



**Cardinia Project, Kyte and Lewis
Phase 4 Deposits**

**Native Vegetation
Clearing Permit
(Purpose):
Supporting
Documentation**

Prepared for
Navigator Mining Pty Ltd

June 2021

● people ● planet ● professional

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- Appendix G Western Botanical – Flora and Vegetation Assessment, Leonora Gold Project 2019**
- Appendix H Stantec – Flora and Fauna Extrapolation Exercise Report, Leonora Gold Project 2018b**
- Appendix I Stantec – Level 1 Flora, Vegetation and Fauna Assessment, Leonora Gold Project 2018c**
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- Appendix K Phoenix Environmental Services – Terrestrial Fauna Survey, Leonora Gold Project 2019**
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- Appendix Q Navigator Mining Pty Ltd ASIC Extract**
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1 Introduction

1.1 Background

360 Environmental Pty Ltd (360 Environmental) was commissioned by Navigator Mining Pty Ltd (Navigator) to prepare a Native Vegetation Clearing Permit (NVCP) (Purpose) application for clearing associated with the next stage of mining at the Cardinia Project (CP). Specifically, this NVCP application relates to the mining of the Kyte and Lewis Phase 4 (Lewis-4) pits, and associated infrastructure including but not limited to 50-person camp, new access road, construction supply water borefield, magazine and laydown areas ('the Site') (Figure 1). The Site is approximately 30 km east north east of Leonora and lies over the following tenements (Figure 2):

- Mining Area (pits, dumps, laydown areas) (Figure 3a):
 - M37/86
 - M37/88
 - M37/227
 - M37/277
 - M37/299
 - M37/300
 - M37/317
 - M37/422
 - M37/428
 - M37/594
 - M37/646
 - M37/1303
 - M37/1304
 - M37/1318
 - M37/1319
 - M37/1328
 - M37/1331
 - M37/1332
- Supporting Infrastructure (borefield, access road and adjacent camp) (Figure 3b):
 - L37/106
 - L37/127
 - L37/242
 - L37/243.

All tenements are held by Navigator Mining, a wholly owned subsidiary of Kin Mining NL (Appendices Q and R; note that Appendix numbering in this application matches the current Mining Proposal for Cardinia, numbering is not consecutive).

Note that some of the Mining tenements are in the process of being consolidated into a single tenement. Current access to site is via the western road, final access will be via the proposed eastern road (Figure 1).

Under Section 51C of the *Environmental Protection Act 1986* (EP Act), the clearing of any native vegetation requires an approved clearing permit, unless an exemption applies. Exemptions for mining generally apply to areas of low impact mining and exploration, or for proposals that have already been assessed by the Environmental Protection Authority (EPA), Department of Water, Environment and Regulation (DWER) or Department of Mines, Industry Regulation and Safety (DMIRS) through a separate process. Sufficient exemptions do not apply for vegetation within the Site; a clearing permit is therefore required.

The NVCP application is to clear up to 400.49 hectares (ha) of native vegetation within the Development Envelope of 4,332.29 ha (Figure 1 and Figure 3).

Note that the scope of the CP as described in the various survey reports is not the same as the current proposed scope of the Project. Some survey reports refer to the installation of a processing plant and additional mining areas that are not currently under consideration.

1.2 Purpose of Clearing Permit Application

The purpose of this NVCP supporting document is to present the results of an assessment of the clearing aspects of this proposal against the ten clearing principles as outlined in the (then) Departments of Environment Regulation (DER)'s *A guide to the assessment of applications to clear native vegetation* (2014) under Part V Division 2 of the EP Act. This report identifies the potential environmental impacts associated with the proposal based on the best available data. This report and accompanying NVCP Purpose Permit application form will be submitted to DMIRS for assessment.

1.3 Proposed Timeframe

Clearing is proposed to commence in Q3 2021 with mining likely to be completed in 2025.

1.4 Responsible Applicant

Navigator are responsible for the implementation of the clearing described within this report.

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2 Site Overview

2.1 Climate

The closest Bureau of Meteorology (BoM) weather station with a complete dataset is Leonora WA (012046), located approximately 27.5 km southwest of the Site (Department of the Environment and Energy, 1990)(Bureau of Meteorology, 2020).

The long-term minimum temperature for Leonora ranges from 6.1°C (July) to 21.8°C (January) and the long-term mean maximum temperature ranges from 18.4°C (July) to 37°C (January) (1957-2014) (Plate 1) (Bureau of Meteorology, 2020). The long-term annual average rainfall is 236.4 mm (1898-2020) (Bureau of Meteorology, 2020).

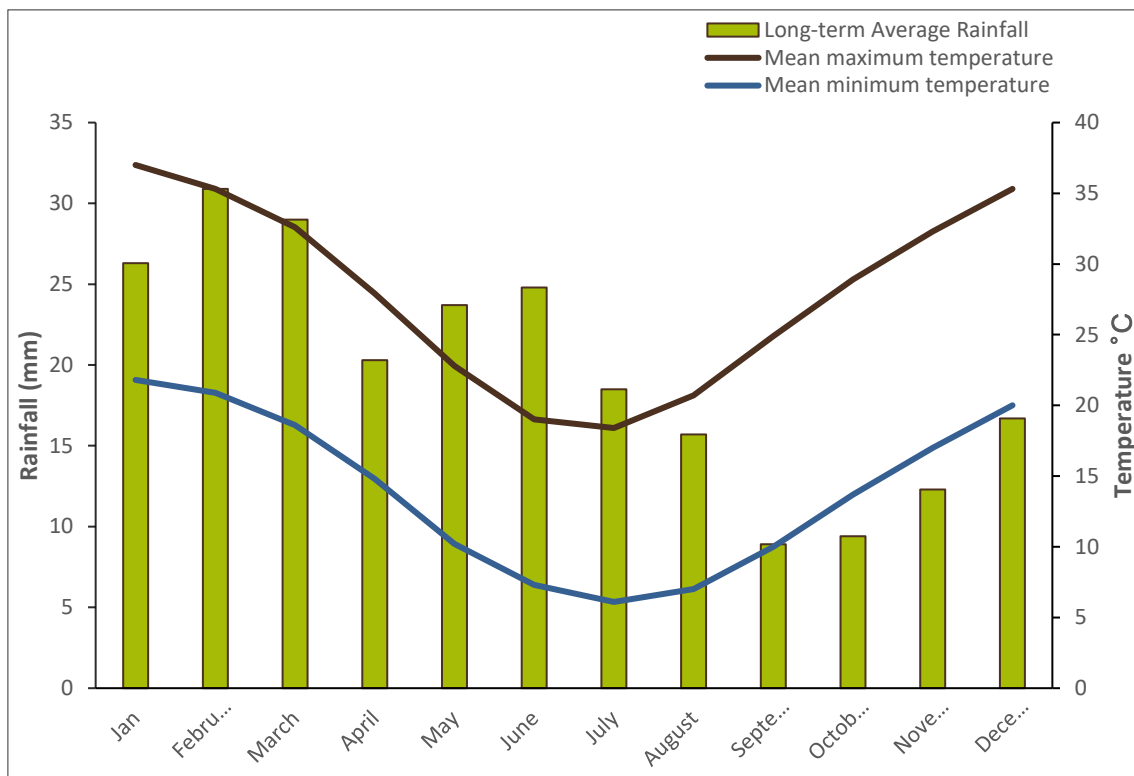


Plate 1: Long-term and Monthly total Rainfall, Maximum and Minimum Temperatures for Leonora (012046) (Bureau of Meteorology, 2020).

2.2 Topography

The topography of the Mining Area is quite flat, ranging from approximately 410 m Australian height Datum (AHD) to approximately 435 m AHD. The topographic lows are associated with Cardinia Creek, an ephemeral creek running through the Development Envelope.

The topography of the Supporting Infrastructure ranges from approximately 380 m AHD to 445 m AHD. The topographic lows are located at the southern ends of the existing and proposed access roads.

2.3 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical, and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Department of the Environment and Energy, 2016). The Site occurs within the Murchison bioregion and the Eastern Murchison subregion. The Eastern Murchison subregion is characterised by internal drainage, extensive areas of elevated red desert sandplains with minimal dune development (Department of Conservation and Land Management, 2002). The vegetation of the subregion is dominated by Mulga Woodlands which are often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrublands (Department of Conservation and Land Management, 2002).

2.4 Soil Landscape Systems

Soil landscapes and land system mapping of Western Australia describes broad soil and landscape characteristics from regional to local scales, and has been captured at scales ranging from 1:20,000 to 1:250,000 (Department of Primary Industries and Regional Development, 2019). The Mining Area and Supporting Infrastructure are located across several Soil Land Systems, as described below, and shown in Figure 4:

- Jundee System: hardpan plains with variable gravelly mantles and minor sandy banks supporting weakly grooved mulga bushes
- Nubev System: gently undulating stony plains, minor mylonitic low rises and drainage floors supporting mulga and halophytic shrublands
- Gundockerta System: extensive, gently undulating calcareous stony plains supporting bluebush shrublands
- Felix System: gently undulating plains with quartz mantles, supporting acacia-eremophila shrublands locally with wanderrie grasses
- Hootanui System: breakaways, hills and ridges with saline gravelly and stony lower plains supporting scattered halophytic low shrublands
- Tiger System: gravelly hardpan plains and sandy banks with mulga shrublands and wanderrie grasses
- Mindura System: low hills, ridges and outcrops of granite, gneiss and quartz above convex, quartz-strewn interfluvial and lower plains supporting sparse acacia shrublands becoming more dense in drainage floors
- Laverton System: greenstone hills and ridges with acacia shrublands
- Leonora System: low greenstone hills and stony plains supporting mixed chenopod shrublands (Department of Primary Industries and Regional Development, 2019). (Department of Primary Industries and Regional Development, 2019).

2.5 Hydrology

An existing surface water channel identified in the DWER dataset '*Hydrography Linear*' (Department of Water and Environmental Regulation, 2019) as Cardinia Creek is located on site (Figure 5). The creek is minor and non-perennial and flows in a northeast to southwest direction after heavy rainfall (Department of Water and Environmental Regulation, 2019). Lewis-4 pit will interact with water flows during flood events and engineering controls (diversions around the pit) are proposed (further detail is provided in the Mining Proposal). The proposed eastern access road intersects the watercourse and crossings have been designed by Lindsay Dynan Engineering Consultants (2019).

The Site is not located within any Surface Water Areas (DWER, 2020). The Water Register (DWER, 2020) indicates that the Site is located within the Goldfields Groundwater Area and within the Raeside Subarea.

2.6 Conservation Features

The Site is not located within any Environmentally Sensitive Areas (ESA) and there are no ESAs located within a 90 km radius of the Site (Department of Water and Environmental Regulation, 2018a). The site is not located within any DBCA Managed Lands (Department of Biodiversity Conservation and Attractions, 2019).

2.7 Flora and Vegetation

Flora and vegetation surveys have been undertaken by Navigator Mining over the period 2017 to 2019, including targeted survey work for the Priority 3 species *Acacia* sp. Marshall Pool (Western Botanical, 2019) (Appendix G). Prior to that, previous survey work had been completed by Mattiske (Mattiske Consulting Pty Ltd, 2002) and Outback Ecology (Navigator Resources Ltd, 2009). The following summary and the assessment against the clearing principles is based on the most recent work completed by Western Botanical (Western Botanical, 2019), supplemented by the 2017-2018 work by Stantec (Stantec, 2018a, 2018b, 2018c) (Appendices H, I and J). Western Botanical surveyed 13,924 ha around the mining areas at Lewis and Kyte, as well as the proposed access road. The survey was undertaken over two seasons (October 2018 and February 2019) with 17 days of active surveying (excluding mobilisation time). The combined Stantec Mining Area surveys covered 3,545 ha including the Lewis and Kyte areas and was undertaken over 17 days. The Stantec survey of the existing access road covered 267 ha over 5 days and included some areas to the north of the Mining Area (not currently proposed to be disturbed and outside of the scope of this application).

While both Western Botanical surveys were taken in periods of below average rainfall, when combined with the previous Stantec survey results (which returned a higher proportion of annual species) the overall dataset is considered to be robust.

2.7.1 Broad Vegetation Types

Mapping of pre-European broad vegetation within Western Australia was completed on a broad scale (1:1,000,000) by (Beard, 1976). These vegetation types were later re-assessed by Shepherd et. al (2002) with some larger vegetation units divided into smaller units. Together, this pre-European database contains a total of 819 vegetation types within Western Australia.

The Mining Area and Supporting Infrastructure is mapped within the Laverton 18 and the Laverton 39 broad vegetation types (Figure 6). Laverton 18 is described as low woodland, open low woodland or sparse woodland and Laverton 39 is described as open scrub or sparse scrub (Department of Primary Industries and Regional Development, 2018). The representation at a state, regional and local level is shown in Table 1.

Table 1: Broad Vegetation Types within the State, Regional and Local Representation (Government of Western Australia, 2019)

Vegetation Type	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	Current Extent Managed in DBCA Lands (%)
Representation across Western Australia				
Laverton 18	19,892,306.46	19,843,148.07	99.75	6.64
Laverton 39	6,613,567.47	6,602,578.43	99.83	12.04
Representation across the Murchison Bioregion				
Laverton 18	12,403,172.2	12,363,252.4748565	99.86	4.97
Laverton 39	1,148,400.30	1,138,064.62	99.10	3.59
Representation across the Eastern Murchison Subregion				
Laverton 18	10,269,896.44	10,234,838.22	99.66	5.14
Laverton 39	711,328.84	701,934.46	98.68	3.09
Representation across the Shire of Leonora				
Laverton 18	2,010,057.24	2,002,508.00	99.62	1.70
Laverton 39	252,141.34	245,994.55	97.56	-

2.7.2 Desktop Assessment

Results from database searches of the Department of Biodiversity, Conservation and Attractions (DBCA) WA Herbarium (WAHERB) Threatened and Priority Flora (TPFL), Priority and Threatened

Ecological Communities (PECs and TECs) were supplemented by data contained in Stantec¹ (2018a, 2018b, 2018c) and Western Botanical's knowledge of the area. The database results were used to generate a pre-survey assessment of the likelihood of presence of those species in the Survey Area. Western Botanical's desktop assessment used the Likelihood classifications shown in Table 2 to develop a likelihood of occurrence ranking for conservation significant flora known from the area. Table 3 represents the results of the likelihood assessment.

Western Botanical reports there are no vegetation related to PECs or TECs within the Survey Area.

Table 2: Likelihood of Occurrence

Likelihood	Description
Known to be present	Species is Known to be Present, has been verified within the Study Area though its entire distribution may not be mapped, and population numbers may be tentative at present.
Probable	Based on habitat preference of the species, similar habitats within or adjoining and contiguous with the Study Area, and geographical distribution of the species in close proximity to the Study Area, it is Probable that the species may occur within the Study Area.
Possible	Based on habitat preference of the species, similar habitats present within the Study Area and proximal geographical distribution of the species, it is Possible that the species may occur within the Study Area.
Unlikely	Based on habitat preference of the species, suitable habitats absent within the Study Area and distant geographical distribution of the species, it is Unlikely that the species may occur within the Study Area.

Table 3: Flora Likelihood Assessment

Species	DBCA*	Source	Preferred Habitat	Likelihood of Occurrence
<i>Acacia</i> sp. Marshall Pool (G. Cockerton 3024)	P3	WAHERB, Stantec, Western Botanical	Upper slopes of gabbro and basalt hills	Known to be present
<i>Eremophila annoscaulis</i>	P3	WAHERB	Stony hills and associated plains	Known to be present
<i>Gunniopsis propinqua</i>	P3	WAHERB, Stantec	Samphire and Frankenia Shrublands, Saline Claypans	Known to be present
<i>Angianthus prostratus</i>	P3	TPFL, WAHERB	Samphire Shrublands, Saline Claypans	Probable
<i>Triglochin protuberans</i>	P3	WAHERB	Drainage lines, margins of claypans	Probable

¹ Note that some taxonomy in the Stantec reports was updated in the Western Botanical reports, so any conflicts should consider the Western Botanical reports as the most reliable (current) version.

