noted that some of the above-mentioned species (e.g. tuart, flooded gum, grey stinkwood and peppermint) while foraged upon on occasions would make up only a small proportion of any one bird’s diet relative to more favoured plant species such as marri and banksia. Some species are also represented by only a small number of specimens and therefore do not contribute to the overall resource to a significant degree.

Evidence of black cockatoos foraging was observed during the field survey at a number of locations. The evidence was in all cases in the form of chewed fruits from marri fruits. The foraging activity was attributed to either the forest red-tailed black cockatoo or Baudin’s black cockatoo. Examples of the foraging debris observed and the species attributed to the activity are provided in Table 4.

Table 4: Foraging Evidence Examples

Foraging Evidence Description	Example Image
Marri fruits – foraging activity attributed to Baudin’s Black Cockatoo.	
Marri fruits – foraging activity attributed to the Forest Red-tailed Black Cockatoo.	

Quality foraging habitat within the survey area can mainly be defined as the areas containing the densest areas of marri, jarrah and/or banksia vegetation. Marri woodland makes up about 3.2 ha of the survey area though the density of marri varies considerably. Jarrah and banksia are the dominant tree species in Unit C which makes up about 50% of the vegetation present however the density of these specific species is relatively low which reduces the overall quality rating of this unit.

Based on available mapping there is about 11,000 ha of remnant native vegetation within 12 km of the survey area (DPIRD 2021). Much of this is likely to represent black cockatoo foraging habitat of some type.

5.2.3.3 Night Roosting Habitat Assessment

No evidence of black cockatoos roosting within trees located within the survey area was observed during the survey period. It is difficult to determine if trees or groves of trees within the survey area represent potential roosting habitat as a range of factors, not all of which can be observed, determine suitability. Some of the larger trees (including non-endemics) may be suitable for roosting but as indicated no actual evidence of use was seen.

A review of the 2019 Great Cocky Count database shows no documented roost sites within the survey area. The 2019 Great Cocky Count recorded the closest active roost,

approximately 4 kilometres north of the survey area (Site ID: CAPCAPR001). This roost was not being used during the April 2019 survey (Peck *et al.* 2019). There are no other documented roost sites within 12 km of the survey area.

5.2.4 WESTERN RINGTAIL POSSUM ASSESSMENT

5.2.4.1 Daytime Survey

Evidence of western ringtail possums were observed during the day survey in the form of scats and dreys at about 14 locations across the survey area (Figure 5).

Fourteen hollow bearing “habitat trees” (i.e. DBH >50cm) were also recorded within the survey area. Some of these trees (and some additional trees with smaller DBHs) may have hollows suitable for WRPs to use for daytime refuge.

5.2.4.2 Night Time Survey

Five WRPs were observed within the survey area during the nocturnal survey. Four common brushtail possum were also recorded (Figure 4).

5.2.4.3 Habitat Assessment

Most of the remnant native vegetation (including advanced regrowth) present within the survey area appears to be suitable for western ringtail possums though the level of occupancy varies from area to area and appears overall to be generally low. The species is likely to be favouring the denser woodland/low woodland habitats with lower levels of occupancy within the areas of tall shrubland which make up about half of the survey area.

6. CONSERVATION SIGNIFICANT FAUNA SPECIES

Based on the information gathered during the site reconnaissance survey and the documented distribution and habitat preferences of the species of conservation significance identified as potentially being present in the general area, their likelihood of occurrence has been assessed. A summary of this assessment is presented in Table 5.

Some comments on the possible impacts of any proposed development are also provided though as no specific development plan has been put forward these are preliminary comments that should be reviewed as planning progresses.

Four vertebrate fauna species of conservation significance (listed as State or Federal threatened/migratory species or as DBCA priority species) was positively identified as utilising the survey area for some purpose during the survey period, these being :

- Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* – S3 (*BC Act*), Vulnerable (*EPBC Act*). Foraging evidence attributed to this species detected. The survey area contains areas of potential black cockatoo breeding habitat (trees with a DBH \geq 50cm) but the number of possibly suitable hollows is low (one

recorded). The majority of the native vegetation within the survey area represents marginal foraging habitat for this species. No evidence of roosting observed.

- Baudin’s Black-Cockatoo *Zanda baudinii* – S2 (BC Act), Endangered (EPBC Act). Foraging evidence attributed to this species detected. The survey area contains areas of potential black cockatoo breeding habitat (trees with a DBH >50cm) but the number of possibly suitable hollows is low (one recorded). The majority of the native vegetation within the survey area represents marginal foraging habitat for this species. No evidence of roosting observed.
- Quenda *Isodon fusciventer* – P4 (DBCA Priority Species) Digging attributed to this species observed. Potentially utilises all areas within the survey area with dense groundcover.
- Western Ringtail Possum *Pseudocheirus occidentalis* – Critically Endangered (BC Act), Critically Endangered (EPBC Act) This species was detected within the survey area. Most of the remnant native vegetation (including advanced regrowth) present represents suitable habitat for this species though its quality varies considerably from area to area, but appears overall to be generally low.

Several additional species of conservation significance may utilise the survey area for some purpose at times, but their status on-site and/or in the general area is difficult to determine because they were not sighted during the field survey, or evidence of use was not observed:

- Carnaby’s Black-Cockatoo *Zanda latirostris* – S2 (BC Act), Endangered (EPBC Act). No evidence of this species recorded. The survey area contains areas of potential black cockatoo breeding habitat (trees with a DBH >50cm) but the number of possibly suitable hollows is low (one recorded). The majority of the native vegetation within the survey area represents marginal foraging habitat for this species. No evidence of roosting observed. Listed as a potential species based on available information.
- Peregrine Falcon *Falco peregrinus* – S7 (BC Act) This species potentially utilises some sections of the survey area as part of a much larger home range though it is only likely to occur infrequently. All areas represent potential foraging habitat for this species. Listed as a potential species based on available information.
- Masked Owl *Tyto novaehollandae* – P3 (DBCA Priority Species) Status in the general area is difficult to determine. May utilise woodland areas within and near the survey area for roosting and may forage in more open areas. Probably only present occasionally and for short periods. Limited number of hollow bearing trees, some of which may represent suitable nest sites. Listed as a potential species based on available information.

- South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger* – S6 (BC Act)
This species has previously been recorded in the general area (Greg Harewood pers. obs.) and so it may occur in the survey area given the presence of suitable habitat. Listed as a potential species based on available information.
- Western False Pipistrelle *Falsistrellus mackenziei* – P4 (DBCA Priority Species)
Status of this species within the survey area is difficult to determine, however, given the location is within its documented range, some recent nearby records (e.g. Capel Wetlands) and the presence of habitat that appears suitable it must be assumed to be present. All sections of the survey area represent potential foraging habitat for this species and any hollow bearing trees represent possible day time roost sites. Listed as a potential species based on available information.

A number of other species of conservation significance (as listed in Table 5), while possibly present in the larger bush remnants in the wider area (e.g. State forest /reserve areas to the east) are not listed as potentially occurring within the survey area primarily due to a complete lack of suitable habitat (quality and extent) and/or known local/regional extinction.

The actual extent of proposed clearing within the survey area has not been finalised and therefore specific impacts on fauna species are difficult to predict. In this instance impacts are most likely to be related to the loss of habitat and the potential for some species to be killed or injured during clearing. Potential impacts on fauna should be reviewed as planning progresses.

Table 5: Likelihood of Occurrence – Fauna Species of Conservation Significance

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Comments/Possible Impacts
	BC Act/ DBCA Priority	EPBC Act				
Carter's Freshwater Mussel <i>Westralunio carteri</i>	S3	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Pouched Lamprey <i>Geotria australis</i>	P3	-	This species lives in mud burrows in the upper reaches of coastal streams for the first four years of life until migrating to the sea. Adults migrate up to 60km upstream during spawning.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Swan Coastal Plain Shield-backed Trapdoor Spider <i>Idiosoma sigillatum</i>	P3	-	Burrows of this species usually found in <i>Banksia</i> woodland and heathland on sandy soils.	Yes/Marginal	Possibly Occurs	Status of this species in the general area unknown but must be assumed to be present. Loss/modification of small areas of potential habitat.
Salamander Fish <i>Lepidogalaxias salamandroides</i>	S2	-	Inhabit small semi-permanent heathland pools and streams that are usually acidic (pH ~3-6) and high in tannins. They 'aestivate' by burrowing into the sandy bottom which remains moistened by ground water.	Yes	Would Not Occur.	Outside of current documented distribution. Known only from heathland peat flats between the Blackwood and Kent Rivers. No impact on this species will occur.
Coastal Plains Skink <i>Ctenotus ora</i>	P3	-	Sandy substrates with low vegetation (including heath) in open <i>Eucalyptus/Corymbia</i> woodland over <i>Banksia</i> .	Yes	Possibly Occurs	Status of this species in the general area unknown but must be assumed to be present. Loss/modification of small areas of potential habitat.
Lined Skink <i>Lerista lineata</i>	P3	-	Inhabits loose white sands and leaf litter under areas of shrubs and heath particularly in association with banksias.	Yes	Unlikely to occur.	Outside of current documented distribution. No impact on this species will occur.
Australasian Bittern <i>Botaurus poiciloptilus</i>	S1	EN	Freshwater wetlands, occasionally estuarine; prefers heavy vegetation such as beds of tall dense <i>Typha</i> , <i>Baumea</i> and sedges in freshwater swamps.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Migratory Shorebirds/Wetland Species/Marine Species (various reptiles, birds and mammals)	S5, Various	Ma, Mig, Various	Varies between species but includes open ocean, beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats sandbars, pastures, airfields, sports fields and lawns.	No	Would Not Occur.	No suitable habitat. No impact on this range of species will occur.
Hooded Plover <i>Thinornis rubricollis</i>	P4	-	Broad sandy ocean beaches and bays, coastal and inland salt lakes.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Comments/Possible Impacts
	BC Act/ DBCA Priority	EPBC Act				
Eastern Osprey <i>Pandion haliaetus</i>	S5	Ma, Mig	Coasts, estuaries, bays, inlets, islands, and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Ascends larger rivers.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Peregrine Falcon <i>Falco peregrinus</i>	S7	-	Diverse from rainforest to arid shrublands, from coastal heath to alpine Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes.	Yes	Possibly Occurs.	This species is uncommon but the survey area may represent part of a larger home range used by individuals of this species. No suitable nest sites observed. Loss/modification of small areas of potential habitat.
Grey Falcon <i>Falco hypoleucos</i>	S3	VU	Lightly treed plains, gibber deserts, sand ridges, pastoral lands, timbered water courses but seldom in driest deserts	No	Would Not Occur.	Rarely if ever recorded in the lower south west. No impact on this species will occur.
Masked Owl (SW population) <i>Tyto n. novaehollandiae</i>	P3	-	Roosts and nests in heavy forest, hunts over open woodlands and farmlands.	Yes	Possibly Occurs.	This species is uncommon but may occur, if only occasionally. Loss/modification of small areas of potential habitat.
Blue-billed Duck <i>Oxyura australis</i>	P4	-	Well vegetated freshwater swamps, large dams and lakes, winters on more open water. Occasionally salt lakes and estuaries freshened by floodwaters.	No/Very Marginal	Unlikely to Occur.	No suitable habitat. No significant impact on this species anticipated
Carnaby`s Black Cockatoo <i>Zanda latirostris</i>	S2	EN	Forests, woodlands, heathlands, farms; feeds on <i>Banksia</i> , <i>Hakea</i> and Marri.	Yes	Possibly Occurs.	Loss/modification of small areas of habitat.
Baudin`s Black Cockatoo <i>Zanda baudinii</i>	S2	EN	Mainly eucalypt forests where it feeds primarily on the marri seeds.	Yes	Known to Occurs.	Loss/modification of small areas of habitat.
Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i>	S3	VU	Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble.	Yes	Known to Occurs.	Loss/modification of small areas of habitat.
Fork-tailed Swift <i>Apus pacificus</i>	S5	Ma, Mig	Low to very high airspace over varied habitat from rainforest to semi desert.	Yes	Unlikely to Occur, Flyover only on very rare occasions.	May occur very occasionally for brief periods. Entirely aerial. No impact on this species will occur.
Grey Wagtail <i>Motacilla cinerea</i>	S5	Mig, Ma	In Australia, near running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Chuditch <i>Dasyurus geoffroi</i>	S3	VU	Forest, mallee shrublands, woodland and desert. The densest populations have been found in riparian jarrah forest.	Yes	Unlikely to Occur,	Locally extinct. Occasional transient individuals may occur but very rarely if at all. No impact on this species anticipated.

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Comments/Possible Impacts
	BC Act/ DBCA Priority	EPBC Act				
Quenda <i>Isoodon fusciventer</i>	P4	-	Dense scrubby, often swampy, vegetation with dense cover.	Yes	Known To Occur	Loss/modification of small areas of habitat.
Bilby <i>Macrotis lagotis</i>	S3	VU	Acacia shrublands, spinifex and hummock grassland. Mitchell grass and stony downs country if cracking clay, also desert sand plains and dune fields sometimes with spinifex hummock grassland and acacia shrubland.	No	Would Not Occur.	Regionally extinct. No impact on this species will occur.
South-west Brush-tailed Phascogale <i>Phascogale tapoatafa wambenger</i>	S6	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover.	Yes	Possibly Occurs.	Loss/modification of small areas of habitat.
Western Ringtail Possum <i>Pseudocheirus occidentalis</i>	S1	CE	Coastal peppermint, coastal peppermint-tuart, jarrah-marri associations, sheoak woodland, and eucalypt woodland and mallee.	Yes	Known To Occur	Loss/modification of small areas of habitat.
Quokka <i>Setonix brachyurus</i>	S3	VU	Currently restricted to densely vegetated coastal heaths, swamps, riverine habitats including tea-tree thickets on sandy soils along creek systems.	No	Would Not Occur.	This species is locally extinct. No impact on this species will occur.
Woylie <i>Bettongia penicillate ogiby</i>	S1	EN	Open sclerophyll forest and woodland with a low, dense, understorey of tussock grasses or woody scrub.	No	Would Not Occur.	This species is locally extinct. No impact on this species will occur.
Western Brush Wallaby <i>Notamacropus irma</i>	P4	-	Open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets.	No	Would Not Occur.	Fragmented and degraded state of habitat within and around the survey area suggests this species is unlikely to persist. No impact on this species will occur.
Western False Pipistrelle <i>Falsistrellus mackenziei</i>	P4	-	Wet sclerophyll forest dominated by karri and in high rainfall zones of the jarrah and marri forest.	Yes	Possibly Occurs.	Loss/modification of small areas of habitat.
Western Mouse <i>Pseudomys occidentalis</i>	P4	-	Long unburnt open woodlands, low and tall shrubland, mallee and heath.	No	Would Not Occur.	This species is regionally extinct. No impact on this species will occur.
Water Rat <i>Hydromys chrysogaster</i>	P4	-	Permanent water, fresh, brackish or marine.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.

See Appendix A for conservation status codes

7. CONCLUSION

The fauna assessment within the survey area was primarily undertaken to document black cockatoo habitat and to determine the possible presence of western ringtail possums and other conservation significant fauna species and/or their habitat.

The fauna habitats present range from completely degraded (existing cleared areas) to very good (intact remnant native vegetation), however the majority is degraded, largely a consequence of historical clearing and livestock grazing. Given the degree of disturbance the original fauna assemblage within the survey area is likely to be depauperate in many aspects, in particular with respect to ground dwelling species which rely on dense native understory (midstorey and ground cover) vegetation, which is absent/sparse in many areas.

The vegetation present does however still have some habitat value for various fauna species and in particular those of conservation significance such as black cockatoos and the western ringtail possum. The assessment identified the presence of “potential” black cockatoo breeding and foraging habitat within the survey area and the presence of western ringtail possums.

The actual extent of proposed clearing within the survey area has not been finalised and therefore specific impacts on fauna species are difficult to predict. In this instance impacts are most likely to be related to the loss of habitat and the potential for some species to be killed or injured during clearing. Potential impacts on fauna should be reviewed as planning progresses.

8. REFERENCES

Commonwealth of Australia (2012). EPBC Act Referral guidelines for three threatened Black Cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

Department of Biodiversity, Conservation and Attractions (DBCA) (2021). NatureMap Database search. "By Circle" Centre - 115° 32' 27" E, 33° 36' 02" S (plus 10km buffer). Accessed 30/07/2021.

Department of Agriculture, Water and the Environment (DAWE) (2021). EPBC Act Protected Matters Report: "By Point" -33.60069 115.5409 (1 km Buffer). Available from: <http://www.environment.gov.au>. Accessed 30/07/2021.

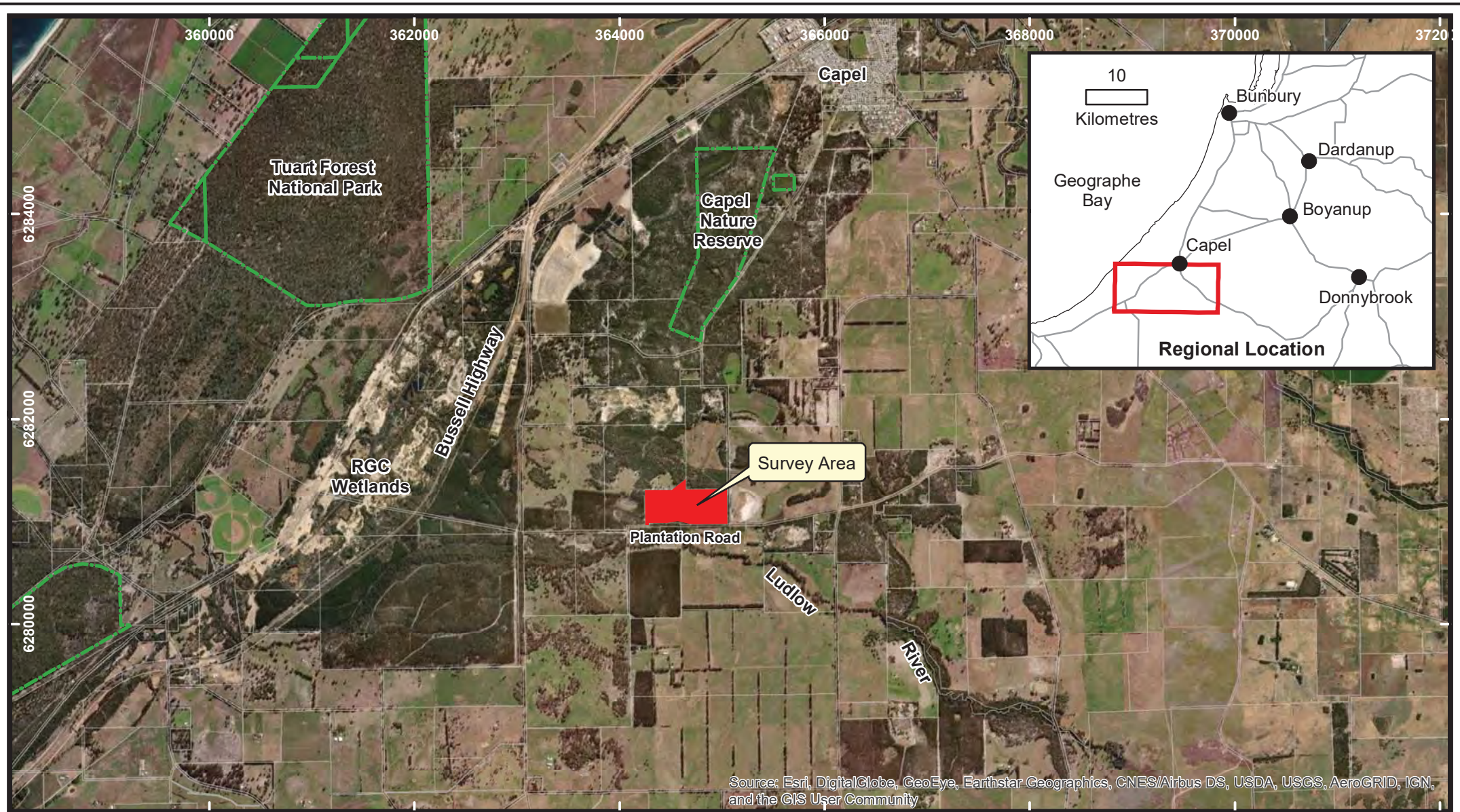
Department of Primary Industries and Regional Development (DPIRD) Geographic Information Services (2021). Native Vegetation Extent (DPIRD-005) (Western Australia) Shapefile - <https://catalogue.data.wa.gov.au/dataset/native-vegetation-extent>.

Ecoedge Environmental Services (Ecoedge) (2022). Reconnaissance and Targeted Flora and Vegetation Survey of Lot 43, Plantation Road, Capel. Memorandum prepared for MBS Environmental.

Environmental Protection Authority (EPA) (2020). Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment, Joondalup, Western Australia.

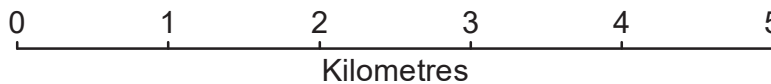
Peck, A., Barrett, G. & Williams, M. (2019). The 2019 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*). BirdLife Australia, Floreat, Western Australia.

FIGURES



Legend

 Survey Area



Drawn: G Harewood
Date: 14-Dec-21
Scale: 1:50,000


Lot 43 Planation Road
Ludlow

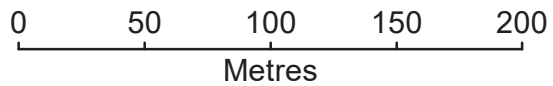
**Survey Area
and
Surrounds**

Projection/Coordinate System: UTM/MGA Zone 50 Figure: 1



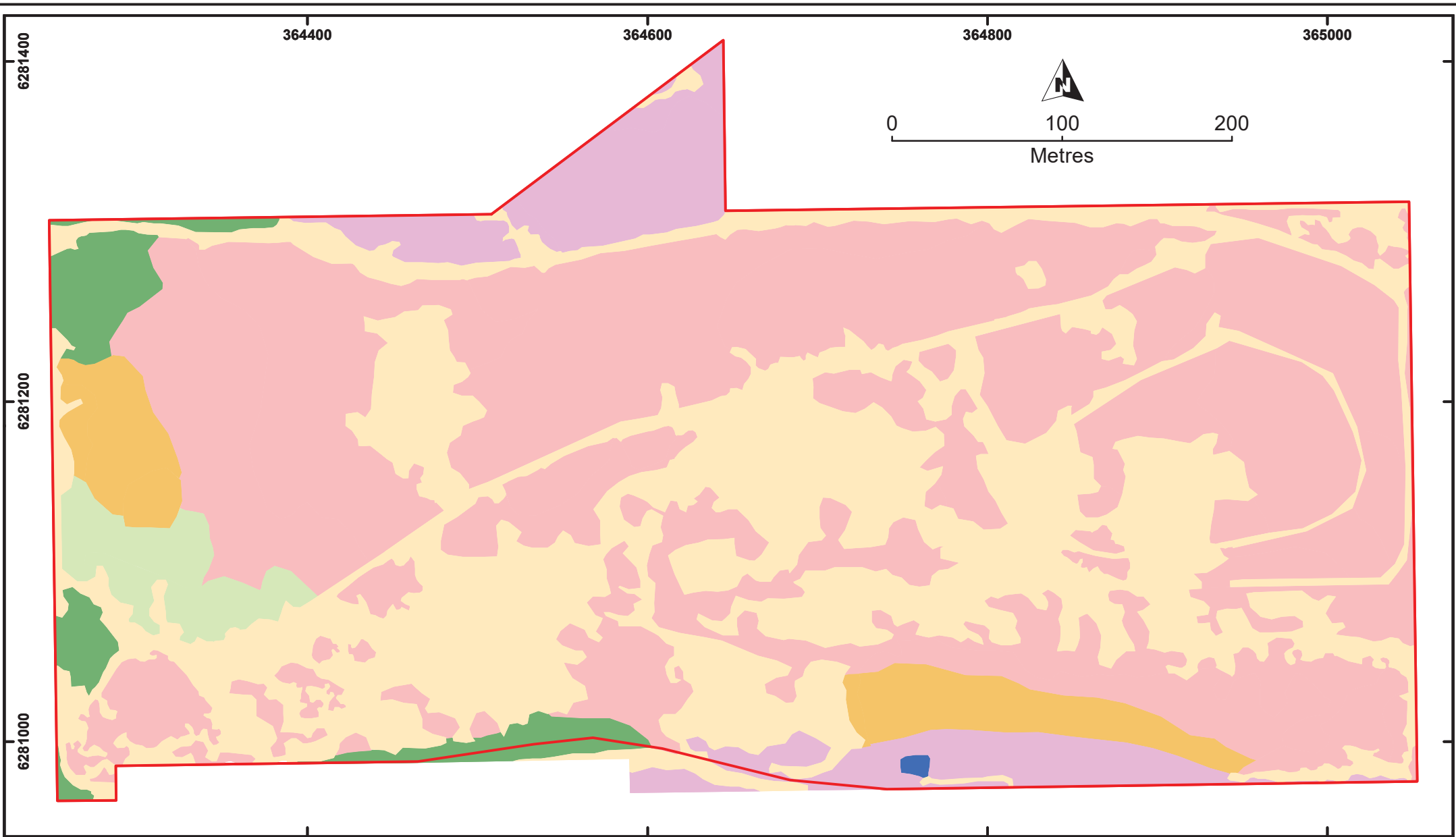
Legend

 Survey Area



Drawn: G Harewood
Date: 14-Dec-21
Scale: 1:3,000

Lot 43 Plantation Road
Ludlow
**Survey Area
Aerial Photograph**



Legend

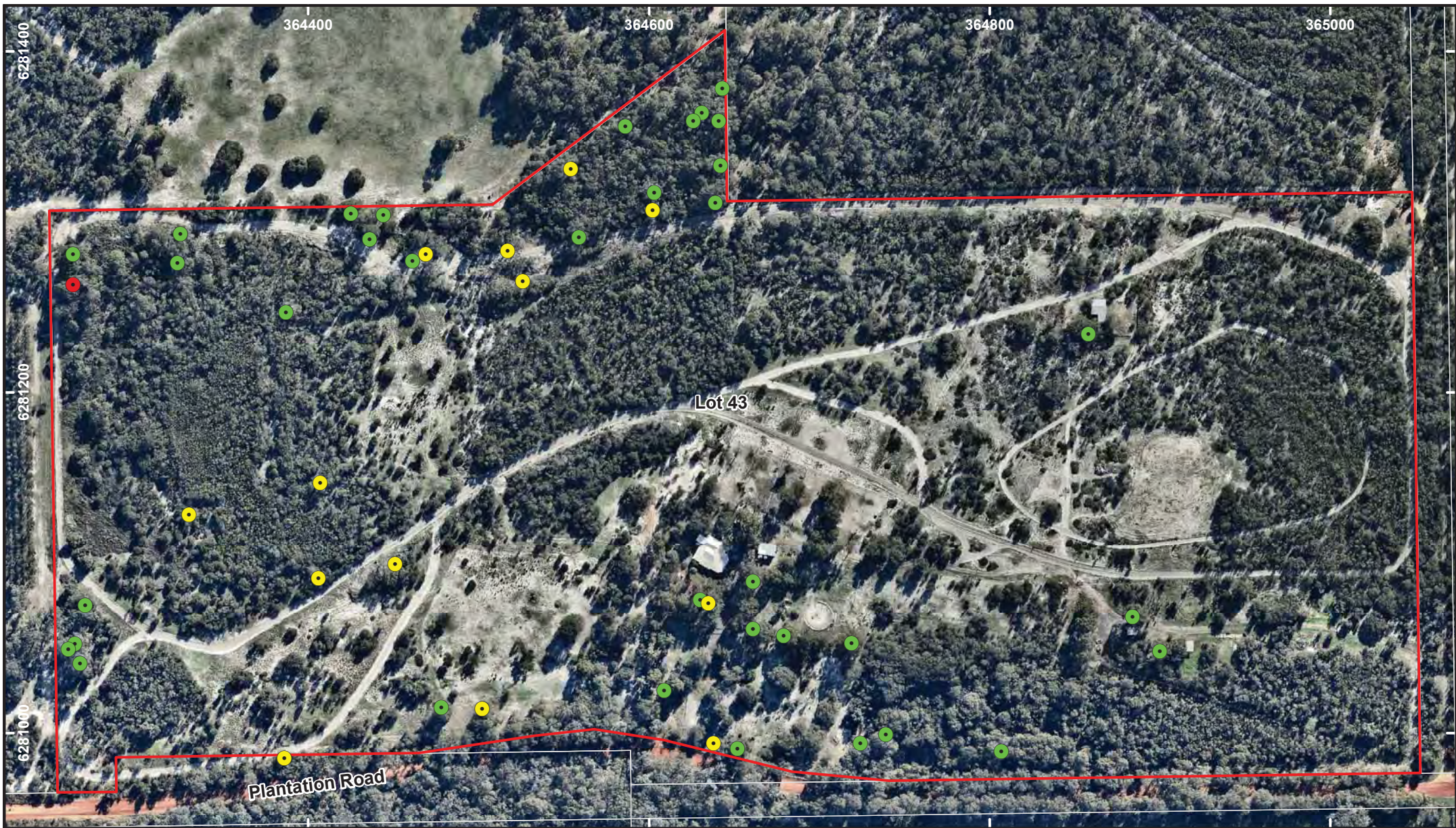
- Survey Area
- Open low woodland of paperbark over sedgeland with patches of tall shrubland
- Very open medium woodland of marri over medium woodland of paperbark
- Medium open forest of marri over a very open low woodland over tall sparse shrubland
- Medium woodland of marri and flooded gum over low woodland of peppermint and paperbark
- Tall shrubland with occasional emergent jarrah, peppermint, Banksia and Nuytsia on grey sand.
- Existing cleared areas
- Dam




