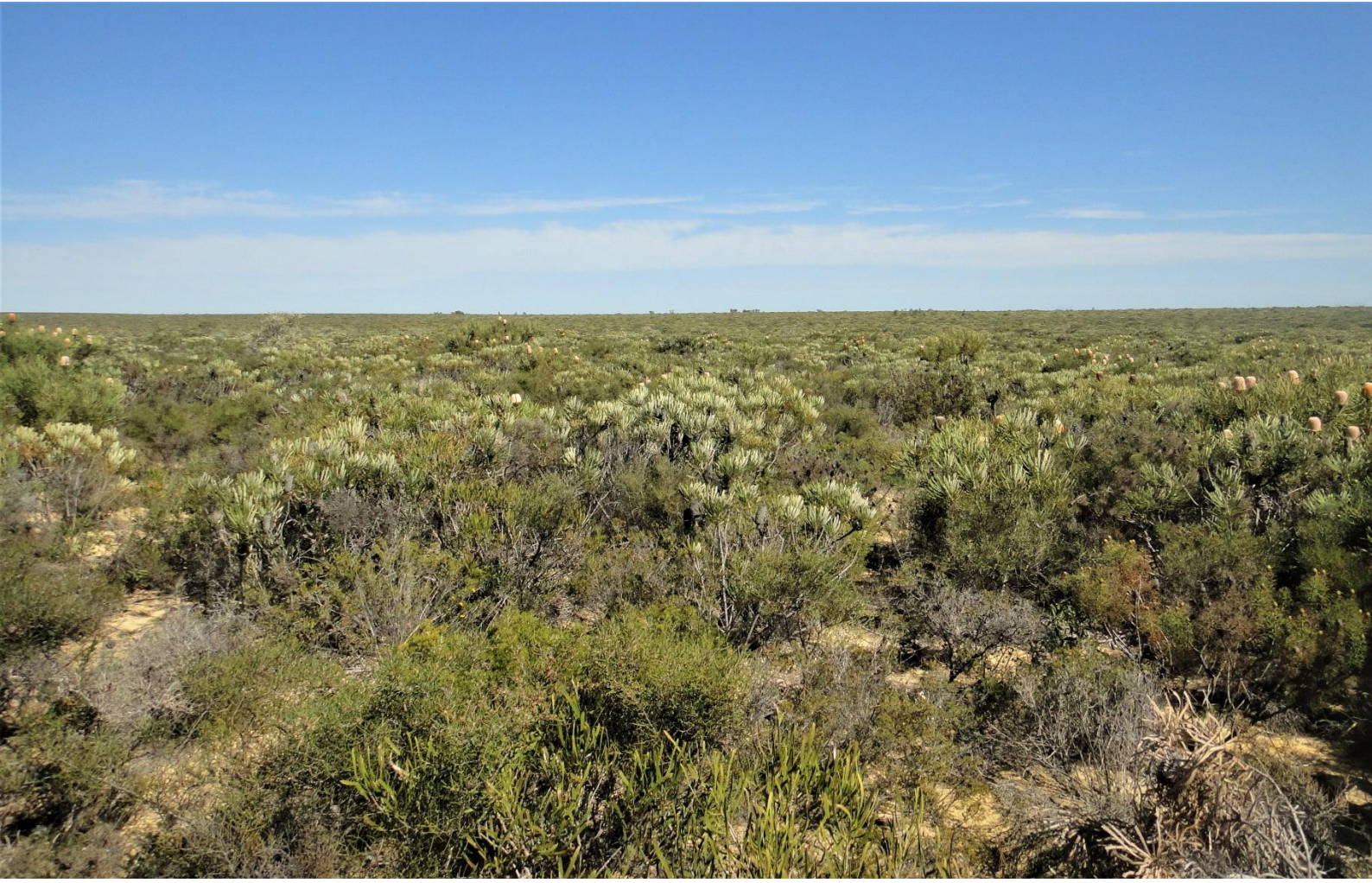

ARROWSMITH NORTH ALTERNATIVE BORE LOCATION

NATIVE VEGETATION CLEARING PERMIT APPLICATION SUPPORTING INFORMATION

VRX-ARN-VCP-02

1 November 2021

PREPARED FOR VRX SILICA LIMITED

BY PRESTON CONSULTING PTY LTD

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DOCUMENT CONTROL

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Checked	Gavin Edwards – Director Preston Consulting	 Signature	29/10/2021
Authorisation	Bruce Maluish – Managing Director VRX Silica Limited	 Signature	29/10/2021

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

VRX Silica Limited (VRX), an Australian Stock Exchange listed company, is seeking to develop the Arrowsmith North Silica Sand Project (the Proposal), a high grade silica sand mine in the Mid-West region of Western Australia (WA). The Proposal is located within the Geraldton Sandplains bioregion, approximately 270 kilometres (km) north of Perth (Figure 1).

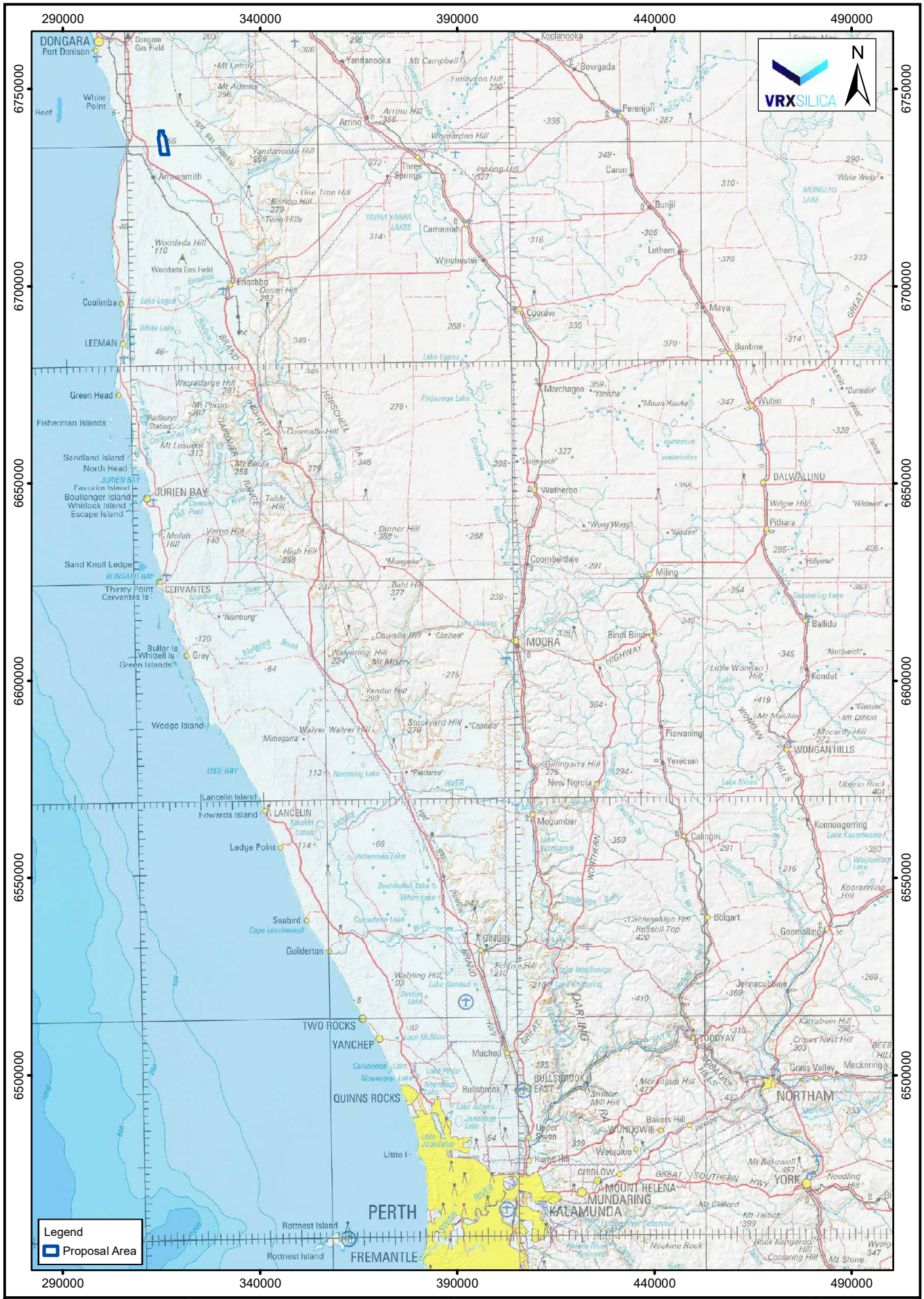
The Proposal will produce a high grade silica sand via extraction and mechanical upgrading which will be hauled (by road) to the Geraldton Port for export. The Proposal includes mining silica sand from the upper 8 – 15 m of the soil profile. Mining will be performed in sections by removing blocks (typically 150 m x 150 m), with an estimated five blocks being mined per year. Mining infrastructure will be comprised of a mine feed plant, moveable surface conveyor and pipeline, processing plant, freshwater supply bore, access corridor, gas fired power station, workshop and supported by ancillary infrastructure.

The Proposal has been referred to the Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act 1986* and the level of assessment has been set at 'Public Environmental Review'.

1.2 PURPOSE

The Proposal has a process water demand of up to 0.9 GL / year. VRX proposes to satisfy this process water demand through abstraction of groundwater from a single bore targeting the Yarragadee aquifer. VRX has commenced drilling investigations for this bore to confirm if it can satisfy the groundwater requirements of the Proposal. Due to the lack of availability of drilling contractors, drilling investigations have ceased (temporarily) and are not expected to recommence until late November 2021. The investigations have not yet been able to confirm the suitability of this bore. As a contingency (in case drilling confirms the original bore is not suitable) VRX proposes to develop an alternative groundwater abstraction bore (Alternative Bore) near the intersection of the Proposed Access Route and the Brand Highway (Figure 2). The Alternative Bore location and associated clearing is the subject of the Native Vegetation Clearing Permit (NVCP) application.

The purpose of this NVCP application is to authorise the clearing of 0.25 ha of native vegetation to enable VRX to install and conduct investigations on the Alternative Bore within tenement L70/208.



CAD Ref: a2602_f31_01	Preston Consulting Level 3, 8/201 Adelaide Terrace Perth WA 6000 Tel: 08 9221 0011 Fax: 08 9221 4783 Email: reception@prestonconsulting.com.au	**Arrowsmith North Project** **Regional Location of the Proposal**	Figure: **1**
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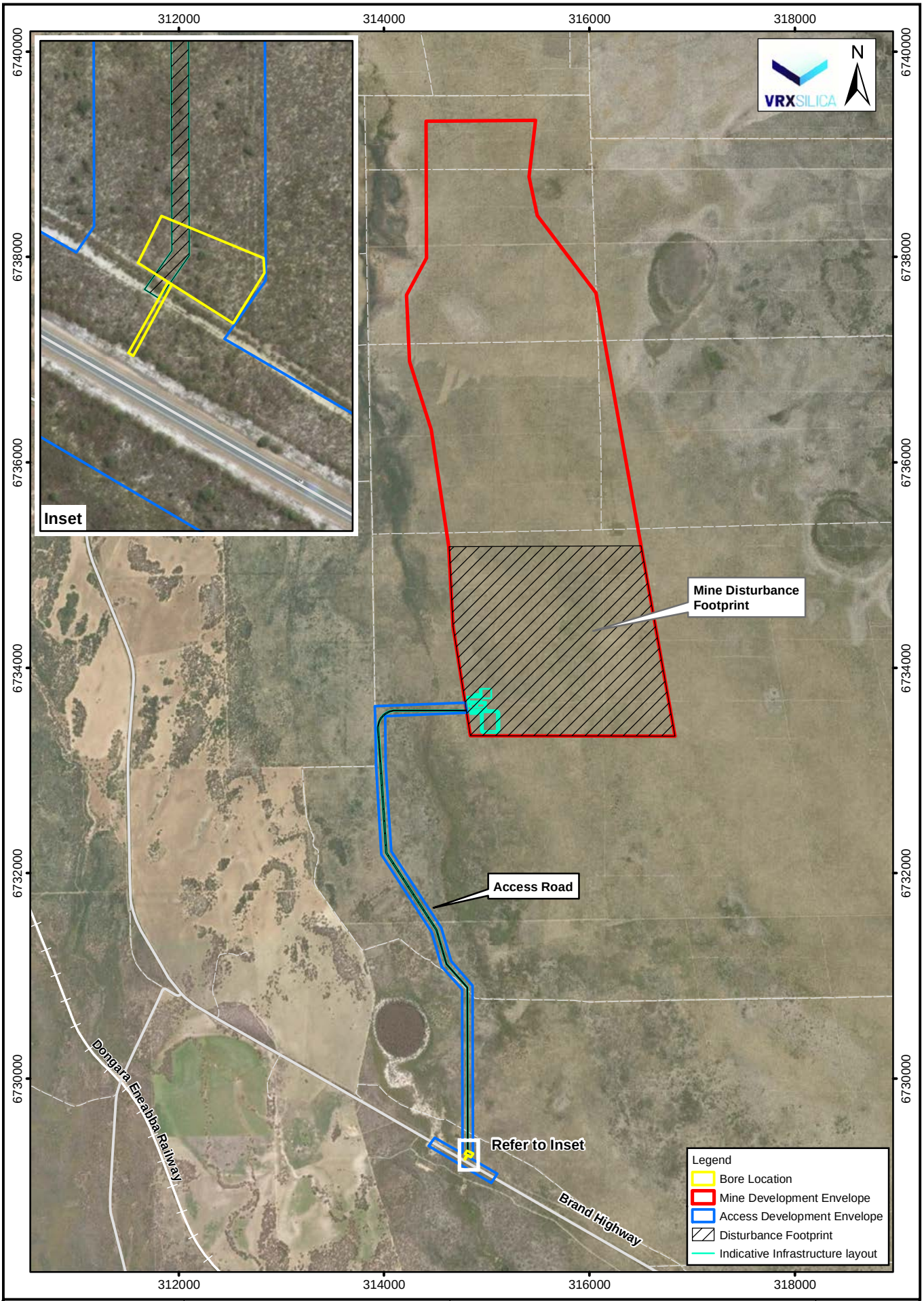

Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019)

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Arrowsmith North Project
Development Envelope and Bore Location

Figure: 2

2 ALTERNATIVE BORE LOCATION

2.1 BOUNDARY

All vegetation clearing required to develop the Alternative Bore will occur within the Bore Location defined in yellow in Figure 2.

2.2 TENURE AND LAND ACCESS

All vegetation disturbance addressed in this NVCP application will occur within granted tenement L70/208 (Figure 3; held by Ventnor Mining Pty Ltd, a wholly owned subsidiary of VRX). The Bore Location is comprised of 0.25 ha of native vegetation, the underlying tenure is comprised of vacant crown land and the Brand Highway road reserve. The area surrounding the Bore Location has been subject to minor exploration for mineral sands mining and seismic surveys for gas.

Access to the Alternative Bore will be via Brand Highway.

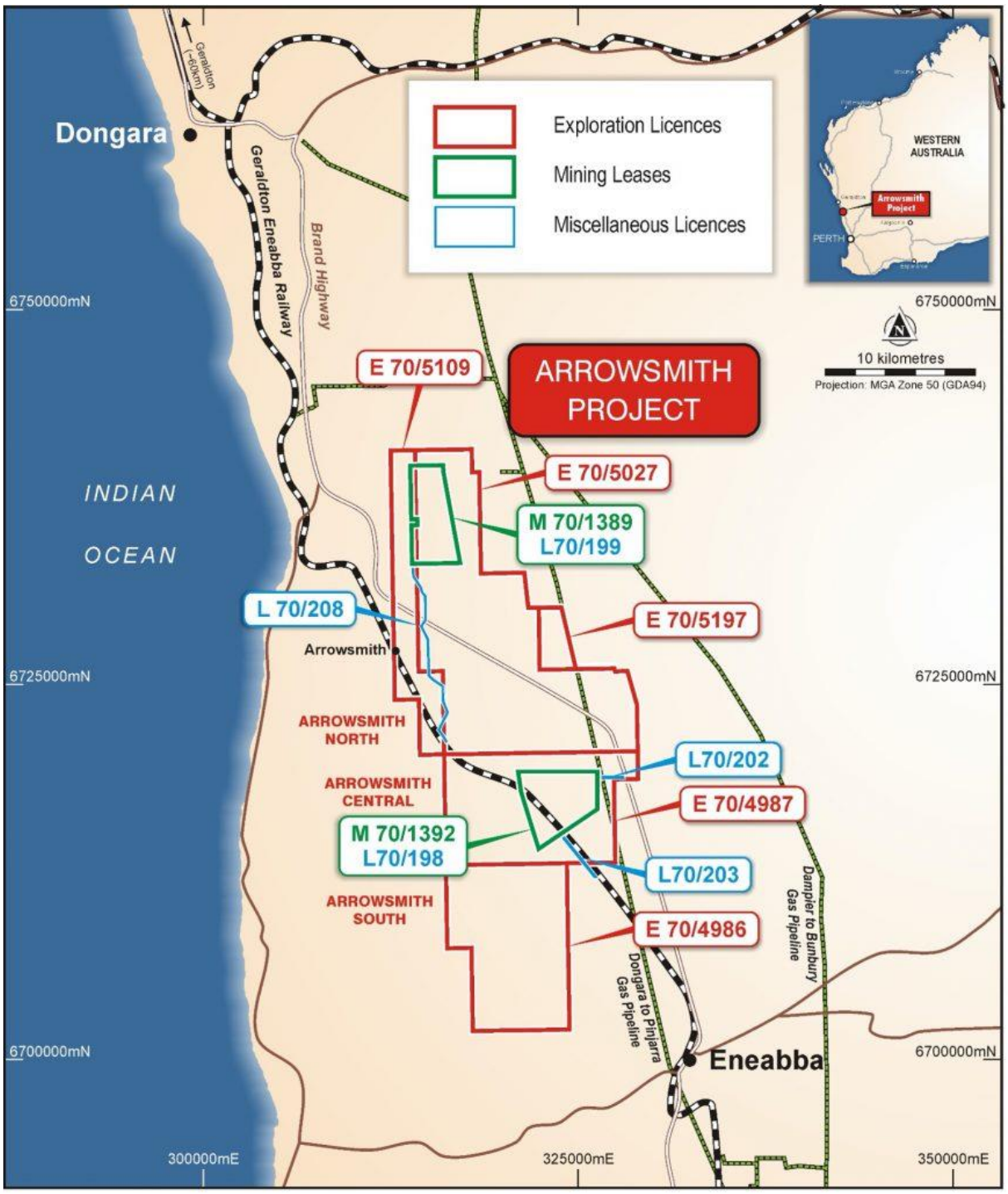


Figure 3: VRX tenure

3 ALTERNATIVE BORE

The Alternative Bore will be installed and investigated to determine if it is suitable for the abstraction of up to 0.9 GL of groundwater per year from the Yarragadee aquifer. The Alternative Bore investigations will require a small pad and access track connection to Brand Highway.

3.1 ESTIMATED VEGETATION DISTURBANCE REQUIREMENTS

Installation of the Alternative Bore will require clearing of 0.25 ha of native vegetation for the bore pad and a narrow access track connection to Brand Highway. All cleared areas will be rehabilitated by respreading topsoil and infill planting if the Proposal does not proceed into operation (or the bore is not suitable).

3.2 METHOD OF VEGETATION DISTURBANCE

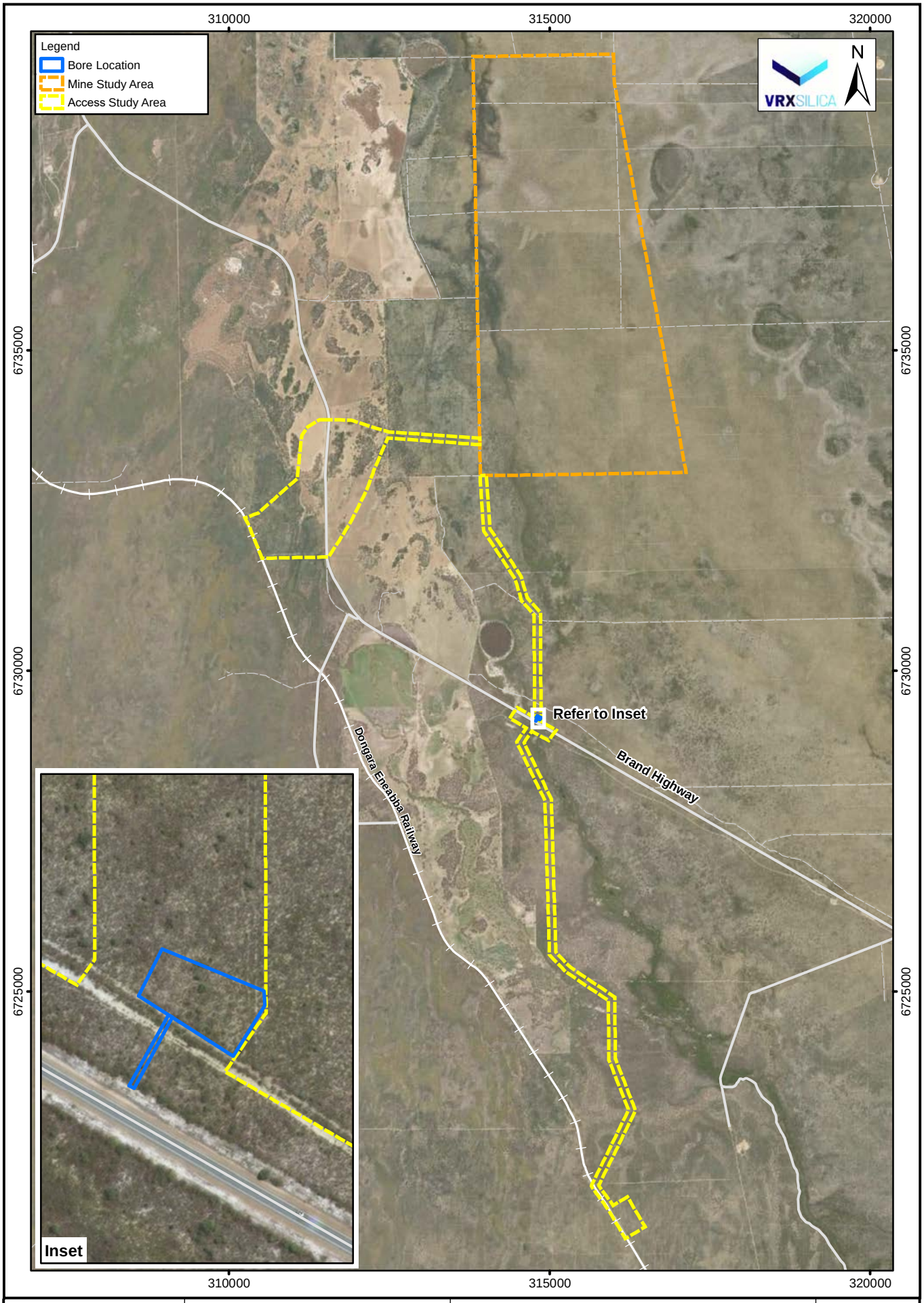
Disturbance will be limited to what is required for the installation and investigation of the Alternative Bore. Clearing will be conducted with a tractor mounted mulcher which will be set at 300mm height above the ground surface, there will be minimal disturbance of topsoil.

3.3 INDICATIVE TIMELINE

Clearing for the installation of the Alternative Bore is planned to commence at the end of 2021, or as soon as the NVCP is granted.

4 ENVIRONMENTAL CHARACTERISTICS

The following sections detail the environmental characteristics of the Bore Location that are relevant to this NVCP. Several biological assessments have been conducted on the Mine and Access Study Areas (Figure 4) to meet the relevant EPA guidance for an Environmental Impact Assessment of the Proposal. Mattiske Consulting Pty Ltd (Mattiske) was commissioned to conduct a desktop and field assessment of the Flora and Vegetation of the Mine and Access Study Areas. Bamford Consulting Ecologists (BCE) was commissioned to conduct a Level 1 Fauna assessment of the Mine and Access Study Areas.



Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS

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Arrowsmith North Project
Survey Areas and Bore Location

Figure: 4

4.1 Environmentally Sensitive Area

The Bore Location lies entirely within an Arrowsmith Lake Area mapped as an Environmentally Sensitive Area on DWER's clearing permit system (object ID112189). The Arrowsmith Lake Area was registered as a natural place in the Register of the National Estate (RNE) in March 1978 under the *Australian Heritage Council Act 2003.* Further information on the Arrowsmith Lake Area is held by the Department of Agriculture, Water and the Environment (DAWE) on the Australian Heritage Database. The registered status means the place was entered in the RNE prior to its closure in 2007. The existence of an entry for a place in the RNE does not in itself create a requirement to protect the place under Commonwealth law. Nevertheless, information in the register may be current and may be relevant to statutory decisions about protection (DAWE, 2021).

4.2 Biogeographic Regions

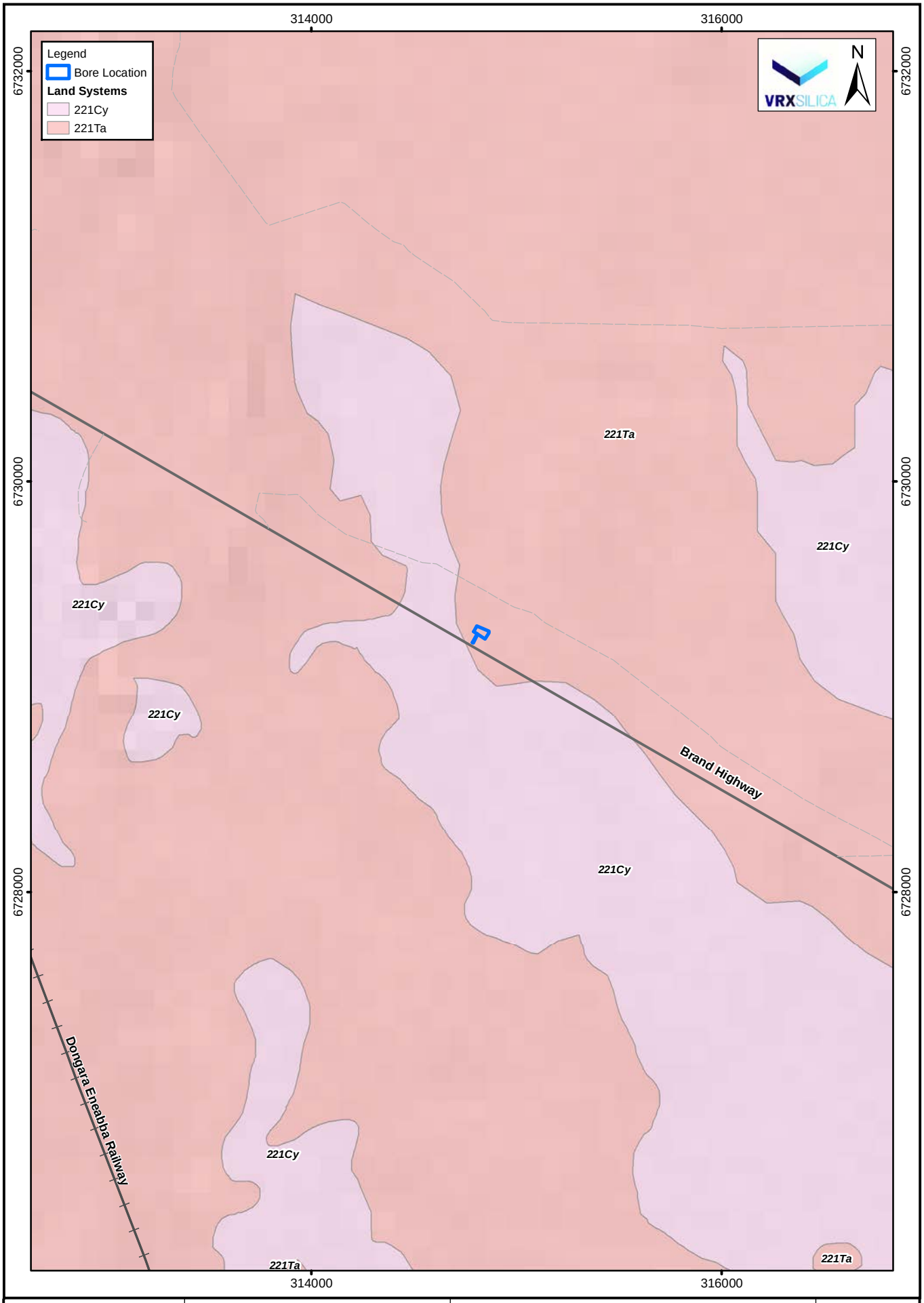
The Interim Biogeographic Regionalisation for Australia (IBRA) has identified 26 bioregions in WA which are further divided into subregions. The Bore Location lies within GS3, comprising coastal Aeolian and limestones of the central Perth basin overlain with shrub-heaths and rich in endemics (BCE, 2021). The broader Geraldton Sandplains Bioregion is composed mainly of proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain. Extensive York Gum and Jam woodlands occur on outwash plains associated drainage (Thackway and Cresswell, 1995). The dominant land uses in this bioregion are agriculture, conservation reserves and crown reserves (BCE, 2021). The area exhibits extremely high floristic endemism, with over 250 species of sandplain flora endemic to the subregion. The area is known Australia-wide and internationally as having particularly high floristic diversity and levels of endemism (Desmond and Chant, 2001).

4.3 Land Systems and Soils

The Department of Primary Industries and Regional Development (DPIRD) identifies the land system within the Bore Location as the Tamala South System (221 Ta; Figure 5).

The Tamala South System has a state-wide extent of approximately 154,103 ha and is comprised of rises and low hills with relict dunes and some limestone outcrops on coastal limestone north of Jurien Bay. Yellow deep sands are common, with yellow/brown shallow sands and calcareous shallow and deep sands.

The underlying geology of the Bore Location is predominantly Permian to Cretaceous sedimentary basins, with horsts of Proterozoic rocks. The Bore Location is characterised by undulating lateritic sandplains with leached sandy soils over laterite in coastal areas; earthy, yellow sands over laterite further inland; and hard-setting loams with red clay subsoils (Beard, 1990; Desmond and Chant, 2001).



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Arrowsmith North Project
Land systems and Bore Location

Figure: 5

4.4 Flora and Vegetation

4.4.1 Survey Effort

Mattiske was commissioned to conduct a desktop assessment on the Survey Area. Mattiske also conducted a reconnaissance field survey to verify and build on the desktop assessment. Mattiske's report provided mapping and descriptions of vegetation types and the condition of flora within the Survey Area.

The information contained within the following sections is from Mattiske (2021) unless otherwise referenced.

4.4.2 Conservation Significant Flora

Potential Conservation Significant Flora

Seven threatened flora species listed by the Department of Biodiversity, Conservation and Attractions (DBCA, 2018) and DAWE (2020), and 20 priority flora listed by Western Australian Herbarium (WAH, 1998) have the potential to occur within the Survey Area. Mattiske (2021) assessed the likelihood of recording any listed threatened and priority taxa within the Survey Area, based on factors including known soil type, topography and distribution.

No Threatened flora species had a high likelihood of occurring in the Survey Area. Six threatened flora species had a moderate likelihood and one had a low likelihood of occurring in the Survey Area. Of the 20 Priority flora that had the potential of occurring within the Survey Area, nine Priority flora species had a low likelihood of occurring, seven had a moderate likelihood and four had a high likelihood of occurring.

The conservation significant taxa with the potential of occurring within the Survey Area are detailed in Table 1.

Table 1: Threatened and Priority Flora potentially occurring within the Survey Area during desktop assessment

Species	Conservation Status	Likelihood of Occurrence
Threatened Species		
Conostylis dielsii subsp. *Teres*	Endangered	Moderate
Conostylis micrantha	Endangered	Moderate
Eucalyptus impensa	Endangered	Low
Hemiandra gardneri	Endangered	Moderate
Leucopogon obtectus	Endangered	Moderate
Paracaleana dixonii	Endangered	Moderate
Tetratheca nephelioides	Critically Endangered	Moderate
Priority Species		
Acacia vittata	Priority 2	Moderate
Banksia elegans	Priority 4	High
Beyeria gardneri	Priority 3	Moderate

Species	Conservation Status	Likelihood of Occurrence
Caladenia denticulate subsp. *albicans*	Priority 1	Moderate
Drosera pedicellaris	Priority 1	Moderate
Eucalyptus zopherophloia	Priority 4	Low
Grevillea erinacea	Priority 3	Low
Guichenotia quasicalva	Priority 2	Low
Hemiandra sp. Eneabba (H. Demarz 3687)	Priority 3	High
Hopkinsia anoectocolea	Priority 3	Low
Hypocalymma tetrapterum	Priority 3	Low
Schoenus griffinianus	Priority 4	High
Scholtzia calcicola	Priority 2	Moderate
Stawellia dimorphantha	Priority 4	High
Stylidium longitubum	Priority 4	Low
Synaphea oulopha	Priority 3	Low
Triglochin protuberans	Priority 3	Low
Verticordia dasystylis subsp. *oestopoia*	Priority 1	Low
Verticordia luteola var. *rosea*	Priority 1	Moderate
Verticordia luteola var. *luteola*	Priority 3	Moderate

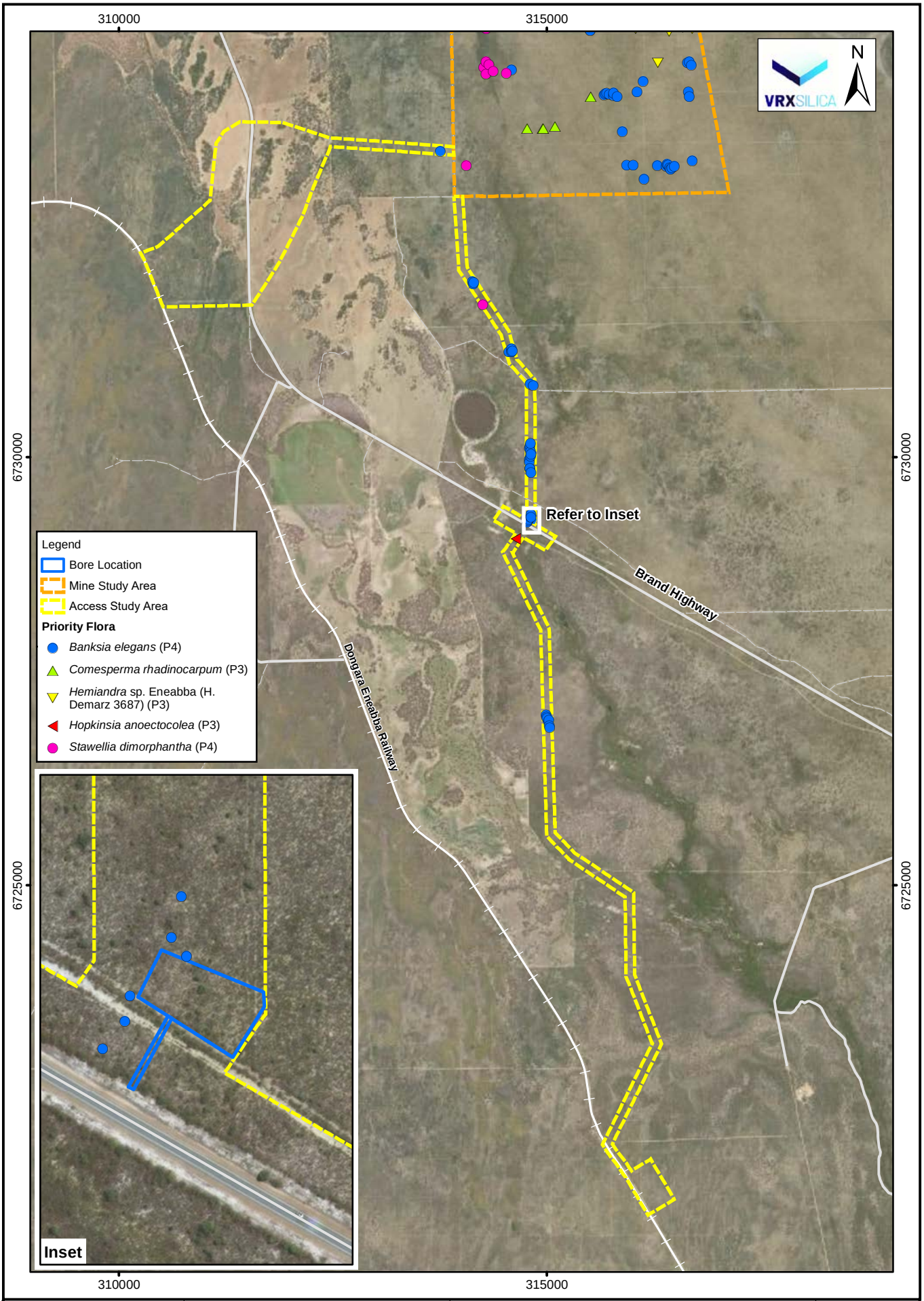
Recorded Significant Flora

No Threatened Flora listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Biodiversity Conservation Act 2016* (BC Act) were recorded in the Survey Area. No Priority flora as listed by the Western Australian Herbarium (WAH, 1988-) were recorded within the Bore Location.