Species	DBCA*	Source	Preferred Habitat	Likelihood of Occurrence
<i>Acacia websteri</i>	P1	WAHERB	Drainage areas	Possible
<i>Calandrinia quartzitica</i>	P1	WAHERB	Samphire and Frankenia Shrublands, Saline Claypans	Possible
<i>Stenanthemum patens</i>	P1	TPFL, WAHERB	Stony chert, quartz and lateritic hills, granite breakaways	Possible
<i>Calytrix hislopii</i>	P3	WAHERB	Lateritic and BIF hills, scree slopes	Possible
<i>Calytrix praecipua</i>	P3	WAHERB	Weathered granite and ironstone breakaways	Possible
<i>Cratystylis centralis</i>	P3	WAHERB	Calcrete expressions, non- saline	Possible
<i>Eremophila shonae</i> subsp. <i>diffusa</i>	P3	WAHERB	Stony ironstone hill tops	Possible
<i>Eremophila simulans</i> subsp. <i>megacalyx</i>	P3	WAHERB	Stony ironstone hill tops	Possible
<i>Eremophila veronica</i>	P3	WAHERB	Hills, plains, drainage areas	Possible
<i>Goodenia lyrata</i>	P3	TPFL, WAHERB	Drainage areas, claypans	Possible
<i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i>	P3	WAHERB	Creeklines associated with gabbro and basalt outcrops	Possible
<i>Micromyrtus serrulata</i>	P3	WAHERB	Stony lateritic, granitic, BIF hills	Possible
<i>Phyllanthus baeckeoides</i>	P3	TPFL	Creeklines associated with lateritic hills	Possible
<i>Grevillea inconspicua</i>	P4	TPFL, WAHERB	Gabbro and basalt outcrops	Possible
<i>Hemigenia exilis</i>	P4	TPFL, WAHERB	Gabbro and basalt outcrops	Possible
<i>Eremophila mirabilis</i>	P2	TPFL, WAHERB	Weathered granite breakaways	Possible
<i>Ptilotus tetrandrus</i>	P1	TPFL, WAHERB	Sandplains, dunes	Unlikely
<i>Conospermum toddii</i>	P4	WAHERB	Sand Dunes	Unlikely

*No Declared Rare/ Threatened Flora protected under the *Biodiversity Conservation Act 2016* were returned in the desktop survey.

Prior to the Western Botanical field survey, two species of conservation significance (although only at the P3 level) were known to be present within the Study Area (Western Botanical 2019):

- *Acacia* sp. Marshall Pool has been recently found to be abundant within the south-eastern portion of the Study Area, specifically associated with low to moderate rounded weathered basalt hills of the Gundockerta Land System on Minara Station and adjacent areas towards Kookynie and on Weebo Station north of Leonora. It was briefly assessed both within parts of the current Study Area (Stantec, 2018b) recording around 10,000 plants (an incomplete assessment of the Study Area); and in the region between Laverton, Leonora and Wiluna (Western Botanical 2018) where over 37,000 individuals were estimated. This is not considered an exhaustive assessment of the species in the region. Note that Stantec referred to this species as “*Acacia* sp. nov. aff. *resinimarginea*” in its’ work.
- *Gunniopsis propinqua* P3 is a small ephemeral halophytic herb growing to 5 cm in height. It is widespread in the Murchison and Gascoyne regions, always associated with saline environments (fringes of claypans, Samphire flats, breakaway footslopes). Stantec recorded four sites supporting *G. propinqua* within the current Study Area. It is considered highly likely that this species is both more prevalent within the Study Area and in the broader region, however, it is cryptic and can only reliably be assessed in favourable seasonal conditions.

Two additional P3 species are associated with the saline margins of salt lakes and Samphire Shrublands or drainage channels and are therefore considered to have a Probable likelihood occurrence within the Study Area (Western Botanical 2019):

- *Angianthus prostratus* is an annual herb to 30 cm diameter and is known from five loci in the eastern Murchison biogeographic region, all in association with paleochannels or salt lakes.
- *Triglochin protuberans* is a tiny, cryptic ephemeral herb to 5 cm high and is known from six loci, five of which occur up to 250 km east of Geraldton while one lies just south-east of the Study Area within the Bummer Creek distributary fan, in the Monitor Land System.

2.7.3 Vegetation Types

Western Botanical recorded 51 Vegetation Associations at NVIS Level 5 within the Study Area. This relatively large number of community types is partially due to:

- the detail of mapping
- the interplay between geological, topographic, hydrological and salinity factors within the Study Area
- the elongated linear nature of the Study Area stretching approximately 37 km north-south from the Leonora – Laverton Road to the Mertondale deposit area, well beyond the scope of this application.

The 51 associations were grouped into 11 Vegetation Complexes as follows (Western Botanical 2019) (Figure 7):

- 1. Mulga Woodlands over Perennial Non-Halophytic Shrubs on hills and plains:** Seventeen vegetation associations with a diverse range of Mulga species (*Acacia aneura*, *A. aptaneura*, *A. caesaneura*, *A. fuscaneura*, *A. incurvaneura*, *A. macraneura*, *A. mulganeura* and *A. pteraneura*) form the dominant upper stratum as trees and shrubs 4 to 6 m in height. The understorey varies considerably with geological substrate type, soil depth and landscape position.
- 2. Mulga Shrublands / Woodlands over Perennial Grasses on Plains:** Two vegetation associations, where silty-sandy soils over hardpan higher in the landscape are present. Here Mulga is associated with a grassy understorey of *Monachather paradoxus* and *Eragrostis eriopoda*, collectively known as Wanderrie grasses.
- 3. Acacia Woodlands over Shrubs and Grasses in Major Drainage Lines and Groves:** Two major drainage tracts and several minor drainage lines occur within the Study Area, draining from the north-east to the south-west. The vegetation of the major drainage line in the west of the Study Area, Cardinia Creek is dominated by Mulga species. Bummer Creek, with a small representation within the south-east of the Study Area is dominated by *Acacia burkittii*. The vegetation of the minor drainage lines within the Study Area reflect the vegetation adjacent hills and plains but are denser and with a greater species representation due to the accumulation of resources.
- 4. Acacia (other than Mulga) Shrublands on Stony Hills:** Four vegetation associations on stony hills within a large proportion of the Study Area are dominated by Acacia trees and shrubs other than Mulga. Here Acacia sp. Marshall Pool (G. Cockerton 3024) is the dominant shrub to small tree on the stony gabbro and basalt hills of the Leonora Land System. It may also be co-dominant with *Acacia sibirica* in some locations. *Acacia doreta* short phyllode form (M. Stone and S. Colwill WB34381), being the typical form of the species, is also present in association with A. sp. Marshall Pool on one small hill in the central west of the Study Area. *Acacia burkittii* was found to be dominant in small well-defined areas of calcrete platform, higher in the landscape, presumably due to an elevated soil moisture availability in the calcrete.
- 5. Acacia papyrocarpa Woodlands:** Four variants of the *Acacia papyrocarpa* woodland were observed. The dominant and defining understorey varies from *Tecticornia disarticulata* in more saline sites; to *Eremophila scoparia* where calcrete is present; to *Ptilotus obovatus* (Upright form), *Maireana triptera* and grasses where there is non-saline but mildly alkaline soil cover over underlying materials; to *Maireana pyramidata* in areas subject to some waterlogging and salinity. *Acacia papyrocarpa* is by far the largest and most prominent tall tree in the landscape within the Study Area and provides refuge and nesting opportunities for some larger birds of prey (Hobbys actively nesting were observed in *Acacia papyrocarpa* woodlands during 2018 and 2019 surveys).

- Hobbys are not listed as having conservation significance (Department of Biodiversity Conservation and Attractions, 2020).
6. ***Acacia victoriae* Shrubland over Chenopods on Calcrete Plains:** The *Acacia victoriae* shrubland occurs on extensive alkaline calcrete plains in the southern part of the Study Area. It has a relatively diverse understorey dominated by chenopods (*Sclerolaena* and *Maireana* spp.) and may support patches of *Eragrostis* sp. Yeelirrie Calcrete (S. Regan LCH26770).
 7. **Perennial Grasslands:** Two perennial grasslands were mapped. These are small, discrete patches of *Eragrostis* sp. Yeelirrie Calcrete (S. Regan LCH26770) on calcrete platforms (relatively low in the landscape); and similarly, small, discrete patches of *Neurachne munroi* Hummock Grassland on Mudstone on low rises.
 8. ***Hakea preissii* and/or Halophytic Chenopod Shrublands:** Thirteen topographically controlled variants of Chenopod Shrublands were recognised with a major distinction being those with *Hakea preissii* emergent above the lower shrubs in areas with a deeper soil profile versus those lacking *H. preissii*, lower in the landscape and more frequently subject to inundation or waterlogging. These environments are all moderately to highly saline and support a largely well-known group of *Maireana*, *Atriplex* (less tolerant of waterlogging) and *Tecticornia* (Samphire, more tolerant of waterlogging) species. They may also support species with conservation significance as identified in the Desktop Study, Table 3.
 9. ***Casuarina pauper* Woodland on Calcrete Outcrops:** *Casuarina pauper* woodland is found in small, isolated, and disjunct populations on calcrete platforms high in the landscape and a lower salinity with reliable soil moisture availability of the alkaline soils here is inferred.
 10. **Claypans:** Two types of grassy claypans were recognised: one supporting almost exclusively *Eragrostis xerophila*; while another forms Gilgais (with heaving clay soils) supporting emergent *Pittosporum angustifolium*, *Acacia tetragonophylla* and *A. victoriae* Shrubland over *Eragrostis setifolia*, *Themeda australis* and other claypan grasses. These are both non-saline environments with heavy clay soils and are internally drained sumps in the landscape. By virtue of their clay soils, high moisture retention and internal drainage, they typically provide refuge for burrowing frogs and support some flora that are not generally found outside these environments. These are small in area, disjunct from each other and uncommon in the landscape within the Study Area.
 11. **Breakaway Complex:** The breakaway complex is represented in the northern part of the Study Area south of Mertondale where *Eucalyptus striatocalyx* is present at the leading edge of the low (5 to 10 m high) lateritised breakaway and a range of species tolerant of kaolin clay soils and some salinity are present in a changing mosaic pattern on the mid to lower slopes of the landscape. Groups of species such as *Frankenia* spp., *Eremophila scoparia*, *Maireana* and *Tecticornia disarticulata* are dominant while

Stantec reported *Gunniopsis propinqua* (P3) in this community type. The Breakaway Complex extends well outside the Study Area near the Mertondale deposit.

These vegetation types are similar to those mapped by Stantec; Figure 7 shows the combined mapping.

2.7.4 Groundwater Dependent Vegetation

Western Botanical (2019) determined the vegetation within their Study Area is dominated by Mulga, Acacia or Chenopods which are highly unlikely to be obligately accessing ground water. It is unlikely that any of the vegetation associations in the Study area are Groundwater Dependent.

2.7.5 Vegetation Condition

Stantec (Stantec, 2018a, 2018b, 2018c) assessed condition across their survey areas to be Degraded to Excellent, with the majority being Excellent. Western Botanical (2019) mapped the bulk of vegetation in their survey area as being in Excellent condition². Figure 8 shows the combined condition mapping. Exceptions to the generally high condition ratings were areas either recently or historically disturbed by exploration, mining, or pastoralism (fence lines). The areas of stony hill tops supporting Acacia and Mulga were generally Pristine, while major drainage lines (Cardinia Creek and Bummer Creek) supported patches of aggressive weed species such as *Cenchrus ciliaris* and *Cenchrus setiger* (Buffel and Birdwood Grasses, respectively) that reduced the condition score to Very Good.

Little evidence of significant impact from grazing was observed on the bulk of native vegetation, except for cattle tracks which were generally located nearby and within the major drainage lines.

2.7.6 Conservation Significant Species

Two hundred and thirty-six species (including subspecies and varieties) from 45 families and 103 genera, inclusive of 224 native endemic species and species 12 weed species were encountered during Western Botanical's 2018-19 studies. When combined with the species lists from the Stantec's studies, the flora statistics stands at 321 species from 132 genera and 44 families, inclusive of 18 weed species.

Significant Flora were dealt with by Western Botanical (2019) in following categories:

- Conservation Significant Flora
 - Threatened Flora
 - Priority Flora
- Species with Taxonomic Interest
- Species at Limit of Range or representing Range Extensions

² Note that the text of the Western Botanical Report states "Pristine", but their GIS data states "Excellent". As the EPA (EPA, 2016) excludes "Pristine" as a class in the Murchison, Navigator considers the in-text reference to be a typographical error.

- Species uncommon in the landscape within the Study Area and the broader NE Goldfields.

No Threatened Flora were identified between Stantec or Western Botanical during surveys from 2017 to 2019. No Threatened Flora are known in the region near the Study Area, and none are considered likely to be present (Western Botanical, 2019).

Three Priority Flora were recorded by Western Botanical and/ or Stantec between 2017 and 2019, all are P3:

- *Acacia* sp. Marshall Pool (G. Cockerton 3024)
- *Eremophila annoscaulis*
- *Gunniopsis propinqua* P3 (Stantec, 2018b, 2018c).

Western Botanical (2019) determined that, within the Study Area, *Acacia* sp. Marshall Pool is confined to low-high rounded hills of weathered gabbro and basalt with infiltrated paleo groundwater calcrete (Figure 9). Western Botanical (2018) estimated 37,266 individual plants at three population centres:

- Major populations on the low basalt ranges north and south of the Leonora-Laverton Road on Minara and Glenorn Stations (>26,364 plants and >5,000 plants respectively)
- Small occurrences on low basalt hills on Melita Station (>300 plants)
- A major population at the original 1997 collection site, on Weebo Station (5,602 plants).

The Western Botanical (2019) Study Area overlaps with part of population 1. Populations 2 is located outside of the study area, approximately 26 km southeast of Leonora. Population 3 is also located outside of the study area, on Weebo Station.

Eremophila annoscaulis is known from four populations in the region (Western Botanical 2019):

- Two populations, respectively 22 km and 35 km east of the Study Area, adjacent to the Murrin Murrin minesite
- Two populations approximately 280 km north and north-north-east of the Study Area, respectively some 150 km to 250 km east of Wiluna.

A fifth point shown on the WA Herbarium's Florabase website is erroneously plotted near Widgiemooltha, south of Coolgardie (Western Botanical, 2019). Within the Study Area it was found associated with stony hill tops and mid to lower slopes associated with these, growing in association with Mulga (Western Botanical, 2019).

Gunniopsis propinqua is a small cryptic succulent annual herb to 5 cm high found growing in association with Samphire species on the margins of saline chenopod dominated plains. It is widespread in W.A. with records in the eastern Gascoyne, throughout the Murchison and one point in the Yalgoo bioregions, suggesting a downwards revision of Priority Status is likely warranted (Western Botanical, 2019). Stantec reported four sites supporting *Gunniopsis propinqua* within the current Study Area (Stantec, 2018b).

All other flora species of conservation interest identified in the desktop survey and field survey were not considered to be of importance to Navigator's proposed development by Western Botanical (2019), even though the proposal at that time was for a larger development than is proposed at this point in time.