Drawn: G Harewood
 Date: 11-Jul-22
 Scale: 1:3,000




**Lot 43 Plantation Road
 Ludlow**

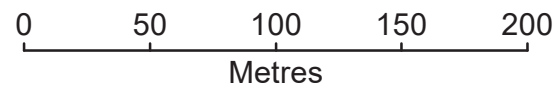
**Fauna
 Habitats**



Legend

 Survey Area

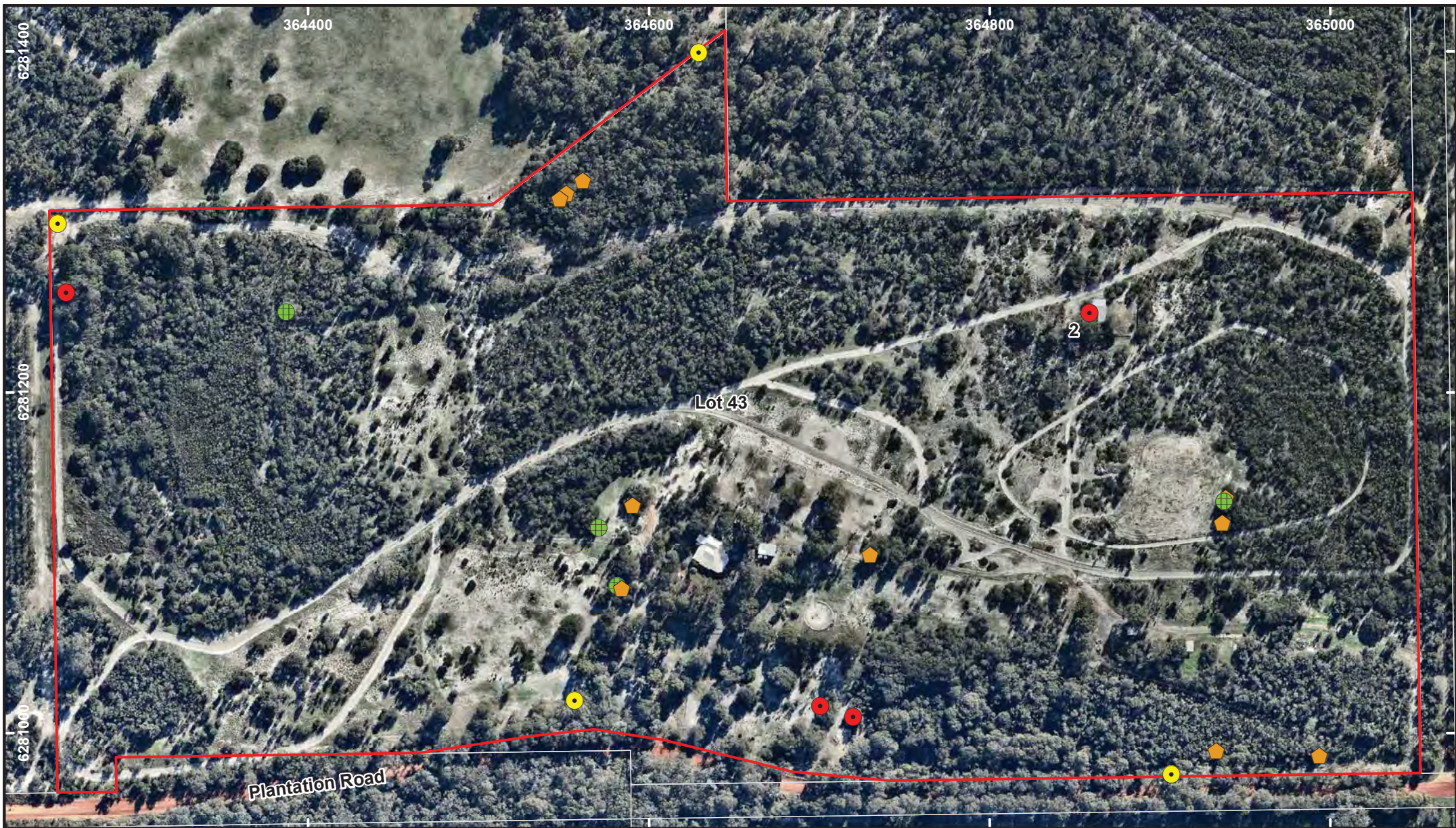
-  Habitat Tree - One or more large hollows possibly suitable for black cockatoos
-  Habitat Tree - One or more possible small/medium hollows
-  Habitat Tree - No hollows seen



Drawn: G Harewood
Date: 12-Jan-22
Scale: 1:3,000

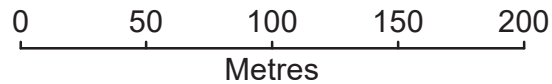
Lot 43 Plantation Road
Ludlow

**Habitat Trees
(DBH >50cm)**



Legend

- Survey Area
- Western Ringtail Possum (WRP)
- ⊗ WRP Scats
- ⬠ WRP Drey
- Common Brushtail Possum



Drawn: G Harewood
 Date: 12-Jan-22
 Scale: 1:3,000

**Lot 43 Plantation Road
 Ludlow**

**Possum
 Observations**

APPENDIX A

CONSERVATION CATEGORIES

EPBC Act (1999) Threatened Fauna Categories

Threatened fauna may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* in any one of the following categories:

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically Endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the <i>EPBC Act</i>

Note: Only species in those categories marked with an asterisk are matters of national environmental significance (NES) under the *EPBC Act*.

Wildlife Conservation (Specially Protected Fauna) Notice 2018 Categories

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Code	Description
Schedule 1 (S1) Critically Endangered species	CR	Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
Schedule 2 (S2) Endangered species	EN	Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
Schedule 3 (S3) Vulnerable species	VU	Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Schedule 4 (S4) Presumed extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last member of the species has died.
Schedule 5 (S5) Migratory birds protected under an international agreement	MI	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6 (S6) Fauna that is of special conservation need as conservation dependent fauna	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7 (S7) Other specially protected fauna.	OS	Fauna otherwise in need of special protection to ensure their conservation.

Western Australian DBCA Priority Fauna Categories

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Description
Priority 1 (P1) Poorly Known Species.	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 (P2) Poorly Known Species.	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3 (P3) Poorly Known Species.	P3	Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 (P4) Rare, Near Threatened and other species in need of monitoring.	P4	<p>(a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened: Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

IUCN Red List Threatened Species Categories

The *IUCN Red List of Threatened Species™* is a checklist of taxa that have undergone an extinction risk assessment using the *IUCN Red List Categories and Criteria*.

Categories are summarized below.

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.
Not Evaluated	NE	Taxa which has not been evaluated.

A full list of categories and their meanings are available at:

<http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria>

APPENDIX B
NATUREMAP DATABASE SEARCH
AND
PROTECTED MATTERS SEARCH TOOL RESULTS

NatureMap - Lot 43 20km Buffer

Created By Greg Harewood on 30/07/2021

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 32' 27" E, 33° 36' 02" S
Buffer 20km
Group By Species Group

Species Group	Species	Records
Amphibian	11	109
Bird	196	14868
Fish	48	137
Invertebrate	164	732
Mammal	33	2199
Reptile	38	226
TOTAL	490	18271

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Amphibian				
1.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
2.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
3.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
4.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
5.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
6.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
7.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
8.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
9.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
10.	25419 <i>Metacrinia nichollsi</i> (Forest Toadlet)			
11.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
Bird				
12.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
13.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
14.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
15.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
16.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
17.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
18.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
19.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
20.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
21.	24310 <i>Anas castanea</i> (Chestnut Teal)			
22.	24312 <i>Anas gracilis</i> (Grey Teal)			
23.	24313 <i>Anas platyrhynchos</i> (Mallard)			
24.	<i>Anas platyrhynchos subsp. domesticus</i>			
25.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
26.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
27.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
28.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
29.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
30.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
31.	25558 <i>Ardea ibis</i> (Cattle Egret)			
32.	25559 <i>Ardea intermedia</i> (Intermediate Egret)			
33.	41324 <i>Ardea modesta</i> (great egret, white egret)			
34.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
35.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
36.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
37.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
38.	24318 <i>Aythya australis</i> (Hardhead)			
39.	<i>Barnardius zonarius</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
40.	24319 <i>Biziura lobata</i> (Musk Duck)			
41.	24345 <i>Botaurus poiciloptilus</i> (Australasian Bittern)		P	
42.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
43.	25715 <i>Cacatua roseicapilla</i> (Galah)			
44.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
45.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
46.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
47.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
48.	24780 <i>Calidris alba</i> (Sanderling)		IA	
49.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		P	
50.	24786 <i>Calidris melanotos</i> (Pectoral Sandpiper)		IA	
51.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
52.	24789 <i>Calidris subminuta</i> (Long-toed Stint)		IA	
53.	24790 <i>Calidris tenuirostris</i> (Great Knot)		P	
54.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
55.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		P	
56.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		P	
57.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		P	
58.	48400 <i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		P	
59.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)		P	
60.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
61.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
62.	47909 <i>Cheramoeca leucosterna</i> (White-backed Swallow)			
63.	<i>Chroicocephalus novaehollandiae</i>			
64.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
65.	25601 <i>Chrysococcyx lucidus</i> (Shining Bronze Cuckoo)			
66.	24432 <i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i> (Shining Bronze Cuckoo)			
67.	<i>Circus aeruginosus</i>			Y
68.	24288 <i>Circus approximans</i> (Swamp Harrier)			
69.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
70.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
71.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
72.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
73.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
74.	25592 <i>Corvus coronoides</i> (Australian Raven)			
75.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
76.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
77.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
78.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
79.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
80.	24322 <i>Cygnus atratus</i> (Black Swan)			
81.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
82.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
83.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
84.	25618 <i>Diomedea exulans</i> (Wandering Albatross)		P	
85.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
86.	<i>Egretta garzetta</i>			
87.	<i>Egretta novaehollandiae</i>			
88.	<i>Elanus axillaris</i>			
89.	47937 <i>Euseyornis melanops</i> (Black-fronted Dotterel)			
90.	<i>Eolophus roseicapillus</i>			
91.	24651 <i>Eopsaltria australis</i> subsp. <i>griseogularis</i> (Western Yellow Robin)			
92.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
93.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
94.	24379 <i>Erythronyctis cinctus</i> (Red-kneed Dotterel)			
95.	25621 <i>Falco berigora</i> (Brown Falcon)			
96.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
97.	24472 <i>Falco cenchroides</i> subsp. <i>cenchrus</i> (Australian Kestrel, Nankeen Kestrel)			
98.	25623 <i>Falco longipennis</i> (Australian Hobby)			
99.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
100.	25727 <i>Fulica atra</i> (Eurasian Coot)			
101.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
102.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
103.	42314 <i>Gavicalis virescens</i> (Singing Honeyeater)			
104.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
105.	24271 <i>Gerygone fusca</i> subsp. <i>fusca</i> (Western Gerygone)			
106.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
107.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
108.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
109.	24295 <i>Haliastur spheurnus</i> (Whistling Kite)			
110.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
111.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
112.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
113.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
114.	24367 <i>Lalage tricolor</i> (White-winged Triller)			
115.	25638 <i>Larus pacificus</i> (Pacific Gull)			
116.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
117.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
118.	<i>Lophoictinia isura</i>			
119.	24690 <i>Macronectes giganteus</i> (Southern Giant Petrel)		IA	
120.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
121.	25650 <i>Malurus elegans</i> (Red-winged Fairy-wren)			
122.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
123.	24552 <i>Malurus splendens</i> subsp. <i>splendens</i> (Splendid Fairy-wren)			
124.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
125.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
126.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
127.	<i>Microcarbo melanoleucos</i>			
128.	25542 <i>Milvus migrans</i> (Black Kite)			
129.	48008 <i>Morus serrator</i> (Australasian Gannet)			
130.	25610 <i>Myiagra inquieta</i> (Restless Flycatcher)			
131.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
132.	24739 <i>Neophema petrophila</i> (Rock Parrot)			
133.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
134.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
135.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
136.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
137.	<i>Pachycephala</i> sp.			Y
138.	24692 <i>Pachyptila becheri</i> (Slender-billed Prion)			
139.	24693 <i>Pachyptila desolata</i> (Antarctic Prion)			
140.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
141.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
142.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
143.	24630 <i>Pardalotus striatus</i> subsp. <i>westraliensis</i> (Striated Pardalote)			
144.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
145.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
146.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
147.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
148.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
149.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
150.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
151.	24668 <i>Phalacrocorax varius</i> subsp. <i>hypoleucos</i> (Pied Cormorant)			
152.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
153.	24463 <i>Phoebastria palpebrata</i> (Light-mantled Albatross)		P4	
154.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
155.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
156.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
157.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
158.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
159.	24745 <i>Platycercus icterotis</i> subsp. <i>icterotis</i> (Western Rosella)			
160.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
161.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
162.	24750 <i>Platycercus zonarius</i> subsp. <i>semitorquatus</i> (Twenty-eight Parrot)			
163.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
164.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
165.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
166.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
167.	24679 <i>Podargus strigoides</i> subsp. <i>brachypterus</i> (Tawny Frogmouth)			
168.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
169.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
170.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
171.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
172.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
173.	24769 <i>Porzana fluminea</i> (Australian Spotted Crane)			
174.	25732 <i>Porzana pusilla</i> (Baillon's Crane)			
175.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
176.	24703 <i>Pterodroma lessonii</i> (White-headed Petrel)			
177.	25710 <i>Pterodroma macroptera</i> (Great-winged Petrel)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
178.	<i>Purpurecephalus spurius</i>			
179.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
180.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
181.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
182.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
183.	24279 <i>Sericornis frontalis</i> subsp. <i>maculatus</i> (White-browed Scrubwren)			
184.	30948 <i>Smicromis brevirostris</i> (Weebill)			
185.	24645 <i>Stagonopleura oculata</i> (Red-eared Firetail)			
186.	48116 <i>Stercorarius antarcticus</i> (Brown Skua)		P4	
187.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
188.	25655 <i>Stipiturus malachurus</i> (Southern Emu-wren)			
189.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
190.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
191.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
192.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
193.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
194.	48135 <i>Thinornis rubricollis</i> (Hooded Plover, Hooded Dotterel)		P4	
195.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
196.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
197.	48141 <i>Tribonyx ventralis</i> (Black-tailed Native-hen)			
198.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
199.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
200.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
201.	48147 <i>Turnix varius</i> (Painted Button-quail)			
202.	24852 <i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
203.	24855 <i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i> (Masked Owl (southwest))		P3	
204.	25577 <i>Vanellus miles</i> (Masked Lapwing)			
205.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
206.	41351 <i>Xenus cinereus</i> (Terek Sandpiper)		IA	
207.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

Fish

208.	??			
209.	<i>Acanthaluteres brownii</i>			
210.	<i>Acanthaluteres spilomelanurus</i>			
211.	<i>Acanthaluteres vittiger</i>			
212.	<i>Anoplocapros robustus</i>			
213.	<i>Apogon rueppellii</i>			
214.	<i>Aseraggodes haackeanus</i>			
215.	<i>Atherinosoma</i> sp.			
216.	<i>Austrolabrus maculatus</i>			
217.	<i>Bostockia porosa</i>			
218.	<i>Brachaluteres jacksonianus</i>			
219.	<i>Cantheschenia longipinnis</i>			
220.	<i>Carassius auratus</i>			
221.	<i>Chelmonops curiosus</i>			
222.	<i>Cochleoceps viridis</i>			
223.	<i>Coryphaena hippurus</i>			
224.	<i>Cristiceps australis</i>			
225.	<i>Dotalabrus aurantiacus</i>			
226.	<i>Echeneis naucrates</i>			
227.	<i>Edelia vittata</i>			
228.	<i>Eubalichthys cyanoura</i>			
229.	34028 <i>Galaxias occidentalis</i> (Western Minnow)			
230.	<i>Gambusia affinis</i>			
231.	<i>Gambusia holbrooki</i>			
232.	34030 <i>Geotria australis</i> (Pouched Lamprey)		P3	
233.	<i>Gymnapistes marmoratus</i>			
234.	<i>Haletta semifasciata</i>			
235.	<i>Halichoeres brownfieldi</i>			
236.	<i>Heteroclinus adelaidae</i>			
237.	<i>Heteroclinus</i> sp.			
238.	47983 <i>Lepidogalaxias salamandroides</i> (Salamanderfish)		P	
239.	<i>Lotella rhacinus</i>			
240.	<i>Meuschenia freycineti</i>			
241.	<i>Meuschenia galii</i>			
242.	<i>Nannoperca vittata</i>			
243.	<i>Parapercis haackei</i>			
244.	<i>Perca fluviatilis</i>			
245.	<i>Phyllophryne scortea</i>			
246.	<i>Posidonichthys hutchinsi</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
247.	<i>Pseudogobius olorum</i>			
248.	<i>Scobinichthys granulatus</i>			
249.	<i>Siphamia cephalotes</i>			
250.	<i>Siphonognathus radiatus</i>			
251.	<i>Stigmatopora argus</i>			
252.	<i>Thunnus maccoyii</i>			
253.	<i>Trachinops noarlungae</i>			
254.	<i>Vanacampus poecilolaemus</i>			
255.	<i>Vincentia punctata</i>			

Invertebrate

256.	<i>Acariformes sp.</i>			
257.	<i>Aeshnidae sp.</i>			
258.	<i>Akamptogonus novarae</i>			
259.	<i>Amblyomma albolimbatum</i>			
260.	<i>Aname mainae</i>			
261.	<i>Aname tepperi</i>			
262.	<i>Ancylidae sp.</i>			
263.	<i>Anisops sp.</i>			
264.	<i>Antichiropus nanus</i>			
265.	<i>Antiporus occidentalis</i>			
266.	<i>Antiporus sp.</i>			
267.	<i>Arachnura higginsi</i>			
268.	<i>Araneus cyphoxis</i>			
269.	<i>Araneus eburneiventris</i>			
270.	<i>Araneus recherchensis</i>			
271.	<i>Araneus senicaudatus</i>			
272.	<i>Argiope protensa</i>			
273.	<i>Argiope trifasciata</i>			
274.	<i>Arkys alticephala</i>			
275.	<i>Arkys walckenaeri</i>			
276.	<i>Arrenuridae sp.</i>			
277.	<i>Artoria flavimana</i>			
278.	<i>Athericidae sp.</i>			
279.	<i>Aturidae sp.</i>			
280.	<i>Austracantha minax</i>			
281.	<i>Austrochthonius strigosus</i>			Y
282.	33972 <i>Austromerope poultoni</i> (earwigfly (southwest), scorpionfly)			
283.	<i>Backbourkia brounii</i>			
284.	<i>Badumna insignis</i>			
285.	<i>Baetidae sp.</i>			
286.	<i>Baiami volucripes</i>			
287.	<i>Berosus discolor</i>			
288.	<i>Berosus munitipennis</i>			
289.	<i>Botryocladus freemani</i>			
290.	<i>Caenidae sp.</i>			
291.	<i>Ceinidae sp.</i>			
292.	<i>Ceratopogonidae sp.</i>			
293.	<i>Cercophonius sulcatus</i>			
294.	<i>Cherax destructor</i>			
295.	<i>Cherax preissii</i>			
296.	<i>Cherax quinquecarinatus</i>			
297.	<i>Chironominae sp.</i>			
298.	<i>Chironomus aff. alternans</i> (V24) (CB)			
299.	<i>Chironomus tepperi</i>			
300.	<i>Chrysomelidae sp.</i>			
301.	<i>Clynotis severus</i>			
302.	<i>Coenagrionidae sp.</i>			
303.	<i>Copepoda sp.</i>			
304.	<i>Corduliidae sp.</i>			
305.	<i>Corixidae sp.</i>			
306.	<i>Corynoneura sp.</i> (V49) (SAP)			
307.	<i>Cricotopus 'parbicinctus'</i>			
308.	<i>Culex (Culex) australicus</i>			
309.	<i>Culicidae sp.</i>			
310.	<i>Cyclosa trilobata</i>			
311.	<i>Cyrtophora parnasia</i>			
312.	<i>Dicrotendipes sp. A</i> (V47) (SAP)			
313.	<i>Dytiscidae sp.</i>			
314.	<i>Ecnomidae sp.</i>			
315.	<i>Eriophora biapicata</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
316.	<i>Eriophora pustulosa</i>			
317.	<i>Gelastocoridae sp.</i>			
318.	<i>Geogarypus taylori</i>			
319.	<i>Gomphidae sp.</i>			
320.	<i>Gripopterygidae sp.</i>			
321.	<i>Gyrinidae sp.</i>			
322.	<i>Harrisius sp.</i>			
323.	<i>Harrisius sp. B (SFM)</i>			
324.	<i>Helochares tenuistriatus</i>			
325.	<i>Helpis minitabunda</i>			
326.	<i>Hemicorduliidae sp.</i>			
327.	<i>Henicops dentatus</i>			
328.	<i>Heurodes turritus</i>			
329.	<i>Hydraenidae sp.</i>			
330.	<i>Hydrobiosidae sp.</i>			
331.	<i>Hydrophilidae sp.</i>			
332.	<i>Hydroptilidae sp.</i>			
333.	<i>Hyriidae sp.</i>			
334.	48935 <i>Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)</i>		P3	
335.	<i>Insulodrilus bifidus</i>			
336.	<i>Isopeda leishmanni</i>			
337.	<i>Isopedella cana</i>			
338.	<i>Kiefferulus intertinctus</i>			
339.	<i>Lampona cylindrata</i>			
340.	<i>Lampona punctigera</i>			
341.	<i>Lancetes lanceolatus</i>			
342.	<i>Latrodectus hasseltii</i>			
343.	<i>Leptoceridae sp.</i>			
344.	<i>Leptoperla australica</i>			
345.	<i>Leptophlebiid genus S sp. AV1</i>			
346.	<i>Leptophlebiidae sp.</i>			
347.	<i>Lestidae sp.</i>			
348.	<i>Libellulidae sp.</i>			
349.	<i>Limbodessus inornatus</i>			
350.	<i>Limnophyes vestitus (V41)</i>			
351.	<i>Limnoxenus zelandicus</i>			
352.	<i>Maratus pavonis</i>			
353.	<i>Megapodagrionidae sp.</i>			
354.	<i>Micronecta robusta</i>			
355.	<i>Microvelia sp.</i>			
356.	<i>Missulena granulosa</i>			
357.	<i>Missulena occatoria</i>			
358.	<i>Mituliodon tarantulinus</i>			
359.	<i>Neoniphargidae sp.</i>			
360.	<i>Nephila edulis</i>			
361.	<i>Newmanoperla exigua</i>			
362.	<i>Notonectidae sp.</i>			
363.	<i>Nousia sp. AV16</i>			
364.	<i>Nunciella aspera</i>			
365.	<i>Ocrisiona parmelliae</i>			
366.	<i>Oligochaeta sp.</i>			
367.	<i>Ommatoiulus moreletii</i>			
368.	<i>Opisthopora sp.</i>			
369.	<i>Oratemnus curtus</i>			
370.	<i>Orthoclaadiinae sp.</i>			
371.	<i>Ostracoda (unident.)</i>			
372.	<i>Palaemonidae sp.</i>			
373.	<i>Paracymus spenceri</i>			
374.	<i>Parakiefferiella variegatus</i>			
375.	<i>Paralimnophyes pullulus (V42)</i>			
376.	<i>Paramerina levidensis</i>			
377.	<i>Parastaciidae sp.</i>			
378.	<i>Pentaneurini genus V20</i>			
379.	<i>Perthiidae sp.</i>			
380.	<i>Philopotamidae sp.</i>			
381.	<i>Phreatoicidae sp.</i>			
382.	<i>Phreodrilidae sp.</i>			
383.	<i>Planorbidae sp.</i>			
384.	<i>Platynectes decempunctatus var polygrammus</i>			
385.	<i>Platynectes sp.</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
386.	<i>Polypedilum nr. convexum (SAP)</i>			
387.	<i>Polypedilum watsoni</i>			
388.	<i>Protoneuridae sp.</i>			
389.	<i>Pyralidae sp.</i>			
390.	<i>Raveniella peckorum</i>			
391.	<i>Rhantus suturalis</i>			
392.	<i>Richardsonianidae sp.</i>			
393.	<i>Riethia v5</i>			
394.	<i>Scirtidae sp.</i>			
395.	<i>Simuliidae sp.</i>			
396.	<i>Staphylinidae sp.</i>			
397.	<i>Sternopriscus browni</i>			
398.	<i>Sternopriscus sp.</i>			
399.	<i>Synsphyronus magnus</i>			
400.	<i>Synthemistidae sp.</i>			
401.	<i>Tabanidae sp.</i>			
402.	<i>Tamopsis distinguenda</i>			
403.	<i>Tamopsis perthensis</i>			
404.	<i>Tanypodinae sp.</i>			
405.	<i>Tanytarsus nr K5</i>			
406.	<i>Tanytarsus palmatus</i>			
407.	<i>Tasmanicosa leuckartii</i>			
408.	<i>Telephlebiidae sp.</i>			
409.	<i>Temnocephalidea sp.</i>			
410.	<i>Tetragnatha demissa</i>			
411.	<i>Tipulidae sp.</i>			
412.	<i>Triplectides sp. AV21 (SFM)</i>			
413.	<i>Urodacus novaehollandiae</i>			
414.	<i>Uvarus pictipes</i>			
415.	<i>Veliidae sp.</i>			
416.	<i>Venator immansueta</i>			
417.	<i>Venatrix pullastra</i>			
418.	34113 <i>Westralunio carteri (Carter's Freshwater Mussel)</i>		P	
419.	<i>Zachria flavicoma</i>			

Mammal

420.	24088 <i>Antechinus flavipes subsp. leucogaster (Yellow-footed Antechinus, Mardo)</i>			
421.	24209 <i>Arctocephalus tropicalis (Subantarctic fur-seal)</i>		P	
422.	24162 <i>Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)</i>		P	
423.	24251 <i>Bos taurus (European Cattle)</i>	Y		
424.	24072 <i>Caperea marginata (Pygmy Right Whale)</i>			
425.	24086 <i>Cercartetus concinnus (Western Pygmy-possum, Mundarda)</i>			
426.	24186 <i>Chalinolobus gouldii (Gould's Wattleed Bat)</i>			
427.	24092 <i>Dasyurus geoffroi (Chuditch, Western Quoll)</i>		P	
428.	24189 <i>Falsistrellus mackenziei (Western False Pipistrelle, Western Falsistrelle)</i>		P4	
429.	24056 <i>Grampus griseus (Risso's Dolphin)</i>			
430.	24215 <i>Hydromys chrysogaster (Water-rat, Rakali)</i>		P4	
431.	48588 <i>Isodon fusciventer (Quenda, southwestern brown bandicoot)</i>		P4	
432.	24132 <i>Macropus fuliginosus (Western Grey Kangaroo)</i>			
433.	24168 <i>Macrotis lagotis (Bilby, Dalgyte, Ninu)</i>		P	
434.	24076 <i>Mesoplodon bowdoini (Andrew's Beaked Whale)</i>			
435.	24078 <i>Mesoplodon grayi (Gray's Beaked Whale)</i>			
436.	24223 <i>Mus musculus (House Mouse)</i>	Y		
437.	48022 <i>Notamacropus irma (Western Brush Wallaby)</i>		P4	
438.	24194 <i>Nyctophilus geoffroyi (Lesser Long-eared Bat)</i>			
439.	24085 <i>Oryctolagus cuniculus (Rabbit)</i>	Y		
440.	25508 <i>Phascogale tapoatafa (Brush-tailed Phascogale)</i>		S	
441.	48070 <i>Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)</i>		S	
442.	24166 <i>Pseudocheirus occidentalis (Western Ringtail Possum, ngwayir)</i>		P	
443.	24240 <i>Pseudomys occidentalis (Western Mouse)</i>		P4	
444.	24245 <i>Rattus rattus (Black Rat)</i>	Y		
445.	24145 <i>Setonix brachyurus (Quokka)</i>		P	
446.	24167 <i>Tarsipes rostratus (Honey Possum, Noolbenger)</i>			
447.	25521 <i>Trichosurus vulpecula (Common Brushtail Possum)</i>			
448.	24158 <i>Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)</i>			
449.	30954 <i>Tursiops aduncus (Indo-Pacific Bottlenose Dolphin)</i>			
450.	24069 <i>Tursiops truncatus (Bottlenose Dolphin)</i>			
451.	24206 <i>Vespadelus regulus (Southern Forest Bat)</i>			
452.	24040 <i>Vulpes vulpes (Red Fox)</i>	Y		

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Reptile				
453.	42368 <i>Acritoscincus triineatus</i> (Western Three-lined Skink)			
454.	44629 <i>Anilius australis</i>			
455.	24990 <i>Aprasia pulchella</i> (Granite Worm-lizard)			
456.	25335 <i>Caretta caretta</i> (Loggerhead Turtle)		P	
457.	43380 <i>Chelodina colliei</i> (South-western Snake-necked Turtle)			
458.	25336 <i>Chelonia mydas</i> (Green Turtle)		P	
459.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
460.	30893 <i>Cryptoblepharus buchananii</i>			
461.	25020 <i>Cryptoblepharus plagiocephalus</i>			
462.	25047 <i>Ctenotus impar</i>			
463.	25049 <i>Ctenotus labillardieri</i>			
464.	25346 <i>Dermochelys coriacea</i> (Leatherback Turtle)		P	
465.	25096 <i>Egernia kingii</i> (King's Skink)			
466.	25100 <i>Egernia napoleonis</i>			
467.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
468.	30919 <i>Hemiergis gracilipes</i> (skink)			
469.	25475 <i>Hemiergis peronii</i>			
470.	25118 <i>Hemiergis peronii</i> subsp. <i>tridactyla</i>			
471.	25119 <i>Hemiergis quadrilineata</i>			
472.	43384 <i>Hydrophis platurus</i> (Yellow-bellied Seasnake)			
473.	25131 <i>Lerista distinguenda</i>			
474.	25133 <i>Lerista elegans</i>			
475.	25147 <i>Lerista lineata</i> (Perth Slider, Lined Skink)		P3	
476.	25005 <i>Lialis burtonis</i>			
477.	42413 <i>Lissolepis luctuosa</i> (Western Swamp Skink)			
478.	25184 <i>Menetia greyii</i>			
479.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)			
480.	25191 <i>Morethia lineocellata</i>			
481.	25192 <i>Morethia obscura</i>			
482.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
483.	25255 <i>Parasuta nigriceps</i>			
484.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
485.	25511 <i>Pseudonaja affinis</i> (Dugite)			
486.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
487.	25519 <i>Tiliqua rugosa</i>			
488.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
489.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
490.	25225 <i>Varanus rosenbergi</i> (Heath Monitor)			

Conservation Codes
P Rare or likely to become ePinct
P Presumed ePinct
IA Protected under international agreement
S Other specially protected fauna
1 Priority 1
2 Priority 2
3 Priority 3
4 Priority 4
5 Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the Query area.



