NGARLUMA SOLAR SITES A AND B
RECONNAISSANCE FLORA AND VEGETATION SURVEY
MAY 2024

Prepared for
Ngarluma Aboriginal Corporation

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Ngarluma Solar Sites A and B
Reconnaissance Flora and Vegetation Survey

Prepared for
Ngarluma Aboriginal Corporation

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Table of Contents

1 Introduction 1
2 Scope of Work 1
3 Methodology 3
3.1 Desktop Assessment 3
3.1.1 Database Searches 3
3.1.2 Determination of Likelihood of Occurrence of Conservation Significant Species within the Survey Areas 3
3.2 Field Survey 3
3.2.1 Flora and Vegetation Survey 3
3.2.1 Weather 5
3.2.2 Limitations of the Survey 5
4 RESULTS AND DISCUSSION 8
4.1 Desktop Assessment 8
4.2 Field Survey 8
4.2.1 Vegetation 8
4.2.2 Flora 20
4.2.3 Introduced Flora 20
5 SUMMARY 21
6 REFERENCES 22

List of Tables

Table 1: Likelihood of occurrence of priority flora criteria. 3
Table 2. Statement of Limitations 5
Table 3. Vegetation descriptions, condition ratings and PEC status for sites surveyed within Solar site A. 10
Table 4. Vegetation descriptions, condition ratings and PEC status for sites surveyed within Solar site B. 13

List of Figures

Figure 1. Location of Solar Site A and Solar Site B 2
Figure 2. Rainfall Data for Karratha Aero (Stn. ID. 4083) for Period January 2023 - April 2024 5
Figure 3. Vegetation associations recorded in Solar site A. 16
Figure 4. Vegetation associations recorded in Solar site B. 17
Figure 5. Vegetation Condition for Solar site A. 18
Figure 6. Vegetation condition rating for Solar site B. 19

List of Appendices

Appendix A. Debrief Email from Initial Site Selection Survey
Appendix B. Likelihood of Occurrence Table for Priority Species
Appendix C. Detailed field sheets and Species Lists for Solar site A and Solar site B.

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1 Introduction

Ngarluma Aboriginal Corporation (NAC) is seeking to develop green energy parks with related infrastructure, including transmission and battery storage over part of the Karratha pastoral lease in close proximity to Karratha. NAC has identified preferred areas within a Section 91 application area for the development of the infrastructure. This application requires the necessary biological surveys to be conducted.

In order to initiate this project, NAC commissioned Vicki Long & Associates (VLA) to conduct a brief overview vegetation and flora survey of four potential sites with a view to identifying those that would be preferential to develop. The preference was to have minimal impact on landform, habitat, vegetation, flora and potential Priority flora and Priority Ecological Communities and other locally significant vegetation. This initial overview survey was conducted on December 15 and 16th 2023. Conditions were dry but vegetation types and potential issues were able to be identified by experienced local botanist, Vicki Long, who conducted the survey. Two sites, Site A and Site B (see Figure 1) were given preference over Sites C and D. An email debrief of this overview survey, including a figure showing the original four sites is provided in Appendix A.

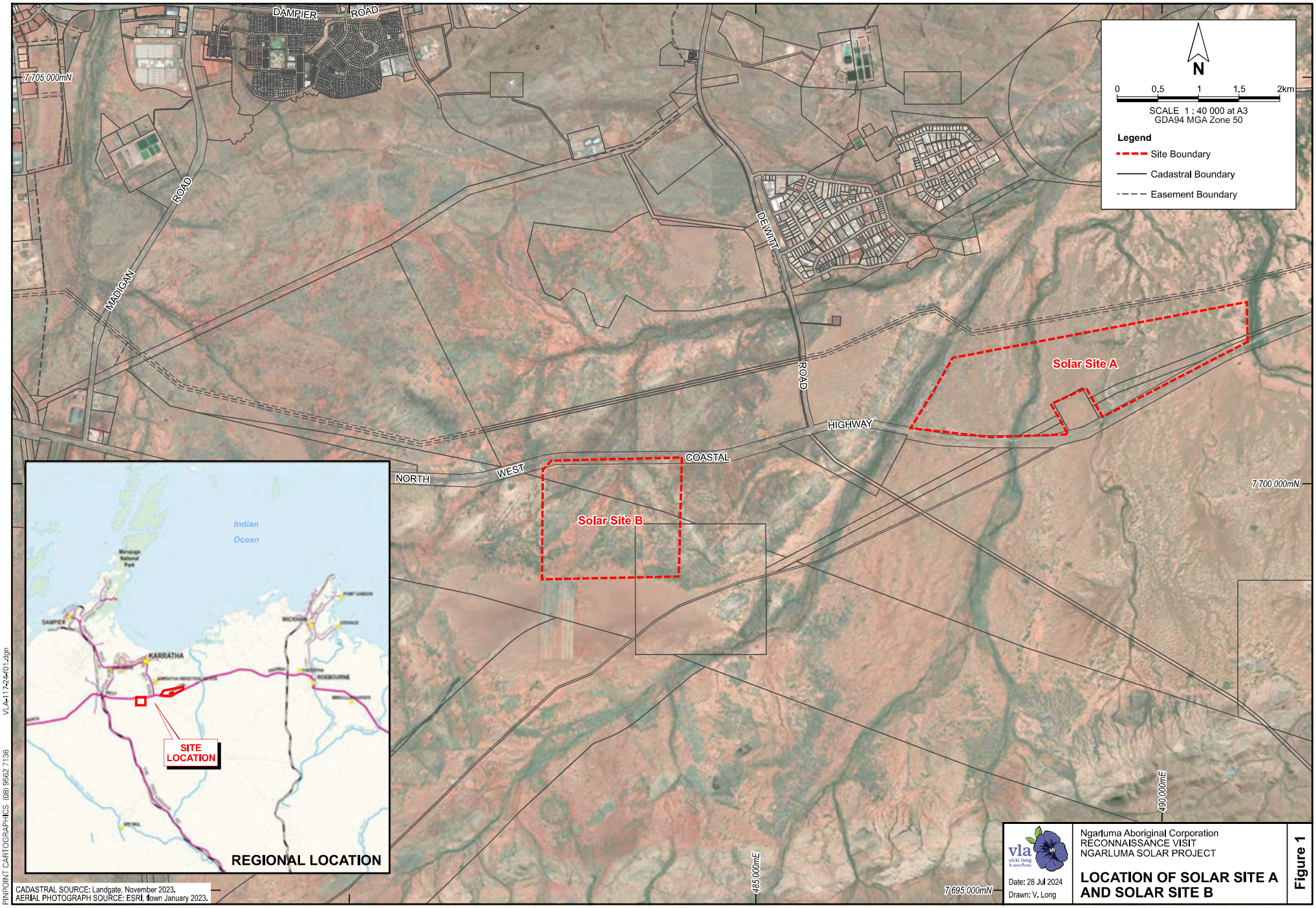
Following the initial overview, NAC again commissioned VLA to conduct a reconnaissance flora and vegetation survey of the two preferred sites, Solar site A and Solar site B. This report provides the results of those surveys.