2.7.7 Weeds

Twenty weed species have been recorded during surveys for Navigator (Stantec, 2018a, 2018b, 2018c; Western Botanical, 2019). Of these:

- Seventeen are regarded as introduced minor weed species and not of concern as they are not strongly competitive and are widely naturalised.
- Two species, (*Cenchrus ciliaris* and *Cenchrus setiger*) are widely promoted by the Pastoral industry, however, both are vigorous invasive weed species and their presence within the Study Area lowers the vegetation condition ranking in the habitat in which they occur.
- One species occurring just outside the Study Area, *Cylindropuntia fulgida* var. *mamillata*, Jumping Cholla or Coral Cactus, is listed as a Weed of National Significance (WoNS).
- One species, *Polycarpon tetraphyllum*, a small and non-competitive introduced species, represents the first collection of the species in the Murchison bioregion and a range extension of at least 500 km. It is a small plant and easily overlooked and may be more widespread than data currently indicates.

Cylindropuntia fulgida var. *mamillata* is known at the northern end of the Study Area, around the Mertondale prospect, and is the subject of largely very effective active control measures (G. Grigg pers. comm., reported in Western Botanical [2019]).

2.8 Fauna

Similarly, to flora and vegetation, fauna studies have been undertaken across the area for over a decade. The most recent work was completed by Phoenix Environmental Sciences (2019) (Appendix K) across the Mining Area and proposed mine access road. Stantec had previously surveyed the existing mine access road (Stantec, 2018c). The following text is based on Phoenix's assessment, any deviations, or additions from Stantec (2018c) are discussed where appropriate.

2.8.1 Desktop Assessment

Database searches and a literature review were undertaken to identify the significant fauna values that may occur within the study area. Desktop review methods entailed (Phoenix, 2019):

- A review of existing environmental information relevant to the biological values of the study area including:
 - Base environmental datasets to define the physical characteristics of the study area
 - Searches of relevant biological databases:
 - Protected Matters Search Tool

- DBCA Threatened and Priority Fauna Database
- DBCA/WAM NatureMap Database
- Atlas of Living Australia
- WA Museum Arachnid and Myriapod Database
- WA Museum Mollusca Database
- Review of the most recent vegetation mapping for the project (Western Botanical, 2019)
- Assessment of 'likelihood of occurrence' of Threatened and Priority species.

Records for 274 terrestrial vertebrate fauna species were identified as potentially occurring within the study area in the desktop review. These comprised seven frogs, 55 reptiles, 174 birds (including two naturalised species) and 38 mammals (including 12 introduced).

A total of 30 species of conservation significant vertebrate taxa were identified in the desktop review (23 birds, seven mammals) as potentially occurring, including 13 species listed under the EPBC Act and/or BC Act as Threatened or Specially Protected. 17 species are listed as Migratory under the EPBC Act and BC Act (two also listed as Threatened). A further three are listed as Priority species by the DBCA. Two locally extinct species were also returned.

The assessment was completed based on the likelihood of occurrence criteria presented in Table 4; vertebrate results are presented in Table 5. Note that Phoenix (2019) assessment is slightly more conservative (i.e. more species were considered to have a higher likelihood of occurring) than Stantec (Stantec, 2018a, 2018b, 2018c), so Phoenix's results are presented.

Table 4: Fauna Likelihood of Occurrence Criteria

Likelihood	Criteria
Recorded	Species recorded within the study area by current or previous surveys.
Likely	Study area within known range of species; suitable or optimal habitat occurring within the study area and/or with current and/or previous records in the vicinity of the study area.
Possible	Within known range of species; suitable habitat present within study area, though not optimal; no records in the vicinity of the study area.
Unlikely	Outside of the species current known range; no records in the vicinity of the study area and/or no suitable habitat present within the study area. Also includes species considered locally or regionally Extinct in relation to the study area due to historic declines.

Table 5: Likelihood of Presence of Conservation Significant Vertebrates

Species	Common Name	Likelihood	Conservation Status*		
			EPBC Act	BC Act	DBCA List
Birds					
<i>Leipoa ocellata</i>	Malleefowl	Possible	VU	VU	-
<i>Apus pacificus</i>	Fork-tailed Swift	Possible	Mig	Mig	-

Species	Common Name	Likelihood	Conservation Status*		
			EPBC Act	BC Act	DBC List
<i>Plegadis falcinellus</i>	Glossy Ibis	Unlikely	Mig	Mig	-
<i>Falco hypoleucos</i>	Grey Falcon	Likely	-	VU	-
<i>Falco peregrinus</i>	Peregrine Falcon	Likely	-	OS	-
<i>Charadrius veredus</i>	Oriental Plover	Possible	Mig	Mig	-
<i>Thinornis rubricollis</i>	Hooded Plover	Unlikely	-	-	P4
<i>Pluvialis fulva</i>	Pacific Golden Plover	Unlikely	Mig	Mig	-
<i>Limosa lapponica</i>	Bar-tailed Godwit	Unlikely	VU/Mig	VU/Mig	-
<i>Actitis hypoleucos</i>	Common Sandpiper	Unlikely	Mig	Mig	-
<i>Tringa nebularia</i>	Common Greenshank	Unlikely	Mig	Mig	-
<i>Tringa glareola</i>	Wood Sandpiper	Unlikely	Mig	Mig	-
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Unlikely	Mig	Mig	-
<i>Calidris canutus</i>	Red Knot	Unlikely	EN/Mig	Mig	-
<i>Calidris melanotos</i>	Pectoral Sandpiper	Unlikely	Mig	Mig	-
<i>Calidris ruficollis</i>	Red-necked Stint	Unlikely	Mig	Mig	-
<i>Calidris subminuta</i>	Long-toed Stint	Unlikely	Mig	Mig	-
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Possible	Mig	Mig	-
<i>Gelochelidon nilotica</i>	Gull-billed Tern	Unlikely	Mig	Mig	-
<i>Polytelis alexandrae</i>	Princess Parrot	Possible	VU	-	P4
<i>Pezoporus occidentalis</i>	Night Parrot	Unlikely	EN	CR	-
<i>Motacilla cinerea</i>	Grey Wagtail	Unlikely	Mig	Mig	-

Species	Common Name	Likelihood	Conservation Status*		
			EPBC Act	BC Act	DBCA List
<i>Motacilla flava</i>	Yellow Wagtail	Unlikely	Mig	Mig	-
Mammals					
<i>Dasyurus geoffroii</i>	Chuditch	Unlikely	VU	VU	-
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	Likely	-	-	P4
<i>Myrmecobius fasciatus</i>	Numbat	Unlikely	VU	VU	-
<i>Macrotis lagotis</i>	Greater Bilby	Unlikely	VU	VU	-
<i>Bettongia lesueur</i>	Boodie	Recorded historical evidence/ Unlikely	VU/EX	VU/EX	-
<i>Lagostrophus fasciatus</i>	Banded Hare-wallaby	Unlikely	VU	VU	-
<i>Leporillus conditor</i>	Greater Stick-nest Rat	Recorded historical evidence/ Unlikely	VU	VU	-

*CR – Critically Endangered; EN – Endangered; VU – Vulnerable; OS – Specially Protected; Mig – Migratory; P4 – Priority 4

The WA Museum database searches returned 42 records of terrestrial invertebrate taxa, none were potential or confirmed SREs (Table 6). No molluscs were returned. The DBCA Threatened fauna database returned six records, representing two taxa of fairy shrimp. Both are P1 species and are currently, confirmed SREs. They are associated with Lake Carey, which is located approximately 50 km to the east of the study area.

Table 6: Desktop Assessment of Invertebrate Fauna

Species	SRE Status	Likelihood of Presence
Anostraca (2)		
Thamnocephalidae (2)		
<i>Branchinella apophysate</i>	SRE	Unlikely
<i>Branchinella simplex</i>	SRE	Unlikely
Araneae (13)		
Araneomorphae (new world spiders) (12)		
Gnaphosidae (2)		
<i>Ellica?</i> `sp.`	No potential	-
<i>Encoptarthria</i> `Leonora sp. 1`	No potential	-
Miturgidae (2)		
<i>Miturga</i> `Leonora sp. 1`	No potential	-
<i>Miturga</i> `Leonora sp. 1`?	No potential	-

Species	SRE Status	Likelihood of Presence
Sparassidae (1)		
<i>Neosparassus</i> `Leonora sp. 1`	No potential	-
Trochanteriidae (1)		
<i>Longrita millewa</i>	No potential	-
Zodariidae (6)		
`Leonora gen. 1` `Leonora sp. 1`	No potential	-
<i>Habronestes</i> `Leonora sp. 1`	No potential	-
<i>Habronestes</i> `Leonora sp. 2`	No potential	-
<i>Neostorena</i> `Leonora sp. 1`	No potential	-
<i>Neostorena</i> `Leonora sp. 2`	No potential	-
<i>Storena</i> `sp.`	No potential	-
Mygalomorphae (trap-door spiders) (1)		
Idiopidae (1)		
<i>Eucyrtops eremaea</i>	No potential	-
Scolopendrida (1)		
Scolopendridae (1)		
<i>Cormocephalus</i> `sp. (fragment)`	No potential	-

2.8.2 Habitat Types

The study area forms part of an undulating plain sloping down from northeast to southwest, with low stony hills and plains dissected by shallow, seasonal or ephemeral drainage lines. In terms of topography, hydrology, and vegetation it has relatively low diversity (e.g. lacking major rock outcrops or natural clifflines, lakes, saltlakes, perennial streams, sandplains, Triodia hummock grasslands, or eucalypt-dominated woodland or mallee).

Seven broad fauna habitats were mapped within Phoenix's (2019) study area (Figure 10):

- Mulga woodland on plain (6,073.62 ha)
- Shrubland on plain (3,356.2 ha)
- Acacia shrubland on stony hills (1,714.79 ha)
- Acacia woodland in drainage lines and groves (1,570.13 ha)
- Mulga woodland on stony hills (944.08 ha)
- Cleared (212.99 ha)
- Outcropping and breakaway (40.22 ha)
- Vegetated gilgai/claypan (12.23 ha).

Mulga woodland on plain was the dominant habitat, occupying approximately 44% of the study area, followed by Shrubland on plain (24%), with the remaining fauna habitats occupying less

than 35% of the study area combined (Table 7). The potential for the study area to support SREs is constrained to significant outcrops, which are few and not proposed to be impacted (Phoenix 2019).

Stantec described four broad fauna habitats were identified within their Study Area (Stantec, 2018c):

- Acacia Shrubland on plains
- Chenopod shrublands
- Wetlands
- Drainage lines.

Table 7: Fauna Habitat Types

Habitat Type	Description	Area (ha)	% of Study Area
Mulga woodland on plain	Open to sparse woodland or shrubland of Mulga (<i>Acacia aneura</i> group) or Bastard Mulga (<i>A. papyrocarpa</i>) over varying mid- and understorey of lower shrubs and/or grasses.	6,071.59	43.62
Shrubland on plain	Open to sparse shrubland dominated by shrub Mulga, other Acacia species, Hakea, chenopods, or hummock grasses on a range of substrates.	3,355.09	24.10
Acacia shrubland on stony hills	Rolling hills with gravel or cobble substrate, with shrubland vegetation dominated by Acacia other than Mulga.	1,714.20	12.31
Acacia woodland in drainage lines and groves	Drainage lines with associated riparian vegetation, usually Mulga or other Acacia over variable understory cover, often dominated by dense grass cover nearer to drainage line.	1,569.58	11.28
Mulga woodland on stony hills	Mulga (<i>Acacia aneura</i> group) woodland on hill slopes and tops; also includes patches of Casuarina pauper woodland on calcrete outcrop.	943.71	6.78
Cleared	Existing cleared and/or disturbed areas (i.e. existing tracks, roads and clearing for previous exploration or mining operations)	212.94	1.53
Outcropping and breakaway	Outcrop of calcrete, basalt or other rock types with boulder piles, small caves or crevices on hilltops, slopes, and breakaways; woodland or shrubland vegetation.	40.22	0.29
Vegetated gilgai/claypan	Vegetated gilgai/claypan: Drainage foci with clay soils and perennial grasses, and with or without shrub vegetation.	12.22	0.09

2.8.3 Recorded Species

A total of 65 terrestrial vertebrate fauna species were recorded during the field survey:

- Amphibians – 2 species
- Reptiles - 12 species
- Native Birds - 38
- Introduced Birds - 0
- Native Mammals - 7
- Introduced Mammals – 7.

2.8.4 Conservation Significant Species

No conservation significant species were positively identified as currently occurring during the field survey, but three were recorded based on secondary evidence (Phoenix, 2019):

- Long-tailed Dunnart (P4)
- Burrowing Bettong (EX)
- Greater Stick-nest Rat (VU).

Long-tailed Dunnart is recorded provisionally based on small dasyurid scats associated with crevices on rocky hills and breakaways at three sites. Morphologically these could not be directly identified to the species and are also consistent with the other *Sminthopsis*, *Ningau* or *Antechinomys* species that occur in the general area. However, the habitat is most suitable for *S. longicaudata* denning and refuge sites, whereas the other small dasyurid species are not associated with rocky hills but inhabit grassland, heath, shrub, and woodland. Long-tailed Dunnart may also occur more broadly across habitats surrounding denning sites to forage or disperse when conditions and cover are suitable.

Burrowing Bettong (Boodie) and Greater Stick-nest Rat were both recorded from historic secondary evidence within the study area. Evidence of past occurrence of Burrowing Bettong was recorded from six sites in the form of burrow complexes (warrens) extending under a layer of hardpan calcrete on plains or lower slopes of hills, and the Greater Stick-nest Rat from two old nests located in a breakaway.

Suitable habitat for (at least) foraging and dispersal was identified for a further seven conservation significant species identified in the desktop review (Table 5).

Fork-tailed Swift are likely to forage in the airspace above the study area; however, it is unlikely to land or nest as the species is a non-breeding visitor and almost exclusively aerial (DoEE 2019b).

Grey Falcon is likely to occur at least occasionally within the study area, as the species is broadly distributed in the area and individuals have large foraging ranges. Breeding could also occur, using stick nests of corvids or other raptors in tall trees (e.g. stands of *Acacia papyrocarpa* with crow nests at site LF010, previously reported as used for nesting by Australian Hobby; Western

Botanical 2019) or power and telecommunications towers (if and when they are built). This species is not reported to nest on cliffs (Debus 2012).

Peregrine Falcon is known to occur adjacent to the study area, and this versatile aerial predator may use all habitat types present for foraging. Due to low relief of outcrop in the area, cliff-ledge nesting sites as typically used by this species do not naturally occur; however, stick nests of crows or other raptors may also be used (as in the case of Australian Hobby or Grey Falcon), and the steep rock walls of old mine pits and quarries provide highly suitable nesting sites (and hunting perches) within the study area.

Oriental Plover has been recorded close to the study area (ALA 2019) and ranges widely through coastal and inland northern parts of Australia during the non-breeding season (September to March), using a range of habitats including flat, open semi-arid grasslands and claypans (DoEE 2019b). It may therefore be expected to visit the study area occasionally.

Sharp-tailed Sandpiper mainly feeds in wetlands like other shorebirds but is also recorded as foraging in open grassy areas after rain (DoEE 2019b), so may use parts of the study area occasionally.

While there are records of Malleefowl in the vicinity, habitat in the study area is generally of low suitability for this species. Nesting habitat requires sandy substrates and abundant leaf litter, whereas vegetation cover throughout much of the study area is open and sparse, with denser vegetation and canopy cover restricted to drainage lines and some hill slopes, where litter tends to be removed or disturbed during rainfall events, or overgrown with grass. Some litter suitable for foraging does occur in Mulga woodland habitats (including *A. papyrocarpa* and *Casuarina*), but of relatively low value due to its patchy occurrence and the mostly open canopy (cf. Benshemesh 2007). The species may occasionally occur when dispersing between areas of suitable habitat outside of the study area; however, it is unlikely to be a frequent visitor.