EPBC Act Protected Matters Report

This report provides General Guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance Guidelines, forms and application process details.

Report created 30/07/21 12:45:31

[Summary](#)

[Details](#)

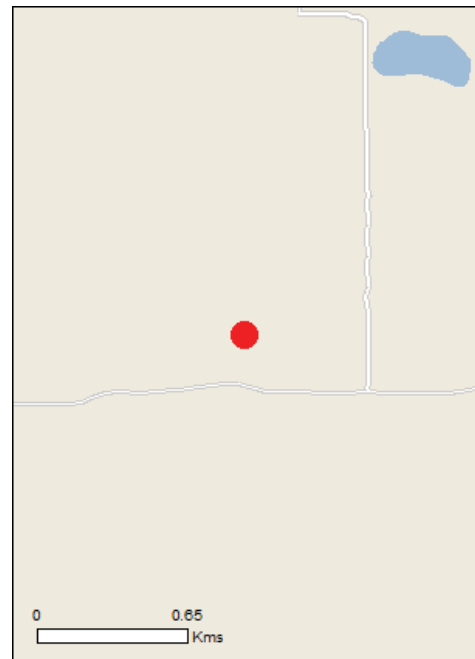
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are Commonwealth of Australia
Geoscience Australia, PPSMA 2015

[Coordinates](#)

[Buffer 0.0 Pm](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance	1
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	2
Listed Threatened Species	24
Listed Migratory Species	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth heritage values of a Commonwealth heritage place. Information on the national heritage lists can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land	None
Commonwealth Heritage Places	None
Listed Marine Species	13
Whales and Other Cetaceans	None
Critical Habitats	None
Commonwealth Reserves Terrestrial	None
Australian Marine Parks	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves	None
Regional Forest Agreements	None
Invasive Species	21
Nationally Important Wetlands	None
Key Ecological Features Marine	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	Resource Information
Name	Proximity
Passeponnerup system	Within 10km of Ramsar

Threatened Ecological Communities

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur Within area
Wuart Eucalyptus Pomphocephala Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur Within area

Threatened Species

Name	Status	Type of Presence
------	--------	------------------

Birds

Botaurus poiciloptilus Australasian Bittern (1001)	Endangered	Species or species habitat may occur Within area
Calidris canutus Red Plover, Plover (155)	Endangered	Species or species habitat may occur Within area
Calidris ferruginea Curlew Sandpiper (156)	Critically Endangered	Species or species habitat likely to occur Within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Parrakeet (17034)	Vulnerable	Species or species habitat likely to occur Within area
Calyptorhynchus baudinii Baudin's Cockatoo, Plain-billed Black-Cockatoo (1769)	Endangered	Breeding known to occur Within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo (19523)	Endangered	Breeding likely to occur Within area
Falco hypoleucos Grey Falcon (1929)	Vulnerable	Species or species habitat may occur Within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew (147)	Critically Endangered	Species or species habitat may occur Within area
Sternula nereis nereis Australian Fairy Tern (12950)	Vulnerable	Species or species habitat may occur Within area

Mammals

Dasyurus Peroffroi Chuditch, Western Quoll (130)	Vulnerable	Species or species
---	------------	--------------------

Name	Status	Type of Presence
Pseudocheirus occidentalis Western Ringtail Possum, NPPayir, Womp, Woder, NPoolanPit 25911P	Critically Endangered	Species or species habitat likely to occur Pithin area

Plants

Banksia nivea subsp. uliginosa SPamp Poneypot 2766P	Endangered	Species or species habitat likely to occur Pithin area
Banksia sphaerosa subsp. arillacea Whicher RanPe Dryandra 2769P	Vulnerable	Species or species habitat may occur Pithin area
Brachyscias verecundus Ironstone Brachyscias 1321P	Critically Endangered	Species or species habitat may occur Pithin area
Chamelaucium sp. S coastal plain R.D.Royce 4872P Royce's Waffleflower 7814P	Vulnerable	Species or species habitat likely to occur Pithin area
Diuris drummondii Pall Donkey Orchid 4365P	Vulnerable	Species or species habitat may occur Pithin area
Diuris micrantha Dwarf Bee Orchid 5082P	Vulnerable	Species or species habitat may occur Pithin area
Drakaea elastica Glossy-leaved Pammer Orchid, Glossy-leaved Pammer Orchid, Warty Pammer Orchid 6753P	Endangered	Species or species habitat likely to occur Pithin area
Drakaea micrantha Dwarf Pammer Orchid 6755P	Vulnerable	Species or species habitat may occur Pithin area
Gastrolobium papilio Butterfly-leaved Gastrolobium 78415P	Endangered	Species or species habitat may occur Pithin area
Pambertia echinata subsp. occidentalis Western Prickly Poneysuckle 4528P	Endangered	Species or species habitat may occur Pithin area
Petrophile latericola Paterite Petrophile 4532P	Endangered	Species or species habitat may occur Pithin area
Ptericordia densiflora var. pedunculata PonPstalked Featherflower 5689P	Endangered	Species or species habitat may occur Pithin area
Ptericordia plumosa var. vassensis Passe Featherflower 5804P	Endangered	Species or species habitat may occur Pithin area

Threatened Migratory Species

Resource Information

Species is listed under a different scientific name on the EPBC Act Threatened Species list.

Name	Threatened	Type of Presence
------	------------	------------------

Migratory Marine Birds

Apus pacificus Fork-tailed Shearwater 78P		Species or species habitat likely to occur Pithin area
--	--	--

Migratory Terrestrial Species

Motacilla cinerea Grey Wattlebird 42P		Species or species habitat may occur Pithin area
--	--	--

Name	Phreatened	Type of Presence
Wetlands Species		
Actitis hypoleucos Common Sandpiper R9309P		Species or species habitat likely to occur Pithin area
Calidris acuminata SharpRailed Sandpiper R74P		Species or species habitat likely to occur Pithin area
Calidris canutus Red Pnot, Pnot R55P	EndanPered	Species or species habitat may occur Pithin area
Calidris ferruPinea CurleP Sandpiper R56P	Critically EndanPered	Species or species habitat likely to occur Pithin area
Calidris melanotos Pectoral Sandpiper R58P		Species or species habitat may occur Pithin area
Numenius madaPascariensis Eastern CurleP , Far Eastern CurleP R47P	Critically EndanPered	Species or species habitat may occur Pithin area
Pandion haliaetus P sprey R52P		Species or species habitat may occur Pithin area
PrinPa nebularia Common Greenshank, Greenshank R32P		Species or species habitat likely to occur Pithin area

Other Matters Protected by the EPBC Act

Listed Marine Species		Resource Information
Species is listed under a different scientific name on the EPBC Act Phreatened Species list.		
Name	Phreatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper R9309P		Species or species habitat likely to occur Pithin area
Apus pacificus ForkRailed SPift R78P		Species or species habitat likely to occur Pithin area
Ardea ibis Cattle EPret R542P		Species or species habitat may occur Pithin area
Calidris acuminata SharpRailed Sandpiper R74P		Species or species habitat likely to occur Pithin area
Calidris canutus Red Pnot, Pnot R55P	EndanPered	Species or species habitat may occur Pithin area
Calidris ferruPinea CurleP Sandpiper R56P	Critically EndanPered	Species or species habitat likely to occur Pithin area
Calidris melanotos Pectoral Sandpiper R58P		Species or species habitat may occur Pithin area

Name	Threatened	Type of Presence
Puffinus pacificus Whitebellied Shearwater #43P		Species or species habitat likely to occur Pithin area
Merops ornatus Rainbow Bee-eater #70P		Species or species habitat may occur Pithin area
Motacilla cinerea Grey Wagtail #42P		Species or species habitat may occur Pithin area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew #47P	Critically Endangered	Species or species habitat may occur Pithin area
Pandion haliaetus Peregrine #52P		Species or species habitat may occur Pithin area
Pipilo chlorurus Common Greenshank, Greenshank #32P		Species or species habitat likely to occur Pithin area

Extra Information

Invasive Species [Resource Information](#)

Weeds reported here are the 20 species of national significance (WoNSP), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
<i>Anas platyrhynchos</i> Mallard #74P		Species or species habitat likely to occur Pithin area
<i>Columba livia</i> Rock Pigeon, Rock Dove, Domestic Pigeon #03P		Species or species habitat likely to occur Pithin area
<i>Streptopelia senegalensis</i> Pouter Dove, Pouter Dove #81P		Species or species habitat likely to occur Pithin area
<i>Sturnus vulgaris</i> Common Starling #89P		Species or species habitat likely to occur Pithin area
Mammals		
<i>Bos taurus</i> Domestic Cattle #16P		Species or species habitat likely to occur Pithin area
<i>Canis lupus familiaris</i> Domestic Dog #2654P		Species or species habitat likely to occur

Name	Status	Type of Presence
<i>Felis catus</i> Cat, Pouse Cat, Domestic Cat P19P		Pithin area Species or species habitat likely to occur Pithin area
<i>Mus musculus</i> Pouse Mouse P120P		Species or species habitat likely to occur Pithin area
<i>PryctolaPus cuniculus</i> Rabbit, European Rabbit P128P		Species or species habitat likely to occur Pithin area
<i>Rattus rattus</i> Black Rat, Ship Rat P84P		Species or species habitat likely to occur Pithin area
<i>Sus scrofa</i> PiP P8P		Species or species habitat likely to occur Pithin area
<i>Pulpes vulpes</i> Red FoP, FoP P18P		Species or species habitat likely to occur Pithin area
Plants		
<i>AsparaPus asparaPoides</i> Bridal Creeper, Bridal Peil Creeper, SmilaP, Florist's SmilaP, SmilaPAsparaPus P22473P		Species or species habitat likely to occur Pithin area
<i>Brachiaria mutica</i> Para Grass P5879P		Species or species habitat may occur Pithin area
<i>Cenchrus ciliaris</i> BuffelPPrass, Black BuffelPPrass P20213P		Species or species habitat may occur Pithin area
<i>Chrysanthemoides monilifera</i> Bitou Bush, Boneseed P18983P		Species or species habitat may occur Pithin area
<i>Genista sp. P Genista monspessulana</i> Broom P7538P		Species or species habitat may occur Pithin area
<i>Plea europaea</i> Plive, Common Plive P160P		Species or species habitat may occur Pithin area
<i>Pinus radiata</i> Radiata Pine Monterey Pine, InsiPnis Pine, WildinP Pine P20780P		Species or species habitat may occur Pithin area
<i>Rubus fruticosus aPPrePate</i> Blackberry, European Blackberry P8406P		Species or species habitat likely to occur Pithin area
<i>SaliP spp. ePcept S.babylonica, S.Pcalodendron P S.Preichardtii</i> WilloPs ePcept WeepinP WilloP, Pussy WilloP and Sterile Pussy WilloP P8497P		Species or species habitat likely to occur Pithin area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a General Guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in General terms. People using this information in making a referral may need to consider the Qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) or point locations and described habitat or environmental modelling (RMAPENP or BIP/CIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short timeframe, maps are derived either from 0.04 or 0.02 decimal degree cells by an automated process using polygon capture techniques (static 100 kilometre grid cells, alpha hull and convex hull) or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100 or 250 map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- Migratory and

- Marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- Threatened species listed as extinct or considered as vulnerable

- Some species and ecological communities that have only recently been listed

- Some terrestrial species that overfly the Commonwealth marine area

- Migratory species that are very widespread, vulnerable, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- Non-threatened seabirds which have only been mapped for recorded breeding sites

- Seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

136.60069 115.5409

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

[Office of Environment and Heritage, New South Wales](#)
[Department of Environment and Primary Industries, Victoria](#)
[Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
[Department of Environment, Water and Natural Resources, South Australia](#)
[Department of Land and Resource Management, Northern Territory](#)
[Department of Environmental and Heritage Protection, Queensland](#)
[Department of Parks and Wildlife, Western Australia](#)
[Environment and Planning Directorate, ACP](#)
[Wildlife Australia](#)
[Australian Bird and Bat Banding Scheme](#)
[Australian National Wildlife Collection](#)
Natural history museums of Australia
[Museum Victoria](#)
[Australian Museum](#)
[South Australian Museum](#)
[Queensland Museum](#)
[Online Zoological Collections of Australian Museums](#)
[Queensland Herbarium](#)
[National Herbarium of NSW](#)
[Royal Botanic Gardens and National Herbarium of Victoria](#)
[Tasmanian Herbarium](#)
[State Herbarium of South Australia](#)
[Northern Territory Herbarium](#)
[Western Australian Herbarium](#)
[Australian National Herbarium, Canberra](#)
[University of New England](#)
[Ocean Biogeographic Information System](#)
[Australian Government, Department of Defence](#)
[Forestry Corporation, NSW](#)
[Geoscience Australia](#)
[CSIRO](#)
[Australian Tropical Herbarium, Cairns](#)
[Bird Australia](#)
[Australian Government Antarctic Data Centre](#)
[Museum and Art Gallery of the Northern Territory](#)
[Australian Government National Environmental Science Program](#)
[Australian Institute of Marine Science](#)
[Reef Life Survey Australia](#)
[American Museum of Natural History](#)
[Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
[Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
Other Groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

APPENDIX C

OBSERVED FAUNA LISTING

Fauna Observed During Survey Period

Lot 43 Plantation Road, Ludlow

Compiled by Greg Harewood - Nov 2021

Class Family Species	Common Name	Conservation Status
----------------------------	----------------	------------------------

Amphibia

Myobatrachidae

Ground or Burrowing Frogs

<i>Heleioporus eyrei</i>	Moaning Frog	LC
--------------------------	--------------	----

Hylidae

Tree or Water-Holding Frogs

<i>Litoria adelaidensis</i>	Slender Tree Frog	LC
-----------------------------	-------------------	----

Reptilia

Varanidae

Monitor's or Goanna's

<i>Varanus rosenbergi</i>	Heath Monitor	LC
---------------------------	---------------	----

Scincidae

Skinks

<i>Tiliqua rugosa</i>	Bobtail	LC
-----------------------	---------	----

Aves

Accipitridae

Kites, Goshawks, Eagles, Harriers

<i>Accipiter fasciatus</i>	Brown Goshawk	Bp LC
----------------------------	---------------	-------

<i>Circus approximans</i>	Swamp Harrier	LC
---------------------------	---------------	----

Psittacidae

Parrots

<i>Cacatua roseicapilla</i>	Galah	LC
-----------------------------	-------	----

<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	S3 VU Bp LC
-------------------------------------	----------------------------------	-------------

<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	S2 EN Bp EN
---------------------------------	-------------------	-------------

<i>Platycercus spurius</i>	Red-capped Parrot	LC
----------------------------	-------------------	----

<i>Platycercus zonarius</i>	Australian Ringneck	LC
-----------------------------	---------------------	----

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions LC = Least Concern - see <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria> for others.

Class Family Species	Common Name	Conservation Status
Cuculidae Parasitic Cuckoos		
<i>Chrysococcyx lucidus</i>	Shining Bronze Cuckoo	LC
Halcyonidae Tree Kingfishers		
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Introduced
Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces		
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill	Bh LC
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	LC
<i>Gerygone fusca</i>	Western Gerygone	LC
<i>Smicrornis brevirostris</i>	Weebill	LC
Pardalotidae Pardalotes		
<i>Pardalotus striatus</i>	Striated Pardalote	LC
Meliphagidae Honeyeaters, Chats		
<i>Anthochaera carunculata</i>	Red Wattlebird	LC
<i>Lichmera indistincta</i>	Brown Honeyeater	LC
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Bp LC
Petroicidae Australian Robins		
<i>Petroica multicolor</i>	Scarlet Robin	Bh LC
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers		
<i>Pachycephala occidentalis</i>	Western Whistler	Bh LC
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo		
<i>Rhipidura fuliginosa</i>	Grey Fantail	LC

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions LC = Least Concern - see <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria> for others.

Class Family Species	Common Name	Conservation Status
Cracticidae Currawongs, Magpies & Butcherbirds		
<i>Cracticus tibicen</i>	Australian Magpie	LC
Corvidae Ravens, Crows		
<i>Corvus coronoides</i>	Australian Raven	LC
Hirundinidae Swallows, Martins		
<i>Hirundo neoxena</i>	Welcome Swallow	LC
Mammalia		
Peramelidae Bandicoots		
<i>Isoodon obesulus fusciventer</i>	Quenda	P5 LC
Phalangeridae Brush-tail Possums, Cuscuses		
<i>Trichosurus vulpecula vulpecula</i>	Common Brushtail Possum	LC
Pseudocheiridae Ringtail Possums		
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	S1 CR CR
Macropodidae Kangaroos, Wallabies		
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LC
Leporidae Rabbits, Hares		
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions LC = Least Concern - see <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria> for others.

APPENDIX D

HABITAT TREE DETAILS

Habitat Trees

DBH >50cm

Datum - GDA94

Entrance Size Ranges - Small = >5cm, Medium = 5 to 10cm, Large = >10cm

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Size Range	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001	50H	364719	6281053	Non-Endemic Eucalyptus	15-20	0					Planted Non-endemic
wpt002	50H	364679	6281057	Non-Endemic Eucalyptus	15-20	0					Planted Non-endemic
wpt003	50H	364661	6281061	Non-Endemic Eucalyptus	10-15	0					Planted Non-endemic
wpt004	50H	364609	6281025	Non-Endemic Eucalyptus	10-15	0					Planted Non-endemic
wpt005	50H	364638	6280994	Dead Unknown	15-20	2+	Small	No Signs	No Signs	No	
wpt006	50H	364652	6280991	Marri	15-20	0					
wpt007	50H	364724	6280994	Marri	15-20	0					
wpt008	50H	364739	6280999	Marri	20+	0					
wpt009	50H	364807	6280989	Marri	20+	0					
wpt010	50H	364630	6281078	Jarrah	15-20	0					
wpt011	50H	364635	6281076	Jarrah	5-10	2+	Small-Medium	No Signs	No Signs	No	
wpt012	50H	364661	6281089	Flooded Gum	15-20	0					
wpt015	50H	364900	6281048	Flooded Gum	10-15	0					
wpt016	50H	364639	6281311	Marri	15-20	0					
wpt017	50H	364858	6281234	Marri	15-20	0					
wpt018	50H	364642	6281333	Marri	15-20	0					
wpt019	50H	364641	6281359	Marri	15-20	0					
wpt020	50H	364631	6281364	Marri	15-20	0					
wpt021	50H	364884	6281068	Tuart	15-20	0					Planted
wpt022	50H	364626	6281359	Marri	15-20	0					
wpt023	50H	364643	6281378	Jarrah	15-20	0					
wpt024	50H	364586	6281356	Marri	15-20	0					
wpt025	50H	364554	6281331	Dead Jarrah	10-15	2+	Small-Medium	No Signs	No Signs	No	
wpt029	50H	364559	6281291	Marri	15-20	0					
wpt030	50H	364517	6281283	Dead Unknown	15-20	2+	Small	No Signs	No Signs	No	
wpt031	50H	364526	6281265	Jarrah	15-20	2+	Small-Medium	No Signs	No Signs	No	
wpt032	50H	364469	6281281	Marri	15-20	2+	Small-Medium	Bees	No Signs	No	
wpt033	50H	364461	6281277	Dead Jarrah	15-20	0					
wpt034	50H	364436	6281290	Marri	20+	0					
wpt035	50H	364425	6281305	Marri	20+	0					
wpt036	50H	364444	6281304	Marri	20+	0					
wpt037	50H	364387	6281247	Jarrah	15-20	0					
wpt038	50H	364323	6281276	Marri	20+	0					
wpt039	50H	364325	6281293	Marri	20+	0					

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Size Range	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt040	50H	364262	6281281	Marri	20+	0					
wpt041	50H	364262	6281263	Marri	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Large Side entry
wpt042	50H	364269	6281075	Marri	20+	0					
wpt043	50H	364263	6281052	Marri	20+	0					
wpt044	50H	364259	6281049	Marri	20+	0					
wpt045	50H	364266	6281041	Marri	20+	0					
wpt046	50H	364330	6281128	Jarrah	15-20	2+	Small-Medium	No Signs	No Signs	No	
wpt047	50H	364407	6281147	Jarrah	15-20	2+	Small-Medium	No Signs	No Signs	No	
wpt048	50H	364451	6281099	Jarrah	10-15	2+	Small-Large	No Signs	No Signs	No	Near horizontal - appears unsuitable for BCs
wpt049	50H	364406	6281091	Jarrah	15-20	2+	Small-Medium	No Signs	No Signs	No	
wpt050	50H	364386	6280985	Jarrah	10-15	2+	Small-Medium	No Signs	No Signs	No	
wpt051	50H	364478	6281015	Marri	15-20	0					
wpt052	50H	364502	6281014	Jarrah	15-20	1	Small	Bees	No Signs	No	
wpt053	50H	364602	6281307	Dead Jarrah	15-20	2+	Small	No Signs	No Signs	No	
wpt054	50H	364603	6281317	Marri	15-20	0					

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.

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report (“the data”). Except as otherwise stated in the report, the Author has not verified the accuracy of completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (“conclusions”) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

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 D

Dust Management Plan

LOT 43 PLANTATION ROAD, LUDLOW

**DUST MANAGEMENT PLAN
REVISION 1**

PREPARED FOR:

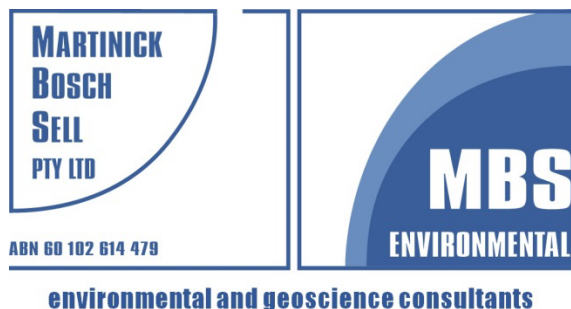
**LUDLOW HOLDINGS PTY LTD HOLDINGS PTY
LTD**

NOVEMBER 2022

PREPARED BY:

Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005
Ph: (08) 9226 3166
Email: info@mbsenvironmental.com.au
Web: www.mbsenvironmental.com.au

MBS
ENVIRONMENTAL



LOT 43 PLANTATION ROAD, LUDLOW DUST MANAGEMENT PLAN REV1

Distribution List:

Company	Contact name	Copies	Date
Ludlow Holdings Pty Ltd	Kelly Hillary, Director Kyle Jackson, Director	Electronic	8 November 2022
Element	Daniel Lewis Planning Consultant	Electronic	8 November 2022

Document Control for Job Number: LHL43EA

Document Status	Prepared By	Authorised By	Date
Draft Report	Erin Marsh Kirsi Kauhanen	Sue Brand	6 August 2022
Final Report	Kirsi Kauhanen	Sue Brand	10 August 2022
Draft Revision 1	Kirsi Kauhanen	Sue Brand	8 November 2022
Final Revision 1	Kirsi Kauhanen	Sue Brand	8 November 2022

Disclaimer, Confidentiality and Copyright Statement

This report is copyright. Ownership of the copyright remains with Martinick Bosch Sell Pty Ltd (MBS Environmental) and **Ludlow Holdings Pty Ltd**.

This report has been prepared for **Ludlow Holdings Pty Ltd** on the basis of instructions and information provided by **Ludlow Holdings Pty Ltd** and therefore may be subject to qualifications which are not expressed.

No person other than those authorised in the distribution list may use or rely on this report without confirmation in writing from MBS Environmental. MBS Environmental has no liability to any other person who acts or relies upon any information contained in this report without confirmation.

This report has been checked and released for transmittal to **Ludlow Holdings Pty Ltd**.

These Technical Reports:

- Enjoy copyright protection and the copyright vests in Martinick Bosch Sell Pty Ltd (MBS Environmental) and **Ludlow Holdings Pty Ltd** unless otherwise agreed in writing.
- May not be reproduced or transmitted in any form or by any means whatsoever to any person without the written permission of the Copyright holder.

TABLE OF CONTENTS

1.	INTRODUCTION	1
1.1	PURPOSE.....	1
1.2	SCOPE.....	1
1.3	OBJECTIVE.....	1
2.	EXISTING ENVIRONMENT	4
2.1	CLIMATE	4
2.2	LAND USE	4
2.3	LANDFORM AND SOILS	4
2.4	VEGETATION	5
2.5	SENSITIVE RECEPTORS	5
3.	POTENTIAL SOURCES OF DUST	8
4.	SITE RISK ASSESSMENT	9
5.	DUST MANAGEMENT ACTIONS	10
5.1	DUST PREVENTION	10
5.2	DUST MONITORING AND MITIGATION	10
5.3	DUST COMPLAINTS	11
6.	ROLES AND RESPONSIBILITIES	12
7.	REFERENCES	13

TABLES

Table 1:	Soil and Landscape Units on Lot 43.....	5
Table 2:	Sensitive Receptors.....	6
Table 3:	Roles and Responsibilities	12

FIGURES

Figure 1:	Project Location.....	2
Figure 2:	Excavation Works Plan.....	3
Figure 3:	Long-term Rainfall and Temperature Data (1997-2022) for Busselton Aero Meteorological Station 9603 (Bureau of Meteorology 2022).....	4
Figure 4:	Sensitive Receptors.....	7

APPENDICES

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

1. INTRODUCTION

1.1 PURPOSE

Landowner Ludlow Holdings Pty Ltd is submitting a Development Application (DA) and Extractive Industry Licence (EIL) application for the extraction of sand on Lot 43 Plantation Road, Ludlow, within the Shire of Capel (Figure 1, Figure 2). The Shire of Capel requires that a Dust Management Plan (DMP) is prepared for EIL purposes.

This DMP was prepared in accordance with the Department of Environment and Conservation's (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). This DMP should be read in conjunction with the DA report.

1.2 SCOPE

The scope of this DMP includes the following:

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

1.3 OBJECTIVE

The objective of this DMP is to minimise dust emissions from the sand extraction operations.



Scale: 1: 200,000
 Original Size: A4

Grid: GDA94 / MGA zone 50

0 2.5 5 km

Ludlow Holdings Pty Ltd
 Lot 43 (No. 546) Plantation
 Road, Ludlow








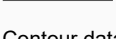

Figure 1

Project Location

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



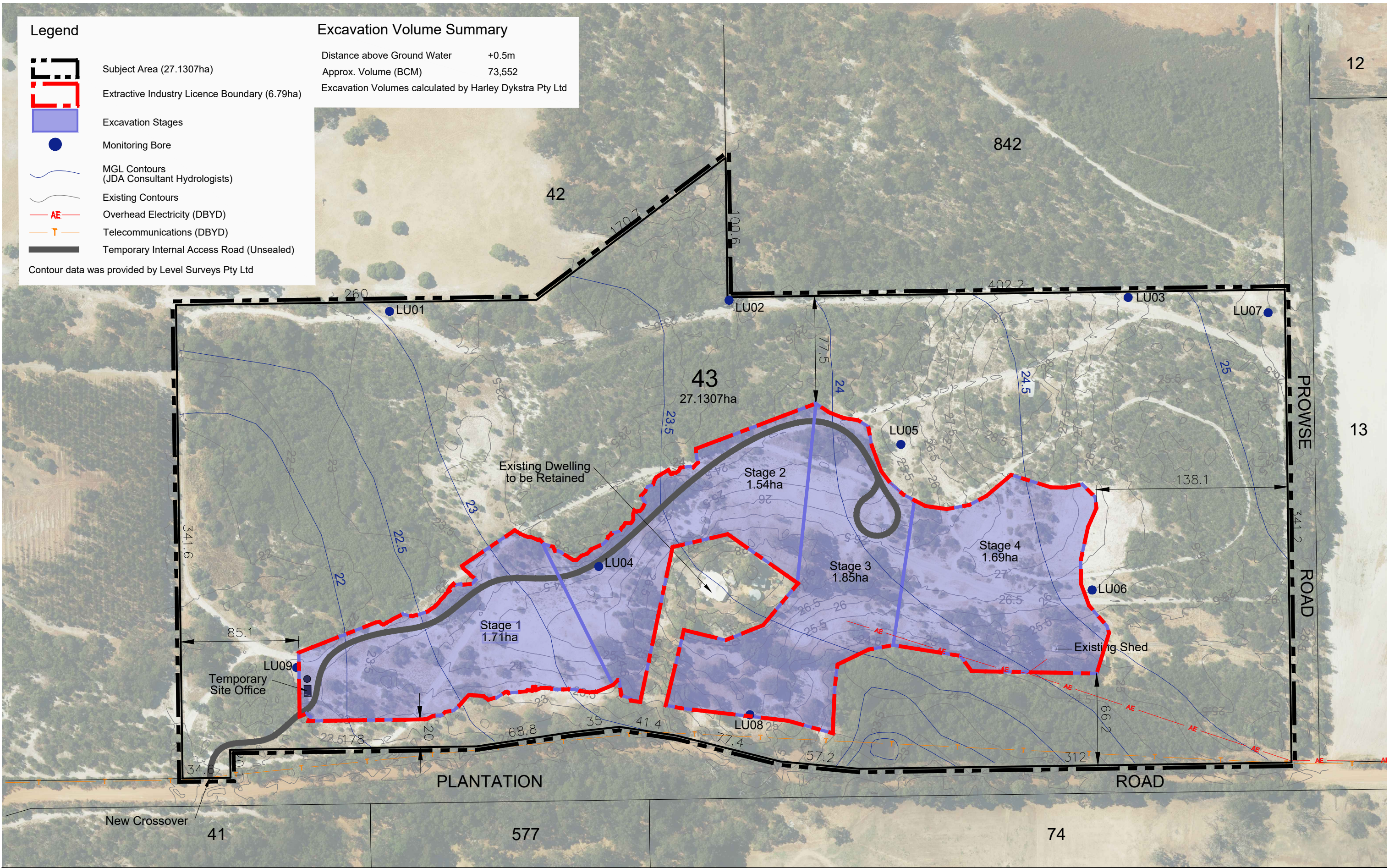
Legend

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Excavation Stages
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)
-  Temporary Internal Access Road (Unsealed)

Contour data was provided by Level Surveys Pty Ltd

Excavation Volume Summary

Distance above Ground Water	+0.5m
Approx. Volume (BCM)	73,552
Excavation Volumes calculated by Harley Dykstra Pty Ltd	



Excavation Works Plan
 Lot 43 (546) Plantation Road, Ludlow



Date: 9 Nov 2022 Scale: 1:2500 @ A3 File: 22-336 CP02B Staff: DL GW Checked: DL

Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
 PO Box 7375 Cloisters Square, Perth Western Australia 6850.
 T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au

© Element Advisory WA Pty Ltd This concept has been prepared for the purpose of meeting client specifications. The drawing does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Although care has been taken in the compilation of this drawing by Element Advisory WA Pty Ltd, all parties associated with the proposed property development disclaim all responsibility for any errors or omissions. The right is reserved to change the plan at any time. Liability is expressly disclaimed by Element Advisory WA Pty Ltd for any loss or damage which may be sustained by any person acting on any visual impression gained from this drawing.

2. EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the project area is Mediterranean, with cool wet winters and hot dry summers. Long-term average climate data for the closest meteorological station (Busselton Aero, 26 km southwest of the project) is shown in Figure 3. The average annual rainfall is 685.4 mm, mean minimum temperatures range between 7°C and 14.2°C and mean maximum temperatures between 16.8°C and 30.2°C (Bureau of Meteorology 2022).

Long-term wind roses for Busselton (Bureau of Meteorology 2022) indicate prevailing winds comprise morning easterlies and afternoon westerlies (varying from northwesterly to southerly) (Appendix 1).

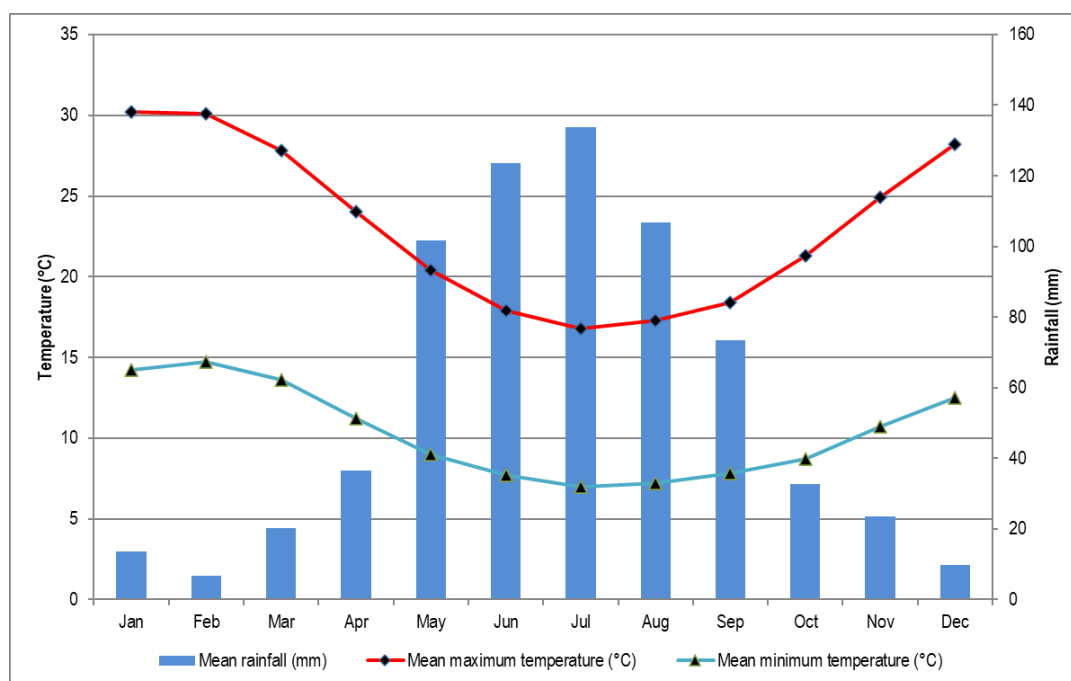


Figure 3: Long-term Rainfall and Temperature Data (1997-2022) for Busselton Aero Meteorological Station 9603 (Bureau of Meteorology 2022)

2.2 LAND USE

The project area is located on Lot 43 Plantation Road, Ludlow, approximately 5 km south of Capel (Figure 1). Lot 43 is zoned as 'Rural' in the Shire of Capel Town Planning Scheme No. 7. The proposed project area (approximately 6.79 ha) covers only a portion of Lot 43 which has a total area of 27.13 ha. The property currently includes patches of native vegetation, one residential dwelling, various outbuildings, and several horse-holding paddocks and an equestrian training track.

2.3 LANDFORM AND SOILS

The elevation of the property ranges from 22 m to 28 m Australian Height Datum (AHD), with the highest elevation recorded on the sand ridge extending from the central part of Lot 43 north to the neighbouring property. The extraction area is positioned along this sand ridge.

The majority of Lot 43 and all of the proposed extraction area is situated within the Bassendean System (212Bs) (DPIRD-064). The Bassendean System is characterised by sand dunes and sandplains with pale deep sand,

semi-wet and wet soil (DPIRD-064). The western and southern edges of Lot 43 intersect the Abba System (213Ab), however this is outside the extraction area.

There are five soil landscape units within Lot 43 (Table 1, DPIRD-027), out of which the proposed extraction area intersects two phases, B1b and B3. The majority of the proposed extraction area is located on B1b.

Table 1: Soil and Landscape Units on Lot 43

Soil Type	Description	Within Extraction Area
Bassendean B1b Phase (212Bs_B1b)	Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale-yellow B horizons.	Yes
Bassendean B3 Phase (212Bs_B3)	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Yes
Abba wet flats Phase (213AbABw)	Winter wet flats and slight depressions with sandy grey, brown duplex (Abba) and gradational (Busselton) soils.	No
Abba wet vales Phase (213AbABvw)	Small narrow swampy depressions along drainage lines. Alluvial soils.	No
Sw – Swamp (Bassendean) (212Bs_Swamp)	Swamp.	No

2.4 VEGETATION

The majority of the proposed extraction area (approximately 70%) is already cleared and the remainder contains mainly woodland of *Agonis flexuosa*, *Banksia ilicifolia* or *Nuytsia floribunda* over tall shrubland of *Kunzea glabrescens* in Completely Degraded to Good condition (Ecoedge 2022).

Ecoedge (2022) found one significant ecological community on Lot 43, called 'Southern *Corymbia calophylla* woodlands on heavy soils' (FCT1b) that is a state listed Threatened Ecological Community (TEC, Vulnerable) but not listed federally. This community is located outside the proposed extraction area (Figure 4). Other significant ecological communities known from records within 5 km of the site were not recorded on the property (Ecoedge 2022).

Significant flora species, including one Threatened species, three Priority species and six potential range extensions or range ends, are present on Lot 43 as recorded by Ecoedge (2022) (Figure 4).

2.5 SENSITIVE RECEPTORS

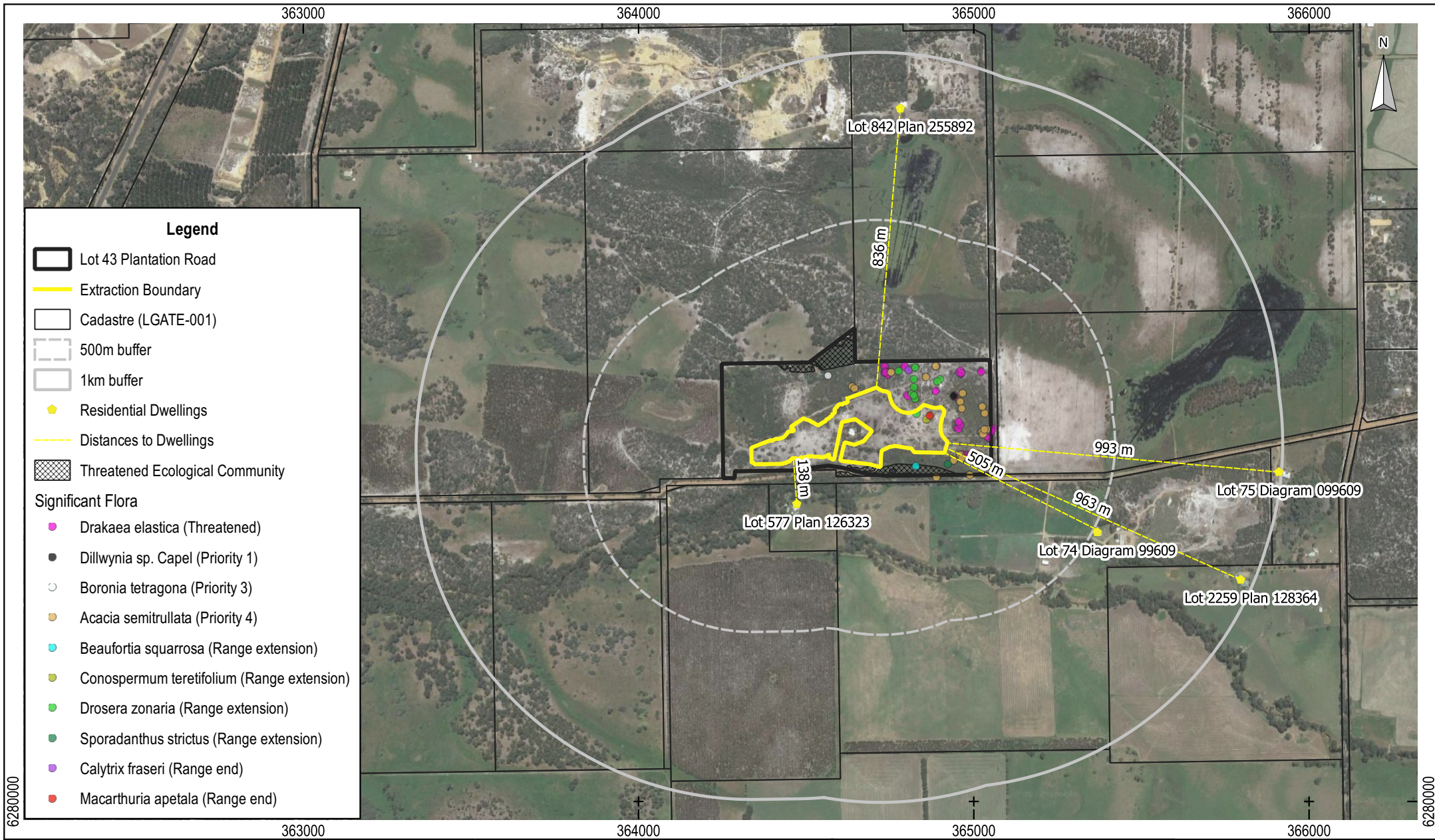
Surrounding properties are zoned 'Rural' and support a range of rural land uses, including paddocks for grazing and hay production, timber plantations, a sand extraction site, and bushland. The sand extraction site to the east is currently undergoing rehabilitation to pasture.

The closest sensitive human receptors are residential dwellings on the surrounding rural properties (Table 2). The residential dwelling on Lot 43, that is surrounded by the proposed extraction area, is not considered a sensitive receptor as it is owned and managed by the applicant/landowner and will remain unoccupied for the duration of the extraction works if necessary. The closest residential dwelling outside Lot 43 is located approximately 138 m south of the proposed extraction area (Table 2, Figure 4). No other residential dwellings are located within 500 m.

Table 2: Sensitive Receptors

Property Details	Distance and Direction from Operations
Lot 577 Plan 126323	138 m
Lot 74 Diagram 99609	505 m
Lot 75 Diagram 099609	993 m
Lot 2259 Plan 128364	963 m
Lot 842 Plan 255892	836 m

The significant flora and ecological communities within Lot 43 and vegetation on surrounding properties (Figure 4) have been taken into consideration in the preparation of this plan. The closest reserves, being the Coolilup State Forest and the Capel Nature Reserve (DBCA-011) are over 1.5 km away from the proposed extraction area and are not expected to be impacted by the operations in any way.



Legend

- Lot 43 Plantation Road
- Extraction Boundary
- Cadastre (LGATE-001)
- 500m buffer
- 1km buffer
- Residential Dwellings
- Distances to Dwellings
- Threatened Ecological Community

Significant Flora

- Drakaea elastica* (Threatened)
- Dillwynia* sp. Capel (Priority 1)
- Boronia tetragona* (Priority 3)
- Acacia semitrullata* (Priority 4)
- Beaufortia squarrosa* (Range extension)
- Conospermum teretifolium* (Range extension)
- Drosera zonaria* (Range extension)
- Sporadanthus strictus* (Range extension)
- Calytrix fraseri* (Range end)
- Macarthuria apetala* (Range end)

Scale: 1: 15,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50 (EPSG:28350)

Ludlow Holdings Pty Ltd
 Lot 43 Plantation Road, Ludlow

Figure 4
Sensitive Receptors

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

3. POTENTIAL SOURCES OF DUST

The proposed project layout is shown in Figure 2. Potential sources of dust associated with the sand extraction operations include the following:

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

4. SITE RISK ASSESSMENT

Dust potentially generated as part of the sand 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's *"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 ground disturbance will be gradual and proceed in stages and that rehabilitation to grazing pasture and native vegetation will also follow gradually in stages. Prevailing summer winds are morning easterlies and afternoon southerly to northwesterlies, and these have been taken into consideration in the risk assessment.

A site classification score of 396 was calculated for the on-site works placing the proposed works to the high end of the 'Low Risk' category (between 200 and 399 points). Based on the Low Risk classification the following are typically required (DEC 2011):

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

The closest dwelling is located approximately 138 m south of the extraction area. It is not downwind of the extractive site under prevailing summer winds and the dwelling is also screened by vegetation on the side of the extractive operations. On the basis of this, the likelihood of dust impacts on the dwelling is considered low with appropriate management and monitoring measures in place. These have been described in Section 5.

The dust management actions described in Section 5 have been designed to minimise, and as far as possible to avoid, dust emissions outside the proposed extraction area. Therefore, these actions also address potential risks posed by dust on surrounding environmental values.

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.
- Revegetation will also be gradual in nature and proceed in stages, closely following the completion of sand extraction.
- Topsoil stockpiles will be no greater than 2 m in height and other stockpiles will not exceed 4 m in height.
- No excavation works or loading of trucks is to occur in winds greater than 40 km/h.
- 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 for the site 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 entering Plantation Road. 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 site on an ongoing basis.
 - Should dust generation be observed and there is a risk of dust being blown out of the extraction area, additional watering of dust sources with the water cart will be organised.
 - Alternative dust controls, such as chemical dust suppressants (soil binding agents) and dust fencing will be implemented on a need basis for any persistent sources of dust such as stockpiles or open areas waiting for extraction.
 - When weather conditions negate the effectiveness of dust prevention and mitigation measures and dust continues to be blown out of the extraction area, the dust generating activities will cease until conditions improve and compliance with this DMP can be achieved.
- During the drier months (typically November to April), visual monitoring will also be undertaken in bushland adjacent to the active extraction stage on a weekly basis to determine whether any dust accumulation is occurring (e.g. on leaves of plants). Records will be kept of this monitoring outside the extraction area and any mitigation measures undertaken.
 - If dust accumulation is observed outside the extraction area, the operations will be reviewed to determine ways to further minimise dust generation (e.g. soil binding agents). The most appropriate additional dust minimisation measures will be implemented. If dust accumulation continues despite the implemented measures, further measures will be trialled.
 - If dust accumulation outside the extraction area cannot be resolved with the above measures, then instrumental dust monitoring with short-term alarms will be implemented to try and determine the exact source of dust. The short-term alarms (based e.g. on a 15 minute monitoring interval) will notify site operators when dust emissions are detected outside the extraction area so that the operations can be adjusted accordingly.

5.3 DUST COMPLAINTS

The dust complaints process will be following:

- A sign will be erected at the entrance to the extraction site to advise 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 complaint within four hours.
- A copy of the completed Dust Complaint Form will be forwarded to the Shire of Harvey 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 3.

Table 3: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	<ul style="list-style-type: none"> • 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. • Will be responsible for record keeping.
All personnel	<ul style="list-style-type: none"> • 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

Bureau of Meteorology 2022. Climate Statistics for Australian Locations. http://www.bom.gov.au/climate/averages/tables/cw_009603_All.shtml. Accessed May 2022.

Department of Environment and Conservation 2011. A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities https://www.der.wa.gov.au/images/documents/your-environment/air/publications/Guideline_for_managing_impacts_of_dust.pdf

Ecoedge 2022. Reconnaissance and Targeted Flora and Vegetation Survey, Lot 43, Plantation Road, Capel. Prepared for Ludlow Holdings Pty Ltd.

Government of Western Australia 2020. Government Published Data. <https://data.wa.gov.au/>. Accessed May 2022.

APPENDICES

APPENDIX 1: WIND ROSES

Rose of Wind direction versus Wind speed in km/h (16 Oct 1997 to 10 Aug 2021)

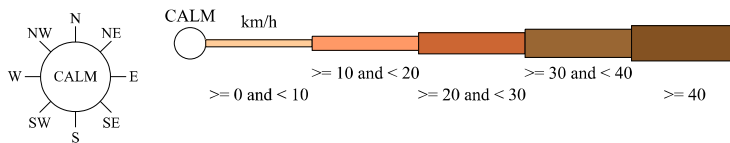
Custom times selected, refer to attached note for details

BUSSELTON AERO

Site No: 009603 • Opened Oct 1997 • Still Open • Latitude: -33.6818° • Longitude: 115.4026° • Elevation 16.m

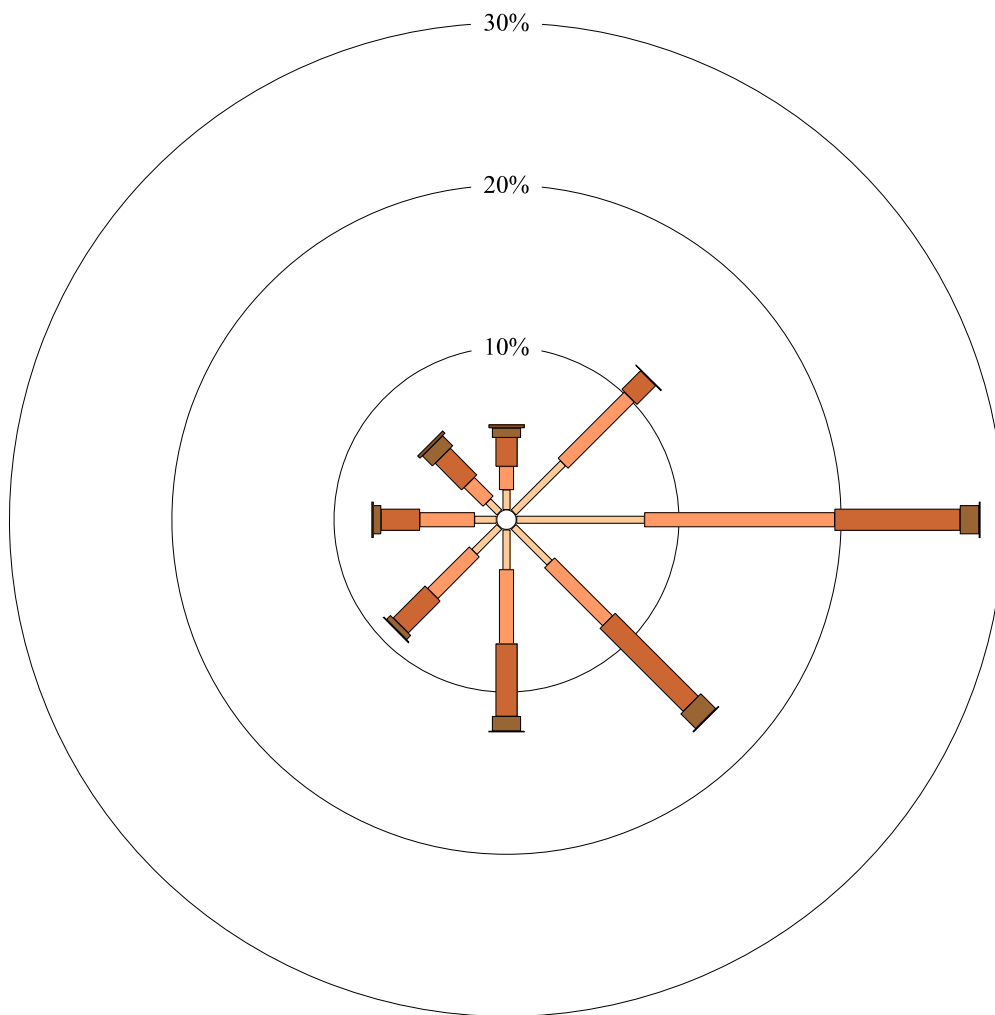
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am
8557 Total Observations

Calm 3%



Rose of Wind direction versus Wind speed in km/h (16 Oct 1997 to 10 Aug 2021)

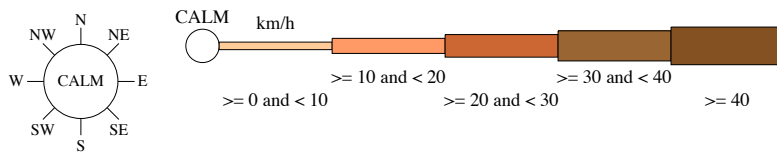
Custom times selected, refer to attached note for details

BUSSELTON AERO

Site No: 009603 • Opened Oct 1997 • Still Open • Latitude: -33.6818° • Longitude: 115.4026° • Elevation 16.m

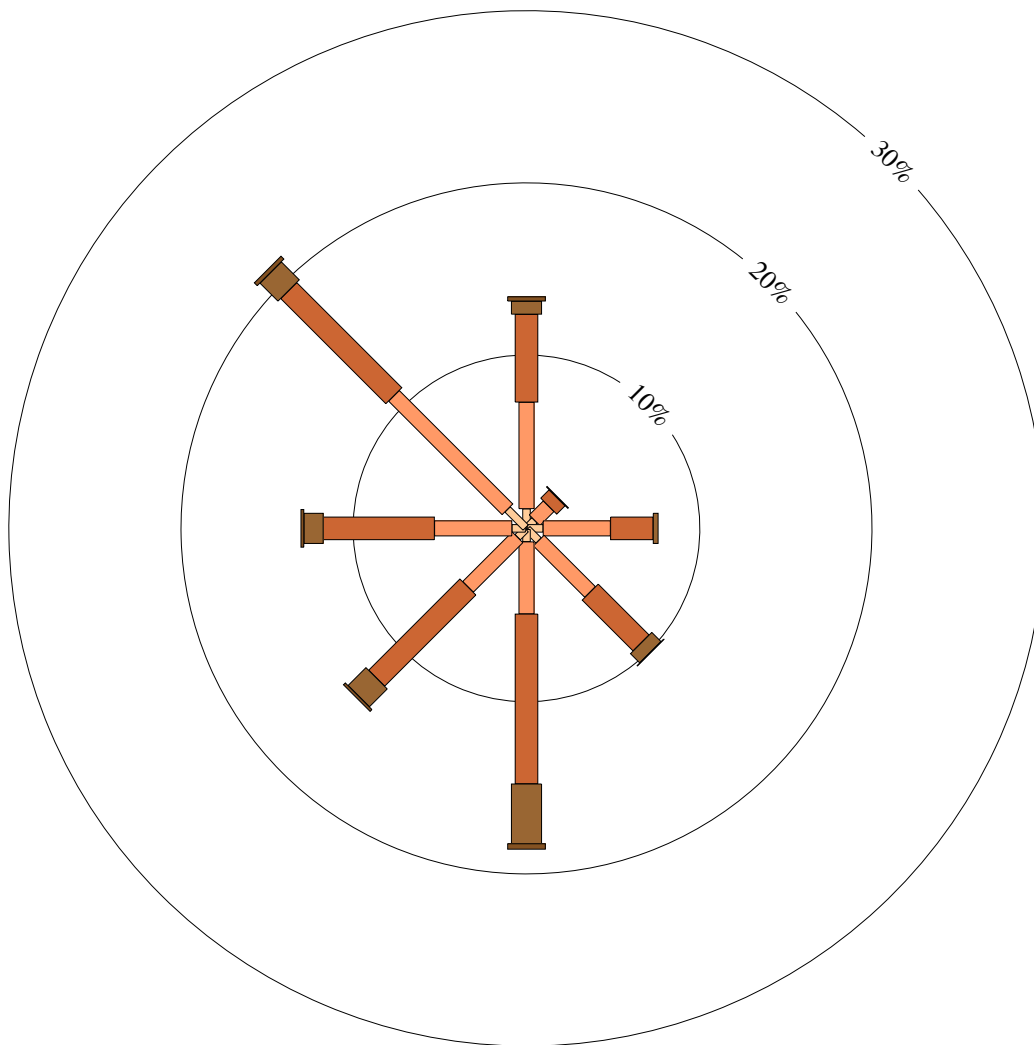
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm
8566 Total Observations

Calm *



APPENDIX 2: RISK ASSESSMENT

SITE RISK ASSESSMENT/CLASSIFICATION FOR ACTIVITIES GENERATING UNCONTAMINATED DUST

Sheet 1: Site classification assessment chart

Assessed Location: Proposed Sand Extraction on Lot 43 Plantation Road, Ludlow.

Part A. Nature of site

Item	Score Options								Allocated Score
	Very low	1	Low	2	Medium	4	High	6	
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 1ha	1	Between 1 ha and 5 ha	3	Between 5 ha and 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
	More than 1 km	1	Between 1 km and 500 m	6	Between 100 m and 500 m	12	Less than 100 m	18	
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	12
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									18

Site Classification Score (A x B)	396
--	------------

APPENDIX 3: DUST COMPLAINT FORM

LOT 43 PLANTATION ROAD, LUDLOW DUST COMPLAINT FORM

Complaint Date:

Complaint Time:

Received by:

Complainant's Details:

Name:

Address:

Tel:

Complaint Details:

Actions taken:

Actions recorded by:

Date:

Copy to City of Busselton

(tick)

Appendix E

Environmental Acoustic Report



LUDLOW HOLDINGS PTY LTD

EXTRACTIVE INDUSTRY
LOT 43 (#546) PLANTATION ROAD, LUDLOW

ACOUSTIC ASSESSMENT

MAY 2022

OUR REFERENCE: 29585-2-22143



DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT
PLANTATION ROAD, LUDLOW

Job No: 22143

Document Reference: 29585-2-22143

FOR

LUDLOW HOLDINGS PTY LTD

DOCUMENT INFORMATION				
Author:	Paul Daly	Checked By:	Tim Reynolds	
Date of Issue:	31 May 2022			
REVISION HISTORY				
Revision	Description	Date	Author	Checked
1	Issued for comment	31/05/2022	PLD	TR
2	Revised layout	10/08/2022	PLD	
DOCUMENT DISTRIBUTION				
Copy No.	Version No.	Destination	Hard Copy	Electronic Copy
1	1	Harley Dykstra Att: Daniel Lewis Email: daniell@harleydykstra.com.au		✓
1	1	Att: Daniel Lewis Email: daniel.lewis@elementwa.com.au		✓

CONTENTS

1.	INTRODUCTION	1
2.	SUMMARY	2
3.	CRITERIA	2
4.	CALCULATED NOISE LEVELS	4
5.	RESULTS	5
6.	ASSESSMENT	5
7.	CONCLUSION	6

APPENDICIES

A	Site Layout
B	Noise Contours

1. INTRODUCTION

Herring Storer Acoustics have been commissioned by Harley Dykstra on behalf of Ludlow Holdings Pty Ltd to undertake an acoustic assessment of noise emissions from the proposed sand extraction operations located at Lot 43 (#546) Plantation Road, Ludlow.

The proposed extraction operations will operate from 07:00 – 19:00 Monday to Friday and 07:00 – 16:00 on Saturdays. No operations would occur on Sundays or Public Holidays. The nearest residential premises are located to the south, north, west and east of the proposed operations, however the residential premises to the south are the most critical in terms of distance from the proposed operations.

The main access road is via Plantation Road as shown in Figure 1.1, along with the proposed operations.