2 Scope of Work

The Ngarluma Aboriginal Corporation (NAC) commissioned VLA to undertake a reconnaissance flora and vegetation survey on Solar Site A and Solar Site B (Figure 1) in accordance with the Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) and Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002).

The scope of work included undertaking a:

- Desktop assessment within a 40 km radius of the centrepoint between the two survey sites to identify any potential flora of conservation significance (Priority, or other), PECs and other vegetation of significance which may occur in the area.
- reconnaissance survey which includes:
    - Verification of information identified from the DBCA search
    - Compiling a species list, including recording locations of any Threatened (Declared Rare) Flora, Priority Flora and introduced flora
    - Vegetation type and vegetation condition with supporting photographs of each vegetation type
    - Discussion of conservation significant vegetation or flora recorded at the survey locations and their abundance and / or extent
    - assessing any potential impacts on this vegetation from the proposed project.
- Targeted survey (in conjunction with the reconnaissance survey) for PEC grassland vegetation and if deemed present, identifying the type and its corresponding Priority status, condition and extent.
- Prepare a report detailing the results of the desktop assessment and field survey to meet the requirements for a vegetation clearing permit assessment.



CADASTRAL SOURCE: Landgate, November 2023.
AERIAL PHOTOGRAPH SOURCE: ESRI, flown January 2023.

Ngarluma Aboriginal Corporation
RECONNAISSANCE VISIT
NGARLUMA SOLAR PROJECT

LOCATION OF SOLAR SITE A AND SOLAR SITE B

Figure 1

Date: 28 Jul 2024
Drawn: V. Long

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3 Methodology

3.1 Desktop Assessment

3.1.1 Database Searches

TECs and PECs listed by DBCA (DBCA 2024) were reviewed to determine if any were analogous with ecological communities recorded in the survey locations.

In addition, a Naturemap database search was conducted to identify listed conservation significant flora and ecological communities within, or in close proximity to, the survey locations.

Introduced flora species were compared to the DPIRD list, to determine if any have been listed as Declared Pests (Department of Primary Industries and Regional Development 2024), and the WoNS list (Australian Weeds Committee 2012).

3.1.2 Determination of Likelihood of Occurrence of Conservation Significant Species within the Survey Areas

Habitat requirements of conservation significant flora species identified from the database and literature searches were assessed to determine whether suitable habitat was present within the survey locations. Descriptions of criteria utilised by VLA to assess the likelihood of species occurrence within the survey locations are presented in Table 1.

Table 1: Likelihood of occurrence of priority flora criteria.

Likelihood of occurrence	Criteria
Recorded	Species previously recorded within the survey area and likely to still occur (records from literature review or recent database records, in areas where no clearing has been undertaken)
Likely	Species previously recorded within the survey area (older records from database searches) or within 10 km of the survey area and suitable habitat appears to be present in the survey area
Potential	Species previously recorded within 10 km to 20 km of the survey area and/or suitable habitat appears to be present in the survey area
Unlikely	No suitable habitat appears to be present in the survey area
Unknown	No information available to assess likelihood.

Following the surveys, the conservation significant flora species identified during the desktop assessment as having the highest potential to occur within the survey locations, but not recorded during the current surveys, were again assessed to determine their likelihood of occurrence within the survey locations. Post-field survey likelihood was primarily based on validating the presence (and thorough inspection) of suitable habitats within each of the survey locations, combined with life form, habitat and flowering information for each flora species.

3.2 Field Survey

3.2.1 Flora and Vegetation Survey

The reconnaissance flora and vegetation survey was conducted at two locations:

- Solar site A
- Solar site B

The locations of the survey sites are shown in Figure 1.

The surveys were conducted by Principal Botanist Vicki Long (VLA) (Flora Taking (Biological Assessment) Licence No. FB62000120/2 (valid until 04/07/2025)) on 13 May 2024 to 14 May 2024.

Vicki has lived and worked in the Pilbara for the past 39 years and has considerable experience identifying both native flora and vegetation and introduced flora of the Eremaean zone. The surveys were undertaken in accordance with the requirements outlined in the scope of works provided.

Information acquired during the desktop assessment assisted with identification of Priority species, conservation significant vegetation and Declared Pests. The survey area was clearly delineated on aerial imagery, produced both as hard paper copies and on a hand-held tablet. Previously recorded conservation significant flora records and associated habitat preference information assisted in identifying vegetation types and habitats within the survey area that have the potential to support conservation significant flora and vegetation.

Solar site A and Solar site B were walked in their entirety to ensure all habitat / vegetation types were covered and recorded. In each major vegetation type present, releves were searched (the number of releves searched in each vegetation type was dependent on the area and extent of vegetation type). In some of the smaller areas of vegetation, traverses rather than releves were undertaken.

Records were made of dominant vegetation types, any conservation significant species, weed species, characteristic species and any vegetation of significance. Species of conservation significance were counted, and a location was recorded on a handheld GPS. Photographs were taken at mapping note points and of Priority species recorded and vegetation of potential conservation significance.

In each vegetation type, the following were recorded:

- Site number
- Date
- Photo
- Location - coordinates measured using a handheld Global Positioning System (GPS) (MGA50, GDA94
- Habitat - a broad description of the surrounding landscape
- Vegetation description – vegetation types were described according to level 5 of the National Vegetation Information System (ESCAVI 2003).
- Vegetation condition – assessed according to the vegetation condition scale adapted from Trudgen (1988)
- Characteristic Species
- Priority flora and the respective GPS location (or any suspected Priority flora)
- Weed species.
- Location of any Declared Pests or WoNS.
- If conservation significant vegetation was identified, the abundance and extent was recorded.

General notes were made regarding the site ecology and any other issues considered relevant to the results.