Typical habitats of Princess Parrot (sand dunes, open savannah eucalypt woodland, *Triodia* grassland) are not present within the study area, but it may also use a wider range of woodland and riparian habitat, and is an irregular and infrequent visitor to most sites within its range (DoEE 2019b). It is considered possible that the Princess Parrot will occur in the study area occasionally when conditions are favourable, particularly following rainfall in its core range, in the arid areas east and north of the study area.

The remaining conservation significant species identified in the desktop review (16 birds, four mammals) are considered unlikely to occur either due to lack of suitable habitat (i.e. suitable salt lakes or other wetlands for Migratory shorebirds), or lack of extant regional populations due to historic declines of Critical Weight Range mammals (Burbidge and McKenzie 1989) (Table 5-5).

3 Environmental Management Measures

3.1 Avoid

Engineering design of the mine and supporting infrastructure has been developed to minimise the clearing of vegetation.

Navigator Mining initially planned to undertake all processing associated with the mine on site. After deliberation, Navigator Mining has since decided to move all processing off site to a third party which will reduce the clearing footprint of the project.

3.2 Mitigation

Navigator Mining have undertaken engineering controls to minimise clearing impact but still ensure safe operation on site.

To enable safe and appropriate access to site, Navigator Mining engaged Lindsay Dynan Consulting Engineers to undertake a concept design for all roads. The roads have been designed to minimise unnecessary vegetation clearing and to optimise safety.

Examples of environmental management measures which can be implemented to mitigate clearing impacts and management on site include but not limited to the following:

- Clearing area will be demarcated prior to the commencement of project activities and prior to the commencement of native vegetation clearing
- Induction of all contractors and/or internal personnel undertaking the clearing in accordance with Navigator Mining's internal procedures. GPS coordinates of clearing permit area to be supplied to contractor
- Prior to clearing and earthworks commencing within the clearing permit area, the area will be clearly outlined (by barrier tape or star pickets) to ensure that no over clearing occurs beyond the permitted area
- Prior to clearing activities, areas of native vegetation to be retained will be clearly demarcated by star pickets, coloured tape or bunting and all personnel should be made aware of the requirement to protect native vegetation in these areas.

Navigator will implement parent-company Kin's Environmental Management System for the CP.

4 Assessment Against the Ten Clearing Principles

The proposed clearing activities have been assessed against the ten clearing principles as defined in DER's Guide to Assessment: Clearing of Native Vegetation under the EP Act, taking into account the current extent and condition of the native vegetation on the site. This assessment is presented in Table 8. The Development Envelope is 4,332.29 ha, of which up to 400.49 ha will be cleared for the development and operation of the Project.

Table 8: Assessment Against the Ten Clearing Principles

Principle	Assessment
Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity	<p>Assessed Outcome: The proposed clearing area of 400.49 ha is not considered to comprise a high level of biological diversity. This assessment is based off desktop assessment and field work completed by Western Botanical (2019), Phoenix (2019) and Stantec (Stantec, 2018a, 2018b, 2018c).</p> <p>Prior to the most recent botanical field surveys, Western Botanical conducted a flora likelihood assessment based on database searches and the data contained in Stantec (Stantec, 2018a, 2018b, 2018c). The assessment identified 21 priority species as having a possible to probable likelihood of occurrence on site. Three P3 species (<i>Acacia</i> sp. Marshall Pool (G. Cockerton 3024), <i>Eremophila annoscaulis</i>, <i>Gunniopsis propinqua</i>) were known to be present in the area. No Threatened Flora protected under the BC Act 2016 were identified in the desktop searches.</p> <p>The 2018 and 2019 field surveys and subsequent Flora and Vegetation Assessment completed by Western Botanical recorded 236 species from 45 families and 103 genera, inclusive of 224 native endemic species and 12 species of weeds. Combining these findings and the species list from the Stantec (Stantec, 2018a, 2018b, 2018c), the flora statistics stand at 321 species from 132 genera and 44 families, inclusive of 18 weed species. No Threatened Flora species pursuant to the EPBC Act and or/gazetted as Threatened/Declared Rare Flora pursuant to the BC Act 2016 were recorded from these findings.</p> <p>Three Priority Flora were recorded by Western Botanical and or Stantec, including <i>Acacia</i> sp. Marshall Pool (G. Cockerton 3024), <i>Eremophila annoscaulis</i>, <i>Gunniopsis propinqua</i> (Stantec, 2018a, 2018b, 2018c; Western Botanical, 2019).</p> <p>None of the 51 Vegetation Associations, which were grouped into 11 Vegetation Complexes correspond to any known Threatened or Priority Ecological Communities (Stantec, 2018a, 2018b, 2018c; Western Botanical, 2019). It was noted that most of the areas assessed as being in pristine condition were areas of stony hill tops whereas the major drainage lines supported patches of aggressive weed.</p> <p>Most of the vegetation in the survey area was assessed to be in Excellent or Pristine condition.</p> <p>No Threatened Fauna or SRE species have been directly identified on site. Historical evidence of locally extinct Boodies and Greater Stick-nest Rats were observed, indirect evidence of what was most likely the P4 Long-tailed Dunnart was observed.</p>
Principle (b) – Native vegetation should not be	<p>Assessed Outcome: The Site is not considered necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia and therefore the proposed clearing of 400.49 ha is not considered to be at variance with this Principle.</p>

Principle	Assessment
<p>cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia</p>	<p>Database searches and a literature review (as described in section 2.8) were completed by Phoenix in (2019) for most of the proposed clearing footprint. Previous work had been completed by Stantec (2018c) on the existing mine access road. Phoenix recorded for 274 terrestrial vertebrate fauna species were identified as potentially occurring within the study area. This included 55 reptiles, 174 birds and 38 mammals. Stantec's results were similar, Phoenix's assessment was more conservative (i.e. they determined that more conservation significant species were Likely to occur).</p> <p>A total of 30 species of conservation significant vertebrate taxa were identified in Phoenix's desktop review (23 birds, seven mammals) as potentially occurring, including 13 species listed under the EPBC Act and/or BC Act as Threatened or Specially Protected. Seventeen species are listed as Migratory under the EPBC Act and BC Act (two also listed as Threatened). A further three are listed as Priority species by the DBCA. Two locally extinct species were also returned in the desktop review. The WA Museum database searches returned 42 records of terrestrial invertebrate taxa, none of which were potential or confirmed SREs.</p> <p>During the field survey conducted by Phoenix in April 2019, 65 terrestrial vertebrate fauna species were identified. No conservation significant species were positively identified however three were recorded on secondary evidence (Phoenix, 2019). The species include: Long-tailed Dunnart, Burrowing Bettong, and the Greater Stick-nest Rat. Suitable habitat for foraging and dispersal was identified for a further seven conservation significant species returned in the desktop review: Fork-tailed Swift, Grey Falcon, Peregrine Falcon, Oriental Plover, Sharp-tailed Sandpiper, Malleefowl and Princess Parrot. None of the species rely on the habitat within the study area however it is interpreted that they may visit the study area occasionally.</p> <p>None of these species are considered solely dependent on any of the terrestrial habitat types identified in the area. Disturbance within the proposed clearing area is unlikely to significantly impact any of the species listed due to the presence of similar habitat within the vicinity of the area.</p>
<p>Principle (c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora</p>	<p>Assessed Outcome: The proposed clearing is not at variance to this Principle.</p> <p>No Threatened Flora were identified between Stantec or Western Botanical during surveys from 2017 to 2019 (Stantec, 2018a, 2018b, 2018c; Western Botanical, 2019).</p> <p>Combining the findings and the species list from the Stantec and Western Botanical studies, the flora statistics stand at 321 species from 132 genera and 44 families, inclusive of 18 weed species. No Threatened Flora species pursuant to the EPBC Act and or/gazetted as Threatened/Declared Rare Flora pursuant to the BC Act 2016 were recorded.</p>
<p>Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the</p>	<p>Assessed Outcome: The proposed clearing is not at variance with this Principle.</p> <p>No Threatened Ecological Communities were identified by Stantec or Western Botanical during the studies from 2017 to 2019. None of the vegetation associations correspond to any known Priority Ecological Communities (Stantec, 2018a, 2018b, 2018c; Western Botanical, 2019).</p>

Principle	Assessment
maintenance of a Threatened Ecological Community (TEC).	
Principle (e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	<p>Assessed Outcome: The proposed clearing is not at variance with this Principal.</p> <p>The site is mapped within two broad vegetation units, Laverton 18, and Laverton 39. The EPA’s Guidance Statement No. 33 has identified a minimum threshold of retention of 30% of pre-European extent of each community (Environmental Protection Authority, 2008). Laverton 18 and 39 are well above this threshold (Table 1).</p>
Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	<p>Assessed Outcome: The proposed clearing is at variance with this Principle.</p> <p>Clearing will intersect with several ephemeral water courses, the most significant being Cardinia Creek which will be intercepted by the Lewis-4 pit. Without appropriate management the Lewis-4 pit is expected to flood in 0.1% Average Exceedance Probability (AEP) rainfall event, as well as 1% AEP and 10% AEP events (i.e. 1 in 1,000 year flood, 1 in 100 year flood and 1 in 10 year flood) (360 Environmental 2021). A diversion bund will be constructed to maintain flows past the pit, and enable safe mining to occur (Appendix M).</p> <p>The significance of the impact is considered to be low based on:</p> <ul style="list-style-type: none"> • Diversions and drainage has been considered in design (documented in the Mining Proposal) • The overall catchment is extensive beyond the reach of Cardinia Creek • Rainfall is occasional, the creek is ephemeral (for example it has not flowed in 2019, 2020 or 2021, despite cyclone Seroja’s influence).
Principle (g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	<p>Assessed Outcome: The Proposed clearing of 400.49 ha is not at variance with this Principle as the works are not likely to cause appreciable land degradation that is different or more significant than what has occurred on Site and the surrounding land to date.</p> <p>The proposed clearing of 400.49 ha is not likely to cause appreciable land degradation. The (then) DER has defined land degradation as including the following (Department of Environment Regulation, 2014).</p> <ul style="list-style-type: none"> • The clearing of vegetation • Decline in vegetation condition • Soil erosion and soil acidity (caused by wind and water erosion due to vegetation clearing) • Salinity; or • Waterlogging/flooding. <p>The land use surrounding the site is mostly undisturbed, except for existing roads and access tracks. As such, the clearing of 400.49 ha of vegetation is not at variance to this Principle.</p>

Principle	Assessment
<p>Principle (h) – 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</p>	<p>Assessed Outcome: The Proposal is not at variance with this Principle.</p> <p>The proposed clearing is not likely to have an impact on the environmental values of any adjacent or nearby conservation areas. The Site is not located within any conservation areas (Department of Biodiversity Conservation and Attractions, 2019a).</p> <p>The Site is not located within an Environmentally Sensitive Area (Department of Water and Environmental Regulation, 2018a).</p>
<p>Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water</p>	<p>Assessed Outcome: The Proposal is not at variance with this Principle.</p> <p>Clearing will not be interacting with groundwater.</p> <p>The Site is not located within a Proclaimed Surface Water Area (DWER, 2020). Drainage/ creek crossings that intersect the proposed mine access road are ephemeral, non-perennial streams. A pit-protection bund is proposed for the Lewis-pit, this will divert water around the pit and enable overall flows downstream to be maintained Engineering controls have been designed to minimise impact to the up and downstream environment.</p> <p>Given that the proposed works will not interact with groundwater, the absence of perennial watercourses across the site, and the consideration of drainage and diversion in the design the Proposal is not at variance with this Principle.</p>
<p>Principle (j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding</p>	<p>Assessed Outcome: The Proposal is not at variance with this Principle.</p> <p>The clearing proposed is not an amount at which flooding is expected to be exacerbated. A pit-protection diversion bund is proposed for the Lewis-4 pit, which will divert flood water from Cardinia Creek downstream to its intended destination (360 Environmental 2021) in period of creek-flow.</p>

5 Summary of Assessment

The assessment concludes that the clearing of 400.49 ha of native vegetation for the development of the Kyte and Lewis-4 Deposits is not at variance with nine of the Clearing Principles. Where the proposed footprint intersects with Cardinia Creek and other ephemeral tributaries clearing will be at variance with principal f. This is not considered to be a significant impact because:

- The creeks are ephemeral and only run after heavy rainfall
- Creek crossings have been designed to have minimal impact on the downstream environment, the crossings will over-top after heavy rainfall
- A pit protection bund will divert water around Lewis-4, and direct it to its natural downstream destination
- The local and wider area is criss—crossed by similar ephemeral drainage lines and minor creeks.

6 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data, and analyses (“client’s information”) provided by the client and other individuals and entities. In most cases where client’s information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client’s information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client’s information is contingent upon the accuracy, exhaustiveness and currency of the client’s information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client’s information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions, and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions, and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

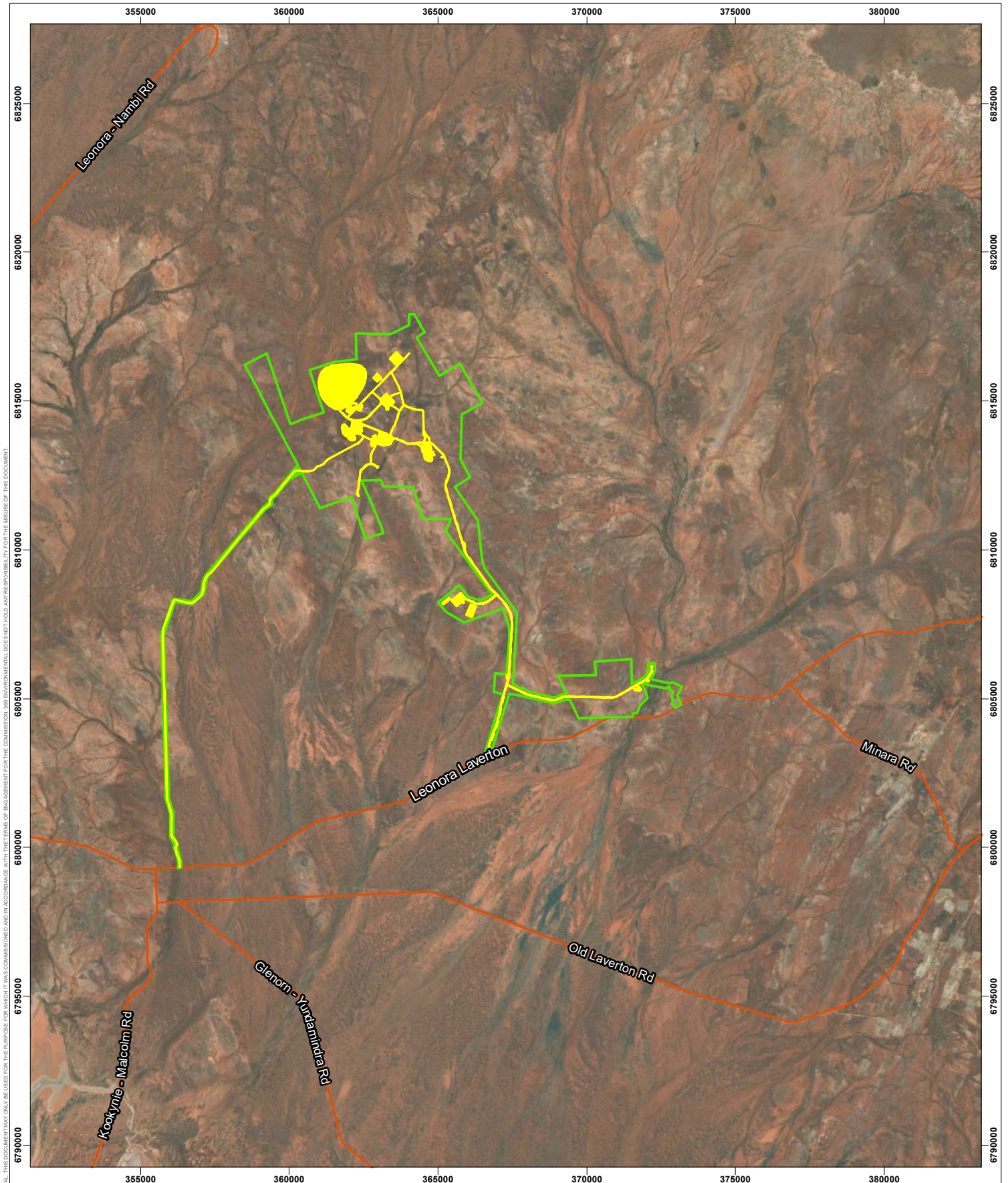
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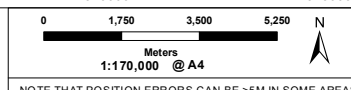
Figures