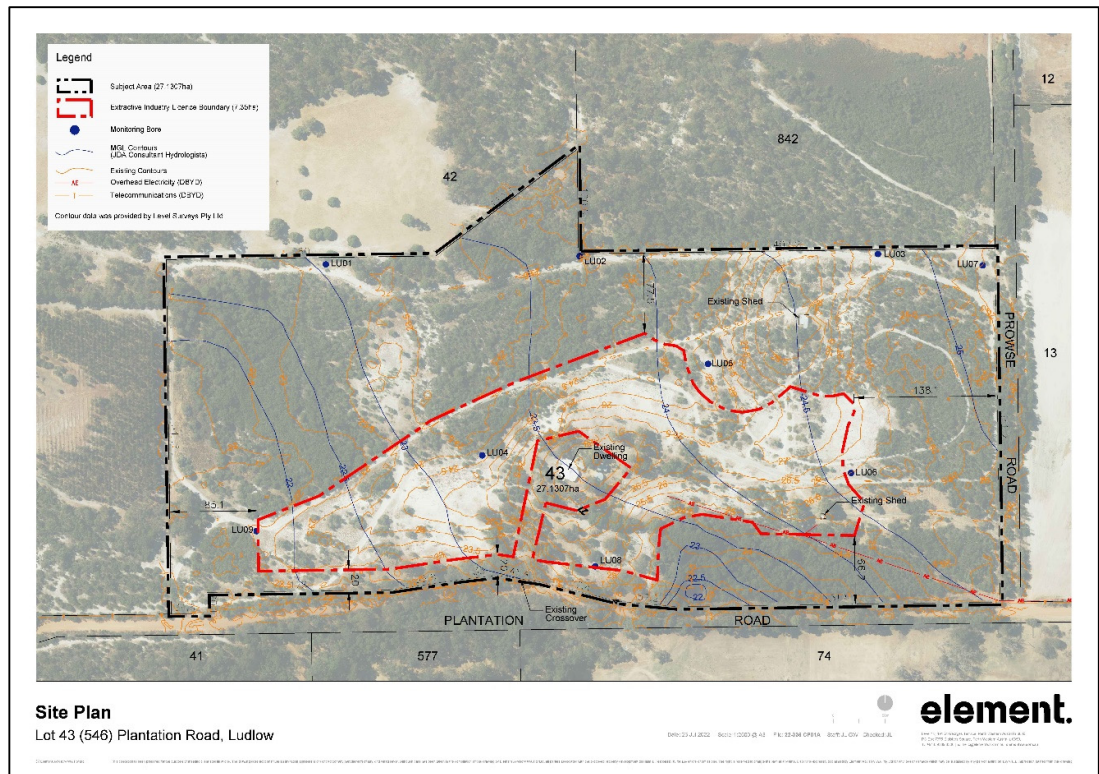


FIGURE 1.1 – EXTRACTION OPERATIONS

This assessment is provided to support the regulatory approvals processes and show that compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997* can be achieved.

As part of the study, the following was carried out:

- Identification of individual operations and the associated noise levels.
- Assess the predicted noise levels at the nearest surrounding highly noise sensitive premises for compliance with the appropriate criteria.
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, a locality plan is shown in Appendix A.

2. SUMMARY

Assessment has been conducted on the proposed limestone and sand extraction operations for Lot 43 Plantation Road, Ludlow.

The facility would only operate during the day period (being Monday to Friday 07:00 to 19:00 hours and 07:00 to 16:00 on Saturdays). Therefore, at the neighbouring residences, the applicable acoustic criteria for this assessment is the assigned L_{A10} day period noise level of 45 dB(A).

Noise received at the nearest residential premises has been determined, to be 43 dB(A) for the sand extraction operations for the highest noise level at any stage of the operations. This can be compared to the applicable assigned noise level criteria of 45 dB(A).

The above assessable noise levels have been considered to contain tonal characteristics and therefore, contains a +5 dB(A) penalty.

For stages 1 and 2, earthen bunds (3m high) are required around the southern side of the fixed screening plant. Locations are shown further in this report.

Given these operating parameters, noise levels received at the nearest premises has been calculated to comply with the *Environmental Protection (Noise) Regulations 1997* for the operating times as outlined in this assessment, even with the inclusion of a +5 dB(A) penalty for tonality.

3. CRITERIA

The allowable noise level for noise sensitive premises in the vicinity of the proposed site is prescribed by the *Environmental Protection (Noise) Regulations 1997*. Regulations 7 and 8 stipulate maximum allowable external noise levels or assigned noise levels that can be received at a premise from another premises. For residential premises, this noise level is determined by the calculation of an influencing factor, which is then added to the base levels shown below. The influencing factor is calculated for the usage of land within two circles, having radii of 100m and 450m from the premises of concern. The base noise levels for residential premises are listed in Table 3.1.

TABLE 3.1 - BASELINE ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises	0700 - 1900 hours Monday to Saturday (Day)	45 + IF	55 + IF	65 + IF
	0900 - 1900 hours Sunday and Public Holidays (Sunday / Public Holiday Day Period)	40 + IF	50 + IF	65 + IF
	1900 - 2200 hours all days (Evening)	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays (Night)	35 + IF	45 + IF	55 + IF

Note: L_{A10} is the noise level exceeded for 10% of the time.
 L_{A1} is the noise level exceeded for 1% of the time.
 L_{Amax} is the maximum noise level.
 IF is the influencing factor.

It is a requirement that received noise be free of annoying characteristics (tonality, modulation and impulsiveness), defined below as per Regulation 9.

“impulsiveness” means a variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amax Slow}$ is more than 15 dB when determined for a single representative event;

“modulation” means a variation in the emission of noise that –

- (a) is more than 3dB $L_{A Fast}$ or is more than 3 dB $L_{A Fast}$ in any one-third octave band;
- (b) is present for more at least 10% of the representative assessment period; and
- (c) is regular, cyclic and audible;

“tonality” means the presence in the noise emission of tonal characteristics where the difference between –

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A slow}$ levels.

The nearest potential noise sensitive premises to the proposed development have been identified using the area map in Figure 3.1.

The usage of the surrounding land use varies from intensive horticulture and residential land use. Therefore, the assigned noise levels for operational times are as noted in Table 3.2.

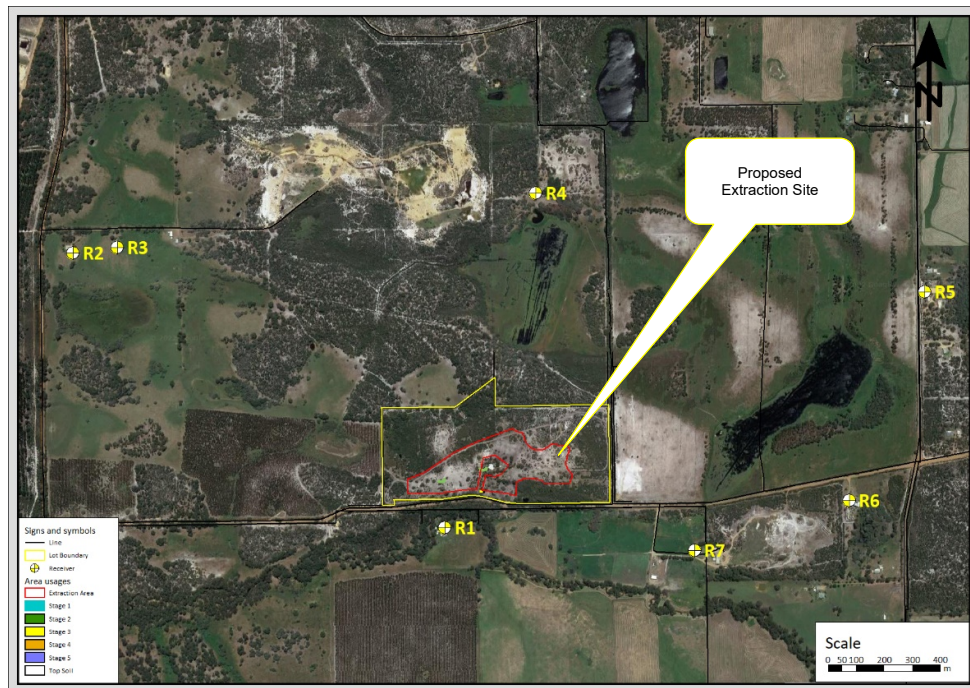


FIGURE 3.1 – RECEIVER LOCATION MAP

TABLE 3.2 – ASSIGNED NOISE LEVELS

Premises Receiving Noise	IF dB	Time of Day	Assigned Level (dB)		
			L _A 10	L _A 1	L _A max
Receiver R1 to R7	0	0700 - 1900 hours Monday to Saturday (Day)	45	55	65

4. CALCULATED NOISE LEVELS

Noise immissions¹ at the nearest neighbouring residential premises, due to noise associated with the proposed operations, were modelled with the computer programme SoundPlan. Sound power levels used for the calculations are based on measured sound pressure levels of similar equipment proposed for use on site.

The modelling of noise levels has been based on noise sources and sound power levels shown in Table 4.1.

TABLE 4.1 – SOUND POWER LEVEL - NOISE SOURCES dB(A)

Source Name	Quantity	SWL dB(A)
Loaders (Cat 980H or similar)	2	102
Screening Plant (McCloskey S190 Screener or Similar)	2	101

Note: The above equipment models have been used to provide an indication of the size. Other models may be used although these have been assumed to have a similar sound power level.

Based on noise emissions from the above equipment, an overall operating scenario has been developed. Figure 5.1 details the source locations assumed in the predictive modelling along with the proposed development of the pit.

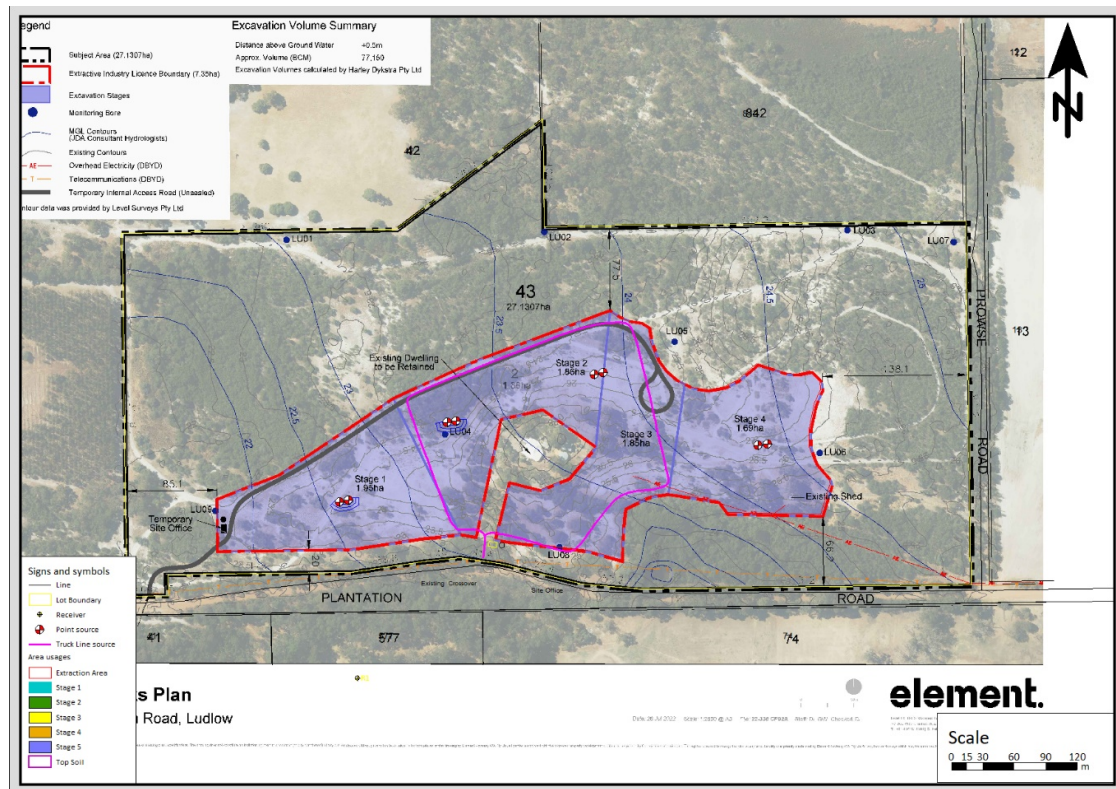


FIGURE 5.1 – SOURCE LOCATION AND PIT PROGRESSION

1 Immissions – noise received at a source
 2 Emissions – noise emanating from a source and / or location

Based on the initial modelling scenario, the noise sources have been placed at the existing surface level. Due to the location of the fixed plant in Stages 1 and 2, additional protection is required to achieve a barrier for noise emissions from the plant.

The following input data was used in the calculations:

- a) Provided area plots.
- b) Sound Power Levels listed in Table 4.1.
- c) Ground contours and receiver point provided by client (Appendix A).

Weather conditions for modelling were as stipulated in the Environmental Protection Authority’s “Draft Guidelines on Environmental Noise for Prescribed Premises” and for the day period are as listed in Table 4.2.

TABLE 4.2 – WEATHER CONDITIONS

Condition	Day
Temperature	20°C
Relative humidity	50%
Pasquill Stability Class	E
Wind speed	4 m/s*

* From sources, towards receivers.

5. RESULTS

Calculated noise levels associated with the noise emissions from the proposed operations for the assumed scenarios, are summarised below in Table 5.1. Appendix B contains the overall noise contour plots.

TABLE 5.1 – CALCULATED NOISE LEVEL

Receiver	Calculated Noise Level (L _{A10} dB(A))	Critical Stage Area
R1	38	1 and 2
R2	20	1 and 2
R3	21	1
R4	27	3
R5	21	4
R6	25	4
R7	33	4

6. ASSESSMENT

For the day time operations, based on calculated noise levels at the nearest premises, noise levels could be considered as being tonal in characteristics. This would be highly conservative as the ambient noise levels range is likely to be around 50 to 60 dB(A) during the day periods. However, a +5 dB(A) penalty has been included to allow for a tonal component for the residence.

Hence, Table 6.1 summarises the applicable Assigned Noise Levels, and assessable noise level emissions, for the cumulative (all industry) scenario considered.

TABLE 6.1 – APPLICABLE ADJUSTMENTS AND ASSESSABLE LEVEL OF NOISE EMISSIONS, dB(A)

Receiver	Calculated Noise Level, dB(A)	Applicable Adjustments to Measured Noise Levels, dB(A)			Assessable Noise Level, dB(A)
		Where Noise Emission Is Not Music			
		Tonality	Modulation	Impulsiveness	
R1	38	+5	-	-	43
R2	20	+5	-	-	25
R3	21	+5	-	-	26
R4	27	+5	-	-	32
R5	21	+5	-	-	26
R6	25	+5	-	-	30
R7	33	+5	-	-	38

Based on the assessable noise levels above, comparison against the relevant assigned noise level is contained in Table 6.2

TABLE 6.2 – ASSESSMENT OF NOISE LEVELS

Receiver	Premises Receiving Noise Assessable Noise Level dB(A)	Time of Day	Assigned Level (dB)	Compliance
R1	43	0700 - 1900 hours Monday to Saturday (Day)	45	Complies
R2	25			Complies
R3	26			Complies
R4	32			Complies
R5	26			Complies
R6	30			Complies
R7	38			Complies

7. CONCLUSION

Assessment has been conducted on the proposed limestone and sand extraction operations for Lot 43 Plantation Road, Ludlow.

The facility would only operate during the day period (being Monday to Friday 07:00 to 19:00 hours and 07:00 to 16:00 on Saturdays). Therefore, at the neighbouring residences, the applicable acoustic criteria for this assessment is the assigned L_{A10} day period noise level of 45 dB(A).

Noise received at the nearest residential premises has been determined, to be 43 dB(A) for the sand extraction operations for the highest noise level at any stage of the operations. This can be compared to the applicable assigned noise level criteria of 45 dB(A).

The above assessable noise levels have been considered to contain tonal characteristics and therefore, contains a +5 dB(A) penalty.

For stages 1 and 2, earthen bunds (3m high) are required around the southern side of the fixed screening plant. Locations are shown further in this report.

Given these operating parameters, noise levels received at the nearest premises has been calculated to comply with the *Environmental Protection (Noise) Regulations 1997* for the operating times as outlined in this assessment, even with the inclusion of a +5 dB(A) penalty for tonality.

APPENDIX A

FIGURE A1 – LOCATION MAP

LEGEND

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Monitoring Bore
-  Datum Mark (Spike or Peg)
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours (BCP Materials Pty Ltd)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

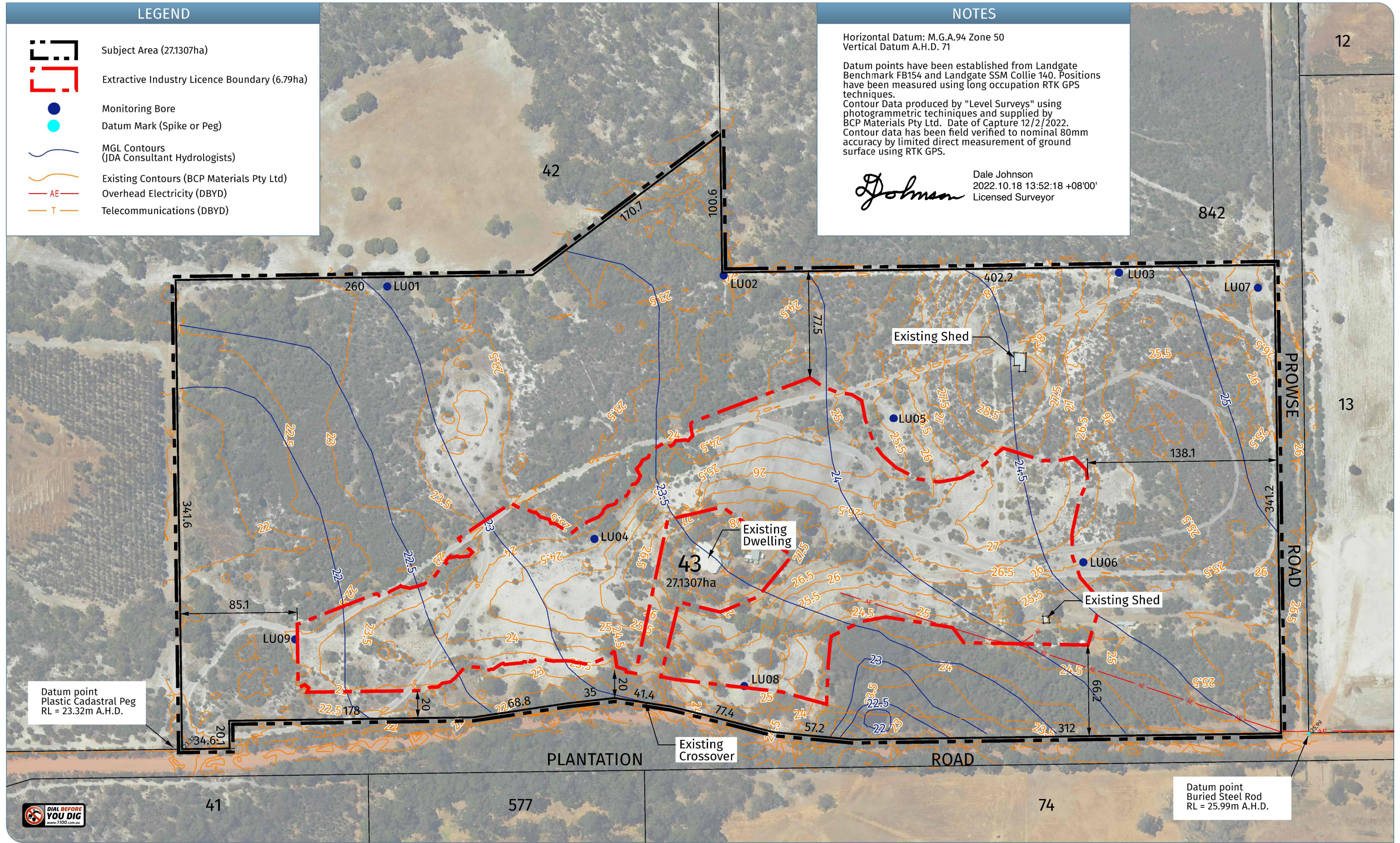
NOTES

Horizontal Datum: M.G.A.94 Zone 50
 Vertical Datum A.H.D. 71

Datum points have been established from Landgate Benchmark FB154 and Landgate SSM Collie 140. Positions have been measured using long occupation RTK GPS techniques.

Contour Data produced by "Level Surveys" using photogrammetric techniques and supplied by BCP Materials Pty Ltd. Date of Capture 12/2/2022. Contour data has been field verified to nominal 80mm accuracy by limited direct measurement of ground surface using RTK GPS.

D. Johnson Dale Johnson
 2022.10.18 13:52:18 +08'00'
 Licensed Surveyor



Datum point
 Plastic Cadastral Peg
 RL = 23.32m A.H.D.

Datum point
 Buried Steel Rod
 RL = 25.99m A.H.D.








FEATURE PLAN

Lot 43 (No. 546) Plantation Road,
 LUDLOW

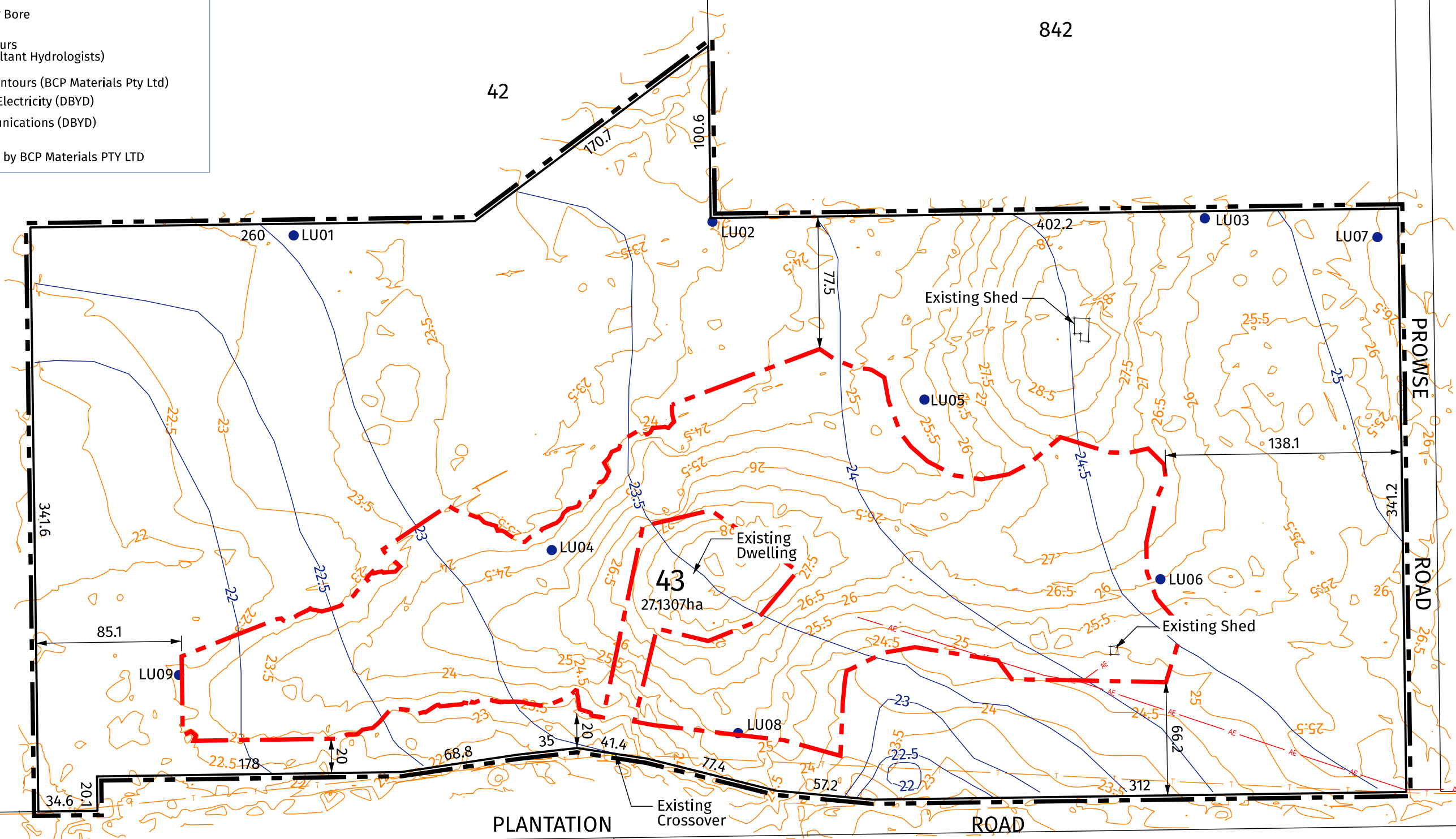
Plan No. 22718-05	BUNBURY OFFICE: 21 Spencer Street, BUNBURY WA 6230 T: 08 9792 6000 E: bunbury@harleydykstra.com.au W: www.harleydykstra.com.au	COPYRIGHT: This document is and shall remain the property of HARLEY DYKSTRA. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.
Date 7/10/22	ALBANY BUNBURY BUSSELTON FORRESTDALE PERTH	
Drawn NP		
Checked DPJ		
Revision B		
Scale 1:2500@A3		

NOTE: This plan has been prepared for Volume purposes. Areas, Contours and Dimensions shown are subject to survey

LEGEND

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours (BCP Materials Pty Ltd)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

Contour data was provided by BCP Materials PTY LTD



41

577

Johnson

Dale Johnson
2022.10.18 15:49:30 +08'00'
Licensed Surveyor

74

SITE PLAN

Lot 43 (No. 546) Plantation Road,
LUDLOW

Plan No. | 22718-01
Date | 14/10/22
Drawn | NP
Checked | DPJ
Revision | H

BUNBURY OFFICE:
21 Spencer Street,
BUNBURY WA 6230
T: 08 9792 6000
E: bunbury@harleydykstra.com.au
W: www.harleydykstra.com.au

COPYRIGHT:
This document is and shall remain the property of HARLEY DYKSTRA. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Scale | 1:2500@A3



NOTE: This plan has been prepared for planning purposes. Areas, contours and Dimensions shown are subject to survey










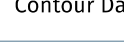

Harley Dykstra

PLANNING & SURVEY SOLUTIONS

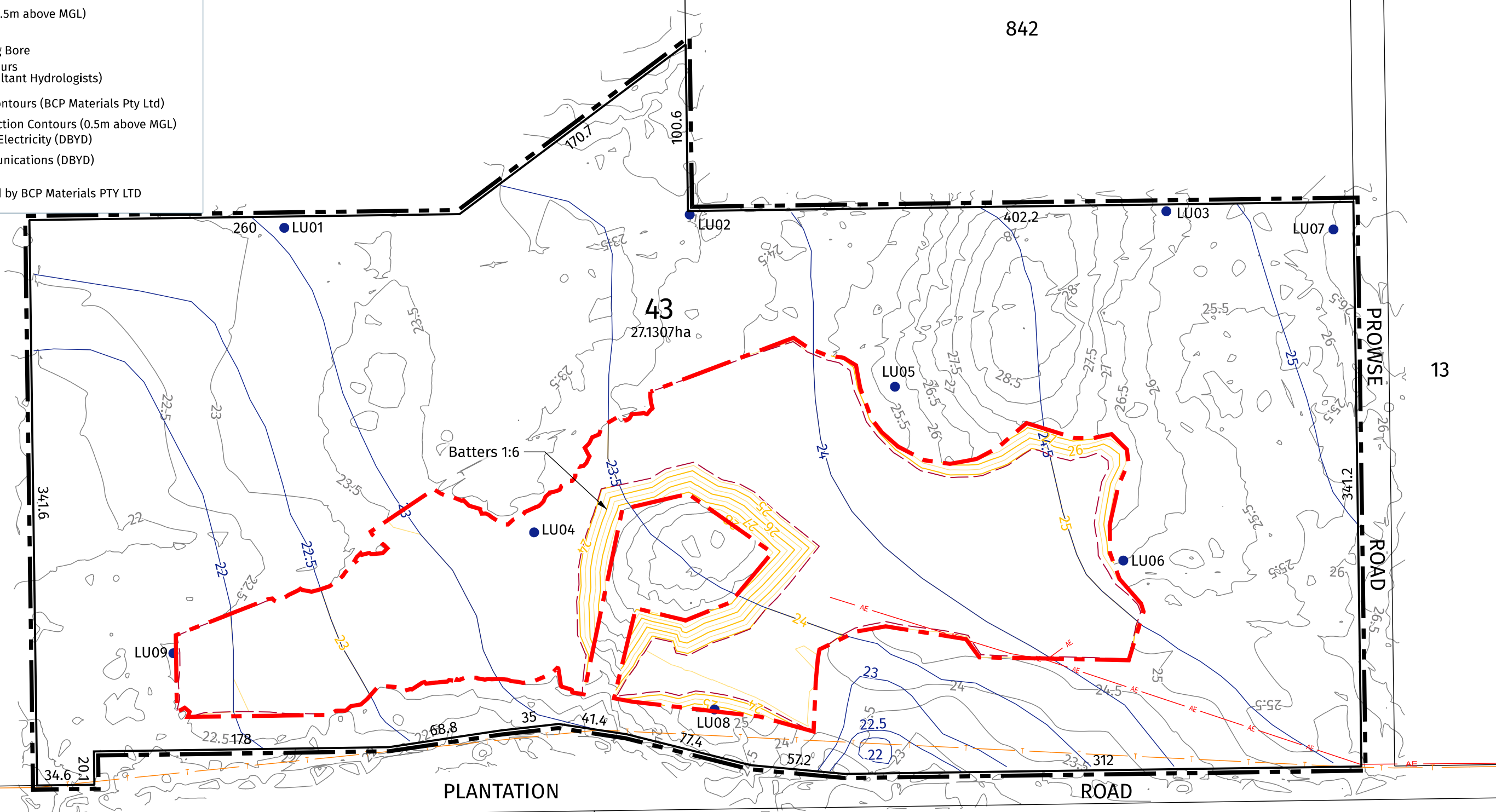
12

13

LEGEND

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Toe Line (0.5m above MGL)
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours (BCP Materials Pty Ltd)
-  Post Extraction Contours (0.5m above MGL)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

Contour Data was provided by BCP Materials PTY LTD



41

577

D Johnson

Dale Johnson
2022.10.18 15:49:30 +08'00'
Licensed Surveyor

74

POST EXTRACTION PLAN

Lot 43 (No. 546) Plantation Road,
LUDLOW

Plan No. | 22718-04
Date | 01/11/22
Drawn | NP
Checked | DPJ
Revision | D

BUNBURY OFFICE:
21 Spencer Street,
BUNBURY WA 6230
T: 08 9792 6000
E: bunbury@harleydykstra.com.au
W: www.harleydykstra.com.au

COPYRIGHT:
This document is and shall remain the
property of HARLEY DYKSTRA.
The document may only be used for the
purpose for which it was commissioned
and in accordance with the terms of
engagement for the commission.
Unauthorised use of this document in
any form whatsoever is prohibited.