The larger number of threatened and priority flora species identified as having the potential to occur within the Survey Area (Table 1) can be attributed to the larger and more diverse desktop search area. Many of these species are restricted to specific landscape features such as lateritic hills and outcrops that do not occur in the Survey Area.

4.4.3 Introduced Flora Species

Four introduced species were recorded within the Arrowsmith North transport corridor survey area: *Aira caryophyllea*, *Brassicaceae* sp., *Briza maxima* and *Ursinia*. None of these species are declared pest organisms pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007* (all are permitted under section 11) and none are Weeds of National Significance (DAWE 2020). All recorded introduced species are well known in the area and are within known distributions.



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Arrowsmith North Project
Priority Flora and Bore Location

Figure: 6

4.4.4 VEGETATION

The Bore Location is located within the Irwin Botanical District, which is described as coastal scrub heath on sandplains, with *Acacia* and *Allocasuarina* thickets further inland, and hard-setting loams with *Acacia* scrub and scattered *Eucalyptus loxophleba* (Beard, 1990).

The Bore Location is comprised of the Eridoon Pre-European vegetation system (Figure 8). The Eridoon system is defined as a flat coastal plain with various small rivers and creeks with numerous small lakes and swamps and some limited alluvial flats of heavier soil on the lower Arrowsmith River. Vegetation within this system is comprised of scattered small trees with an open layer of tall shrubs over a closed layer of small heath-like shrubs, which experiences frequent fires.

More recently, the vegetation of WA has been assigned to bioregions and subregions under the IBRA, with the Survey Area falling within the Lesueur Sandplain subregion of the Geraldton Sandplain Region (DAWE, 2020). The Geraldton Sandplain 3 (GS3 – Lesueur Sandplain subregion) is described as having high floristic diversity and levels of endemism, with vegetation comprised mainly of proteaceous scrub heaths. Extensive York Gum (*Eucalyptus loxophleba*) and Jam (*Acacia acuminata*) woodlands occur on outwash plains associated with drainage (Desmond and Chant, 2001).

Regional Native Vegetation Extent

Native vegetation within 10, 15 and 20 km of the Mine Development Envelope was mapped using DPIRDs Native Vegetation Dataset and is shown in Figure 7. The extent of native vegetation surrounding the Mine Development Envelope is summarised in Table 2.

Table 2: Native vegetation surrounding the Proposal

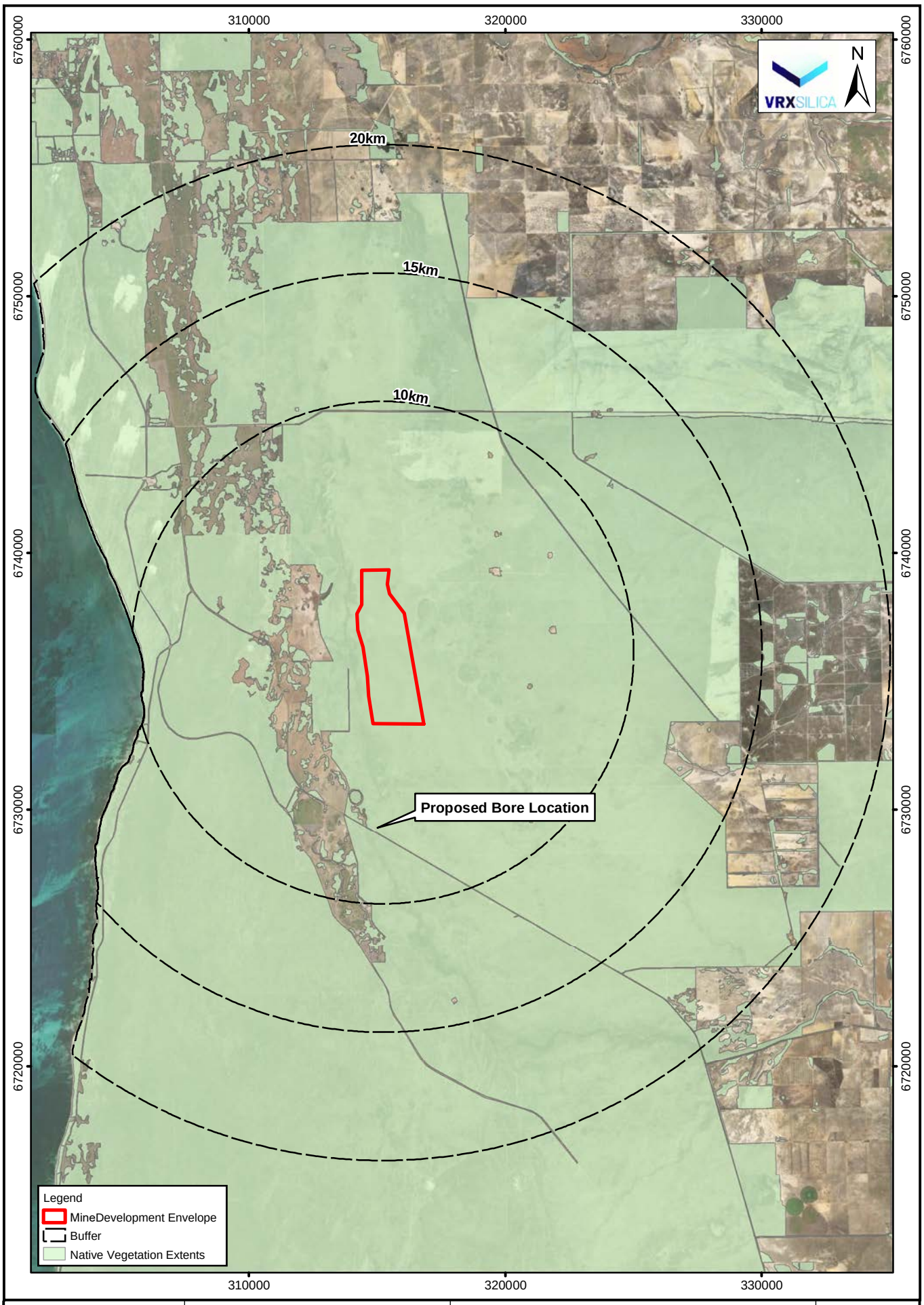
Radius (km)	Area (ha)	% of native vegetation remaining
Survey Area	1,297.4	88.14
10	27,134	90.45
15	57,388.5	91.17
20	86,122.9	82.85

Vegetation Associations

The Bore Location occurs within one vegetation association which is summarised in Table 5 and shown in Figure 8.

Table 3: Vegetation associations of the Survey Area

Pre-European System	Vegetation Association	Description	State-wide Pre-European Extent (ha)	Extent remaining (ha)	Survey Area	
					Area of Intersection (ha)	Proportion of Current Extent (%)
Eridoon	378.1	Mixed heath with scattered tall shrubs *Acacia* spp., *Proteaceae* and *Myrtaceae*	124,192.7	80,734.1 (65.0%)	0.25	<0.001%



Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS, Veg Extents: DPIRD (3/8/2020)

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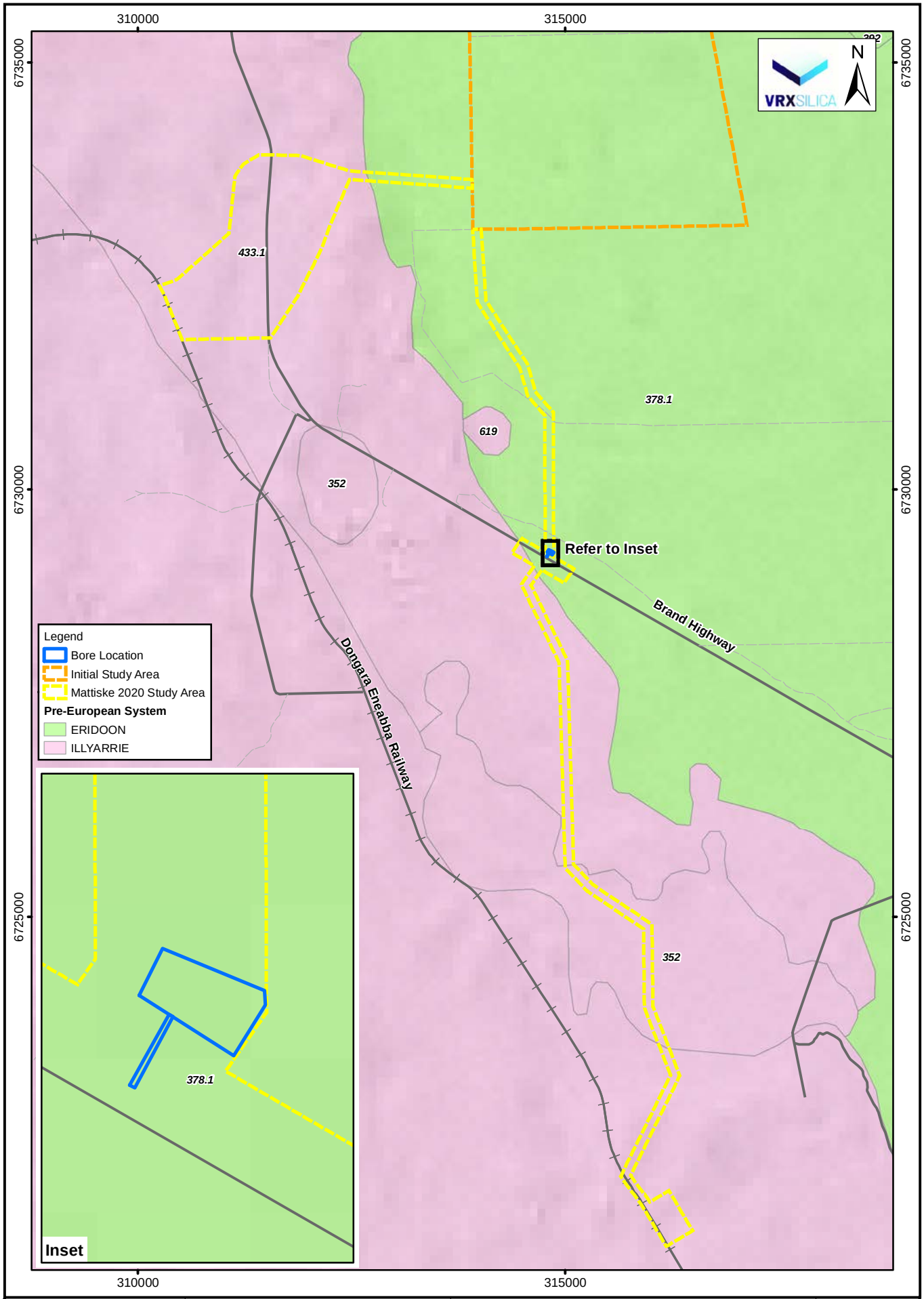
Arrowsmith North Project
Native vegetation within 20km