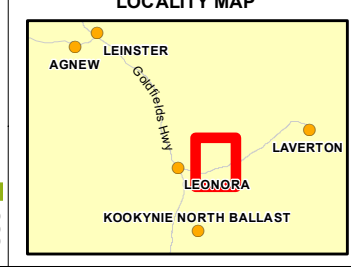
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Legend

- State Road
- Local Roads
- Indicative Clearing Footprint
- Development Envelope



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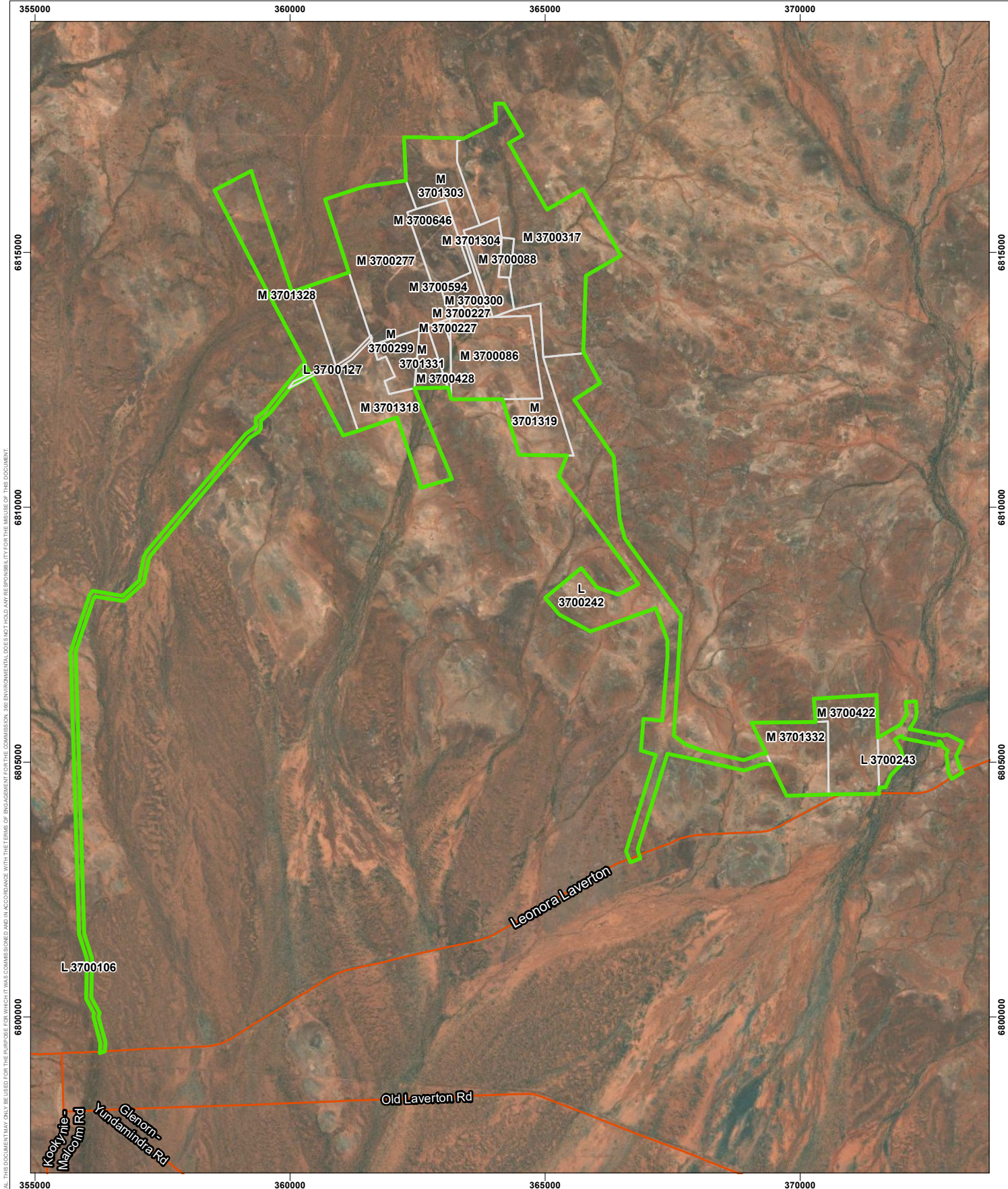
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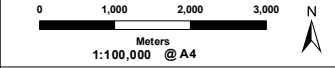
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Figure 1
Site Location

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- State Road
 - Local Roads
 - Cardinia Mining Tenements
 - Development Envelope

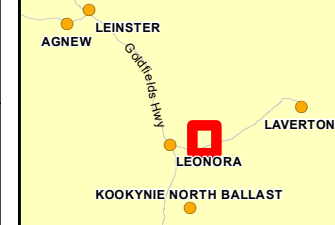


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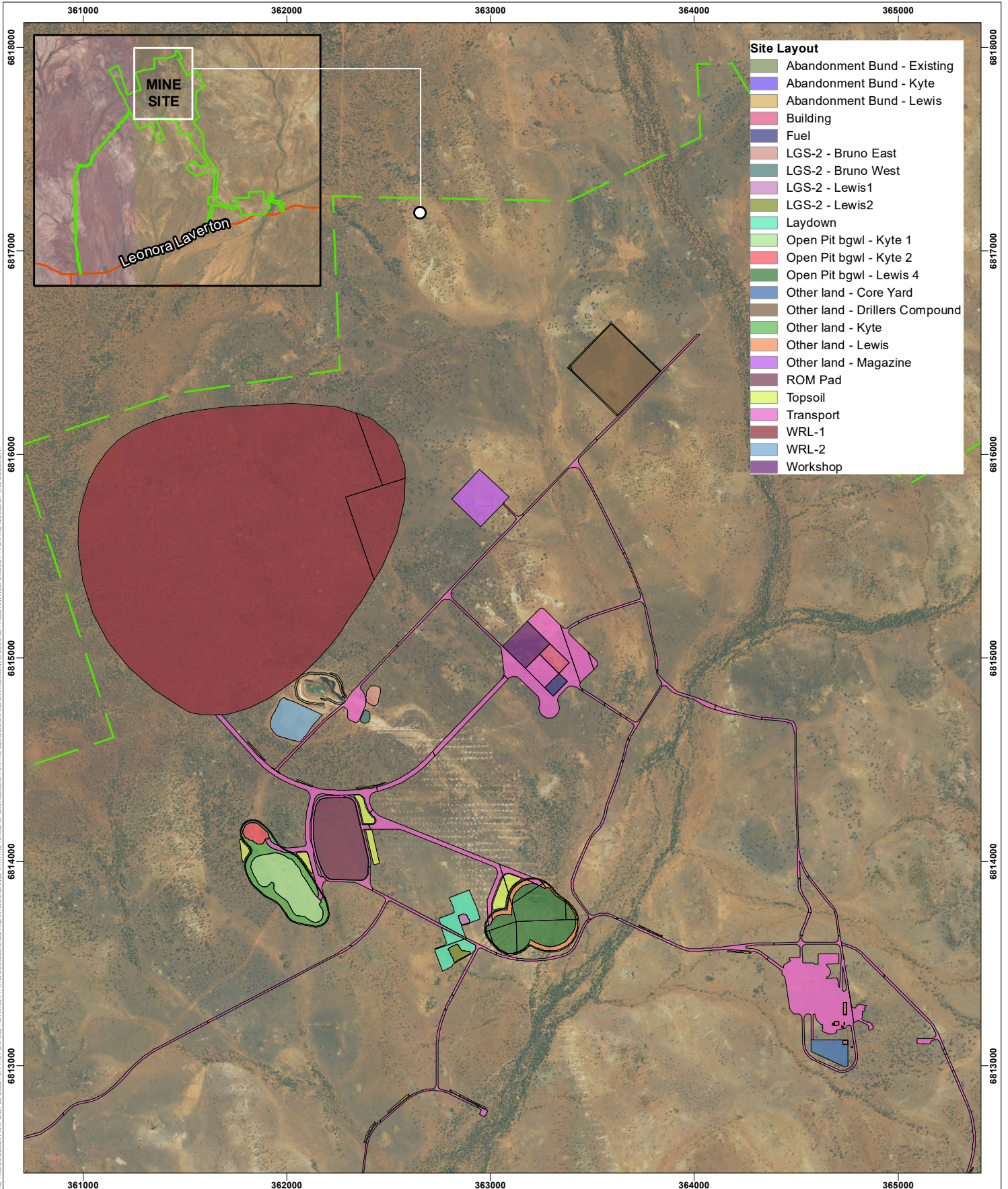
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Figure 2
Mining Tenements

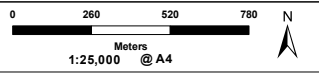
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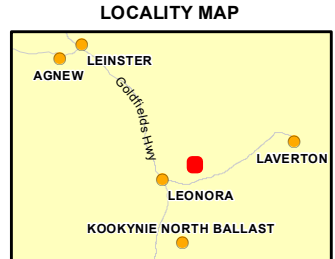


- Site Layout**
- Abandonment Bund - Existing
 - Abandonment Bund - Kyte
 - Abandonment Bund - Lewis
 - Building
 - Fuel
 - LGS-2 - Bruno East
 - LGS-2 - Bruno West
 - LGS-2 - Lewis1
 - LGS-2 - Lewis2
 - Laydown
 - Open Pit bgwl - Kyte 1
 - Open Pit bgwl - Kyte 2
 - Open Pit bgwl - Lewis 4
 - Other land - Core Yard
 - Other land - Drillers Compound
 - Other land - Kyte
 - Other land - Lewis
 - Other land - Magazine
 - ROM Pad
 - Topsoil
 - Transport
 - WRL-1
 - WRL-2
 - Workshop

- Legend**
- Development Envelope
 - Indicative Clearing Footprint



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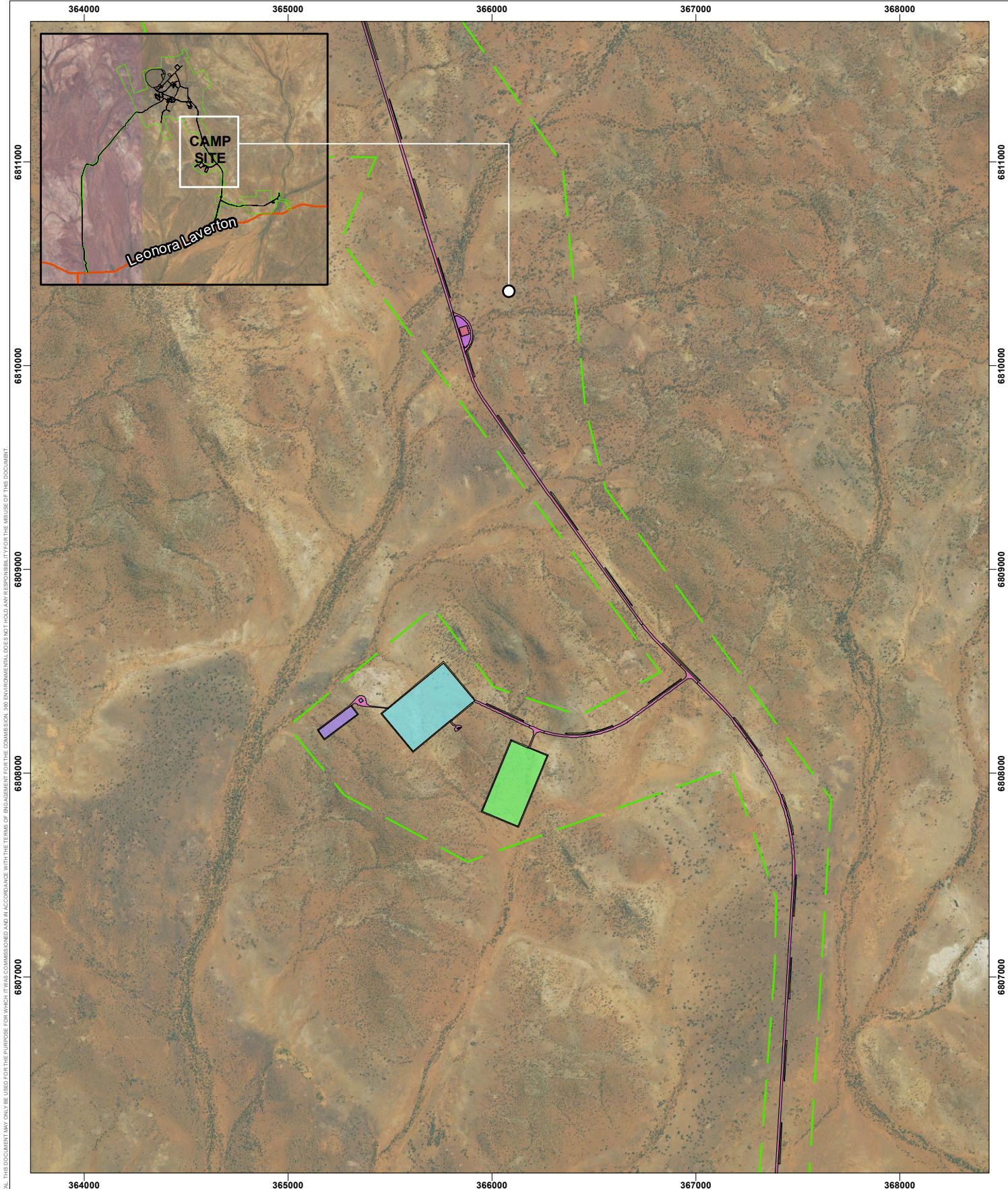
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Figure 3a
Mine Site

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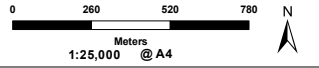
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Legend

- Indicative Clearing Footprint
- Development Envelope
- Site Layout**
- Building
- Camp
- Landfill
- Other land - Magazine
- Sewage Pond
- Topsoil
- Transport