Scale | 1:2500@A3



NOTE: This plan has been prepared for Volume purposes. Areas, Contours and Dimensions shown are subject to survey










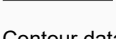

Harley Dykstra

PLANNING & SURVEY SOLUTIONS

12

13

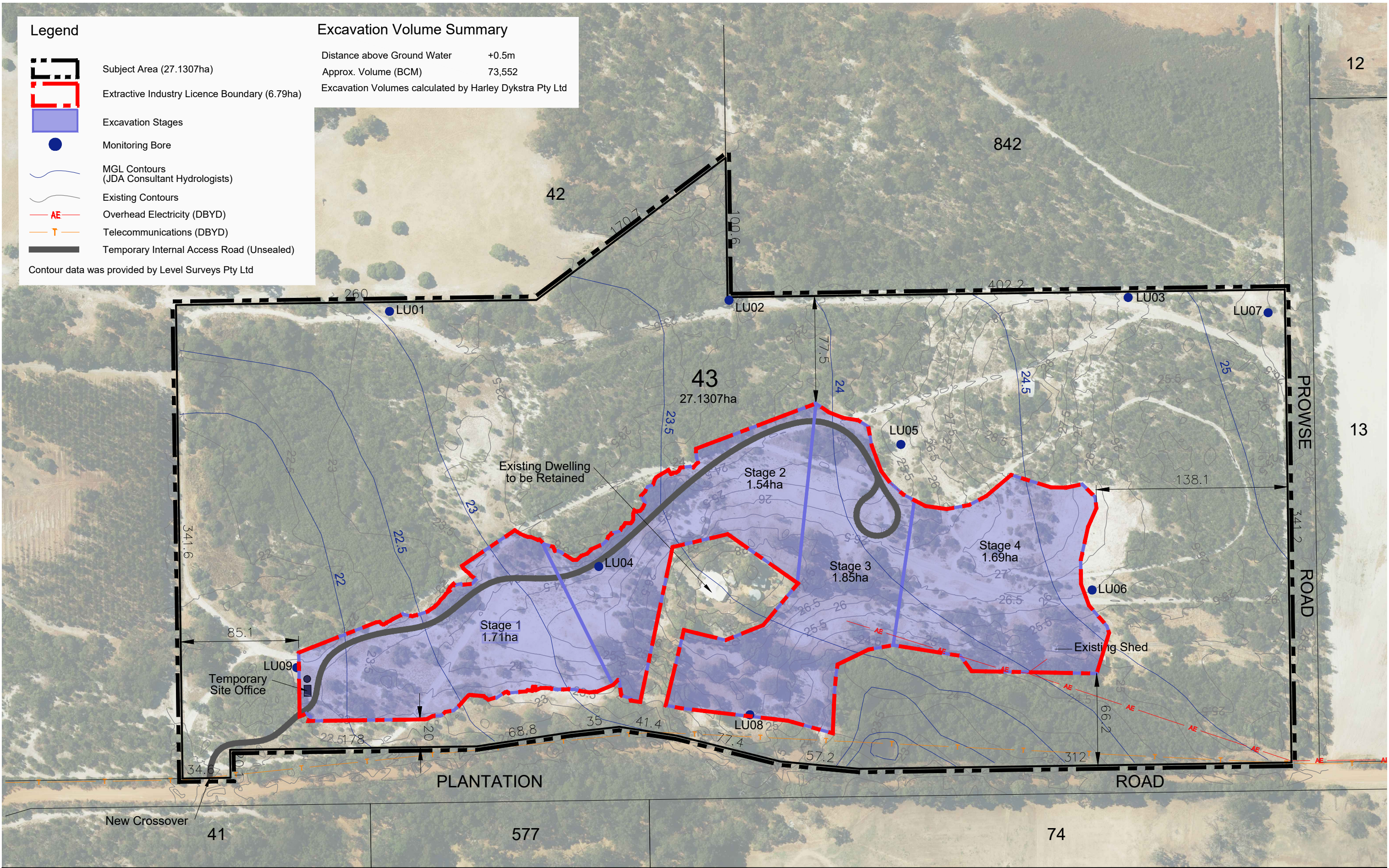
Legend

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Excavation Stages
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)
-  Temporary Internal Access Road (Unsealed)

Contour data was provided by Level Surveys Pty Ltd

Excavation Volume Summary

Distance above Ground Water	+0.5m
Approx. Volume (BCM)	73,552
Excavation Volumes calculated by Harley Dykstra Pty Ltd	



Excavation Works Plan
 Lot 43 (546) Plantation Road, Ludlow









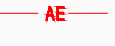

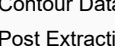


Date: 9 Nov 2022 Scale: 1:2500 @ A3 File: 22-336 CP02B Staff: DL GW Checked: DL

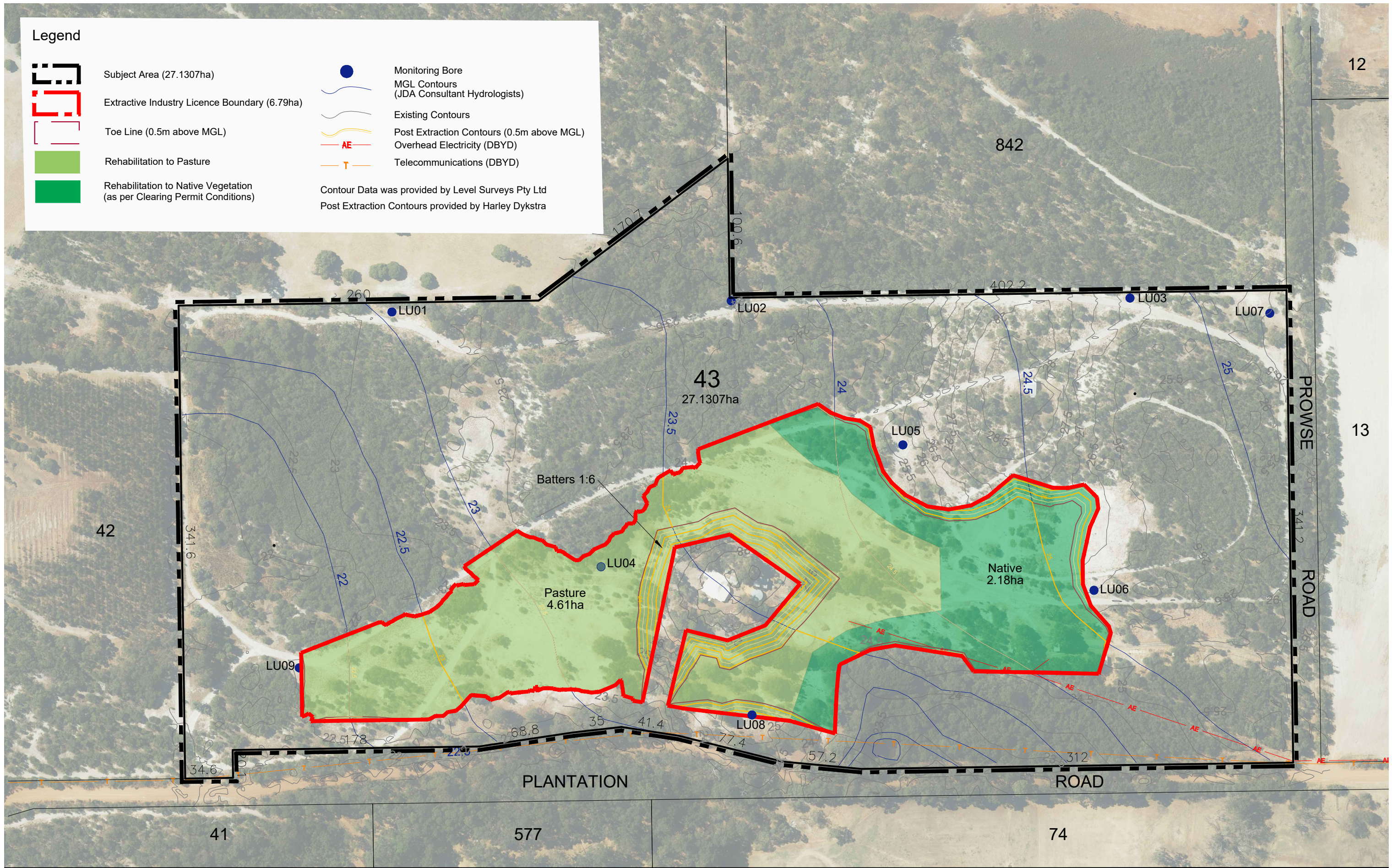
Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
 PO Box 7375 Cloisters Square, Perth Western Australia 6850.
 T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au

© Element Advisory WA Pty Ltd This concept has been prepared for the purpose of meeting client specifications. The drawing does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Although care has been taken in the compilation of this drawing by Element Advisory WA Pty Ltd, all parties associated with the proposed property development disclaim all responsibility for any errors or omissions. The right is reserved to change the plan at any time. Liability is expressly disclaimed by Element Advisory WA Pty Ltd for any loss or damage which may be sustained by any person acting on any visual impression gained from this drawing.

Legend

-  Subject Area (27.1307ha)
-  Extractive Industry Licence Boundary (6.79ha)
-  Toe Line (0.5m above MGL)
-  Rehabilitation to Pasture
-  Rehabilitation to Native Vegetation (as per Clearing Permit Conditions)
-  Monitoring Bore
-  MGL Contours (JDA Consultant Hydrologists)
-  Existing Contours
-  Post Extraction Contours (0.5m above MGL)
-  Overhead Electricity (DBYD)
-  Telecommunications (DBYD)

Contour Data was provided by Level Surveys Pty Ltd
 Post Extraction Contours provided by Harley Dykstra



Post Extraction Plan
 Lot 43 (546) Plantation Road, Ludlow



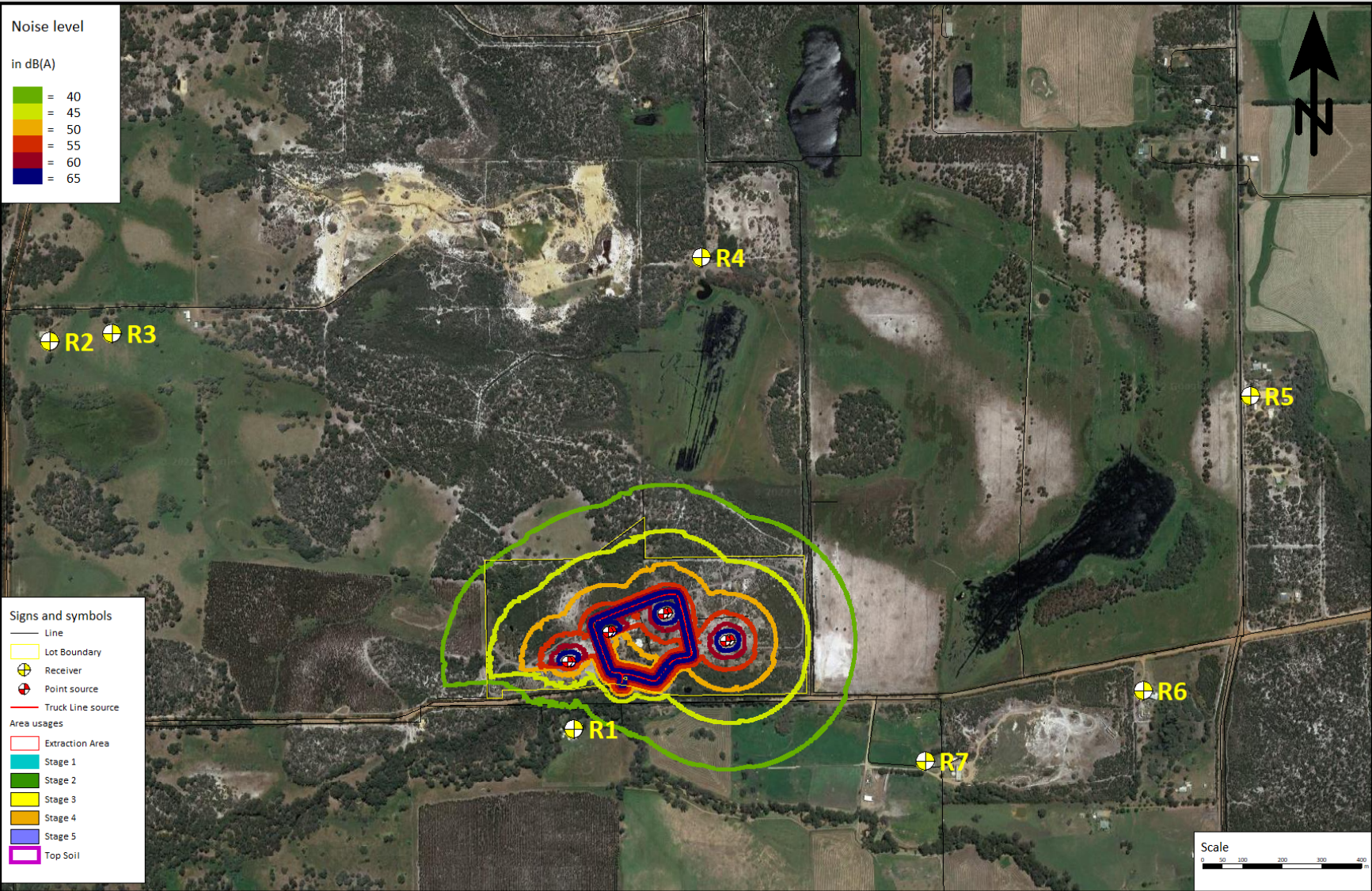
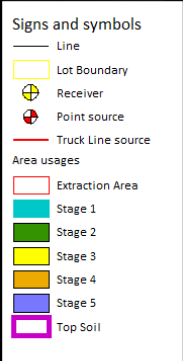
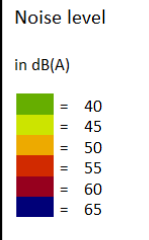
Date: 9 Nov 2022 Scale: 1:2500 @ A3 File: 22-336 CP03B Staff: DL GW Checked: DL

Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
 PO Box 7375 Cloisters Square, Perth Western Australia 6850.
 T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au

© Element Advisory WA Pty Ltd This concept has been prepared for the purpose of meeting client specifications. The drawing does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Although care has been taken in the compilation of this drawing by Element Advisory WA Pty Ltd, all parties associated with the proposed property development disclaim all responsibility for any errors or omissions. The right is reserved to change the plan at any time. Liability is expressly disclaimed by Element Advisory WA Pty Ltd for any loss or damage which may be sustained by any person acting on any visual impression gained from this drawing.

APPENDIX B

Noise Contours



HERRING STORER ACOUSTICS
Job 22143



LOT 43 PLANTATION ROAD - SAND EXTRACTION
DAY OPEARTIONS
WORST CASE NOISE LEVEL FROM ALL STAGES

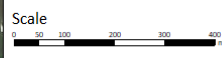


FIGURE B1
Ref #003

Appendix F

Groundwater Monitoring Report



Jim Davies & Associates Pty Ltd
ABN 24 067 295 569
Suite 1, 27 York Street, Subiaco WA 6008
PO Box 117, Subiaco WA 6904
Ph: (08) 9388 2436
info@jdahydro.com.au
www.jdahydro.com.au

To : Ludlow Holdings Pty Ltd (c/o – Harley Dykstra)
Attention : Daniel Lewis (Harley Dykstra)
Email : daniel@harleydykstra.com.au

Date : 29 Nov 21
Our Ref : J7054a
Pages : 27

LOT 43 PLANTATION ROAD, LUDLOW GROUNDWATER LEVEL MONITORING – JUNE TO OCTOBER 2021

1. INTRODUCTION

JDA was appointed by Ludlow Holdings Pty Ltd to conduct groundwater level monitoring at Lot 43 Plantation Road, Ludlow (Figure 1) (herein referenced as the Study Area) between June and October 2021.

JDA understands the Study Area is proposed for future sand extraction and an application for an Extractive Industries Licence (EIL) is being prepared for submission to the Shire of Capel. To support the EIL application, groundwater level monitoring was performed across winter-spring 2021 to determine the maximum groundwater levels across the potential EIL area.

Presented below is a summary of JDA’s groundwater level monitoring and analysis.

2. EXISTING STUDY AREA CHARACTERISTICS

The topography of the Study Area generally grades to east to west from 26 mAHD to 22 mAHD, Figure 2. A sand ridge transects the Study Area from the east with elevations rising to 28 to 29 mAHD in areas across the eastern half of the Study Area.

Regional groundwater flow direction is generally east to west (Commander, 1984). The Ludlow River flows east to west adjacent to the Study Area’s southern boundary which together with watercourses to north and east may influence local groundwater flow direction (Figure 2).

The surface geology of the Study Area is generally mapped as Sand (S8, S10) in Gozzard (1987) with a significant area of Peaty Sand (Sp1) in the north-west. Approximately half of the Study Area, both to the west and east, is mapped as multiple use palusplain and is expected to be seasonally waterlogged (Figure 2).

In 2015, 17 preliminary holes were drilled using a rotary mud rig to determine the depth of sand. Drill logs were kept as 1 m interval samples with the driller instructed to cease drilling once clay was encountered (Lundstrom, 2019). Drill holes were not professionally logged but suggest a depth of sand of between 2 m and 6 m.

In June 2021, JDA supervised the installation of 6 monitoring bores. Lithological logs confirm sand with presence of clay at depth (Appendix A), consistent with Lundstrom (2019) and Gozzard (1987).

3. CLIMATE

The Ludlow area is characterised by a Mediterranean climate with warm dry summers and cool wet winters.

Rainfall data is provided by the nearby Bureau of Meteorology Capel North rain gauge (Site ID. 009992) for 2003 to 2021 and the closed Capel WA gauge (Site ID. 009516), Figure 3. The Capel rain gauges are located 5.5 km north-east of the Study Area. The Ludlow rain gauge (Site ID. 009877), Figure 3, is located closer to the Study Area, 3 km west, but has only been regularly monitoring since 2004. In general, the Ludlow annual rainfall totals are relatively similar to the Capel gauges (< ±10%).

The average annual rainfall, 1914 to 2020, for Capel is 808 mm, with 30-year and 10-year averages of 721 mm and 711 mm, respectively. This represents a 10.5% (30-year average) and 12% (10-year average) decrease from the long-term average annual rainfall and is consistent with decreasing rainfall across south west Western Australia (DoW, 2015). The seasonal rainfall distribution has also altered since 1990, with a reduction of average monthly totals in the winter months, but no reduction in summer months.

For 2021, there was above-average rainfall in February, April, May and July whilst June and August rainfall recorded significantly below-average rainfall. Rainfall recorded to end-October in 2021 was 790.8 mm at Ludlow (Site ID. 009877) and at 758.8 mm at Capel North (Site ID. 009992), with complete 2021 rainfall likely to be at or greater than the long-term (1914-2020) average of 808 mm.

Pan evaporation is provided by the Department of Primary Industries and Regional Development (DPIRD) Capel weather station (2012 – 2020) and which shows an average annual pan evaporation of 1,730 mm (DPIRD, 2020). This is significantly higher than the estimated pan evaporation in Luke (1987) of 1,400 mm.

4. MONITORING LAYOUT

4.1 Study Area Groundwater Monitoring Bores

Lundstrom Environmental installed 3 monitoring bores, MB1 to MB3, referred to herein as LU07 (MB3), LU08 (MB2) and LU09 (MB1) (Figure 4) in January 2015, for which there are no details or lithological logs available.

Manual water level measurements were conducted by Lundstrom in bores LU07 to LU09 between January 2015 and January 2017 (Appendix B). However, the readings (mAHD and mbGL) do not provide a consistent top of casing (ToC) from which still water measurements could be made. Therefore, these levels have not been considered further.

On 03 June 2021, JDA supervised the installation of 6 monitoring bores, LU01 to LU06 on Figure 4, by E드릴 Environmental. The bores were constructed with 50 mm Class 18 threaded PVC, 1.5 m to 3 m screen, gravel pack and bentonite seal to depths of 2.7 to 6 m. Bore LU02 was terminated at a depth of 1.9 m due to a hard cemented sand layer (coffee rock) and was dry at the time of installation.

Monitoring bores were pumped for 20 minutes post-drilling to develop out fines and drilling water. Lithological logs are attached as Appendix A, with bore details in Table 1 and locations shown on Figure 4.

Odyssey capacitance water level loggers were installed in all 9 bores on 03 June 2021. Static groundwater levels were recorded at 15 minute intervals by the water level loggers and verified on-site via manual still water level measurements using an electrical depth probe. Logger data were downloaded on 27 October 2021.

The HYDSTRA data management system was used to store, process and analyse water level data recorded by the Odyssey capacitance loggers.

4.2 DWER Long-Term Monitoring Bore

DWER monitoring bore SCPD19B is located 1 km east of the Study Area and shown on Figure 5. The bore is capped at surface, screened from 0.9 m to 4.2 m below surface within Bassendean Sand and has a total depth of 5 m.

The bore has been fitted with a continuously-recording data logger since August 2010 with only sporadic manual still water level measurements. Logger data, as daily maximum values, was extracted from DWER's *Water Information Reporting* platform. Details of the bores are shown in Table 1.

TABLE 1: GROUNDWATER MONITORING BORE DETAILS

Bore ID	GDA 1994 Coordinates		Natural Surface (mAHD)	Top of Casing (mAHD)	Stick-up (m)	Depth (m)	Date Constructed
	Easting	Northing					
LU01	364402	6281302	23.31	24.26	0.95	2.76	03 June 2021
LU02	364647	6281310	24.02	24.87	0.85	2.76	03 June 2021
LU03	364935	6281312	26.42	27.22	0.8	6	03 June 2021
LU04	364553	6281118	24.4	25	0.6	3.25	03 June 2021
LU05	364771	6281206	25.84	26.74	0.9	6	03 June 2021
LU06	364909	6281101	26.04	26.84	0.8	5.85	03 June 2021
LU07 ¹	365036	6281301	26.75	27.53	0.78	7.02	January 2015
LU08 ¹	364662	6281011	25.64	26.44	0.8	7	January 2015
LU09 ¹	364335	6281045	22.65	23.55	0.9	7	January 2015
SCPD19B	366168	6281145	29.58	29.53	-0.05	5	31 March 2009

Note: LU07, LU08 and LU09 referenced as MB3, MB2 and MB1 respectively in Lundstrom Environmental (2019).

5. STUDY AREA MONITORING RESULTS AND ANALYSIS

Recorded fluctuations in logged groundwater levels are presented on Figures 5 and 6. Manually recorded groundwater levels by JDA are presented in Table 2, with peak winter groundwater levels in Table 3.

TABLE 2: MANUALLY RECORDED WATER LEVELS – JUNE AND OCTOBER 2021

Site ID	Water Level (mAHD)		
	03 June	01 July	27 October
LU01	22.15	22.2	22.63
LU02	<i>Dry</i>	<i>Dry</i>	23.23
LU03	23.94	23.96	24.51
LU04	22.71	22.68	23.00
LU05	23.49	23.5	23.89
LU06	-	23.85	24.27
LU07	24.46	24.53	24.89
LU08	22.64	22.62	22.89
LU09	21.17	21.08	21.46

TABLE 3: PEAK WINTER GROUNDWATER LEVELS 2021

Site ID	Date Recorded	Natural Surface (mAHD)	Water Level (mAHD)	Separation to Natural Surface (m)
LU01	19 August 2021	23.31	22.74	0.57
LU02	27 August 2021	24.02	23.23	0.79
LU03	27 August 2021	26.42	24.60	1.82
LU04	11 August 2021	24.40	23.17	1.23
LU05	18 August 2021	25.84	24.12	1.72
LU06	19 August 2021	26.04	24.45	1.59
LU07	14 August 2021	26.75	25.11	1.64
LU08	13 August 2021	25.64	23.14	2.50
LU09	11 August 2021	22.65	21.61	1.04

Groundwater levels generally increased from early to mid-July with a peak around mid-August 2021 as shown in Figures 6 and 7. Peak winter 2021 groundwater levels ranged from 21.61 mAHD (LU09) to 25.11 mAHD (LU07) with a seasonal variation of around 0.53 to 0.65 m in most bores except for 0.75 m in LU03 and 1.12 m in LU02.

Bore LU02 was the only site that was dry at time of installation on 03 June and also on the 01 July site visit. Groundwater level in this bore rose sharply 0.65 m in response to the 40 mm rainfall recorded at Ludlow across 05 to 07 July 2021, Figure 5. Thereafter, groundwater levels show a similar trend to the other monitoring bores. The unconformity of the underlying cemented sand layer is presumed to influence levels below 22.7 mAHD.

Groundwater levels in bores LU01 and LU02 are the closest to natural surface (Table 3) with large fluctuations in response to individual rainfall events. The other bores had separations to peak winter 2021 groundwater levels across the period of 1.04 m to 2.5 m.

6. DETERMINATION OF MAXIMUM GROUNDWATER LEVEL (MGL)

Logged water level time series for DWER bore SCPD19B is shown on Figure 7 for the period 2010 to 2020. The calculated Average Annual Maximum Groundwater Level (AAMGL) is 27.28 mAHD with an average seasonal variation of 1 m, marginally higher than that of the Study Area. The Maximum Groundwater Level (MGL) of 27.72 mAHD was recorded on the 01 October 2016; a year with above long-term average (Figure 3). Logger data for SCPD19B is currently available to 28 June 2021.

Water levels in DWER bore SCPD19B were monitored by JDA on 03 June, 01 July and 27 October 2021. JDA's 27 October measurement was 0.05 m above its calculated AAMGL (2010-2020) but 0.39 m below its calculated long-term MGL.

JDA therefore considers that groundwater levels measured on 27 October 2021 across the Study Area in LU01 to LU09 were also similarly just above their AAMGL. To estimate MGL, an adjustment of +0.39 m was applied to the 27 October 2021 groundwater levels, as shown in Table 4.

TABLE 4: ESTIMATED MAXIMUM GROUNDWATER LEVELS

Site ID	Natural Surface (mAHD)	Water Level 27 Oct 2021 (mAHD)	Adjustment to MGL (m)	Estimated MGL (mAHD)	MGL Separation to Natural Surface (m)
LU01	23.31	22.63	0.39	23.02	0.29
LU02	24.02	23.23	0.39	23.62	0.40
LU03	26.42	24.51	0.39	24.9	1.52
LU04	24.40	23.00	0.39	23.39	1.01
LU05	25.84	23.89	0.39	24.28	1.56
LU06	26.04	24.27	0.39	24.66	1.38
LU07	26.75	24.89	0.39	25.28	1.47
LU08	25.64	22.89	0.39	23.28	2.36
LU09	22.65	21.46	0.39	21.85	0.80

The estimated MGL values, together with LiDAR DEM, were used to create MGL contours across the Study Area as shown in Figure 8. The MGL ranges from less than 22 mAHD in the south-west corner of the Study Area to 25.3 mAHD in the north-east corner.

Figure 9 shows depth to MGL from natural surface, with the majority of the western half of the Study Area showing low-lying areas with < 0.5 m separation. Based on assessment of LiDAR DEM, groundwater in part of this area is at natural surface. The sand ridge through the centre of the Study Area is clearly evident with > 1.5 m separation to natural surface from MGL, up to an estimated maximum of approximately 5.0 m at the centre of the ridge.

7. CONCLUSIONS

JDA concludes that:

- Rainfall for 2021 (to end-October) was 790.8 mm at BoM's Ludlow rain gauge and 758.8 mm at the Capel North rain gauge. The 2021 rainfall year is likely to be at or greater than the long-term average of 808 mm (Capel North), Figure 3.
- Groundwater levels in the period were consistent with the regional groundwater flow, east to west towards the ocean.
- Groundwater levels generally peaked within the monitoring period during August 2021, Table 2 and Figures 5 and 6.
- The seasonal variation across the Study Area was generally 0.53 to 0.65 m with separation from peak winter 2021 groundwater levels to natural surface ranging from 0.57 m to 2.5 m, Table 3.
- JDA's measurement of 27.33 mAHD in DWER bore SCPD19B on 27 October 2021 was 0.05 m higher than AAMGL (2010-2020) for the bore, Figure 7. The bore MGL of 27.72 mAHD was recorded on 01 October 2016, 0.44 m higher than the AAMGL (2010-2020).
- Groundwater levels measured on 27 October 2021 in the Study Area are considered to be just above AAMGL.
- The Estimated Maximum Groundwater Level (MGL) for the Study Area, Figure 8, was estimated by applying a correction of +0.39 m to the groundwater levels measured on 27 October 2021. The Study Area MGL ranges from approximately 21.5 mAHD (south-west corner) to 25.3 mAHD (north-east corner).
- Separation to MGL varies from a minimum of 0.0 m in the western wetland area to a maximum of approximately 5.0 m at the centre of the ridge, Figure 11.

References:

- Bureau of Meteorology (2021) *Climate Data Online, Capel WA (Site No. 009516), Capel North (Site No. Rain Gauge (Site No. 009515) and Ludlow (009877)*.
- Commander, D.P. (1984) *The Bunbury Shallow-Drilling Groundwater Investigation*. Geological Survey of Western Australia, Report 12, 1 January 1984.
- Department of Primary Industries and Regional Development [DPIRD] (2021) Capel Weather Station Pan Evaporation Data.
- Department of Water [DoW] (2015) Selection of future climate projections for Western Australia. Water Science Technical Series, Report no. WST 72.
- DWER (2021) *Water Information Reporting, Bores SCPD19B (61000038)*. Accessed September/October 2021.
- Gozzard (1987) 1: 50 000 environmental map - Capel (2030-IV). Geological Survey of Western Australia.
- Luke, G.L, Burke, K.L. & O'Brien, T.M. (1987) *Evaporation data for Western Australia – Resource Management Technical Report No. 65*. Perth: W.A. Department of Agriculture, division of Resource Management. October 1987.
- Lundstrom Environmental Consultants (2019) *546 Plantation Road, Ludlow Water Management Plan*. Prepared for Coastal Sand Supplies, May 2019.