Figure: 7



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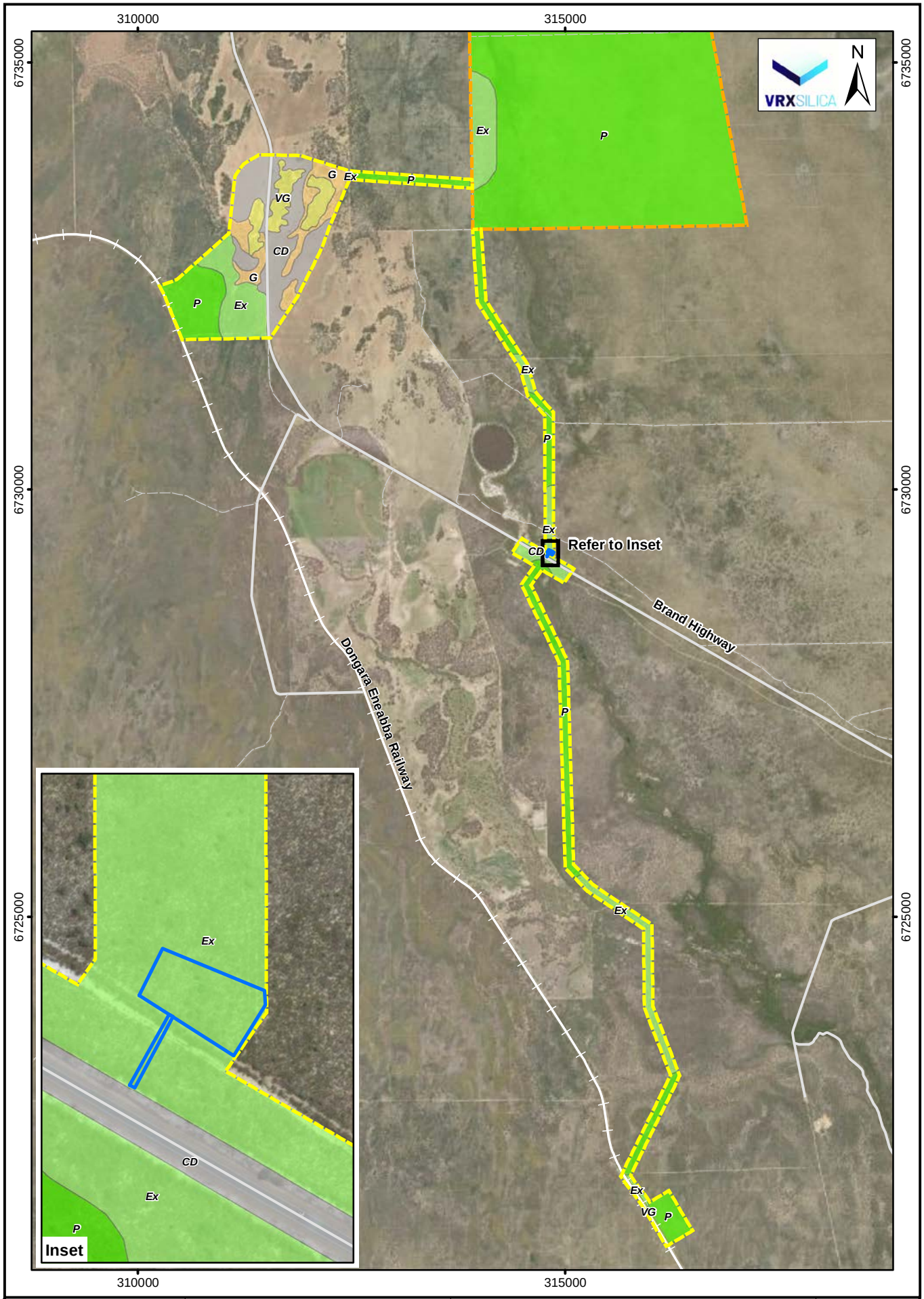
Arrowsmith North Project
Pre-European Vegetation and Bore Location

Figure: 8

Vegetation Condition

The condition of vegetation within the Survey Area ranges from Pristine to Excellent, with the majority of the area considered Pristine according to the Keighery (1994) scale. The condition of the vegetation within the Bore Location is mapped as Excellent (Figure 9).

The Eridoon system experiences frequent bushfires. The Survey Area was subject to bushfire in 2010. The extent and timing of fires within 20 km of the Proposal are mapped in Figure 10.



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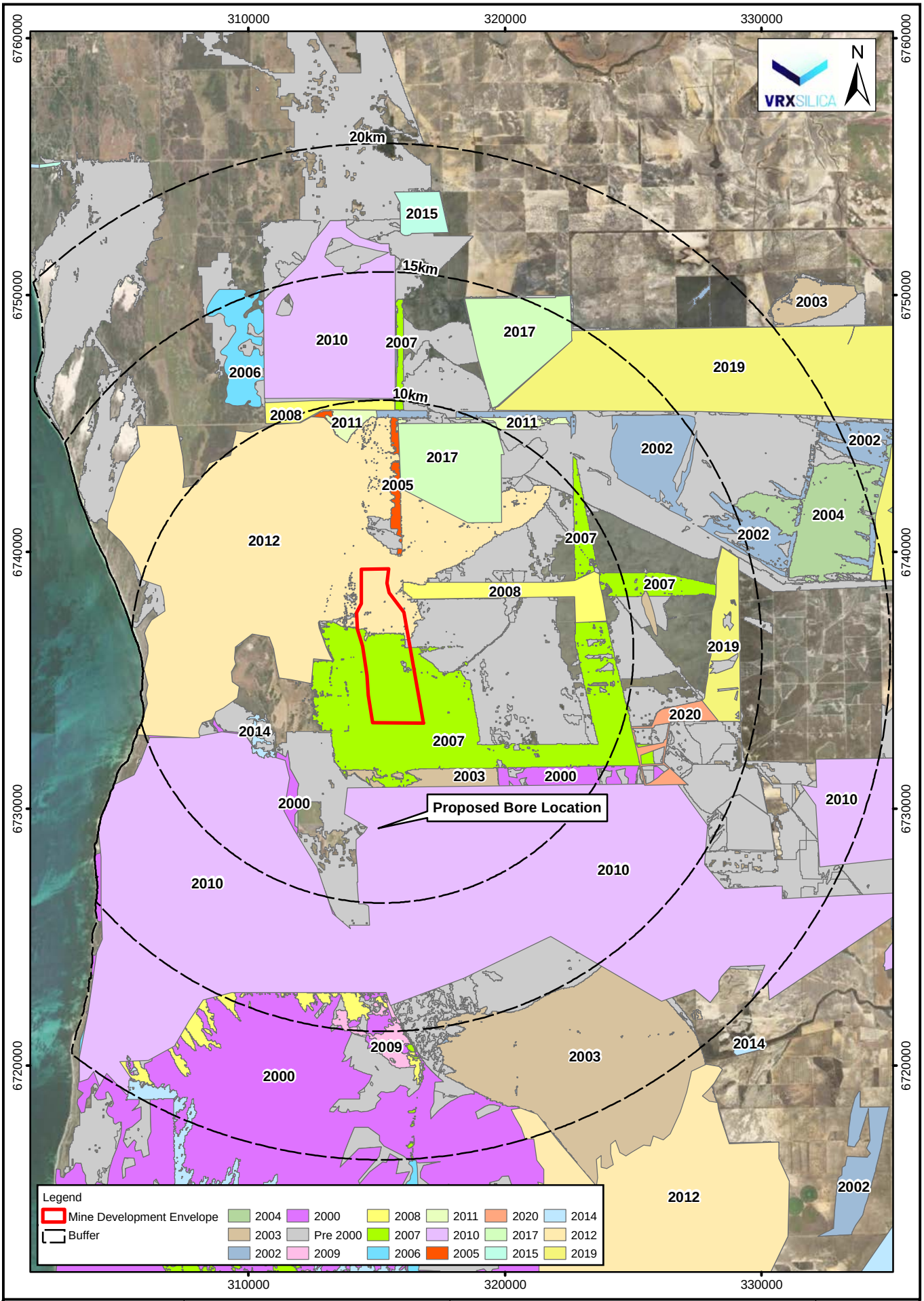
Arrowsmith North Project
Vegetation condition and Bore Location

Figure: 9



Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS, Fire History: DBCA (10/2/2021)

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Arrowsmith North Project
Extent of bushfires

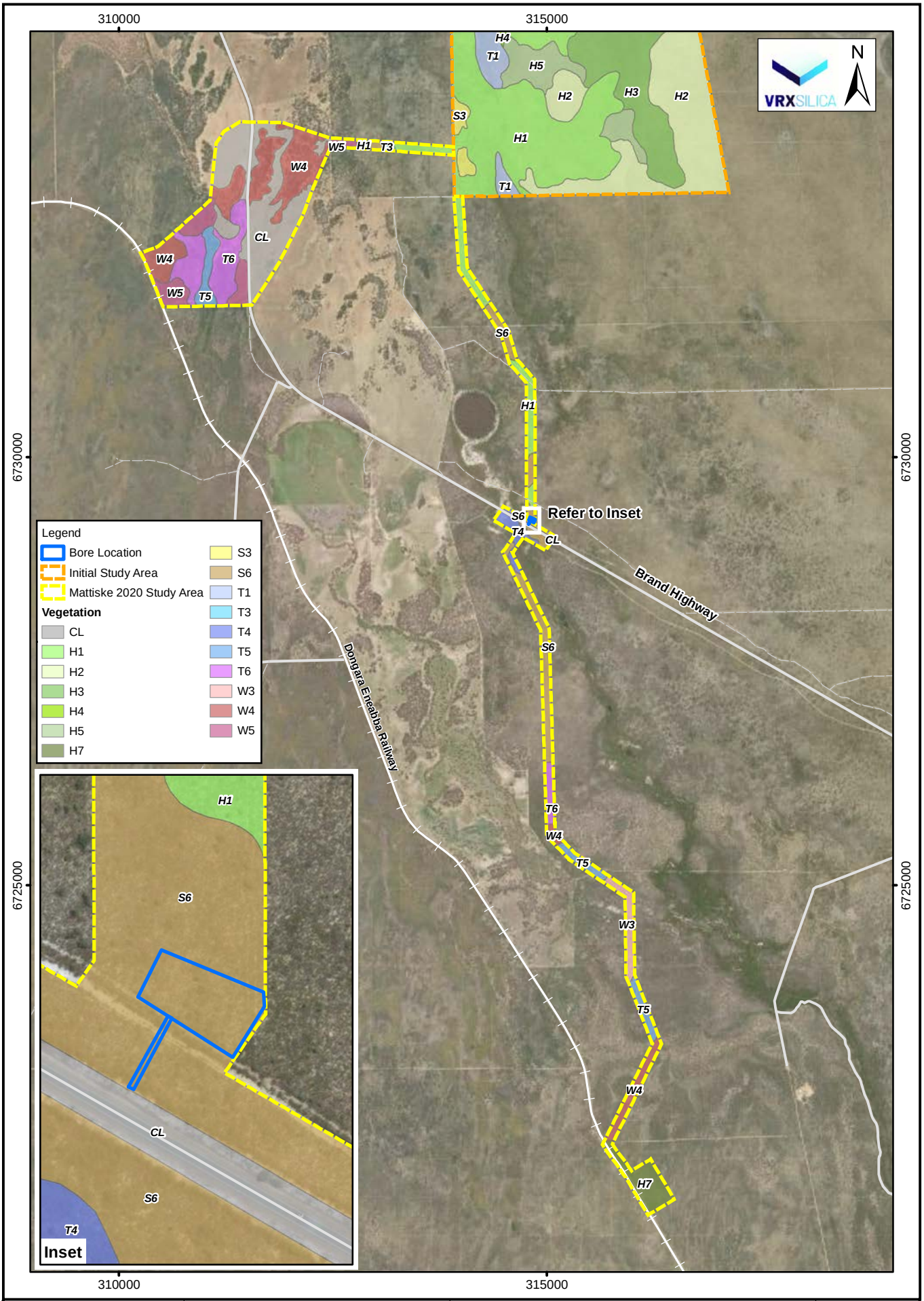
Figure: 10

Vegetation Communities

Ten vegetation communities were defined and mapped across the Survey Area. Survey quadrat physical data and aerial photographic maps were used to delineate the boundaries of the vegetation communities. The vegetation communities of the Survey Area, mapped by Mattiske (2021), are presented in Figure 11. Vegetation community descriptions and their extent within the survey areas is presented in detail in Mattiske (2021; Appendix 1). The Bore Location only intersects with the S6 vegetation community described in Table 4.

Table 4: Vegetation community within the Bore Location

Name	Vegetation Community Description	Extent of Survey Area	
		ha	%
S6	Open shrubland of *Acacia blakelyi* and *Allocasuarina campestris*, over *Ecdeiocolea monostachya, Jacksonia hakeoides* and *Lepidobolus preissianus* on cream/grey sand on flats to lower slopes.	42.634	27.10



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Arrowsmith North Project
Vegetation communities and Bore Location

Figure: 11

4.4.5 Significant Vegetation Communities

No Threatened Ecological Communities (TECs), pursuant to Part 2, Division 1, Subdivision 1 of the BC Act and as listed by the DBCA (2018) or DAWE (2020), or Priority Ecological Communities (PECs) as listed by DBCA (2020) were recorded within the survey areas.