Species were identified in the field by the Principal botanist. Any species not able to be identified in the field were collected, labelled and pressed for later identification by Vicki Long (utilising the Pilbara Regional Herbarium) or sent to the WA Herbarium.

3.2.1 Weather

Daily weather observations recorded from the Bureau of Meteorology (BoM) Karratha Aero weather station (004083) which is located approximately 15 km north-west of the survey sites were used to describe local rainfall and temperatures in the 6 months preceding the survey (Figure 2) (BoM 2024).

In the six month period prior to the survey being undertaken, a total of 130.4 mm of rain was recorded which is about 100 mm below average for that six month period (average is 229.4 mm).

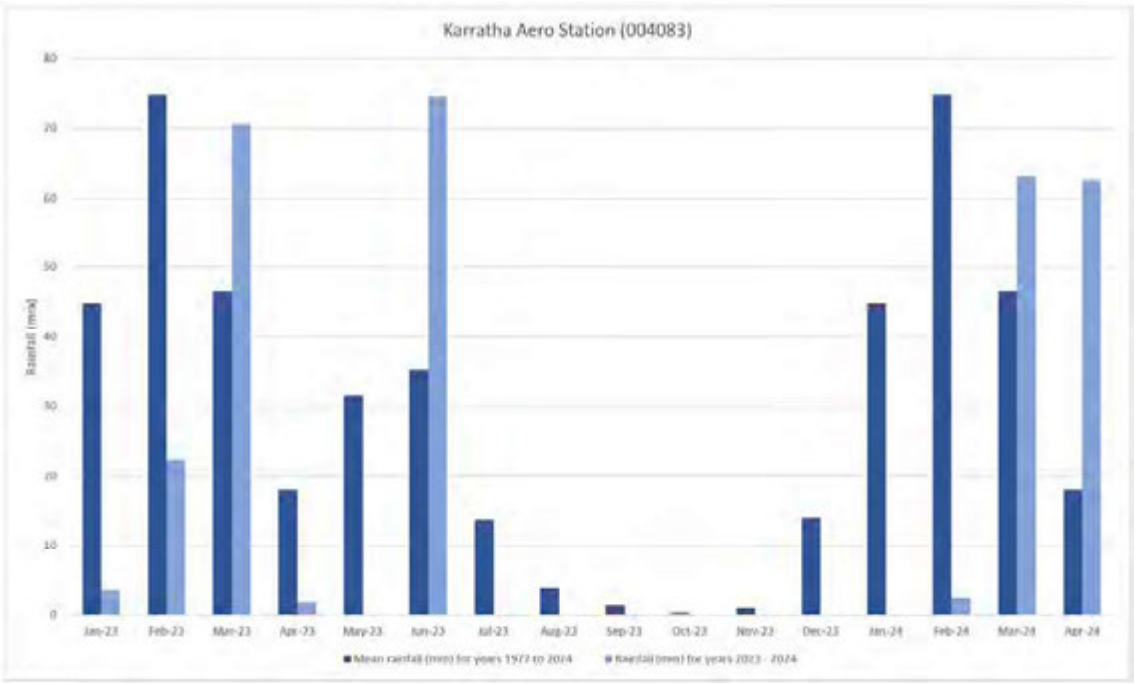


Figure 2. Rainfall Data for Karratha Aero (Stn. ID. 4083) for Period January 2023 - April 2024

3.2.2 Limitations of the Survey

Following completion of the desktop assessment and field surveys, a review of any limitations that may have affected a complete assessment of the data collected was conducted.

Table 2 is based on those suggested as considerations in Section 10.2 of the Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016)

Table 2. Statement of Limitations

Potential limitation	Statement regarding potential limitations
(i) Sources of information and availability of contextual information Is the region well documented?	Previous biological surveys have been conducted in the broader regional area, and broad-scale information is available from Beard (1975) and Payne et al. (1980). More specifically, Vicki Long, as VLA or as Astron Environmental Services, has conducted numerous vegetation and flora surveys in similar habitat in the area. (eg VLA2020, 2014, 2013, 2011, 2008. Knowledge of the area and contextual information was not a limitation.

Potential limitation	Statement regarding potential limitations
(ii) Scope The level of survey and detail required to undertake the survey. Was there adequate time to complete the survey to the desired standard?	There was adequate time to complete the reconnaissance flora and survey and conduct targeted searches for Threatened and Priority flora and conservation significant vegetation within identified preferred habitats and landforms within the survey area. Time was not considered a limiting factor.
(iii) Proportion of flora and fauna identified, recorded and/or collected Was the survey sampling, timing and intensity considered adequate? Was the survey conducted at what was considered an appropriate time of the year for plant identification? Were any taxonomic groups considered to be under-represented?	The reconnaissance survey was conducted at an appropriate time for the PEC tussock grasslands to be identified after a total of 125 mm was received in the preceding March and April. The desktop review and the December 2023 overview survey indicated that the most significant conservation issues would relate to the potential presence of PECs (P1 and P3). Summer rainfall allows for necessary rejuvenation of the PEC grasses for identification. Whilst grasses had rejuvenated and could be positively identified, by May conditions were already drying out and some of the ephemeral species associated with these areas may not have been present – this did not, however impact the potential presence of any Priority flora. The relatively dry 12 months previous to the survey meant that many of the annuals and shorter lived perennial species were somewhat defoliated, however, the field botanist was able to identify them from the material present. Overall, it was considered this was an appropriate time to conduct this survey and it is estimated that 85% of expected species in this type of habitat were recorded. Proportion of flora and vegetation types identified and recorded was not seen as a limitation.
(iv) Completeness Is there further work which may be required i.e. was the relevant area fully surveyed?	The survey areas were considered adequately surveyed to compile representative lists of species, (including Priority and introduced flora species), as well as describe vegetation at a level appropriate for management decisions. The survey areas were comprehensively surveyed and as such completeness is not a limiting factor.
(v) Mapping reliability Were the aerial photographs, satellite images and site maps available considered adequate to fully understand the area surveyed? Was the mapping generated considered to have a high degree of reliability?	Colour aerial photography at a scale of 1:10,000 was used to locate the survey areas and to assist in navigation and delineation of vegetation boundaries. The aerial photography was of good resolution and, in general, accurately represented ground conditions. As such mapping reliability was not considered a limiting factor.
(vi) Timing When was the survey conducted in terms of season, rainfall, severe weather events etc. Was the survey conducted at an appropriate time for access, observation of the optimal suite of species and for identification of flowering and fruiting species?	Seasonal conditions were considered appropriate for being able to identify the potential PECs on the survey area, with the area having received 125 mm of rain in the preceding March and April. Although the area was already drying out again by the May survey, it was considered that the Priority Species, identified from the desktop as having potential to occur, would still have been present. In fact, one *Gomphrena* species was collected and is currently with the WA Herbarium for identification. The field botanist has worked in the area for the past 39 years and was confident in identifying species which were more defoliated. It is estimated that at least 85% of the species expected in the survey habitat types would have been recorded. Timing was not seen as a limitation.