Attachments:

- Figure 1: Location Plan
- Figure 2: Existing Study Area Characteristics
- Figure 3: Rainfall and Evaporation
- Figure 4: Study Area and DWER Monitoring Bore Locations
- Figure 5: Logged Groundwater Levels: LU01, LU02, LU04, LU08 and LU09
- Figure 6: Logged Groundwater Levels: LU03, LU05, LU06 and LU07
- Figure 7: DWER Bore SCPD19B Groundwater Level Time-Series, AAMGL and MGL
- Figure 8: Estimated Maximum Groundwater Level (MGL) Contours
- Figure 9: Depth to Estimated MGL
- Appendix A: Bore Lithological Logs
- Appendix B: 2016 to 2017 Monitoring Data (Lundstrom Environmental Consultants, 2019)

If you have any queries on this report, please do not hesitate to contact Matthew Yan or Michael Ioannidis.

Regards,



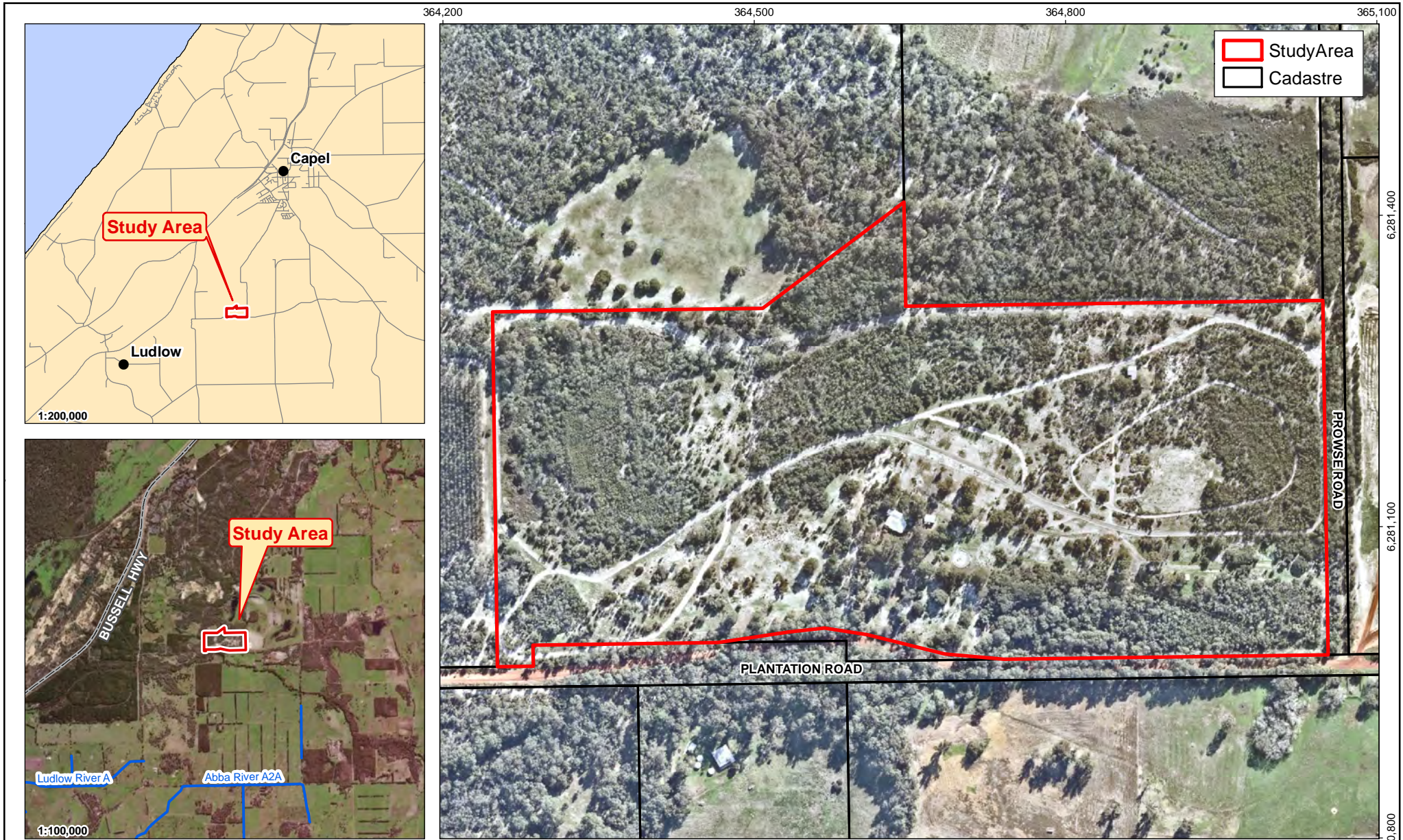
JDA CONSULTANT HYDROLOGISTS

DISCLAIMER

This document is published in accordance with and subject to an agreement between JDA Consultant Hydrologists ("JDA") and the client for whom it has been prepared ("Client"), and is restricted to those issues that have been raised by the Client in its engagement of JDA. It has been prepared using the skill and care ordinarily exercised by Consultant Hydrologists in the preparation of such documents.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by JDA and the Client without first obtaining a prior written consent of JDA, does so entirely at their own risk and JDA denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the Client.

FIGURES

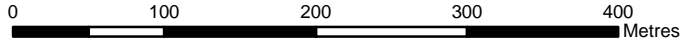


Data Source: Nearmap Digital Imagery (2021), 09 April 2021

Coordinate System: GDA 94, Zone 50

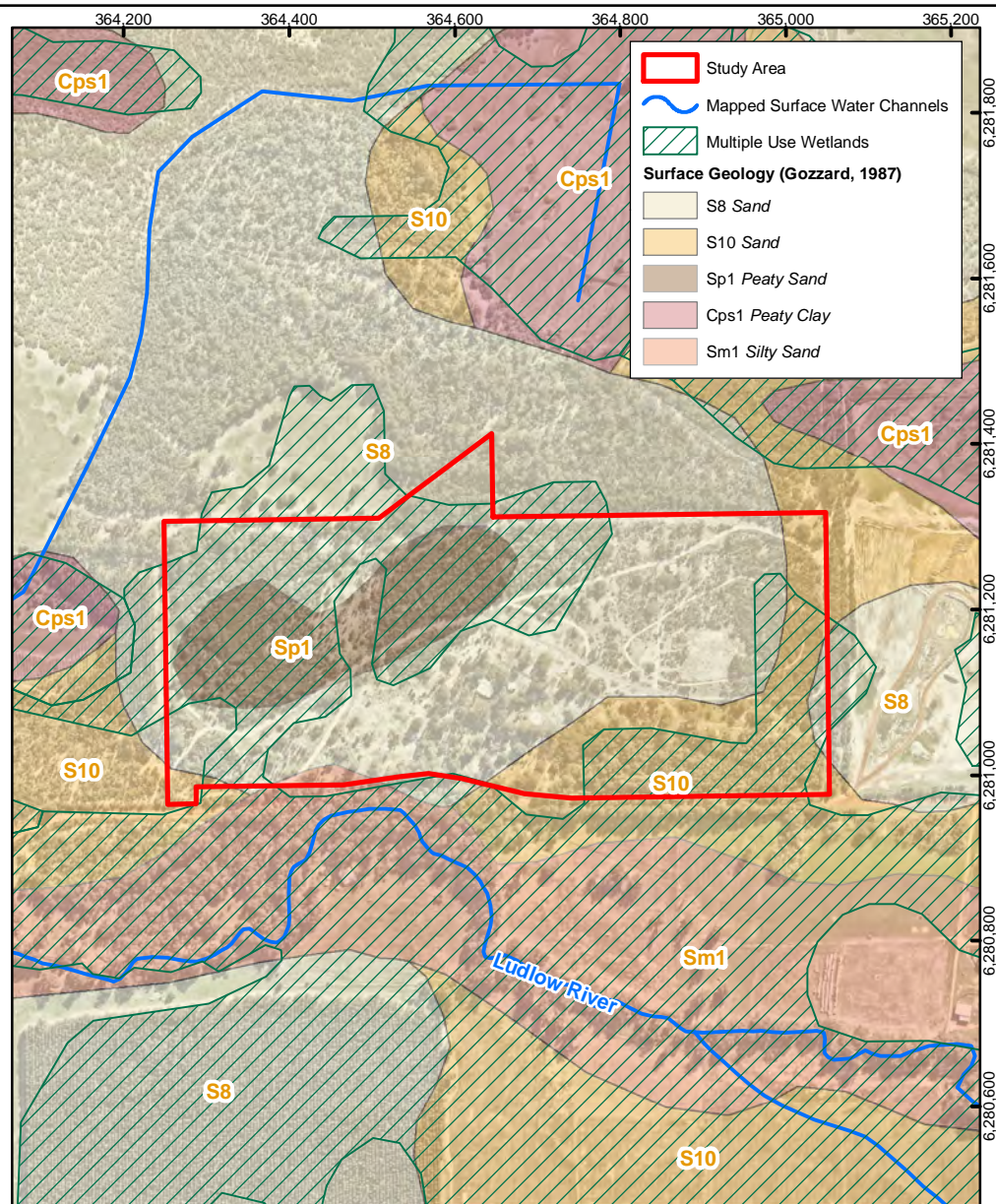
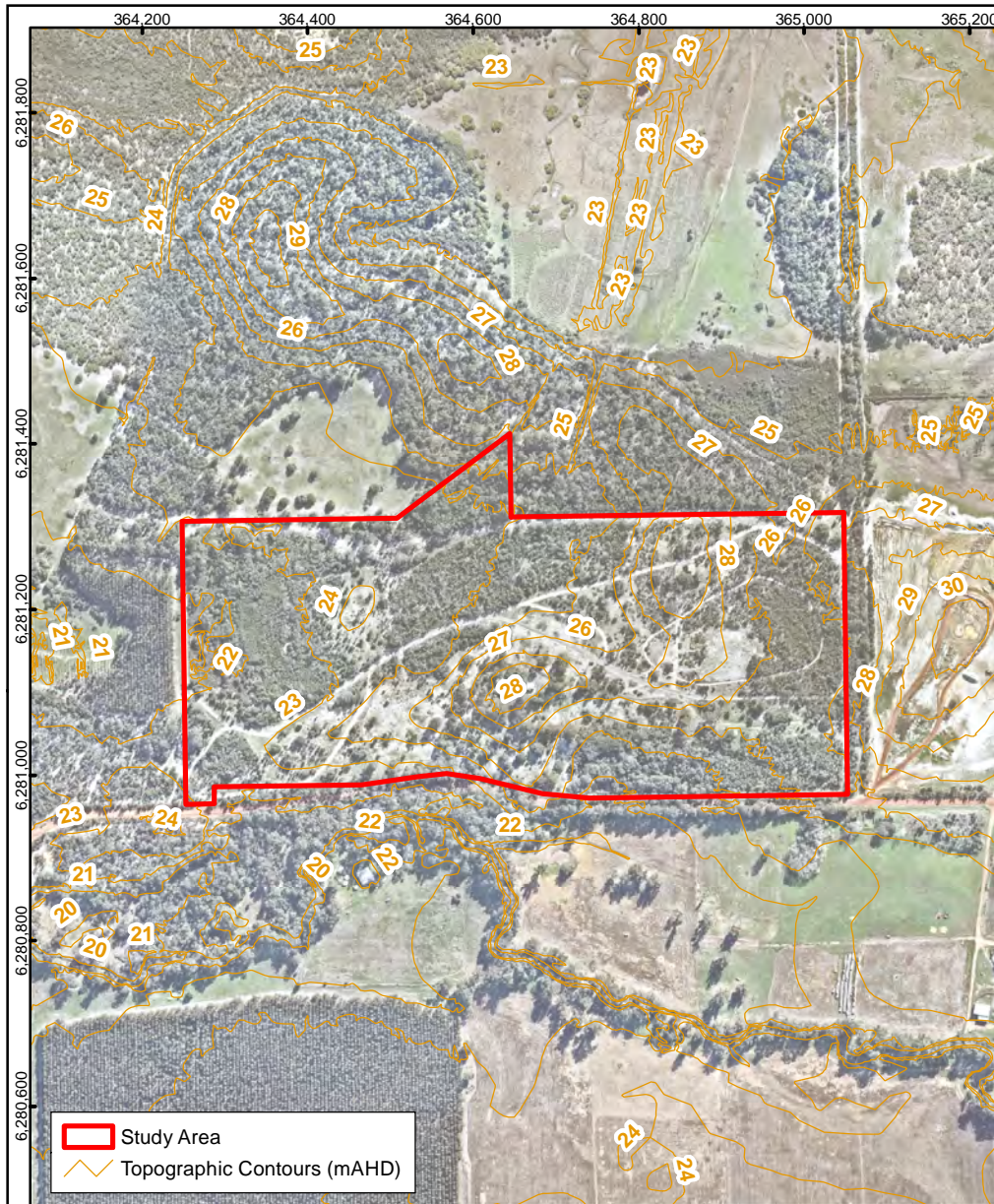


Job No. J7054
Scale: 1:5,000 @A4



Ludlow Holdings Pty Ltd
Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
Figure 1: Location Plan

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021



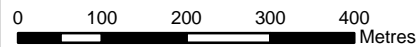
Data Source: Gozzard (1987) 1: 50 000 environmental map - Capel (2030-IV). Landgate (2019) Medium Scale Topo Water Line (LGATE-018); NearMaps (2021)

Coordinate System: GDA 94, Zone 50



Job No. J7054

Scale: 1:9,000 @A4



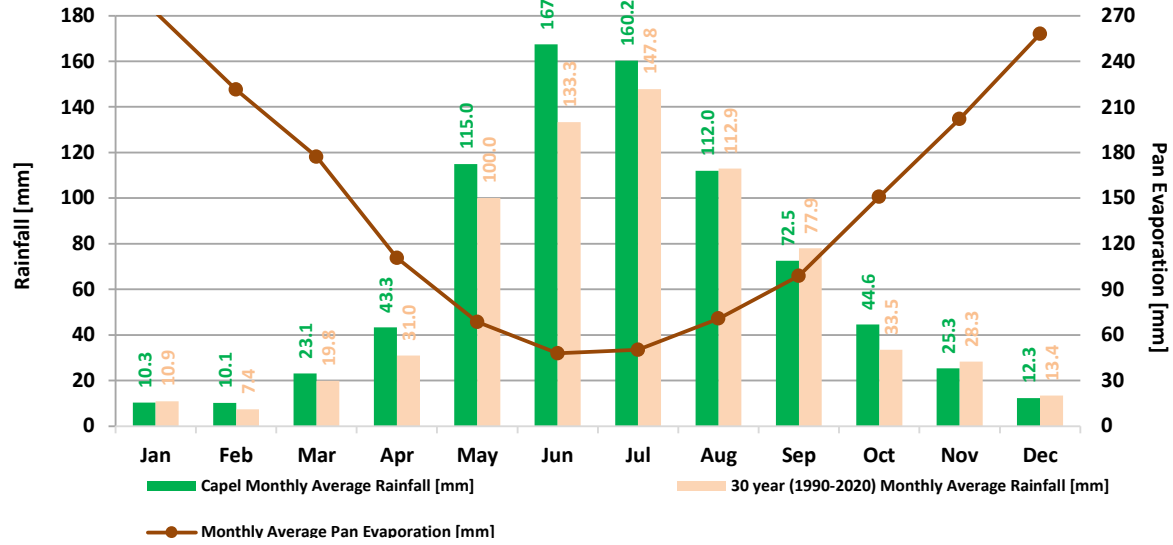
© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021



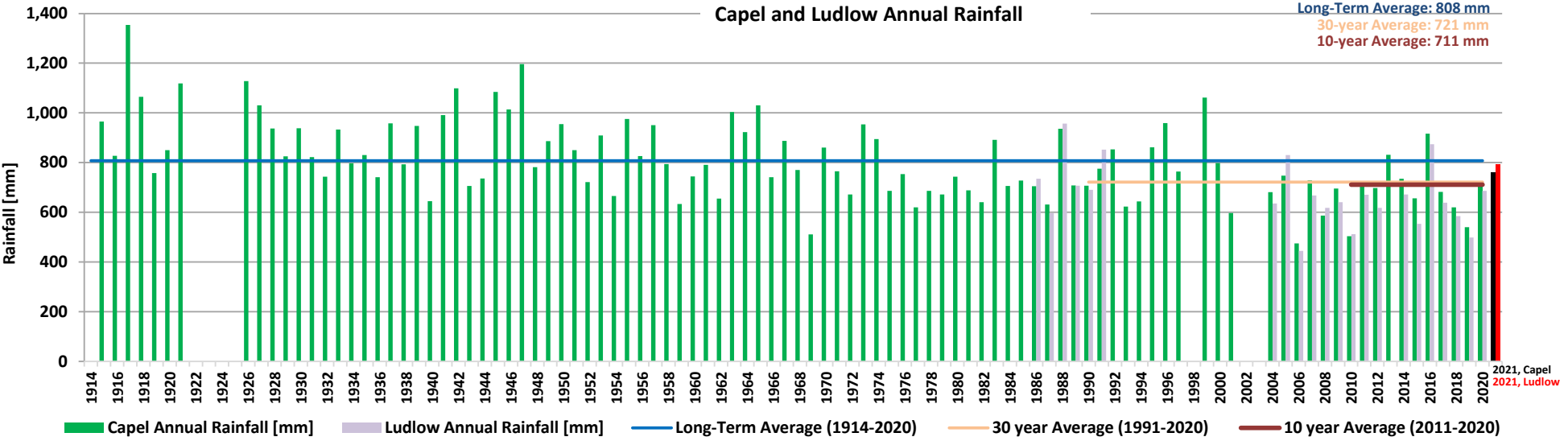
Ludlow Holdings Pty Ltd
 Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
Figure 2: Existing Study Area Characteristics



Capel
 Long-Term Average: 808 mm
 30-year Average: 721 mm
 10-year Average: 711 mm



Capel and Ludlow Annual Rainfall



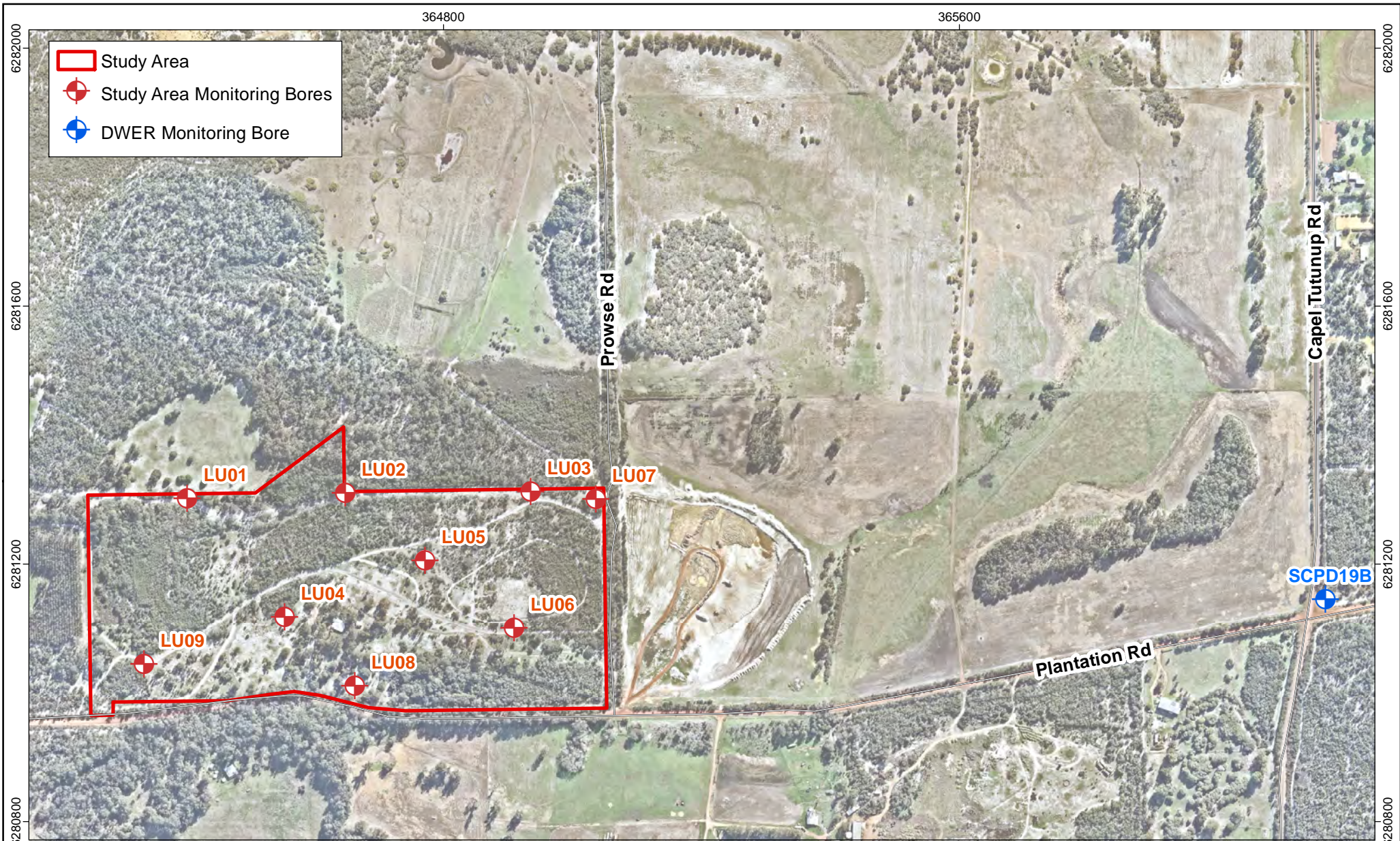
Data Source: BoM (2021) Climate Data Online Capel WA (009516; 1914-2002), Capel North (009992; 2003-2021) and Ludlow (009877) Rain Gauges; DPIRD (2021) Capel Weather Station



Job No. J7054

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021

Ludlow Holdings Pty Ltd
 Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
Figure 3: Rainfall and Evaporation



Data Source: Nearmaps (09 April 2021)

Coordinate System: GDA 94, Zone 50



Job No. J7054

Scale: 1:8,000 @A4

0 50 100 150 200
Meters

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021



Ludlow Holdings Pty Ltd
 Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
Figure 4: Study Area and DWER Monitoring Bore Locations

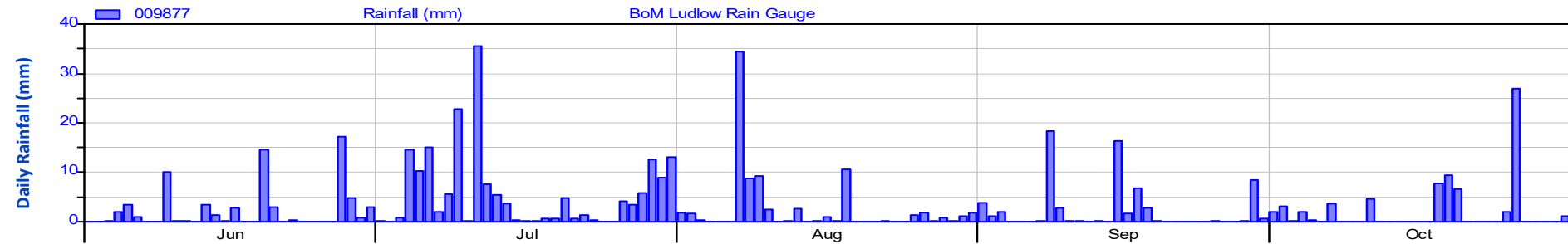
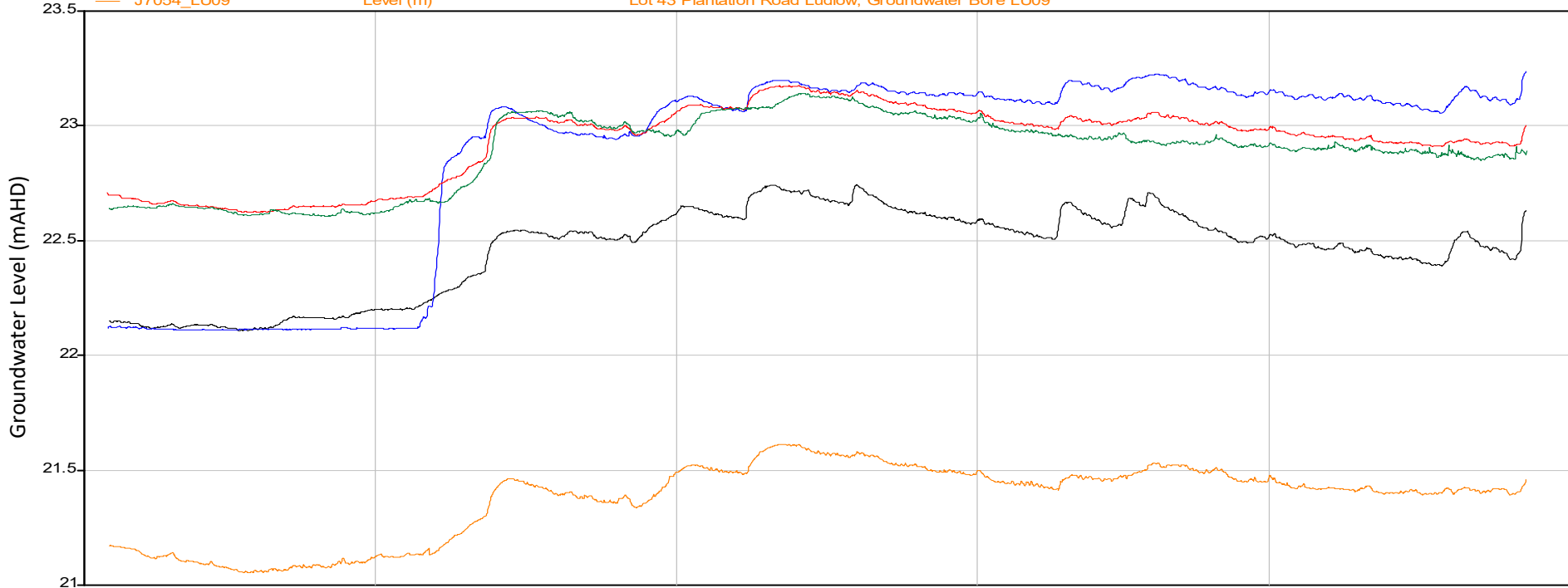
JDA Consultant Hydrologists

HYFLOT V134 Output 11/11/2021

Period 5 Month 01/06/2021 to 01/11/2021

2021

- | | | |
|--------------|-----------|--|
| — J7054_LU01 | Level (m) | Lot 43 Plantation Road Ludlow, Groundwater Bore LU01 |
| — J7054_LU02 | Level (m) | Lot 43 Plantation Road Ludlow, Groundwater Bore LU02 |
| — J7054_LU04 | Level (m) | Lot 43 Plantation Road Ludlow, Groundwater Bore LU04 |
| — J7054_LU08 | Level (m) | Lot 43 Plantation Road Ludlow, Groundwater Bore LU08 |
| — J7054_LU09 | Level (m) | Lot 43 Plantation Road Ludlow, Groundwater Bore LU09 |



Data Source:



Job No. J6927

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021

Ludlow Holdings Pty Ltd
 Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
Figure 5: Logged Groundwater Levels - LU01, LU02, LU04, LU08 and LU09

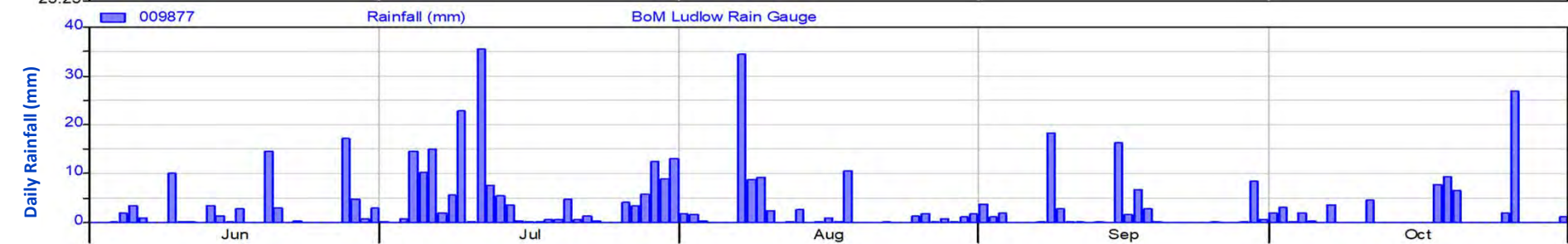
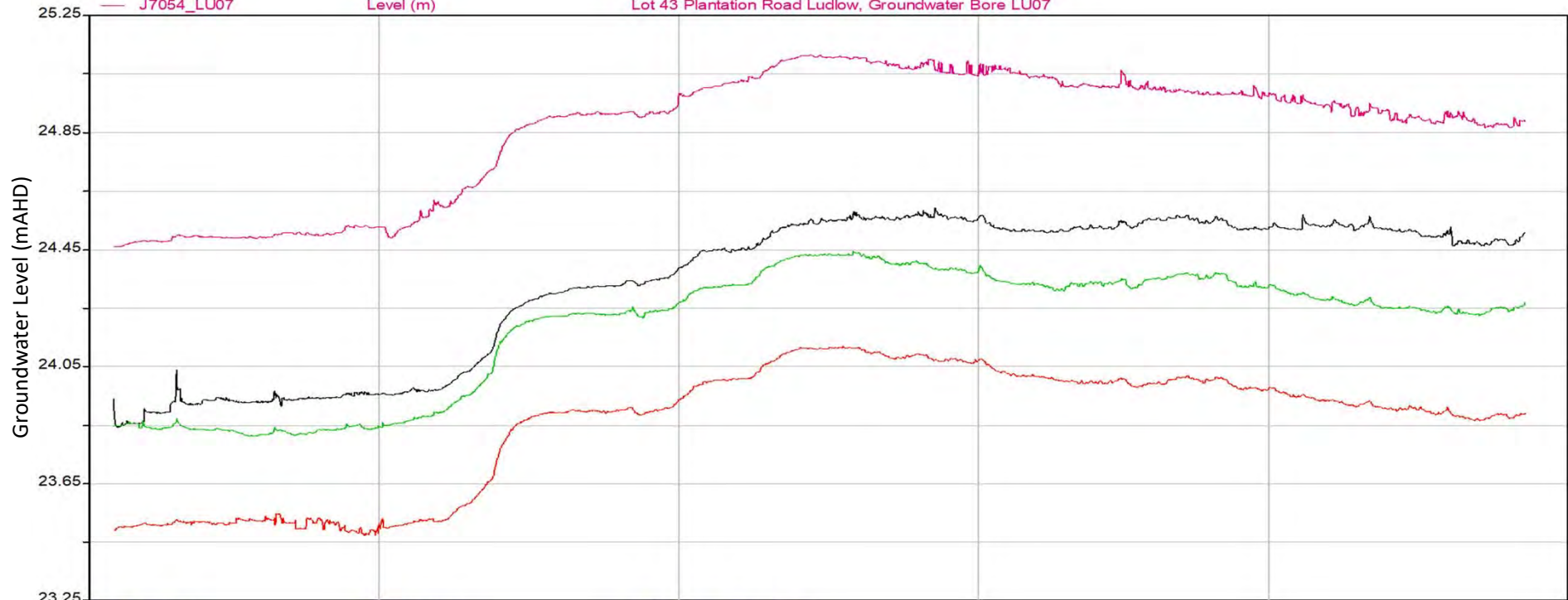
JDA Consultant Hydrologists