None of the vegetation communities recorded within the Bore Location were considered locally or regionally unique and all are well represented in the wider area (Mattiske, 2021).

4.4.6 Dieback Assessment

Assessments have been conducted by Glevan Consulting Pty Ltd within and surrounding the Mine Development Envelope of the Proposal since 2006. In that period, 56 sites displaying suspicious deaths have been sampled to determine if Phytophthora was the cause of the vegetation decline. Twenty-six sites have shown the presence of *P. arenaria*; no other Phytophthora species have been recorded. Significantly, *P. cinnamomi* has not been recovered from the greater area. Due to the period and repetition of assessments in the area, and the spatial distribution of *Phytophthora* recoveries, it is considered highly unlikely that *P. cinnamomi* will present in the undisturbed vegetation.

4.5 Fauna

4.5.1 Survey Effort

A Level 1 fauna assessment and targeted surveys for significant fauna were conducted by BCE in November 2018, September 2019 and October 2019 in the Survey Area. All information contained within the following sections is from BCE (2021) unless otherwise referenced.

4.5.2 Fauna Habitat

General Fauna

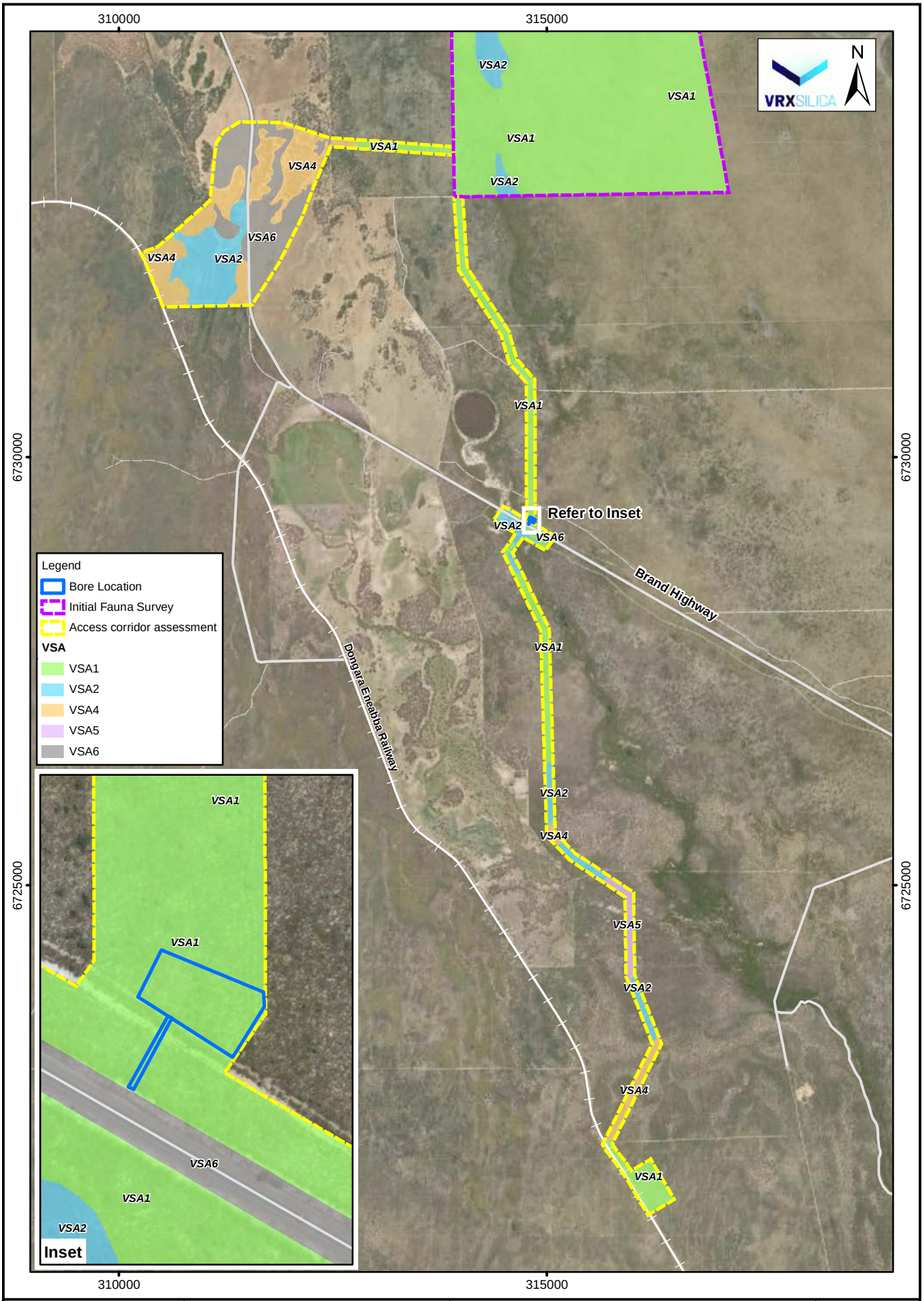
The Survey Area reflects major components of the Lesueur Sandplain Subregion. They provide habitat values for species which utilise low dense shrubland and open woodland. There are several narrow natural drainage lines in some low-lying areas (excluded from the development envelopes of the Proposal) which may provide a limited amount of habitat for wetland species. These may be taken advantage of by wetland species visiting several wetland features in the surrounding landscape such as the system to the east and lakes to the south. It is unlikely that the drainage systems and wetlands in the Survey Area are ever directly linked to Ejarno Spring, or to the Arrowsmith River system to the south.

Vegetation and Substrate Associations (VSAs) combine broad vegetation types, the soils or other substrates with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. Five VSAs were identified in the Survey Area during the field survey; their locations are shown in Figure 12. The descriptions and extents of the VSAs within the Survey Area are detailed in BCE (2021; Appendix 2).

Only one of the three VSA's was identified in the Bore Location (VSA1; Figure 12).

Table 5: VSA within the Bore Location

VSA	Description	Extent within the Survey Area (ha)
VSA1 Kwongan Heath	 Low, dense, proteaceous/myrtaceous shrubland on yellow and pale sands. This VSA contained several *Banksia* species that were in flower during September 2019. Occurs across majority of the project area and varies with landscape position from high to low on stabilised dunes. Vegetation types H1, H2, H3, H4, H5, S3 and S6(Mattiske, 2021) Occurs across majority of the Survey Area and varies with landscape position from high to low on stabilised dunes. Occurs along the eastern end of the western corridor and along much of the southern corridor.	1,254



Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS

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Date: October 2021 | Rev: A | A4

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Arrowsmith North Project
VSAs and Bore Location

Figure: 12

4.5.3 General Fauna

The desktop survey (BCE, 2021) identified 209 vertebrate fauna species as potentially occurring in the survey areas including ten frogs, 50 reptiles, 122 birds and 24 mammals. The assemblage includes 14 listed vertebrate species, these species discussed further in Section 4.4.5. It is expected that at least 13 mammals and one bird identified in the desktop survey have become locally extinct.

4.5.4 Significant Fauna

For the purposes of this assessment the term 'significant fauna' refers to fauna listed under the EPBC Act or BC Act, DBCA Priority Fauna, or species that have declined extensively across the region, and some species that occur at the edge of their range. The potential fauna assemblage of the Survey Area includes 15 significant fauna species (Table 6). BCE (2021) contains a description of each of these species.

Table 6: Significant fauna potentially occurring within the Survey Area

Species	Conservation listing	Presence within Survey Area	Expected Status
Invertebrates			
Millipede (*Antichiropus* Eneabba 1)*	Locally Significant	Unconfirmed	Uncertain Records within 12 km of the survey area
Bothriembryontid Land Snail (*Bothriembryon perobesus*)	P1	Unconfirmed	Uncertain Records within 50 km of survey area
Kwongan Heath Shield-Backed Trapdoor Spider (*Idiosoma kwongan*)	P1	Unconfirmed	Uncertain Records within 12 km of survey area
Springtime Corroboree Stick Katydid (Eneabba) (*Phasmodes jeeba)*	P3	Unconfirmed	Uncertain Records within 50 km of survey area
Thorny Bush Katydid (Moora) (*Hemisaga vepreculae*)	P2	Unconfirmed	Resident
Woollybush Bee (*Hylaeus globuliferus*)	P3	Unconfirmed	Resident
Reptiles			
Carpet Python (*Morelia spilota imbricate*)	Locally Significant	Unconfirmed	Resident
Black-striped Snake (*Neelaps calonotos*)	P3	Confirmed	Resident
Birds			
Malleefowl (*Leipoa ocellata*)	V, S3	Unconfirmed	Irregular visitor
Fork-Tailed Swift (*Apus pacificus*)	M, S5	Unconfirmed	Regular migrant
Peregrine Falcon (*Falco peregrinus*)	S7	Unconfirmed	Irregular visitor
Rainbow Bee-eater (*Merops ornatus*)	Locally Significant	Confirmed	Regular migrant
Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)	E, S2	Confirmed	Regular migrant
Rufous Fieldwren (*Calamanthus campestris*)	Locally Significant	Unconfirmed	Resident

Species	Conservation listing	Presence within Survey Area	Expected Status
Shy Heathwren (*Calamanthus cautus*)	Locally Significant	Unconfirmed	Irregular visitor
White-browed Babbler (*Pomatostomus superciliosus*)	Locally Significant	Unconfirmed	Irregular visitor
Mammals			
Brush Wallaby (*Notamacropus Irma*)	P4	Confirmed	Resident
Rakali (*Hydromys chrysogaster*)	P4	Unconfirmed	Irregular visitor

*EPBC Act listed species: V = Vulnerable, E = Endangered, C = Critically Endangered, M = Migratory. BC Act listed species: S1 – S7 = Schedule 1 - 7; DBCA Priority Species: P1 - P5 = Priority 1 - 5. * SRE*

Carnaby's Black-Cockatoo

One species of Black-Cockatoo of conservation significance has been confirmed in the general area, Carnaby's Black-Cockatoo. The other two significant black-cockatoos in the South-West, Baudin's and the Forest Red-tailed, do not occur on the northern Swan Coastal Plain. Carnaby's Black-Cockatoo may forage on proteaceous and myrtaceous vegetation in the survey areas and roost in large trees near water courses. Foraging and roosting by Carnaby's Black-Cockatoos has been confirmed adjacent to the survey areas and is discussed below. Locations of foraging signs and sightings of Carnaby's Black-Cockatoo collected in September 2019 are shown in Figure 13. Breeding nearby is also a possibility.

Breeding habitat

The survey areas are unlikely to support breeding by Carnaby's Black-Cockatoos due to a lack of suitable nesting sites (no large trees of sufficient size to provide nesting hollows). However, there are large trees (River Gums) along the drainage system to the east of the Survey Area, and it is possible these are suitable for roosting and could contain hollows of suitable size for nesting by the Black-Cockatoos.

Roosting habitat

Two Carnaby's Black-Cockatoo roost sites have been confirmed within proximity of the Survey Area. While there are no large trees suitable for roosting within the survey area, there are large trees nearby, particularly along drainage lines that may be suitable. The presence of the roosts 10 km south and 13 km north to the south means that the survey areas may regularly be visited by foraging Carnaby's Black-Cockatoos.