Potential limitation	Statement regarding potential limitations
(vii) Disturbance Had the survey area been impacted by any disturbance which may have limited the survey, i.e. fire, flood, accidental human intervention etc.?	There had been disturbance history on both Sites A and B, relating to grazing and associated pastoral activities, fire, access and some borrowing. It is probable that this history of disturbance, which has occurred over decades, has impacted the flora and vegetation present. However, because this has occurred historically and over a long period of time, the resulting landform, vegetation types and flora present today cannot be seen as a 'limitation' to the results. The results apply to what has been created historically and this won't change.
(viii) Intensity In retrospect, was the intensity considered to be adequate?	The intensity of the survey was considered adequate to compile representative species lists. Intensity was not considered a limiting factor.
(ix) Resources Were the appropriate tools and materials available to complete the task effectively?	Resources were adequate to complete the survey and all appropriate tools and materials required to complete the task were available. Resources were not considered a limiting factor.
(x) Access Were there any factors limiting access to the survey area?	Each survey area was able to be accessed by vehicle. Sites were small enough to be able to be traversed by foot in each instance. As such access is not considered a limiting factor.
(xi) Experience Were personnel undertaking the field survey and plant identification trained and/or experienced in undertaking the required tasks?	The scientist responsible for undertaking the field survey has considerable experience in conducting vegetation and flora surveys. The identification of specimens brought back from the field was conducted by Principal botanist Vicki Long or by botanists at the WA Herbarium. Personnel experience was not considered a limiting factor.

4 RESULTS AND DISCUSSION

4.1 Desktop Assessment

Database sources indicate that Solar site A and Solar site B fall within either Priority 1 PEC 'Roebourne Plains coastal grasslands with gilgai microrelief on cracking clays' (Roebourne Plains gilgai grasslands), P1 PEC 'Chenopod vegetation associations of the Roebourne Plains' or Priority 3 PEC or their buffers (DBCA 2024).

Identification of the P1 and P3 Roebourne Plains grassland PECs relies on soil type as well as live, identifiable component grass and annual species, rather than just the persisting perennial *Eragrostis xerophila* (Roebourne Plains grass).

The Naturemap search identified 22 Priority flora species which have been known to occur within a 40 km radius of the survey sites. Of these, six Priority 3 (P3) species could potentially occur in the area based on the presence of suitable habitat. There are no known occurrences of these species within the survey sites. A Likelihood of Occurrence table is provided in Appendix B

VLA (various surveys 2020, 2014, 2013, 2011, 2008) has identified that the general vicinity surrounding and including the survey areas has been historically disturbed for grazing, borrowing and local access.

4.2 Field Survey

Both Solar site A and Solar site B have been historically overgrazed, randomly accessed for station purposes and past fencing, and in some areas, lightly borrowed and this has impacted the current state of vegetation.

Solar site A has a drainage line intersecting the western portion of the site and another adjacent to the eastern boundary of the site. These drainage lines should not be impacted either directly or indirectly (through changed landform) and a 100 m buffer should be maintained between any potential works and the drainage lines at all times.

An area of Chenopod P1 PEC occurs on Solar site A predominantly along the northern most boundary. Interestingly a recent major power transmission line and associated access track has been constructed through the Chenopod P1 PEC.

4.2.1 Vegetation

Three broadscale (NVIS Level III) vegetation types were identified in Solar site A comprising of 11 vegetation associations (NVIS Level V). On Solar site B, five broadscale (NVIS Level III) vegetation types were identified housing nine vegetation associations (NVIS Level V). The vegetation associations and condition ratings for vegetation recorded in Solar site A and Solar site B are presented in Tables 3 and 4 and represented on Figures 3, 4, 5 and 6.

4.2.1.1 Conservation significant vegetation

Of the eleven vegetation types identified in Solar site A, two were identified as having current PEC status, PEC P1 *'Roebourne Plains coastal grasslands with gilgai microrelief on cracking clays'* and PEC P1 '*Chenopod vegetation associations of the Roebourne Plains'.* Occurrences of these P1 PECs were predominantly found along the northern boundary, with one extending north-south across the survey area. The small area of "*Roebourne Plains coastal grassland*" was recorded as being in Excellent condition, but it is represented as a very small area only. The "*Chenopod vegetation association*" occurs in two areas both of which have been previously impacted to some degree. They were recorded as ranging from Good to Fair condition but retained enough integrity to be still considered a PEC. Note

that this PEC has not previously been recorded on this site, no doubt due to lack of previous survey on this particular area. There were other occurrences of these PECs over Solar site A, but they were all considered to be too degraded by historical disturbances and an apparent lack of ability to regenerate (at this stage) to be considered PECs. There was an area of potential PEC P3 ('*Horseflat land system of the Roebourne Plains'*) which also occurred on Site A, but it was also considered too degraded and without apparent ability to regenerate fully to be considered to have PEC status.

Of the nine vegetation types present in Solar site B, one P3 PEC *'Horseflat land system of the Roebourne Plains'* was identified. This P3 PEC grassland occurs on the southern end of Solar Site B and forms the northern edge of an extensive PEC area extending to the south beyond Solar Site B and is in good condition. Small patches of the P3 PEC were also found mosaiced with *Acacia xiphophylla* but these are small areas only, not the extensive grasslands which characterise the PEC, hence these small areas were not considered to be the P3 PEC.

The vegetation types recorded on Solar site A and Solar site B are considered to be widely represented within their particular habitat types in the local area.

Table 3. Vegetation descriptions, condition ratings and PEC status for sites surveyed within Solar site A.