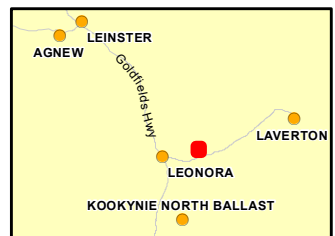
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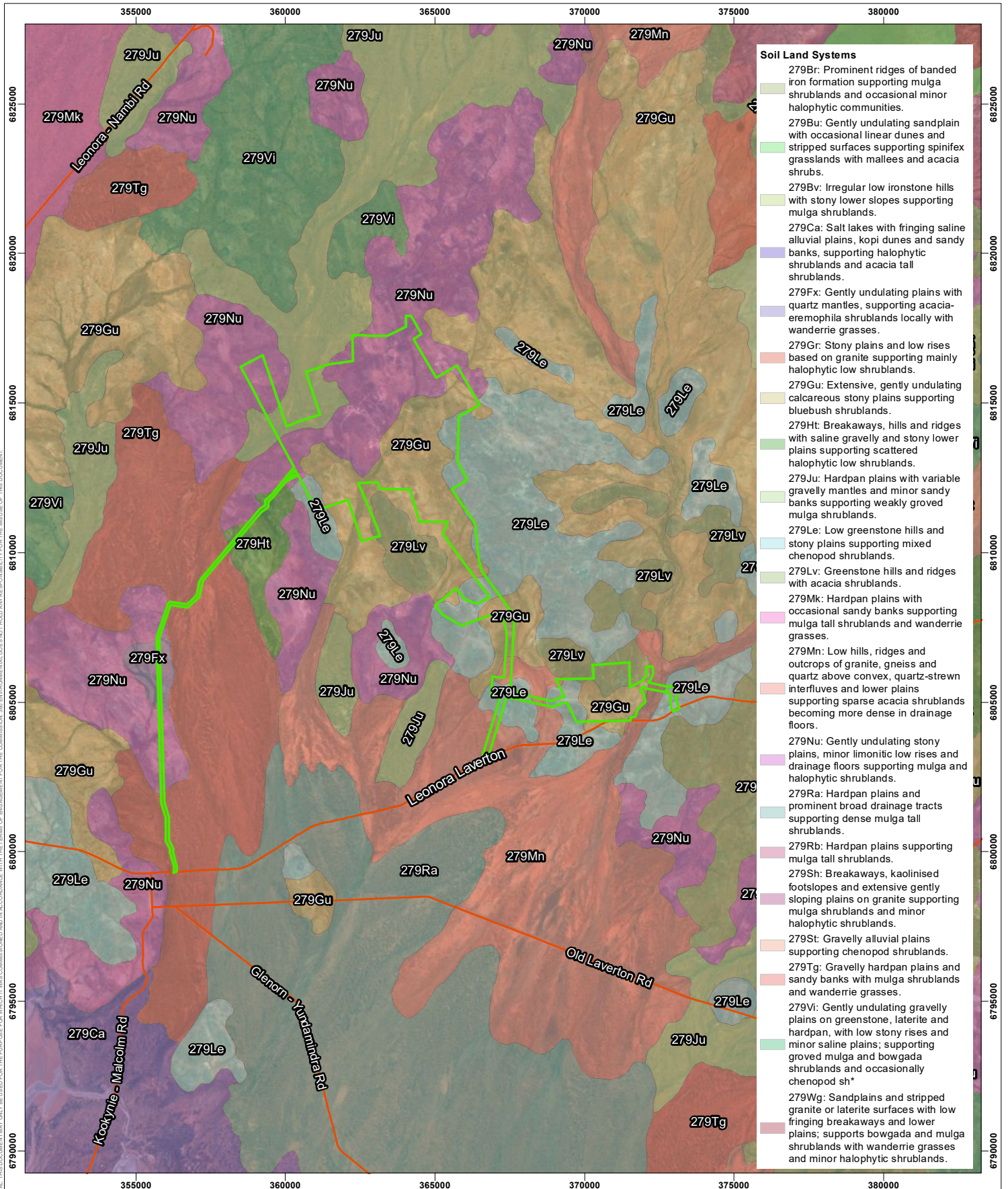
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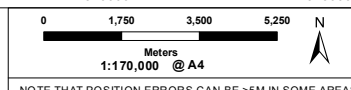
Figure 3b
 Camp Site



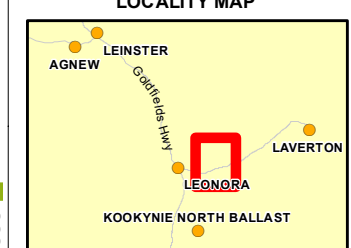
- ### Soil Land Systems
- 279Br: Prominent ridges of banded iron formation supporting mulga shrublands and occasional minor halophytic communities.
 - 279Bu: Gently undulating sandplain with occasional linear dunes and stripped surfaces supporting spinifex grasslands with mallees and acacia shrubs.
 - 279Bv: Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.
 - 279Ca: Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.
 - 279Fx: Gently undulating plains with quartz mantles, supporting acacia-eremophila shrublands locally with wanderie grasses.
 - 279Gr: Stony plains and low rises based on granite supporting mainly halophytic low shrublands.
 - 279Gu: Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.
 - 279Ht: Breakaways, hills and ridges with saline gravelly and stony lower plains supporting scattered halophytic low shrublands.
 - 279Ju: Hardpan plains with variable gravelly mantles and minor sandy banks supporting weakly groved mulga shrublands.
 - 279Le: Low greenstone hills and stony plains supporting mixed chenopod shrublands.
 - 279Lv: Greenstone hills and ridges with acacia shrublands.
 - 279Mk: Hardpan plains with occasional sandy banks supporting mulga tall shrublands and wanderie grasses.
 - 279Mn: Low hills, ridges and outcrops of granite, gneiss and quartz above convex, quartz-strewn interfluvies and lower plains supporting sparse acacia shrublands becoming more dense in drainage floors.
 - 279Nu: Gently undulating stony plains, minor limonitic low rises and drainage floors supporting mulga and halophytic shrublands.
 - 279Ra: Hardpan plains and prominent broad drainage tracts supporting dense mulga tall shrublands.
 - 279Rb: Hardpan plains supporting mulga tall shrublands.
 - 279Sh: Breakaways, kaolinised footslopes and extensive gently sloping plains on granite supporting mulga shrublands and minor halophytic shrublands.
 - 279St: Gravelly alluvial plains supporting chenopod shrublands.
 - 279Tg: Gravelly hardpan plains and sandy banks with mulga shrublands and wanderie grasses.
 - 279Vi: Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved mulga and bowgada shrublands and occasionally chenopod sh*
 - 279Wg: Sandplains and stripped granite or laterite surfaces with low fringing breakaways and lower plains; supports bowgada and mulga shrublands with wanderie grasses and minor halophytic shrublands.

Legend

- State Road
- Local Roads
- Development Envelope



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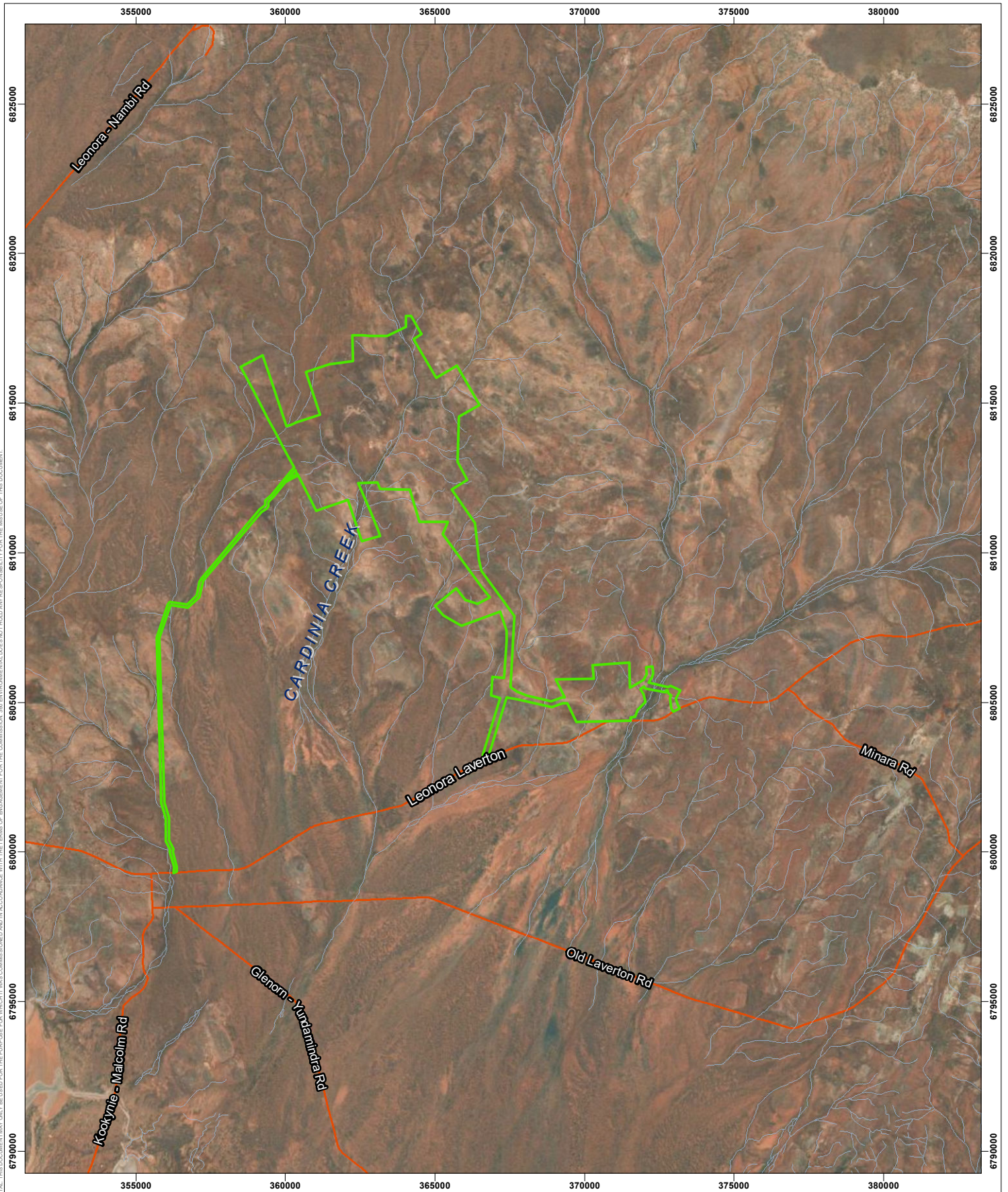
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Figure 4
 Soil Land Systems

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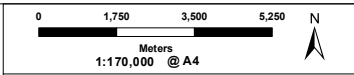
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Legend

- State Road
- Local Roads
- Watercourse - minor, perennial
- Development Envelope

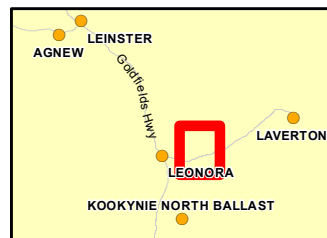
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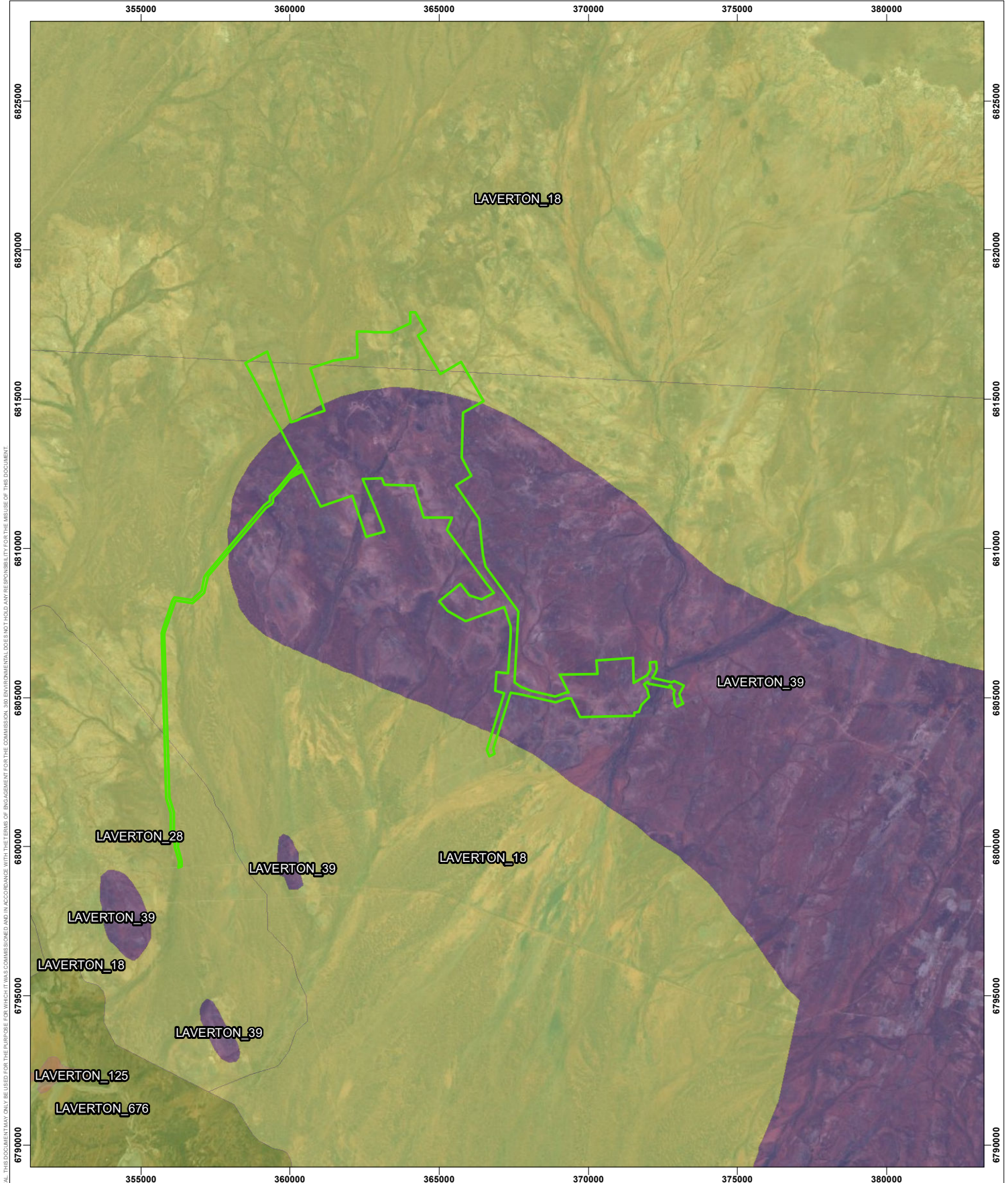
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Figure 4

Hydrology



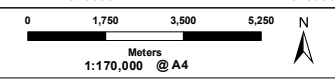
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Legend

- Development Envelope
- Broad Vegetation Associations**
- Low woodland, open low woodland or sparse woodland
- Salt lake, lagoon, clay pan
- Samphire
- Scrub, open scrub or sparse scrub