HY PLOT V134 Output 11/11/2021

Period 5 Month 01/06/2021 to 01/11/2021

2021

- J7054_LU03 Level (m) Lot 43 Plantation Road Ludlow, Groundwater Bore LU03
- J7054_LU05 Level (m) Lot 43 Plantation Road Ludlow, Groundwater Bore LU05
- J7054_LU06 Level (m) Lot 43 Plantation Road Ludlow, Groundwater Bore LU06
- J7054_LU07 Level (m) Lot 43 Plantation Road Ludlow, Groundwater Bore LU07



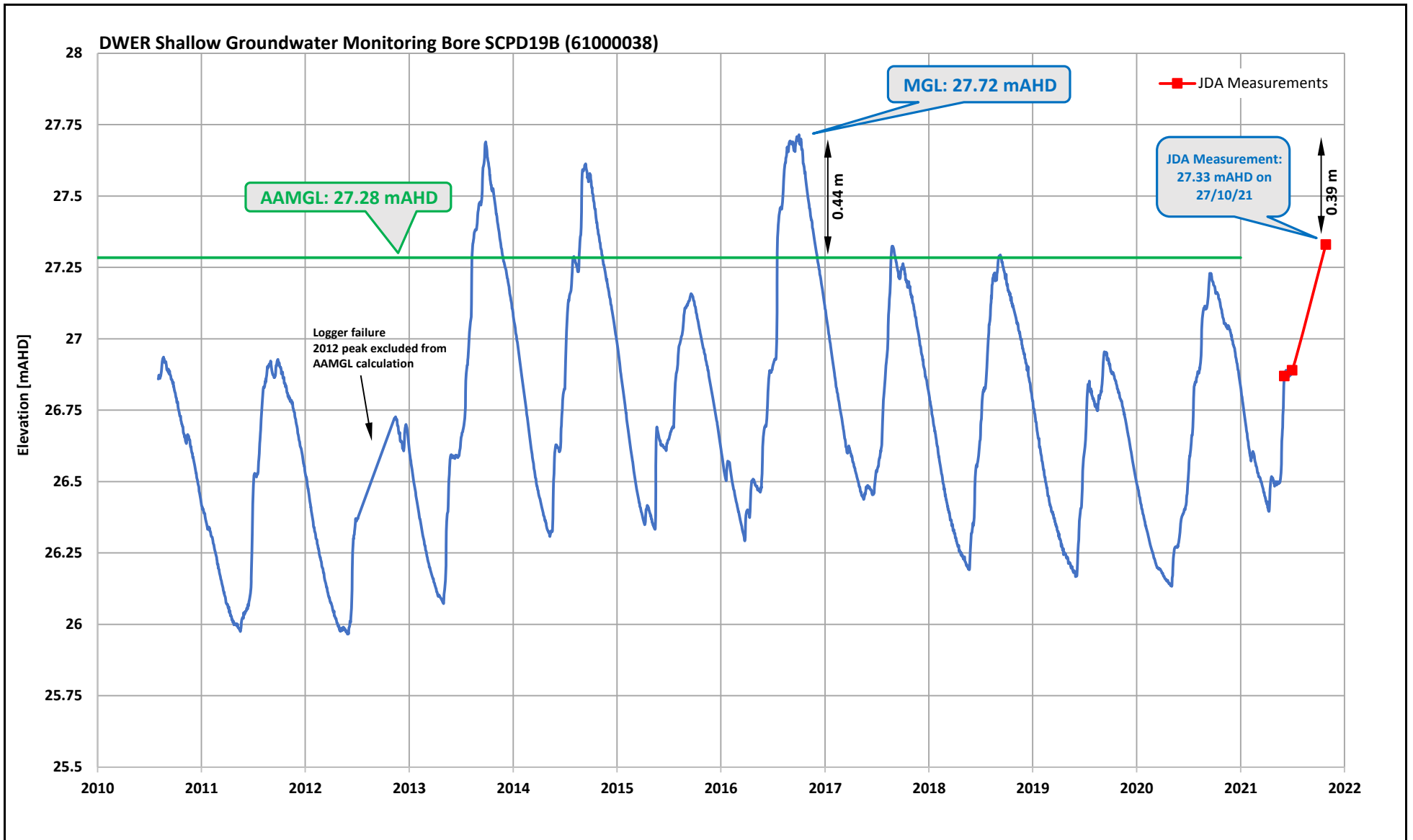
Data Source:



Job No. J7054

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021

Ludlow Holdings Pty Ltd
 Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
Figure 6: Logged Groundwater Levels - LU03, LU05, LU06 and LU07



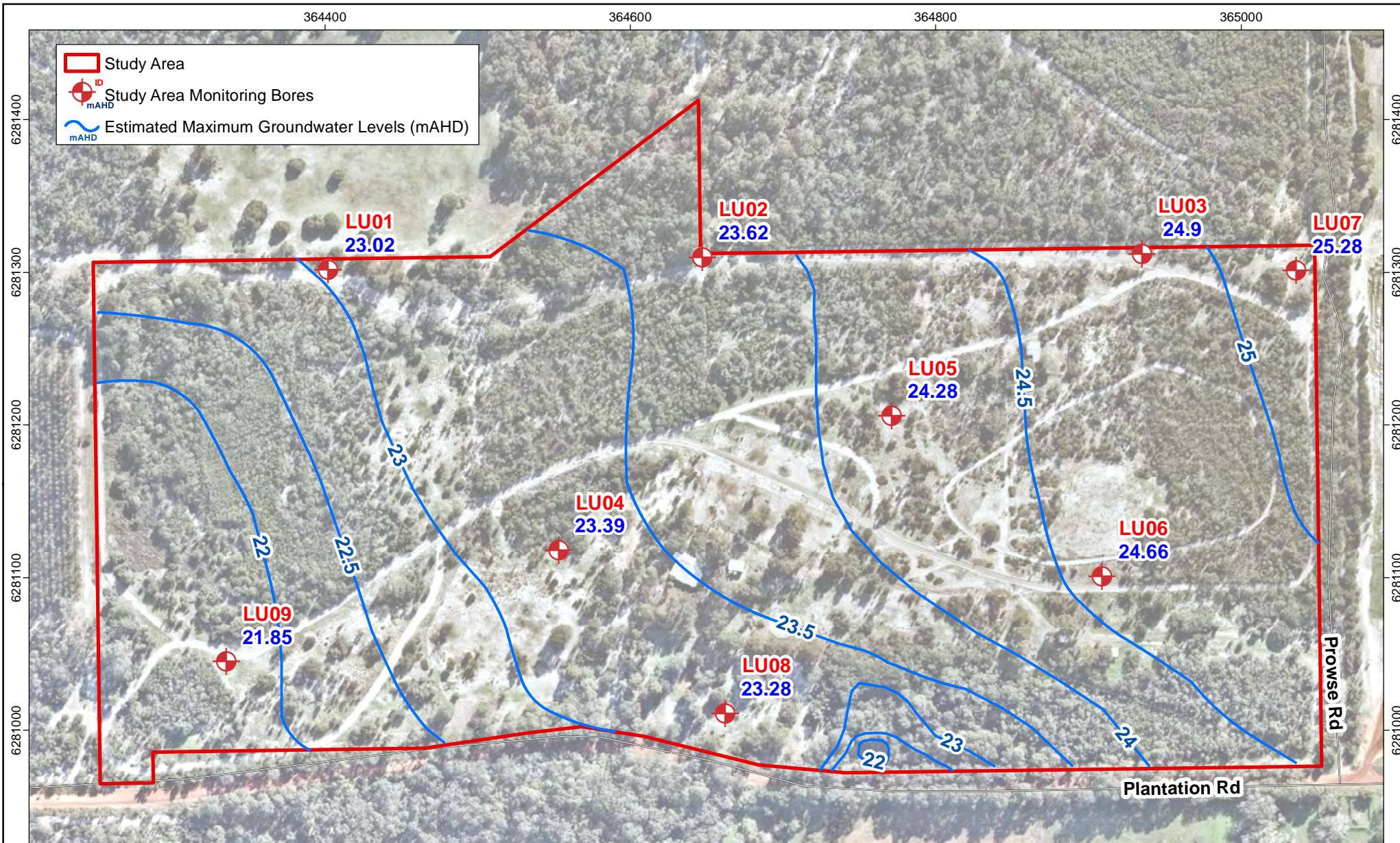
Data Source: Department of Water and Environmental Regulation Online Water Information Reporting (WIR) (DWER, 2021)



Job No. J7054

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021

Ludlow Holdings Pty Ltd
 Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
**Figure 7: DWER Bore SCPD19B Groundwater Level Time-Series, AAMGL
 and MGL**

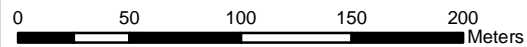


Data Source: Nearmaps (09 April 2021)

Coordinate System: GDA 94, Zone 50



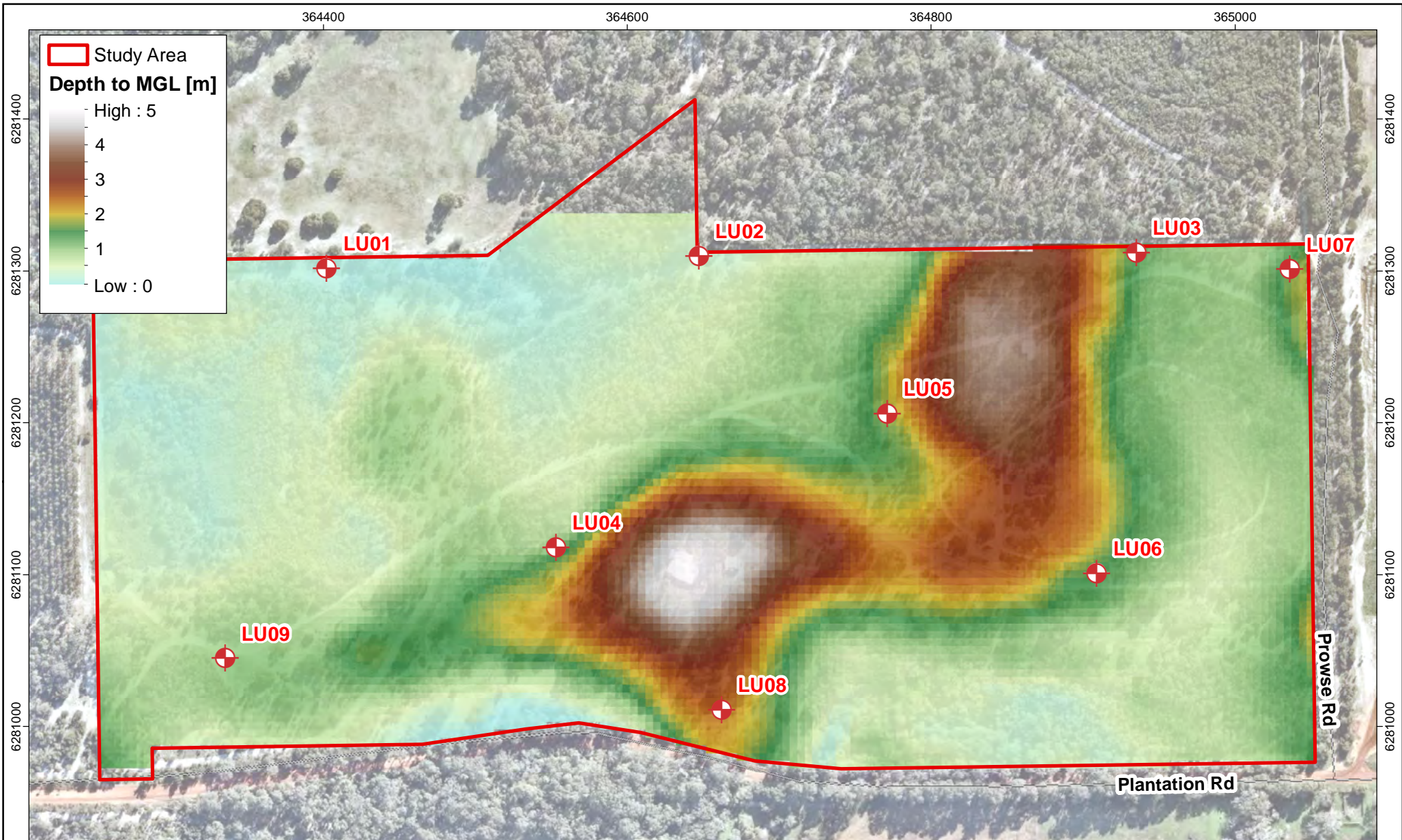
Job No. J7054
Scale: 1:3,400 @A4



© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021



Ludlow Holdings Pty Ltd
Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring
Figure 8: Estimated Maximum Groundwater Level (MGL) Contours

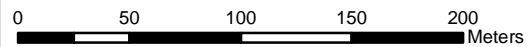


Data Source: Nearmaps (09 April 2021)

Coordinate System: GDA 94, Zone 50



Job No. J7054
Scale: 1:3,400 @A4



© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2021



Ludlow Holdings Pty Ltd
Lot 43 Plantation Road, Ludlow: Groundwater Level Monitoring

Figure 9: Depth to Estimated MGL

APPENDICES

APPENDIX A

Bore Lithological Logs



JDA Consultant Hydrologists
 Suite 1, 27 York Street
 Subiaco WA 6008
 Tel: 9388 2436
 Fax: 9381 9279

LITHOLOGICAL LOG

Client: Ludlow Holdings	Job No: J7054
Project: Lot 43 Plantation Rd, Ludlow	Hole commenced: 03/06/2021
Bore location: LU01	Hole completed: 03/06/2021
Datum: GDA 94 MGA Zone 50 E 364402 N 6281302	Logged by: GW
Bore Name: LU01	Total Depth: 2.00 m
Driller and drill type: Hollow Stem Auger	R.L. TOC: 24.26 mAHD
Hole diameter: 0.15m Casing Diam: 0.05m	Natural Surface: 23.31 mAHD

Depth (m)	BORE CONSTRUCTION	GRAPHICAL LOG	LITHOLOGICAL LOG						
			LITHOLOGY	COLOUR	GRAIN SIZE	SORTING	GRAIN SHAPE	MOISTURE	COMMENTS
0.5m	▽		Sand	Light Grey	Medium	Moderate	Sub R	Dry	
1.0m			Grey	Saturated					
1.5m			Sandy Clay	Orange	Fine/Medium	Hard to Penetrate			
EOH 2.0m									
2.5m									
3.0m									
3.5m									
4.0m									
4.5m									
5.0m									
5.5m									
6.0m									

- Gravel
- Sand
- Clayey Sand
- Sandy Clay
- Clay
- Coffee Rock
- Bentonite

Grain Size	Sorting	Grain Shape	Moisture
Very Fine	Poor	Angular	Dry
Fine	Moderate	Subangular	Moist
Medium	Well	Subrounded	Saturated
Coarse	Very well	Rounded	
Very coarse		Well rounded	
Gravel			

Date	03/06/2021
Stick Up	0.95 m
Total Depth	2.95 mBTOC
Water Level	2.11 mBTOC

NOTES: _____
 Sand saturated above hard sand clay/coffee rock layer



JDA Consultant Hydrologists
 Suite 1, 27 York Street
 Subiaco WA 6008
 Tel: 9388 2436
 Fax: 9381 9279

LITHOLOGICAL LOG

Client: Ludlow Holdings	Job No: J7054
Project: Lot 43 Plantation Rd, Ludlow	Hole commenced: 03/06/2021
Bore location: LU02	Hole completed: 03/06/2021
Datum: GDA 94 MGA Zone 50 E 364647 N 6281310	Logged by: GW
Bore Name: LU02	Total Depth: 1.92 m
Driller and drill type: Hollow Stem Auger	R.L. TOC: 24.87 mAHD
Hole diameter: 0.15m Casing Diam: 0.05m	Natural Surface: 24.02 mAHD

Depth (m)	BORE CONSTRUCTION	GRAPHICAL LOG	LITHOLOGICAL LOG						
			LITHOLOGY	COLOUR	GRAIN SIZE	SORTING	GRAIN SHAPE	MOISTURE	COMMENTS
0.5m 1.0m 1.5m EOH 1.92m			Sand	Dark Brown	Medium	Moderate	Sub R	Dry	
				Grey					
				Red/Brown					Hard Coffee Rock

2.5m 3.0m 3.5m 4.0m 4.5m 5.0m 5.5m 6.0m									
--	--	--	--	--	--	--	--	--	--

- Gravel
- Sand
- Clayey Sand
- Sandy Clay
- Clay
- Coffee Rock
- Bentonite

Grain Size	Sorting	Grain Shape	Moisture
Very Fine	Poor	Angular	Dry
Fine	Moderate	Subangular	Moist
Medium	Well	Subrounded	Saturated
Coarse	Very well	Rounded	
Very coarse		Well rounded	
Gravel			

NOTES: _____

Date	03/06/2021
Stick Up	0.85 m
Total Depth	2.77 mBTOC
Water Level	Dry mBTOC



JDA Consultant Hydrologists
 Suite 1, 27 York Street
 Subiaco WA 6008
 Tel: 9388 2436
 Fax: 9381 9279

LITHOLOGICAL LOG

Client: Ludlow Holdings	Job No: J7054
Project: Lot 43 Plantation Rd, Ludlow	Hole commenced: 03/06/2021
Bore location: LU03	Hole completed: 03/06/2021
Datum: GDA 94 MGA Zone 50 E 364935 N 6281312	Logged by: GW
Bore Name: LU03	Total Depth: 5.20 m
Driller and drill type: Hollow Stem Auger	R.L. TOC: 27.22 mAHD
Hole diameter: 0.15m Casing Diam: 0.05m	Natural Surface: 26.42 mAHD

Depth (m)	BORE CONSTRUCTION	GRAPHICAL LOG	LITHOLOGICAL LOG							
			LITHOLOGY	COLOUR	GRAIN SIZE	SORTING	GRAIN SHAPE	MOISTURE	COMMENTS	
0.5m			Sand	Dark Grey	Medium	Moderate	Sub R			
1.0m				Grey						
1.5m										
2.0m								Moist		
2.5m										
3.0m			▽							
3.5m								Saturated		
4.0m										
4.5m						Dark Grey				
5.0m						Grey				
EOH 5.2m			Clay		Fine/Medium			Very Thick Clay		
5.5m										
6.0m										

- Gravel
- Sand
- Clayey Sand
- Sandy Clay
- Clay
- Coffee Rock
- Bentonite

Grain Size	Sorting	Grain Shape	Moisture
Very Fine	Poor	Angular	Dry
Fine	Moderate	Subangular	Moist
Medium	Well	Subrounded	Saturated
Coarse	Very well	Rounded	
Very coarse		Well rounded	
Gravel			

NOTES: _____

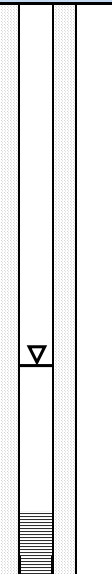

Date	03/06/2021
Stick Up	0.80 m
Total Depth	6.00 mBTOC
Water Level	2.43 mBTOC










JDA Consultant Hydrologists
 Suite 1, 27 York Street
 Subiaco WA 6008
 Tel: 9388 2436
 Fax: 9381 9279

LITHOLOGICAL LOG

Client: Ludlow Holdings Job No: J7054
 Project: Lot 43 Plantation Rd, Ludlow Hole commenced: 03/06/2021
 Bore location: LU04 Hole completed: 03/06/2021
 Datum: GDA 94 MGA Zone 50 E 364553 N 6281118 Logged by: GW
 Bore Name: Lu04 Total Depth: 2.60 m
 Driller and drill type: Hollow Stem Auger R.L. TOC: 25.00 mAHD
 Hole diameter: 0.15m Casing Diam: 0.05m Natural Surface: 24.40 mAHD

Depth (m)	BORE CONSTRUCTION	GRAPHICAL LOG	LITHOLOGICAL LOG						
			LITHOLOGY	COLOUR	GRAIN SIZE	SORTING	GRAIN SHAPE	MOISTURE	COMMENTS
0.5m			Sand	Dark Grey	Medium	Moderate	Sub R	Dry	
1.0m				Grey					
1.5m				Light Grey				Saturated	
2.0m									
2.5m									
EOH 2.6m									
3.0m									
3.5m									
4.0m									
4.5m									
5.0m									
5.5m									
6.0m									

-  Gravel
-  Sand
-  Clayey Sand
-  Sandy Clay
-  Clay
-  Coffee Rock
-  Bentonite

Grain Size	Sorting	Grain Shape	Moisture
Very Fine	Poor	Angular	Dry
Fine	Moderate	Subangular	Moist
Medium	Well	Subrounded	Saturated
Coarse	Very well	Rounded	
Very coarse		Well rounded	
Gravel			

NOTES: _____

Date	03/06/2021
Stick Up	0.60 m
Total Depth	3.20 mBTOC
Water Level	2.29 mBTOC



JDA Consultant Hydrologists
 Suite 1, 27 York Street
 Subiaco WA 6008
 Tel: 9388 2436
 Fax: 9381 9279

LITHOLOGICAL LOG

Client: Ludlow Holdings	Job No: J7054
Project: Lot 43 Plantation Rd, Ludlow	Hole commenced: 03/06/2021
Bore location: LU05	Hole completed: 03/06/2021
Datum: GDA 94 MGA Zone 50 E 364771 N 6281206	Logged by: GW
Bore Name: LU05	Total Depth: 5.17 m
Driller and drill type: Hollow Stem Auger	R.L. TOC: 26.74 mAHD
Hole diameter: 0.15m	Casing Diam: 0.05m
	Natural Surface: 25.84 mAHD

Depth (m)	BORE CONSTRUCTION	GRAPHICAL LOG	LITHOLOGICAL LOG						
			LITHOLOGY	COLOUR	GRAIN SIZE	SORTING	GRAIN SHAPE	MOISTURE	COMMENTS
0.5m 1.0m 1.5m 2.0m 2.5m 3.0m 3.5m 4.0m 4.5m 5.0m EOH 5.17m			Sand	Dark Grey	Medium	Moderate	Sub R	Dry	
				Grey				Moist	
								Saturated	
			Clayey Sand	Brown Cream					
			Sandy Clay	Brown					
5.5m 6.0m									

- Gravel
- Sand
- Clayey Sand
- Sandy Clay
- Clay
- Coffee Rock
- Bentonite

Grain Size	Sorting	Grain Shape	Moisture
Very Fine	Poor	Angular	Dry
Fine	Moderate	Subangular	Moist
Medium	Well	Subrounded	Saturated
Coarse	Very well	Rounded	
Very coarse		Well rounded	
Gravel			

NOTES: _____

Date	3/06/2021
Stick Up	0.90 m
Total Depth	6.07 mBTOC
Water Level	3.25 mBTOC



JDA Consultant Hydrologists
 Suite 1, 27 York Street
 Subiaco WA 6008
 Tel: 9388 2436
 Fax: 9381 9279

LITHOLOGICAL LOG

Client: Ludlow Holdings	Job No: J7054
Project: Lot 43 Plantation Rd, Ludlow	Hole commenced: 03/06/2021
Bore location: LU06	Hole completed: 03/06/2021
Datum: GDA 94 MGA Zone 50 E 364909 N 6281101	Logged by: GW
Bore Name: LU06	Total Depth: 5.13 m
Driller and drill type: Hollow Stem Auger	R.L. TOC: 26.84 mAHD
Hole diameter: 0.15m Casing Diam: 0.05m	Natural Surface: 26.04 mAHD

Depth (m)	BORE CONSTRUCTION	GRAPHICAL LOG	LITHOLOGICAL LOG						
			LITHOLOGY	COLOUR	GRAIN SIZE	SORTING	GRAIN SHAPE	MOISTURE	COMMENTS
0.5m	▽		Sand	Grey	Medium	Moderate	Sub R	Dry	
1.0m									
1.5m									
2.0m			Moist						
2.5m			Saturated						
3.0m									
3.5m									
4.0m			Dark Grey						
4.5m			Clayey Sand	Grey					
5.0m			Sandy Clay	Grey Yellow					
EOH 5.13m								Thick Clay	

5.5m									
6.0m									

- Gravel
- Sand
- Clayey Sand
- Sandy Clay
- Clay
- Coffee Rock
- Bentonite

Grain Size	Sorting	Grain Shape	Moisture
Very Fine	Poor	Angular	Dry
Fine	Moderate	Subangular	Moist
Medium	Well	Subrounded	Saturated
Coarse	Very well	Rounded	
Very coarse		Well rounded	
Gravel			

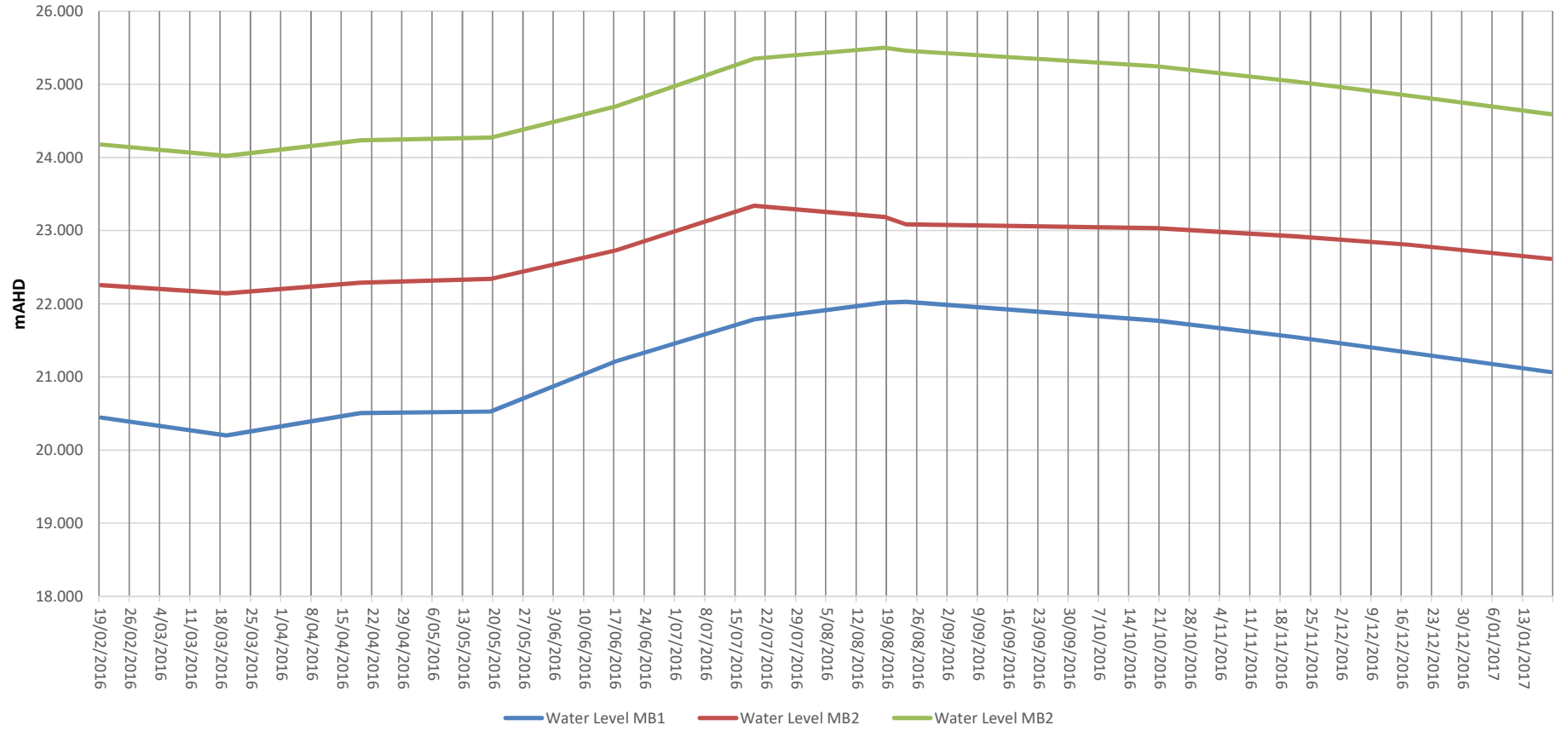
NOTES: _____

Date	03/06/2021
Stick Up	0.80 m
Total Depth	5.93 mBTOC
Water Level	2.40 mBTOC

APPENDIX B

2016 to 2017 Monitoring Data
(Lundstrom Environmental Consultants, 2019)

Hydrographs for On-Site Monitoring Bores



Suite 1, 27 York St, Subiaco WA 6008
PO Box 117, Subiaco WA 6904
Ph: +61 8 9388 2436

www.jdahydro.com.au

info@jdahydro.com.au



element.

the art and science of place

Level 18, 191 St Georges Tce, Perth WA 6000

T. (08) 9289 8300 – E. hello@elementwa.com.au

elementwa.com.au