Site No	Veg Code	Vegetation Description	Habitat	Vegetation Condition[1]	Status	GPS Location (E/N)
Tussock Grassland						
***Eriachne benthamii* mixed tussock grassland**						
A1	EbChEx	*Eriachne benthamii* tussock grassland with *Chrysopogon fallax, Panicum decompositum, Eragrostis xerophila* tussock grassland over annual mixed herbland and *Ipomoea coptica* vines.	Small localised pocket of deeply cracking dark brown clay on flat weakly gilgai plain.	Excellent	PEC P1 (a) Roebourne Plains gilgai grassland[2]	490809 7720209 9
***Eragrostis xerophila* tussock grassland**						
A4 A4a A4b	Ex	*Eragrostis xerophila* open tussock grassland. Scattered annual herbs	Flat plan. Weakly gilgai mosaiced with areas of stony gibber. Disturbed with tracks, old fences, and over grazed.	Fair	Degraded so not a PEC	490137 7701696 A4a 489315 7701885 A4b
Chenopod low shrubland over *Eragrostis xerophila* open tussock grassland						
***Atriplex bunburyana, Sclerolaena* ssp over open tussock grassland.**						
A2 (Sites A2a A2b A2c A2d)	AbSspEx (degraded)	Mosaic of *Atriplex bunburyana, Sclerolaena hostilis, Sclerolaena bicornis* open shrubland over open annual *Xerochloa barbata* open grassland on stony scalds with *Sclerolaena hostilis, Atriplex bunburyana, Sclerolaena bicornis, S. glabra* scattered to open shrubs over *Eragrostis xerophila* on self-mulching gilgai soils with surface veneer of stones.	Flat plain. Mosaic of stoney scalds mixed with on pinky brown silty clay mixed with areas of weakly gilgai semi saline soils with surface veneer of stones.	Good – Fair some historical disturbance	PEC P1 (b) Degraded so not a PEC.	490691 7701970 A2a 490395 7702048 A2b 491001 7702158 A2c 491021 7701885 A2c
***Sclerolaena* spp over *Eragrostis xerophila* tussock grassland**						
A6 A6a	AbSspEx (PEC P1)	*Sclerolaena hostilis, S. bicornis, Atriplex bunburyana* low shrubland, sometimes closed low shrubland over *Eragrostis*	Flat plain. Mosaic of semi saline stony silts, with dense stony mantle in places with	Good	PEC P1 (b) with small intrusions	489819 7701968 A6a(N)

Site No	Veg Code	Vegetation Description	Habitat	Vegetation Condition[1]	Status	GPS Location (E/N)
A6b		*xerophila* tussock (or open tussock) grassland. Small intrusions of *Eriachne benthamii* mixed grassland on deep cracking clays.	areas of weakly gilgai clays and intrusions of deep cracking clays.		of PEC P1(b)[3]	489797 7701584 A6a(S) 489694 7701823 A6bNW 489436 7701940 A6b(W)
A5 A11	ShEx	*Sclerolaena hostilis* open low shrubland, scattered *Sclerolaena bicornis* over *Eragrostis xerophila* open tussock grassland.	Flat plain. Weakly gilgai and soft reb-brown loamy soils, mosaiced with areas of stony gibber and scattered quartz. Area degraded, historical tracks, overgrazed	Good Fair to Good Overgrazed	Degraded so not a PEC	490250 7701934 487919 7701545
***Acacia* tall shrubland over *Acacia* shrubland over mixed tussock and hummock grassland.**						
***Acacia* tall shrubland over mixed shrubland over **Cenchrus ciliaris* tussock and patchy *Triodia* spp hummock grassland.**						
A7	AcAb*Cc	*Acacia coriacea* tall shrubland, occasional *Ehretia saligna* over *Acacia bivenosa, A. pyrifolia, Senna oligophylla* open shrubland over **Cenchrus ciliaris, *Cenchrus setiger* tussock grassland with patchy *Triodia epactia.*	Broad shallow low-lying area, pale pinky silts, scattered stones. Lots of dead shrubs here	Fair		489342 7701759
A8	At*CcTssp	*Acacia trachycarpa* tall shrubland with *Acacia coriacea* over *Acacia trachycarpa* shrubland over mixed **Cenchrus ciliaris, *Cenchrus setiger, Eriachne flaccida, Bothriochloa ewartiana,* tussock grassland and *Triodia epactia, Triodia longiceps* hummock grassland. Scattered *Corymbia hamersleyana* trees.	Narrow incised creek line with washed stones and gravels over brown silty loams. Becomes more narrow, less stony and more densely vegetated upstream.	Good		488446 7701660

Site No	Veg Code	Vegetation Description	Habitat	Vegetation Condition[1]	Status	GPS Location (E/N)
Mosaic *Acacia pyrifolia* over *Triodia wiseana* with tussock grass on scalds						
A9	ApTw(Ex)	Mosaic of *Acacia pyrifolia* tall shrubland over *Triodia wiseana* with *Triodia epactia* on areas of stony gibber with open *Eragrostis xerophila* tussock grassland on scalds.	Slightly undulating plain, pinky-red brown silts with patches of stony gibber mosaiced with scalds.	Good		488276 7701544
***Acacia xiphophylla* shrubland over mixed tussock and hummock grassland**						
A10 A10a	AxEx	*Acacia xiphophylla* open shrubland over *Eragrostis xerophylla* open tussock grassland, patchy *Triodia epactia.*	Flat plain. Mosaic of stony gibber with scalds, red-brown silty loams.	Good		488326 7701361 A10 487581 7701557 A10a
A12	AxTl	*Acacia xiphophylla* shrubland over mosaic of *Triodia longiceps* on stony silts and *Eragrostis xerophila* on silty loams.	Flat plain, Mosaic of red-brown silts with quartz scatter and red-brown soft loams, sometimes weakly gilgaied.	Good		487440 7701472
***Hakea chordophylla* open woodland over low mixed shrubland over mixed hummock and tussock grassland.**						
A3	HcCsTeEx	*Hakea chordophylla* open low woodland with *Ehretia saligna* over *Capparis spinosa, Acacia pyrifolia* scattered to open shrubland over mixed open *Triodia epactia* hummock and *Eragrostis xerophila* tussock grassland.	Very shallow broad drainage feature, pinky pale brown silty loams.	Good		490651 7701849