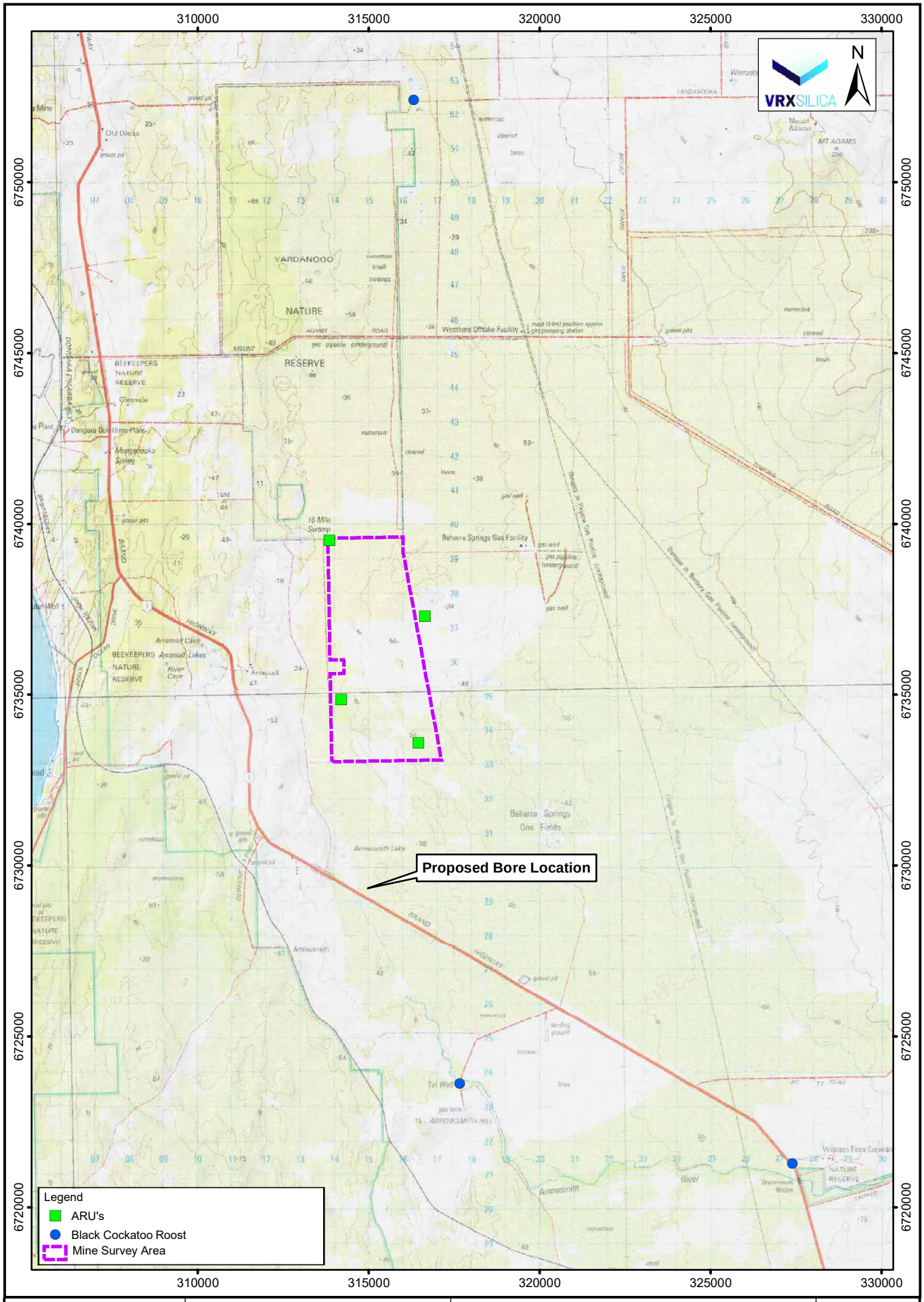
A search of the wider landscape for suitable roosting and breeding trees was conducted in September 2019. This identified several locations with trees of possibly suitable stature along the Arrowsmith River and around wetlands to the south and east of the project area, although the trees themselves were not inspected.

Foraging habitat

Banksias, hakeas, eucalypt trees, acacias and Woody Pears (*Xylomelum*) provide foraging habitat for Carnaby's Black-Cockatoos, Acacias and Banksias in particular are widespread throughout the survey areas. Furthermore, a large number of scattered and chewed Banksia inflorescences consistent with Carnaby's were found across the Survey Area in September 2019. Two flocks (one

of 50 individuals) were also spotted flying over the Survey Area in the mid-afternoon during the September 2019 survey. Flocks have occasionally been recorded in the general area, foraging in Kwongan heath and Banksia low woodland, including approximately 500 individuals north of Yardanogo Nature Reserve (April 2015; Bamford *et al.* 2015) and flocks of over 300 individuals near the Arrowsmith River west of Brand Highway (Bamford and Chuk 2015-2017).

BCE (2021) assigned a foraging value score to the VSAs in the survey areas for Carnaby's Black-Cockatoo. The Kwongan heath (VSA1) present within the Bore Location has the highest foraging value for the species (7 out of 10). This is on the basis of having high proportions of key food plants, notably Banksias.



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MGA94 (Zone 50)

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Arrowsmith North Project
Carnaby's Black-Cockatoo foraging signs and sightings

Figure: 13

4.6 Surface Water Drainage

4.6.1 Regional

At a regional scale, surface water drains west and to the sea, notably in a dryland Arrowsmith River, and into Arrowsmith Lake. The Bore Location lies within a low, slightly undulating sandplain landscape with maximum terrain slopes in the order of 4%. The land elevations over the Survey Area vary from about 30 - 50 m RL.

The Bore Location is not subject to external concentrated flows from water courses or creeks due to it having a higher elevation than the surrounding terrain, and the high infiltration rate of the sandy landscape around the area. Similarly, runoff from the area is limited by the sandy substrate. Due to the high infiltration characteristics of the sandy soils and lack of water courses in the area, runoff, within and from the site, has low potential and is only anticipated to occur in short intense rain bursts.

4.6.2 Local

The closest significant surface water features are the Arrowsmith River, approximately 300 m south of the Bore Location, and Arrowsmith Lake which lies approximately 1 km north-west of the Bore Location.

The Arrowsmith River traverses the landscape westward from the small town of Arrino for approximately 85 km then heads north for 10 km before splitting into two arms, one of which terminates at Arrowsmith Lake, the other continues in a north westerly direction. This arm is ephemeral and is likely to only flow in extreme rain events such as when Arrowsmith Lake overflows. Arrowsmith Lake is a permanent pool approximately 850 m long and 30 ha in size. Arrowsmith Lake is one of the few permanent water bodies in the wider area, but has no recreational use.

4.7 Current Land Use

The dominant land use within the Lesueur Sandplain subregion is dry-land agriculture (69.34%), with lesser areas of conservation and unallocated crown land and crown reserves (Desmond & Chant, 2001).

The Bore Location lies within the Yamitji Nation native title determination. The Yamitji Nation is comprised of the Traditional Owner groups; Yamatji Nation, Hutt River, Southern Yamatji and Widi Mob native title claims and a portion of the Mullewa Wadjari native title claim. The Traditional Owners, who broadly identify as being Yamatji people, continue to hunt in the region, as well as practice their traditional culture, such as performing ceremonies and paying respects to ancestral spirits (Horizon Heritage, 2021).

The underlying tenure of the Bore Location includes Unallocated Crown Land and the Brand Highway Road reserve, the current land use is Leases and Licences issued under the *Mining Act 1978*. The Bore Location intersects land that is designated as File Notation Area (FNA) 1453. The FNA defines the Yamatji Nation Indigenous Land Use Agreement Area (formerly the Geraldton

Alternative Settlement Agreement). All leases held by VRX that intersect this FNA will be compatible with the proposed land use.

5 STAKEHOLDER CONSULTATION

Stakeholder consultation specific to the Bore has not been undertaken however, extensive consultation has been undertaken for the broader Proposal. The development of the Alternative Bore occurs entirely within the Proposal development envelopes and the proposed activities for the Bore comprise investigations for the Proposal therefore, VRX considers the stakeholder consultation undertaken for the Proposal is relevant for the development of the Alternative Bore. The stakeholder consultation conducted for the Proposal is summarised in the Proposal's EPA Referral Supplementary Report found at https://www.epa.wa.gov.au/proposals/arrowsmith-north-silica-sand-project.

6 ASSESSMENT OF CLEARING AGAINST THE TEN CLEARING PRINCIPLES

The proposed vegetation clearing has been assessed against the ten clearing principles described within *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER, 2014). The assessment is summarised in Table 7.

Table 7: Assessment of proposed vegetation clearing against the ten clearing principles.

Relevant information	Assessment of potential impacts	Proposed control measures	Outcome - Assessment of variance with clearing principle
1. Native vegetation should not be cleared if it comprises a high level of biological diversity			
The Bore Location and surrounding environment has been subject to numerous desktop, and field flora and vegetation surveys. No Threatened or Priority Flora were recorded in the Bore Location. The Bore Location is comprised entirely of VSA1 fauna habitat which represents high value foraging habitat for the threatened Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*). No suitable Carnaby's Black-Cockatoo breeding or roosting habitat was recorded within the Bore Location or broader Survey Area. Malleefowl (*Leiopa ocellata*) was identified as potentially occurring within the Survey Area, however no sightings or evidence of its presence was observed during VRXs exploration activities, Aboriginal Heritage, fauna or flora and vegetation surveys (including foot traverses and targeted surveys).	No clearing of any known locations of Threatened or Priority flora will occur as a result of the development of the Alternative Bore. The proposed clearing will result in the removal of 0.25 ha of native vegetation, a portion of which will be rehabilitated once installation of the Bore is complete. The extent of clearing of native vegetation is limited to 0.25 ha which represents: • 0.073% of all native vegetation within the Survey Area • Less than 0.24% of VSA1 extent within the Survey Area; and • 0.56% of the S6 vegetation community within the Survey Area.	The Bore Location has been located adjacent to the proposed access track for the Proposal to minimise the extent of additional clearing required to develop the Proposal. To minimise the impact of the clearing on the environment, VRX proposes the following control measures: • The extent of vegetation clearance is limited to 0.25 ha; • Clearing will be done with a tractor mounted mulcher set at 300mm height above the ground, there will be minimal disturbance of topsoil; • Disturbed areas not required for operations or further investigations will be rehabilitated once installation of the Bore is complete; • The extent of vegetation clearing will be managed through Programme of Works approvals under the *Mining Act 1978*, and internal ground disturbance procedures; • The Bore Location will be identified using GPS coordinates and demarcated using tape and pickets; • Mapped boundaries will be provided to the front end loader operator to restrict clearing to within the Bore Location only; • All rubbish will be managed appropriately and taken off site for disposal; • Materials used for demarcation will be removed once the Bore construction is complete; • Access to the Bore Location will be via Brand Highway or existing tracks only; and • All vehicles, equipment and personnel will be inspected and cleaned as required to prevent the incidental spread of weeds and dieback.	Development of the Bore will include clearing of native vegetation known as Kwongan Heath and occurs within the Geraldton Sand Plains Bioregion which is known for its high level of biological diversity hence the proposed clearing may be at variance with this principle. The area of impact is however small (<0.25 ha) and represents only a small percentage of the available habitat in the local area.
2. Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA			
The Bore Location is comprised entirely of VSA1 which represents high value foraging habitat for the threatened Carnaby's Black-Cockatoo. No Carnaby's Black-Cockatoo breeding or roosting habitat was recorded within the Bore Location. Malleefowl were identified as potentially occurring within the Survey Area however, no sightings or evidence of its presence was observed during VRXs exploration activities, Aboriginal Heritage, fauna and flora and vegetation surveys (including foot traverses and targeted surveys). Three invertebrate species that are or may be of conservation significance with the potential to occur within the Survey Area, these species include: • A Bothriembryontid Land Snail (*Bothriembryon perobesus*); • Woollybush Bee (*Hylaeus globuliferus*); and • Kwongan Heath Shield-Backed Trapdoor Spider (*Idiosoma kwongan*). No conservation significant invertebrates were recorded within the Survey Area.	Any fauna encountered during the development of the Bore are expected to be able to be completely avoided (refer to control measures). The conservation significant fauna species relevant to the Bore Location include: • Carnaby's-Black Cockatoo (*Calyptorhynchus latirostris* - listed as Endangered under the EPBC and BC Act); and • Malleefowl (*Leiopa ocellata* - listed as vulnerable under the EPBC Act and BC Act); The proposed clearing will result in the removal of 0.25 ha of VSA1 representative of high value Carnaby's Black-Cockatoo foraging habitat (less than 0.01% of the extent of VSA1 within the Survey Area). A portion of this area will be rehabilitated once installation of the Bore is complete. The proposed clearing will include a very small part of a significant fauna habitat. The proposed clearing will not prevent access to an area necessary for maintaining a significant fauna habitat.	Implement measures described above. Any fauna injuries or fatalities will be reported to the VRX environment team.	The proposed clearing may be at variance with this principle however the area of impact is small (<0.25 ha) and represents only a small percentage of the available habitat in the local area.
3. Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora			
The Bore Location and surrounding environment has been subject to numerous desktop, and field flora and vegetation surveys. No Threatened or Priority flora were recorded in the Bore Location.	No clearing of any known locations of Threatened or Priority flora will occur as a result of the development of the Alternative Bore.	Implement control measures described above.	The proposed clearing does not include any known records of Threatened or Priority Flora therefore it is