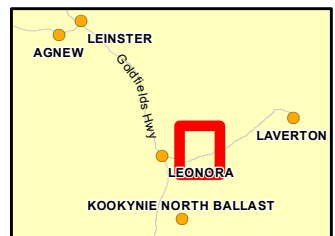
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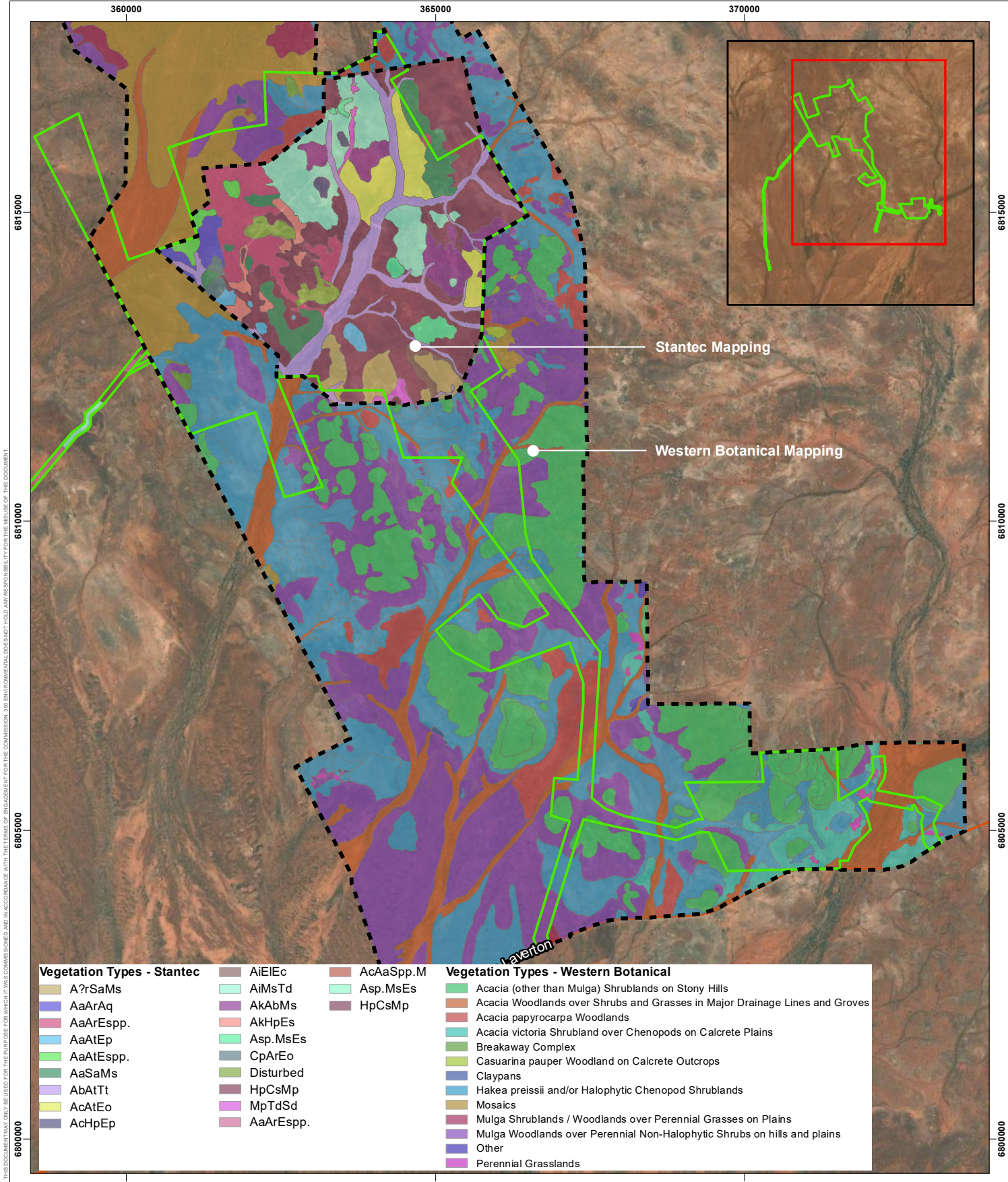
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LF	FJ	FJ	0

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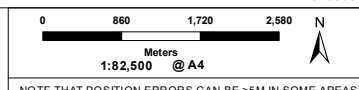
Figure 6
Broad Vegetation Associations



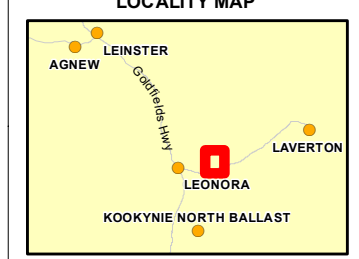
Vegetation Types - Stantec		Vegetation Types - Western Botanical	
A?rSaMs	AiEIEc	AcAaSpp.M	Acacia (other than Mulga) Shrublands on Stony Hills
AaArAq	AiMsTd	Asp.MsEs	Acacia Woodlands over Shrubs and Grasses in Major Drainage Lines and Groves
AaArEsp.	AkAbMs	HpCsMp	Acacia papyrocarpa Woodlands
AaAtEp	AkHpEs		Acacia victoria Shrubland over Chenopods on Calcrete Plains
AaAtEsp.	Asp.MsEs		Breakaway Complex
AaSaMs	CpArEo		Casuarina pauper Woodland on Calcrete Outcrops
AbAtTt	Disturbed		Claypans
AcAtEo	HpCsMp		Hakea preissii and/or Halophytic Chenopod Shrublands
AcHpEp	MpTdSd		Mosaics
	AaArEsp.		Mulga Shrublands / Woodlands over Perennial Grasses on Plains
			Mulga Woodlands over Perennial Non-Halophytic Shrubs on hills and plains
			Other
			Perennial Grasslands

Legend

- State Road
- Development Envelope



-NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS-



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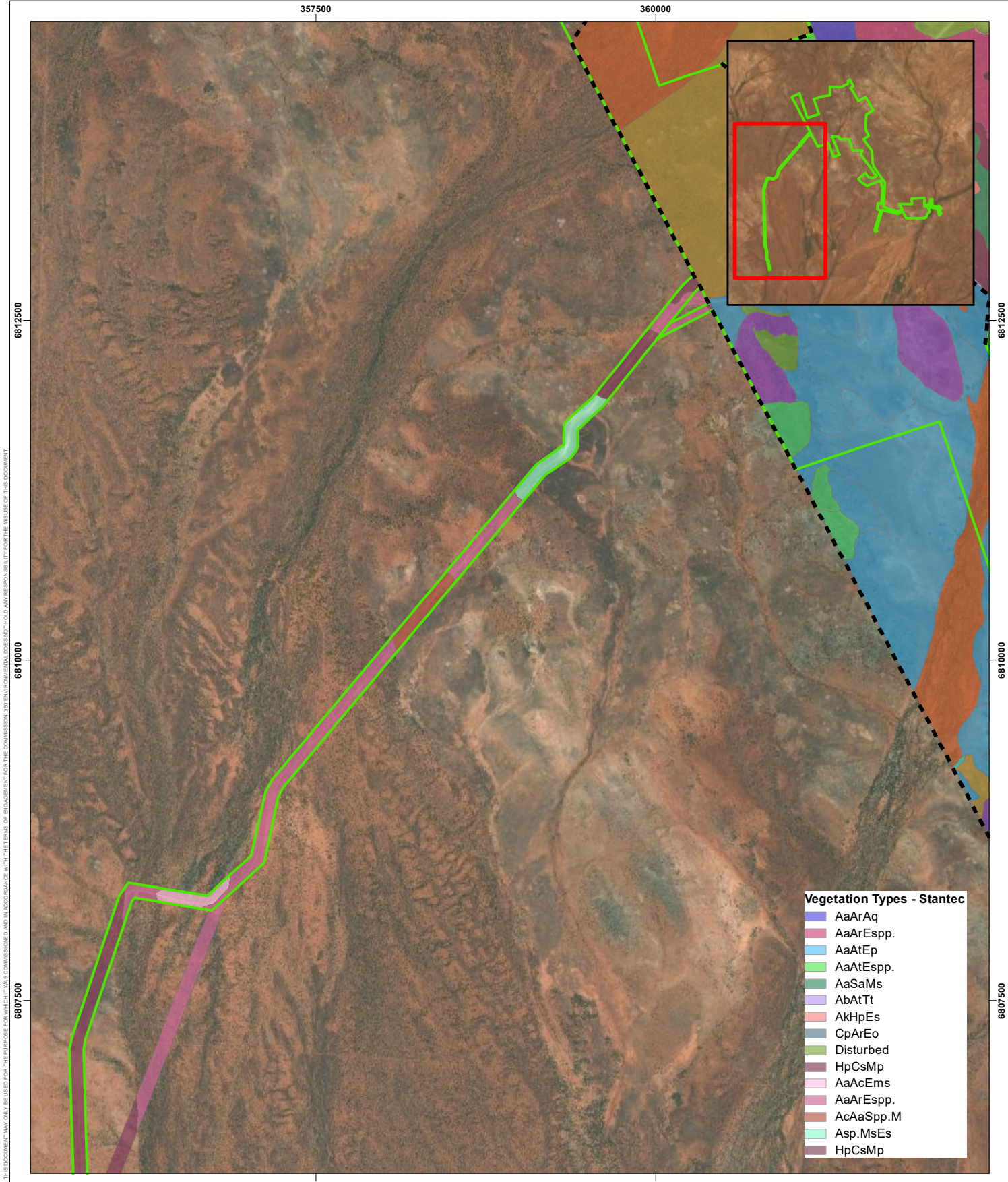
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Figure 7a
Vegetation Types

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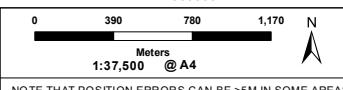
Vegetation Types - Stantec

Blue	AaArAq
Purple	AaArEsp.
Light Blue	AaAtEp
Light Green	AaAtEsp.
Green	AaSaMs
Light Purple	AbAtTt
Light Blue	AkHpEs
Dark Green	CpArEo
Light Green	Disturbed
Purple	HpCsMp
Pink	AaAcEms
Purple	AaArEsp.
Light Green	AcAaSp.M
Light Green	Asp.MsEs
Purple	HpCsMp

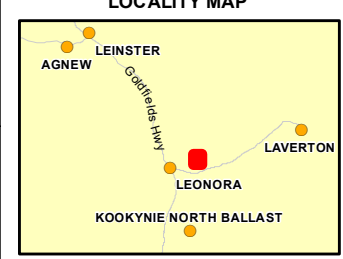
- Legend**
- Development Envelope
 - Western Botanical Mapping Boundary

Note:
Vegetation Types Mapping outside of the Western Botanical Boundary was done by Stantec

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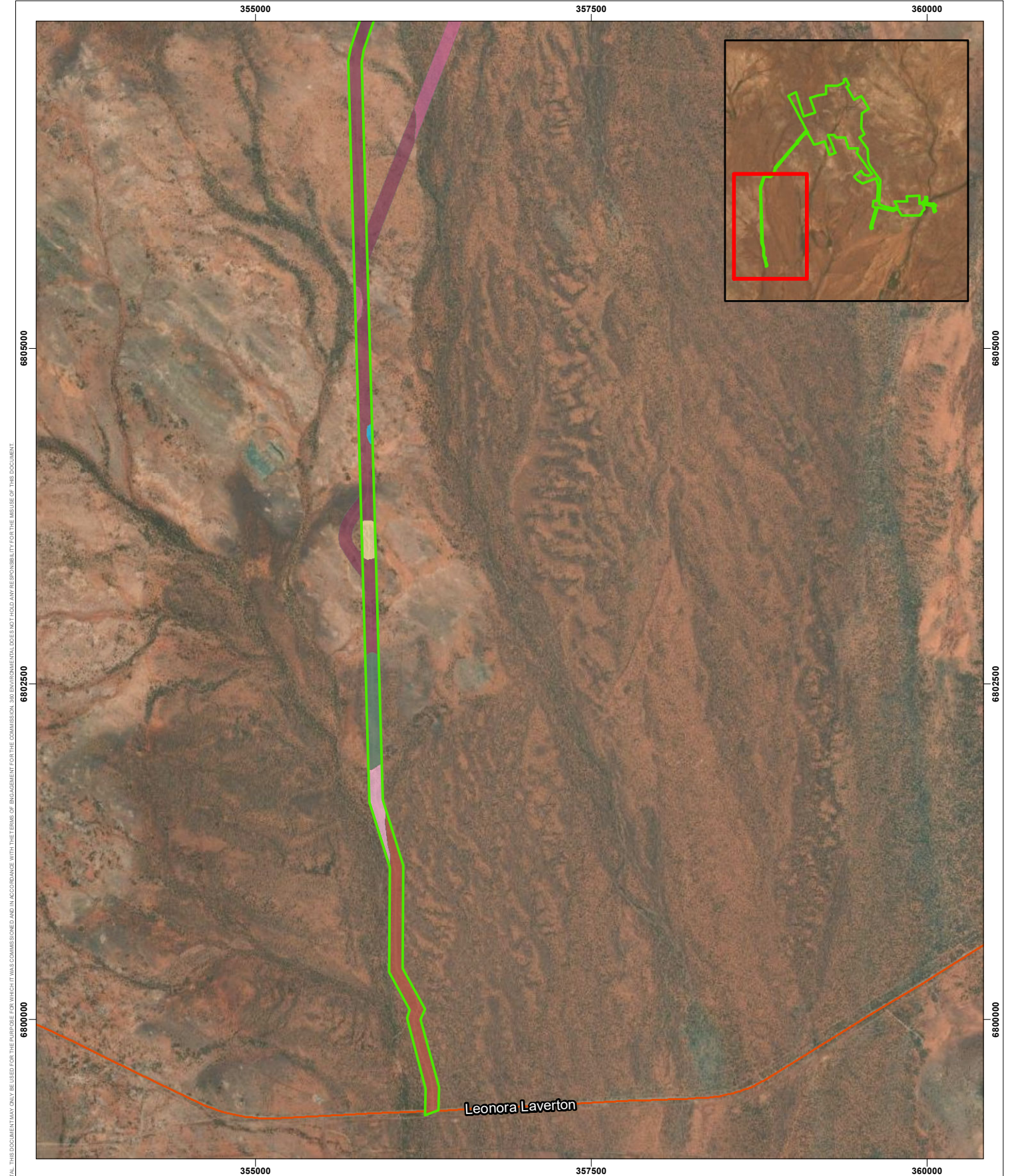
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Figure 7b
Vegetation Types

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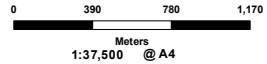
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Legend

- State Road
- Development Envelope
- Vegetation Types - Stantec**
- A?dArrEsp.
- AaAaEsp.
- AaAcEms.
- AaArEsp.
- AcAaSpp.M
- HpCsMp
- PaAtEp

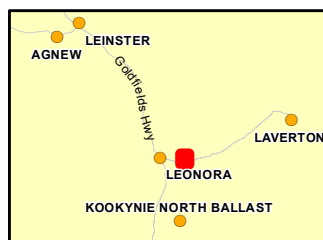
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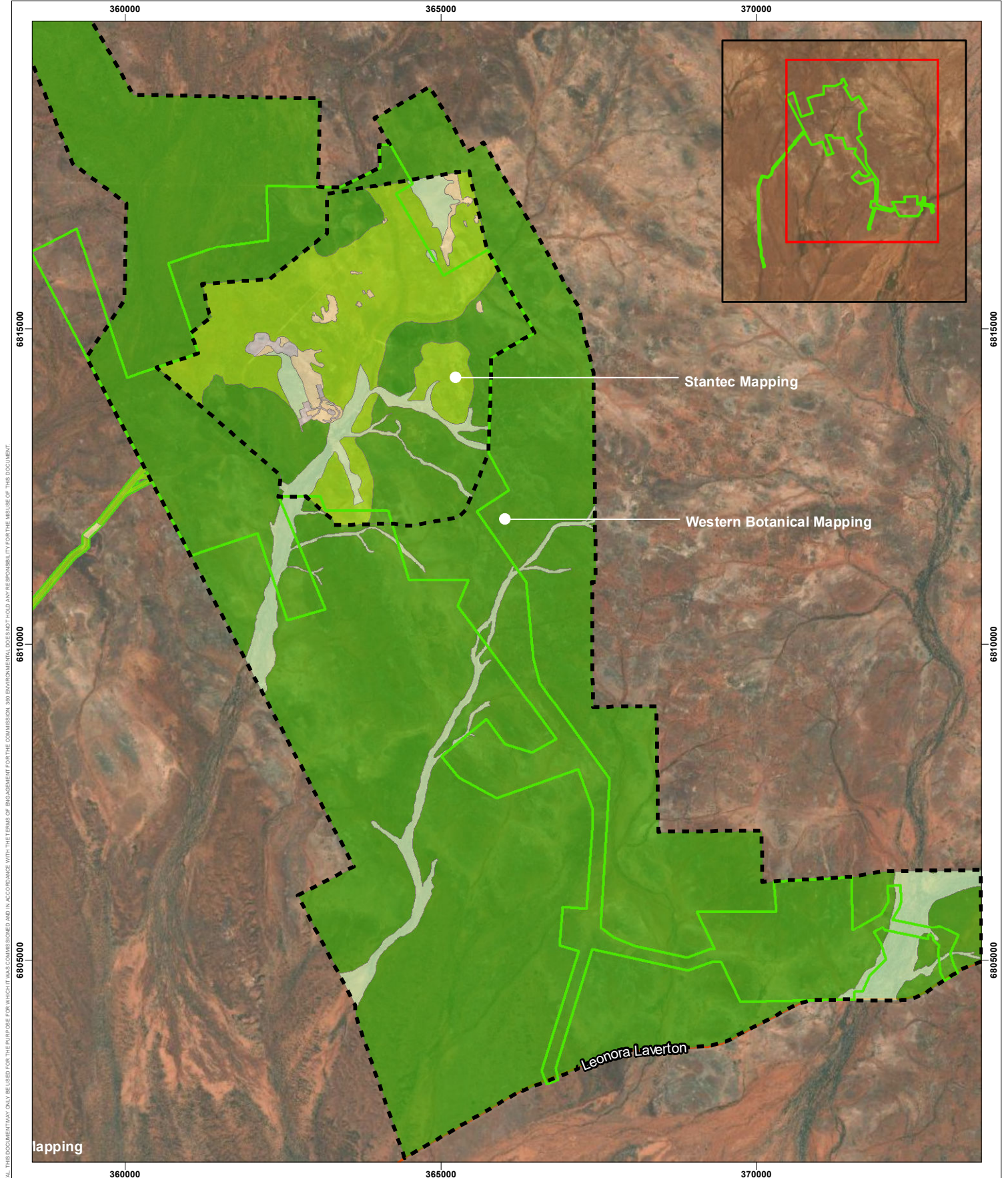
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Figure 7c
Vegetation Types