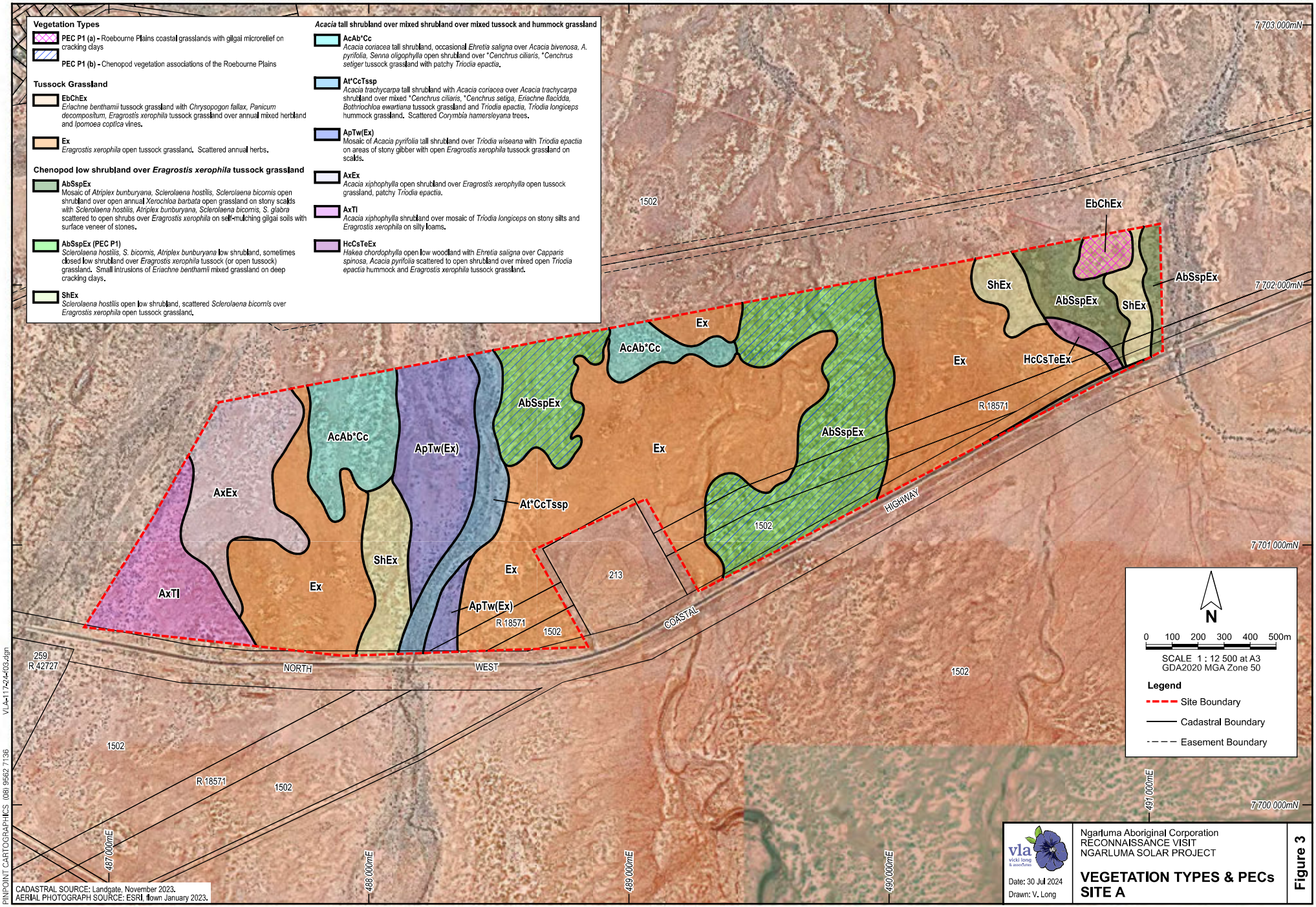
1. Vegetation condition scale adapted from Keighery (1994) and Kaesehagen (1995)
2. PEC P1 – (a) Roebourne Plains coastal grasslands with gilgai microrelief on cracking clays.
3. PEC P1 – (b) Chenopod vegetation associations of the Roebourne Plains

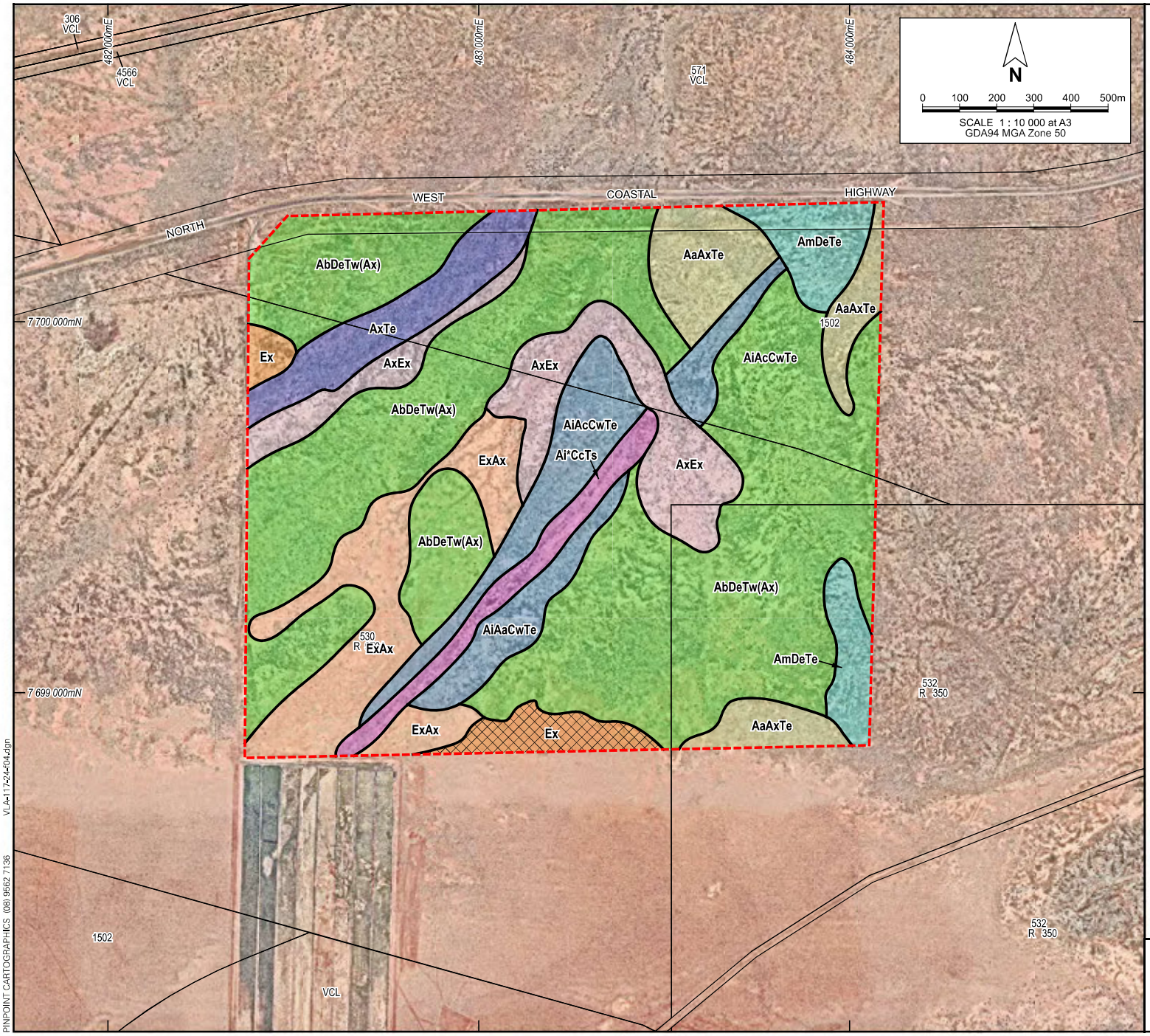
Table 4. Vegetation descriptions, condition ratings and PEC status for sites surveyed within Solar site B.