Relevant information	Assessment of potential impacts	Proposed control measures	Outcome - Assessment of variance with clearing principle
	The proposed clearing will result in the removal of 0.25 ha of native vegetation, which forms habitat for several Priority Flora species. The extent of clearing of native vegetation is limited to 0.25 ha which represents: • 0.073% of all native vegetation within the Survey Area • Less than 0.24% of the VSA1 within the Survey Area; and • 0.56% of the S6 vegetation community within the Survey Area.		not at variance with this principle.
4. Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a TEC			
No TEC's or PEC's were recorded in the Survey Area. The Bore Location is not necessary for the maintenance of a TEC or PEC.	Not Applicable	Not Applicable	The proposed clearing is not at variance with this principle.
5. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared			
The vegetation within the Bore Location lies within a much broader area of native vegetation. 88.14% of the Survey Area and 90.45% of the area within 10 km of the Mine Development Envelope is mapped as remnant native vegetation. 27% of the Survey Area is mapped as the S6 Vegetation Community. No other proposals are located in close proximity to the Proposal, however local vegetation has been impacted by agriculture, the resource industry and road infrastructure.	The proposed clearing will result in removal of 0.25 ha of remnant native vegetation within the Bore Location. The proposed clearing represents a loss of 0.019% of the remnant native vegetation within the Survey Area or a loss of <0.001% of the remnant native vegetation within 10 km of the Mine Development Envelope. The proposed clearing will result in a loss of 0.58% the S6 Vegetation Community mapped within the Survey Area.	Implement the control measures listed above.	The proposed clearing is unlikely to be at variance with this principle.
6. Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland			
The Bore Location occurs within the Arrowsmith Hydrological Zone and is not in a proclaimed surface water area. No wetlands are contained within or are in close proximity to the Bore Location.	Not Applicable	Not Applicable	The proposed clearing is not at variance with this principle
7. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation			
The vegetation within the Bore Location lies within a much broader area of native vegetation. The northern extent of the Survey Area was subject to bushfire in 2012 and the southern extent in 2007. Vegetation surrounding the Survey Area has been impacted by agriculture, the resource industry and road infrastructure. The condition of vegetation within the Survey Area ranges from Pristine to Excellent, with the majority of the area considered Pristine according to the Keighery (1994) scale. The condition of the vegetation within the Bore Location is mapped as Pristine.	The proposed clearing is only 0.25 ha within a broader uncleared landscape and does not include any activities that would lead to appreciable land degradation	Implement the control measures listed above.	The proposed clearing is unlikely to be at variance with this principle.
8. Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area			
The Bore Location does not occur within or adjacent to any conservation areas	Not Applicable	Not Applicable	The proposed clearing is not at variance with this principle.
9. Native vegetation should not be cleared if the clearing is likely to cause deterioration in the quality of surface or underground water			
The Bore Location occurs within the Arrowsmith Hydrological Zone and is not in a proclaimed surface water area. No wetlands lie within or are in close proximity to the Bore Location.	The proposed clearing is only 0.25 ha within a broader uncleared landscape and the clearing is not expected to cause deterioration in the quality of surface or underground water.	Implement the control measures listed above.	The proposed clearing is unlikely to be at variance with this principle.
10. Native vegetation should not be cleared if the clearing is likely to cause, or exacerbate, the incidence or intensity of flooding			
The soils of the Bore Location are characterised has having a high infiltration rate that is slightly reduced by a humus surface layer. If surface runoff is generated, it is anticipated that it will infiltrate the sandplain relatively quickly. Runoff from the site is only anticipated in short intense rain bursts (RPS, 2020).	The proposed vegetation clearing is not expected to cause, or exacerbate, the incidence or intensity of flooding within the Bore Location or surrounding landscape.	Implement the control measures listed above.	The proposed clearing is unlikely to be at variance with this principle.

7 SUMMARY AND CONCLUSIONS

The purpose of this NVCP Application is to allow the clearing of up to 0.25 ha of native vegetation within the Bore Location to enable VRX to construct and operate the Bore described in Section 3.

The following key points are noted:

- Minimal vegetation clearing is proposed with only 0.25 ha of vegetation clearing within the Bore Location;
    - Clearing will be completed by a tractor mounted mulcher set at 300mm height above the ground, there will be minimal disturbance of topsoil;
- The area within and surrounding the Bore Location has been extensively surveyed for the Proposal, and the results of these surveys have been used to assess the impacts of the development of the Alternative Bore;
- The proposed clearing will not result in significant impacts to the following:
    - Significant Flora;
    - Threatened or Priority Ecological Communities;
    - Wetlands / surface water;
    - Remnant vegetation;
    - Land that has been subject to considerable degradation;
    - Groundwater; or
    - Conservation areas.

In summary, VRX has undergone extensive planning to identify control measures that will minimise the impacts of the clearing on the environment. These control measures include the following:

- The extent of vegetation clearance is limited to 0.25 ha;
- Clearing will be completed by a tractor mounted mulcher set at 300mm height above the ground, there will be minimal disturbance of topsoil;
- The extent of vegetation clearing will be managed through internal ground disturbance procedures;
- The Bore Location will be identified using GPS coordinates and demarcated using tape and pickets;
- Mapped boundaries will be provided to the Mulcher operator to restrict clearing to within the Bore Location only;
- All rubbish will be managed appropriately and taken off site for disposal;
- Materials used for demarcation will be removed once construction is complete;
- Access to the Bore Location will be via existing tracks only;
- All vehicles, equipment and personnel will be inspected and cleaned as required to prevent the incidental spread of weeds and dieback; and
- Any fauna injuries or fatalities will be reported to the VRX environment team.

This NVCP application assessed the proposed vegetation clearing against the ten clearing principles described in *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER, 2014). The clearing may be at variance with two of the principles and is unlikely to be at variance with eight of the principles.

8 GLOSSARY

Term	Meaning
BC Act	Biodiversity Conservation Act 2016 (WA)
BCE	Bamford Consulting Ecologists
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DPIRD	Department of Primary Industries and Regional Development
EPA	Environmental Protection Authority (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FNA	File Notation Area
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
Mattiske	Mattiske Consulting Pty Ltd
m	Metres
NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Communities – plant communities listed as being potentially threatened under the Biodiversity Conservation Act 2016
Proposal	Arrowsmith North Silica Sand Project
RL	Reduced Level
RNE	Register of the National Estate
SRE	Short-range Endemic
Survey Area	Mine Survey Area
TEC	Threatened Ecological Community
Bore Location	Bore Location (Figure 2)
VDT	Vegetation Direct Transfer
VRX	VRX Silica Limited
VSA	Vegetation and Substrate Association
WA	Western Australia
WAH	Western Australian Herbarium
WONS	Weeds of National Significance

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APPENDIX 1

Vegetation Community Descriptions (Mattiske, 2021)

Name	Vegetation Community Description	Survey Area (ha)	% of Survey Area
H1	Open Heath to Closed Heath of *Hakea polyanthema, Calothamnus blepharospermus, Conospermum triplinervium, Petrophile macrostachya* and *Melaleuca leuropoma* with emergent *Banksia attenuata* over *Acanthocarpus preissii* and *Ecdeiocolea monostachya* on cream and white surface sands.	284.70	16.48
H2	Open Heath to Closed Heath of *Banksia hookeriana, Banksia attenuata* with occasional *Banksia menziesii* over *Melaleuca leuropoma, Eremaea beaufortioides* var. *beaufortioides, Scholtzia laxiflora, Conospermum triplinervium, Eremaea violacea* subsp. *violacea* over *Mesomelaena pseudostygia* on white sands on plains.	314.13	18.19
H3	Open Heath of *Melaleuca leuropoma, Leptospermum oligandrum, Hakea polyanthema, Conospermum triplinervium, Beaufortia elegans* and *Pileanthus filifolius*, with isolated trees of *Banksia attenuata* and *Xylomelum angustifolium* over *Mesomelaena pseudostygia* and *Ecdeiocolea monostachya* on cream/grey sand on plains.	258.15	14.95
H4	Open Heath of *Conospermum triplinervium, Banksia attenuata, Banksia hookeriana, Melaleuca leuropoma, Daviesia divaricata subsp. divaricata* and *Eremaea beaufortioides* var. *beaufortioides* over *Mesomelaena pseudostygia* and *Dampiera spicigera* on yellow-cream/white sand on flats.	518.10	30.00
H5	Open Heath to Closed Heath of *Banksia shuttleworthiana, Banksia attenuata* with occasional *Banksia menziesii over Melaleuca leuropoma, Eremaea beaufortioides* var. *beaufortioides, Conospermum triplinervium, Scholtzia laxiflora and Verticordia grandis* over *Mesomelaena pseudostygia, Ecdeiocolea monostachya* and *Lepidobolus preissianus subsp. preissianus* on pale yellow sandy flats.	112.44	6.51
S3	Scrub of *Banksia attenuata, Banksia leptophylla var. melletica, Hakea polyanthema* and *Melaleuca leuropoma* over *Scholtzia laxiflora, Petrophila macrostachya, Petrophile drummondii, Allocasuarina humilis, Hakea costata* and *Acacia spathulifolia over Scaevola repens* subsp. Northern Sandplains (R.J. Cranfield & P.J. Spencer 8445) and *Mesomelaena pseudostygia* on white-yellow sand on flats and slopes.	24.76	1.43
T1	Thicket to Scrub of *Allocasuarina campestris*, *Grevillea leucopteris, Guichenotia ledifolia, Acacia lineolata, Calothamnus quadrifidus subsp. quadrifidus* with occasional *Eucalyptus todtiana* and *Banksia attenuata* over *Dianella revoluta* and *Ecdeiocolea monostachya* on grey/cream/orange/red sand on flats and slopes.	119.46	6.92
W2	Low Open Woodland of *Banksia attenuata* and *Banksia menziesii* over open shrubland of *Melaleuca leuropoma, Eremaea beaufortioides var. beaufortioides, Daviesia triflora, Styphelia xerophylla, Pileanthus filifolius* and *Stirlingia latifolia* over *Alexgeorgea nitens, Lyginia imberbis* and *Stylidium crossocephalum* on cream to white sands on plains.	95.39	5.52
Total		**1,727.14**	**100**

APPENDIX 2

Vegetation Substrate Associations (BCE, 2020)

VSA	Description	Extent within the Survey Area (ha)
VSA1 Kwongan Heath	 Low, dense, proteaceous/myrtaceous shrubland on yellow and pale sands. This VSA contained several *Banksia* species that were in flower during September 2019. Occurs across majority of the project area and varies with landscape position from high to low on stabilised dunes. Vegetation types H1, H2, H3, H4, H5, H7, S3 and S6 (Mattiske, 2021) Occurs across majority of the Mine Survey Area and varies with landscape position from high to low on stabilised dunes. Occurs along the eastern end of the western corridor and along much of the southern corridor.	105.1

VSA	Description	Extent within the Survey Area (ha)
VSA2 Dense Riparian Thickets (and seasonal watercourse and swamps)	 Dense thickets mostly of Acacia, in some areas Allocasuarina campestris, growing on peaty-sand low in the landscape but extending onto slopes. These thickets are limited in the survey area to a small drainage line in the west, but are extensive along the southern transport corridor where this passes close to and across the Arrowsmith River. There are large wetlands lying east (outside) of the survey area that include tall woodland of eucalypts. While outside the project area, they may be relevant to some fauna using the survey area. There is also a wetland (Arrowsmith Lake) just west of the southern option of the Access and Processing corridor. This contained water at the time of the September 2019 site inspection. Occurs in the west of the western corridor, near damplands, and along the southern corridor where this crosses damplands and the upper reaches of the Arrowsmith River. Vegetation types T1, T3, T4, T5 and T6 (Mattiske, 2021).	93
VSA 4 Low Woodland	 Low woodland of *Eucalyptus erythrocorys* over shrubs on sand with outcropping limestone, generally high in the landscape. Extensive in the western corridor and present in the south of the southern corridor. Vegetation types W4 and W5 (Mattiske, 2021).	130.2

VSA	Description	Extent within the Survey Area (ha)
VSA 5 Open Mallee	 Open mallee of Eucalyptus drummondii over shrubs on loam-clay flats low in the landscape. Vegetation type W3 (Mattiske, 2021). Occurs only in one section of the southern corridor.	13.3
VSA 6 Cleared Land	This is primarily land cleared for agriculture on the western corridor but includes some small, cleared areas where the southern corridor crosses the Brand Highway. Vegetation type CL (Mattiske, 2021).	106.6