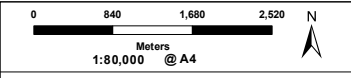
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Legend

- State Road
- Development Envelope
- Western Botanical Mapping Boundary
- Vegetation Condition**
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

Note:
Condition Mapping outside of the Western Botanical Boundary was done by Stantec

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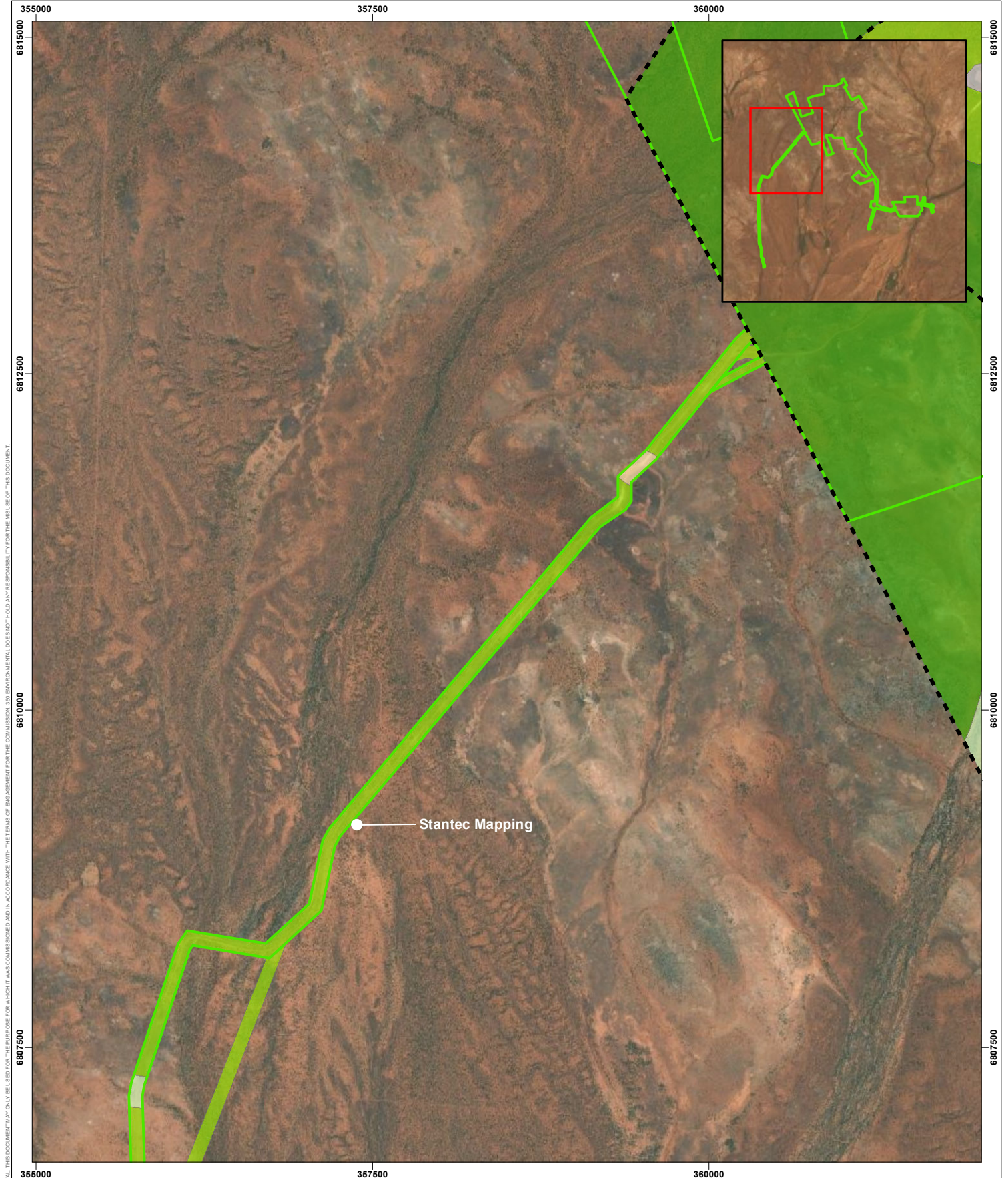
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**Figure 8a
Vegetation Condition**



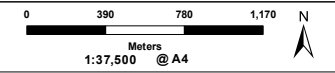
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Legend

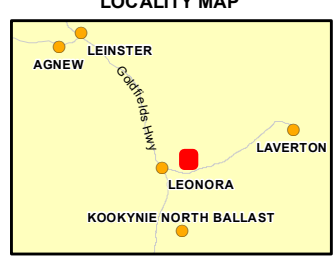
- Western Botanical Mapping Boundary
- Vegetation Condition**
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

Note:
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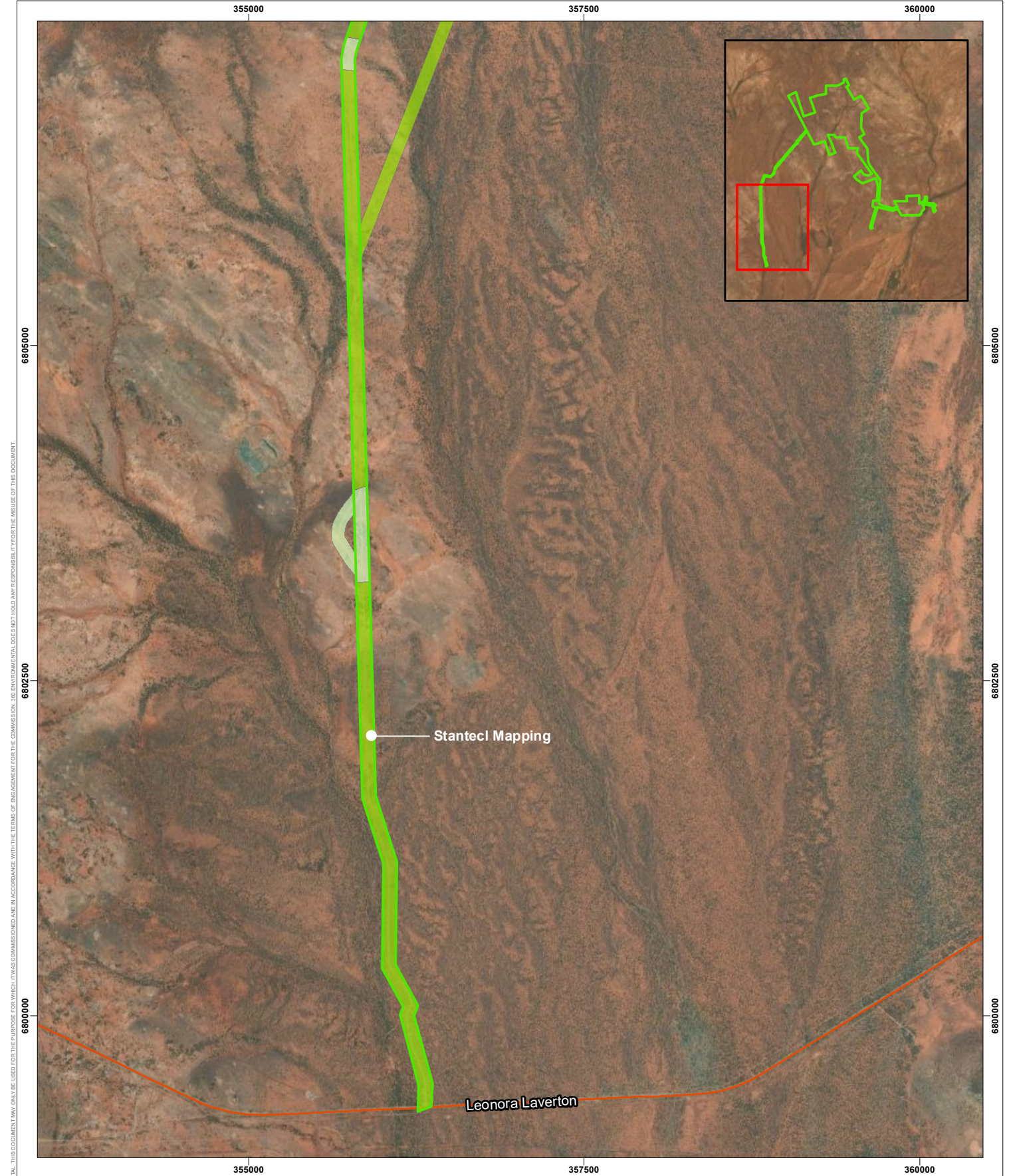
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Figure 8b
Vegetation Condition



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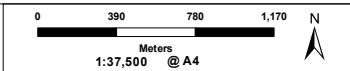
Legend

- State Road
- Development Envelope
- Vegetation Condition**
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

Note:
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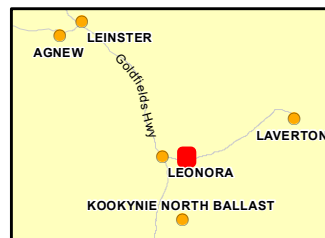
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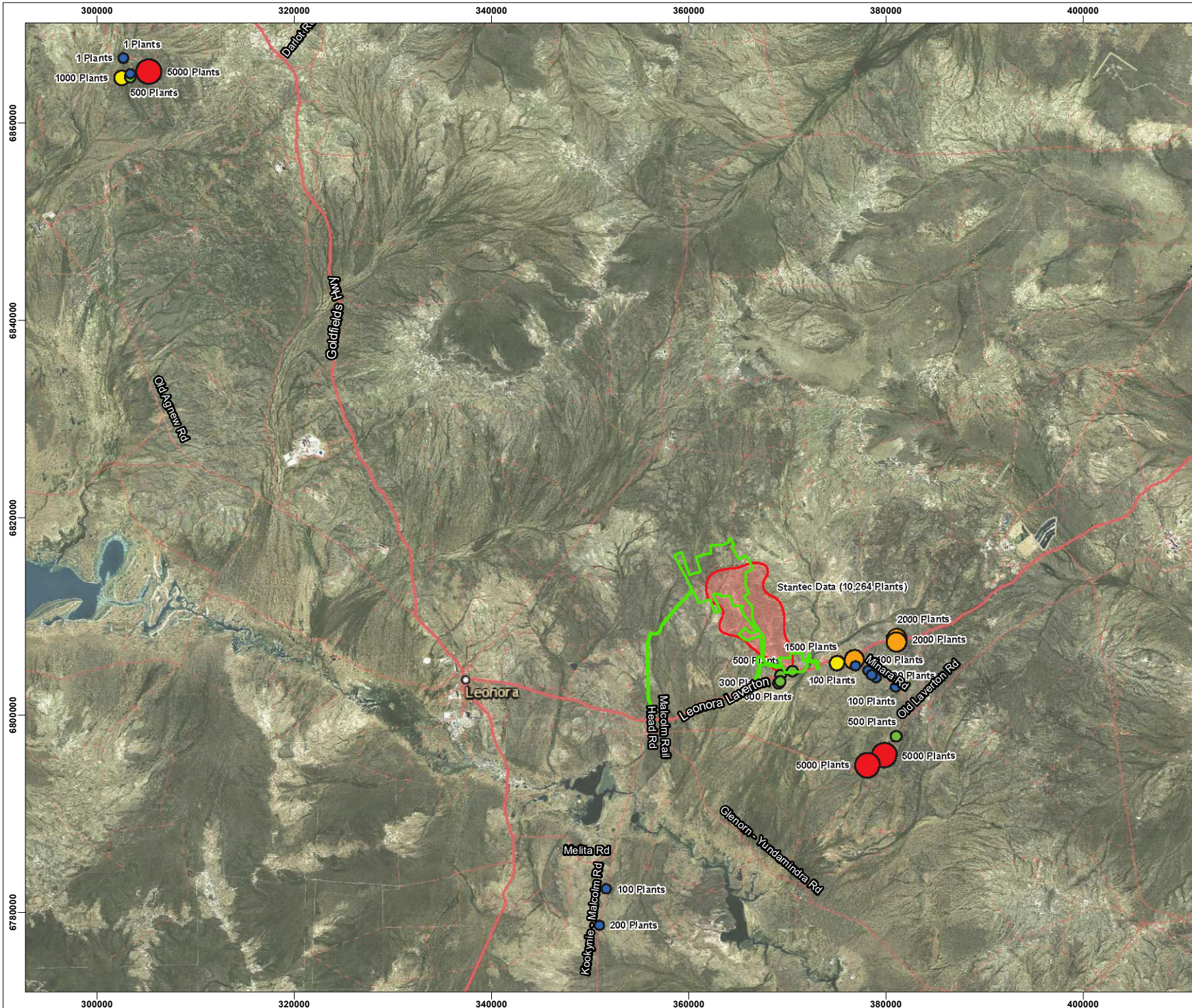
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Figure 8c Vegetation Condition

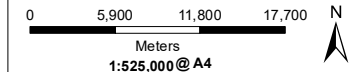


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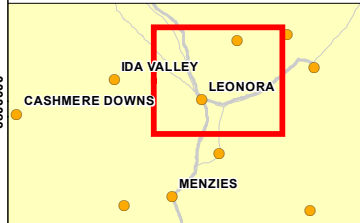
Development Envelope

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Figure 9
Acacia Sp. Marshall Pool

Appendices

Appendix G Western Botanical – Flora and Vegetation Assessment, Leonora Gold Project 2019

Appendix H Stantec – Flora and Fauna Extrapolation Exercise Report, Leonora Gold Project 2018b

Appendix I Stantec – Level 1 Flora, Vegetation and Fauna Assessment, Leonora Gold Project 2018c

Appendix J Stantec – Flora, Vegetation and Fauna Report, Proposed Mertondale Haul Road and Pipeline Deviation and Cardinia Access Road 2018d

Appendix K Phoenix Environmental Services – Terrestrial Fauna Survey, Leonora Gold Project 2019

Appendix M 360 Environmental – Surface Water Assessment, Cardinia Gold Project 2021

Appendix Q Navigator Mining Pty Ltd ASIC Extract

Appendix R Navigator Mining ASIC Extract



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