Site No	Veg Code	Vegetation Description	Habitat	Vegetation Condition[1]	Status	GPS Location (E/N)
***Eragrostis xerophila* tussock grassland**						
B1	Ex	*Eragrostis xerophila* tussock grassland with annual herbland.	Flat plain. Weakly gilgaied silty loam plain, pinky-brown silty loams.	Good	PEC P3	482967 7698888
B9 and B10	ExAx	*Eragrostis xerophila* open tussock grassland. Very scattered *Acacia xiphophylla, Acacia bivenosa* shrubs.	Flat degraded plain, red-brown silty loams with patches of cracking clay – sheetwash area, overgrazed and historically burnt. Surface compact, very dry.	Varies good to poor	Includes small areas of degraded PEC P3[2], hence doesn't have PEC status.	482569 7698981 (B9) 482910 7699377 (B10)
***Acacia xiphophylla* shrubland over *Eragrostis xerophila* tussock grassland.**						
B7	AxEx	*Acacia xiphophylla* open tall shrubland over *Acacia xiphophylla* shrubland over *Eragrostis xerophila* open to scattered tussock grassland.	Flat plain, pinky-brown silts and loams with some quartz scatter, large areas of bare scald.	Good		483590 7699594
***Acacia* mixed shrubland over *Triodia wiseana* hummock grassland**						
***Acacia bivenosa, Acacia ancistrocarpa* shrubland over low shrubland over *Triodia wiseana* hummock grassland in mosaic with *Acacia xiphophylla* (on scalds)**						
B2, B3 B6	AbDeTw(Ax)	*Acacia bivenosa, Acacia ancistrocarpa* tall open shrubland to tall shrubland over *Diplopeltis eriocarpa* open low shrubland over *Triodia wiseana* hummock grassland with *Cassytha capillaris* open vines in mosaic with *Acacia xiphophylla* over open annual herbland on scalds.	Flat plain, red-brown silty loams with scattered quartz in mosaic with areas of dense quartz mantle.	Good		483446 7699014 B2 483946 7699420 B2a483879 7698981 B3 482854 7699751 B3a 483761 7699689 B6a

Site No	Veg Code	Vegetation Description	Habitat	Vegetation Condition[1]	Status	GPS Location (E/N)
						482422 7699095 B6b 482936 7699766 B6c
***Acacia* shrubland over *Triodia epactia* hummock grassland.**						
***Acacia ancistrocarpa* scattered shrubs over *Triodia epactia* hummock grassland.**						
B4	AaAxTe	*Acacia ancistrocarpa* scattered to open tall shrubland with scattered *Acacia xiphophylla, Acacia pyrifolia* over *Triodia epactia* hummock grassland.	Flat plain bordering B1 grassland, red-brown silty soils, scattered stones.	Good		483919 7698873
***Acacia maitlandii* shrubland over mixed low shrubland over *Triodia epactia* hummock grassland.**						
B5	AmDeTe	*Acacia maitlandii* tall open shrubland over *Acacia maitlandii, Acacia bivenosa* open low shrubland over *Diplopeltis eriocarpa* open low shrubland over *Triodia epactia* with *Triodia wiseana* mixed hummock grassland.	Flat plain, red-brown silty loams with quartz scatter.	Good		483953 7699123
***Acacia inaequilatera* tall shrubland over mixed shrubland over *Triodia epactia* hummock grassland.**						
B8	AiAaCwTe	*Acacia inaequilatera* tall open shrubland over *Acacia ancistrocarpa, Acacia bivenosa* shrubland over *Corchorus walcottii, Senna notabilis* open low shrubland over *Triodia epactia* hummock grassland.	Flat plain, Pale pinky-brown sandy loams running parallel to outcropping vein of rock with some granite outcrop. (see B12)	Good		483395 7699654 B8 483134 7699378 B8a
***Acacia xiphophylla* shrubland over *Triodia epactia* hummock grassland**						

Site No	Veg Code	Vegetation Description	Habitat	Vegetation Condition[1]	Status	GPS Location (E/N)
B11	AxTe	*Acacia xiphophylla* shrubland over mixed *Triodia epactia* hummock, with patchy *Eragrostis xerophila* grassland.	Very shallow drainage line, red-brown silty loams with areas of sheetwash scald along edges.	Good		482510 7699817
***Acacia* shrubland over **Cenchrus ciliaris* tussock grassland.**						
B12	Ai*CcTs	*Acacia inaequilatera* tall open or scattered shrubs over *Acacia bivenosa, Acacia pyrifolia, Eremophila longifolia* scattered shrubs over **Cenchrus ciliaris* tussock grassland with open *Triodia epactia* hummocks and *Tinospora smilacina* vineland.	Very narrow linear outcropping vein of red-brown rock with intrusions of granite. Vegetation is predominantly along base of outcrop. Extends entire length of site. **Aerva javanica* (weed) only found along the base of this ridge (see Weeds section)	Fair		483378 7699646 (N End) 482656 7698837 (S end)


Vegetation Types
PEC P1 (a) - Roebourne Plains coastal grasslands with gilgai microrelief on cracking clays
PEC P1 (b) - Chenopod vegetation associations of the Roebourne Plains
Tussock Grassland
EbChEx
Eriachne benthamii tussock grassland with Chrysopogon fallax, Panicum decompositum, Eragrostis xerophila tussock grassland over annual mixed herbland and Ipomoea coptica vines.
Ex
Eragrostis xerophila open tussock grassland. Scattered annual herbs.
Chenopod low shrubland over Eragrostis xerophila tussock grassland
AbSspEx
Mosaic of Atriplex bunburyana, Sclerolaena hostilis, Sclerolaena bicornis open shrubland over open annual Xerochloa barbata open grassland on stony scalds with Sclerolaena hostilis, Atriplex bunburyana, Sclerolaena bicornis, S. glabra scattered to open shrubs over Eragrostis xerophila on self-mulching gilgai soils with surface veneer of stones.
AbSspEx (PEC P1)
Sclerolaena hostilis, S. bicornis, Atriplex bunburyana low shrubland, sometimes closed low shrubland over Eragrostis xerophila tussock (or open tussock) grassland. Small intrusions of Eriachne benthamii mixed grassland on deep cracking clays.
ShEx
Sclerolaena hostilis open low shrubland, scattered Sclerolaena bicornis over Eragrostis xerophila open tussock grassland.
Acacia tall shrubland over mixed shrubland over mixed tussock and hummock grassland
AcAb*Cc
Acacia coriacea tall shrubland, occasional Ehretia saligna over Acacia bivenosa, A. pyrifolia, Senna oligophylla open shrubland over *Cenchrus ciliaris, *Cenchrus setiger tussock grassland with patchy Triodia epactia.
At*CcTssp
Acacia trachycarpa tall shrubland with Acacia coriacea over Acacia trachycarpa shrubland over mixed *Cenchrus ciliaris, *Cenchrus setiga, Eriachne flaccida, Bothriochloa ewartiana tussock grassland and Triodia epactia, Triodia longiceps hummock grassland. Scattered Corymbia hamersleyana trees.
ApTw(Ex)
Mosaic of Acacia pyrifolia tall shrubland over Triodia wiseana with Triodia epactia on areas of stony gibber with open Eragrostis xerophila tussock grassland on scalds.
AxEx
Acacia xiphophylla open shrubland over Eragrostis xerophylla open tussock grassland, patchy Triodia epactia.
AxTl
Acacia xiphophylla shrubland over mosaic of Triodia longiceps on stony silts and Eragrostis xerophila on silty loams.
HcCsTeEx
Hakea chordophylla open low woodland with Ehretia saligna over Capparis spinosa, Acacia pyrifolia scattered to open shrubland over mixed open Triodia epactia hummock and Eragrostis xerophila tussock grassland.
7 703 000mN
7 702 000mN
7 701 000mN
7 700 000mN
487 000mE
488 000mE
489 000mE
490 000mE
491 000mE
1502
R 18571
R 42727
259
213
HIGHWAY
COASTAL
NORTH
WEST
N
0 100 200 300 400 500m
SCALE 1 : 12 500 at A3
GDA2020 MGA Zone 50
Legend
Site Boundary
Cadastral Boundary
Easement Boundary
CADASTRAL SOURCE: Landgate, November 2023.
AERIAL PHOTOGRAPH SOURCE: ESRI, flown January 2023.
PINPOINT CARTOGRAPHICS (08) 9562 7136
VLA-117-24-03.dgn
Ngarluma Aboriginal Corporation
RECONNAISSANCE VISIT
NGARLUMA SOLAR PROJECT
VEGETATION TYPES & PECs
SITE A
Date: 30 Jul 2024
Drawn: V. Long
Figure 3



Legend

Site Boundary

Cadastral Boundary

Easement Boundary

Vegetation Types

PEC P3 - Horseflat land system of the Roebourne Plains

***Eragrostis xerophila* tussock grassland**

Ex
Eragrostis xerophila tussock grassland with annual herbland.

ExAx
Eragrostis xerophila open tussock grassland. Very scattered *Acacia xiphophylla, Acacia bivenosa* shrubs.

***Acacia xiphophylla* shrubland over *Eragrostis xerophila* tussock grassland.**

AxEx
Acacia xiphophylla open tall shrubland over *Acacia xiphophylla* shrubland over *Eragrostis xerophila* open to scattered tussock grassland.

***Acacia* mixed shrubland over *Triodia wiseana* hummock grassland**

AbDeTw(Ax)
Acacia bivenosa, Acacia ancistrocarpa tall open shrubland to tall shrubland over *Diplopeltis eriocarpa* open low shrubland over *Triodia wiseana* hummock grassland with *Cassytha capillaris* open vines in mosaic with *Acacia xiphophylla* over open annual herbland on scalds.

***Acacia* shrubland over *Triodia epactia* hummock grassland**

AaAxTe
Acacia ancistrocarpa scattered to open tall shrubland with scattered *Acacia xiphophylla, Acacia pyrifolia* over *Triodia epactia* hummock grassland.

***Acacia maitlandii* shrubland over mixed low shrubland over *Triodia epactia* hummock grassland**

AmDeTe
Acacia maitlandii tall open shrubland over *Acacia maitlandii, Acacia bivenosa* open low shrubland over *Diplopeltis eriocarpa* open low shrubland over *Triodia epactia* with *Triodia wiseana* mixed hummock grassland.

***Acacia inaequilatera* tall shrubland over mixed shrubland over *Triodia epactia* hummock grassland**

AiAaCwTe
Acacia inaequilatera tall open shrubland over *Acacia ancistrocarpa, Acacia bivenosa* shrubland over *Corchorus walcottii, Senna notabilis* open low shrubland over *Triodia epactia* hummock grassland.

***Acacia xiphophylla* shrubland over *Triodia epactia* hummock grassland**

AxTe
Acacia xiphophylla shrubland over mixed *Triodia epactia* hummock, with patchy *Eragrostis xerophila* grassland.

***Acacia shrubland* over **Cenchrus ciliaris* tussock grassland.**

Ai*CcTs
Acacia inaequilatera tall open or scattered shrubs over *Acacia bivenosa, Acacia pyrifolia, Eremophila longifolia* scattered shrubs over **Cenchrus ciliaris* tussock grassland with open *Triodia epactia* hummocks and *Tinospora smilacina* vineland.

CADASTRAL SOURCE: Landgate, November 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2023.

vla vicki long & associates

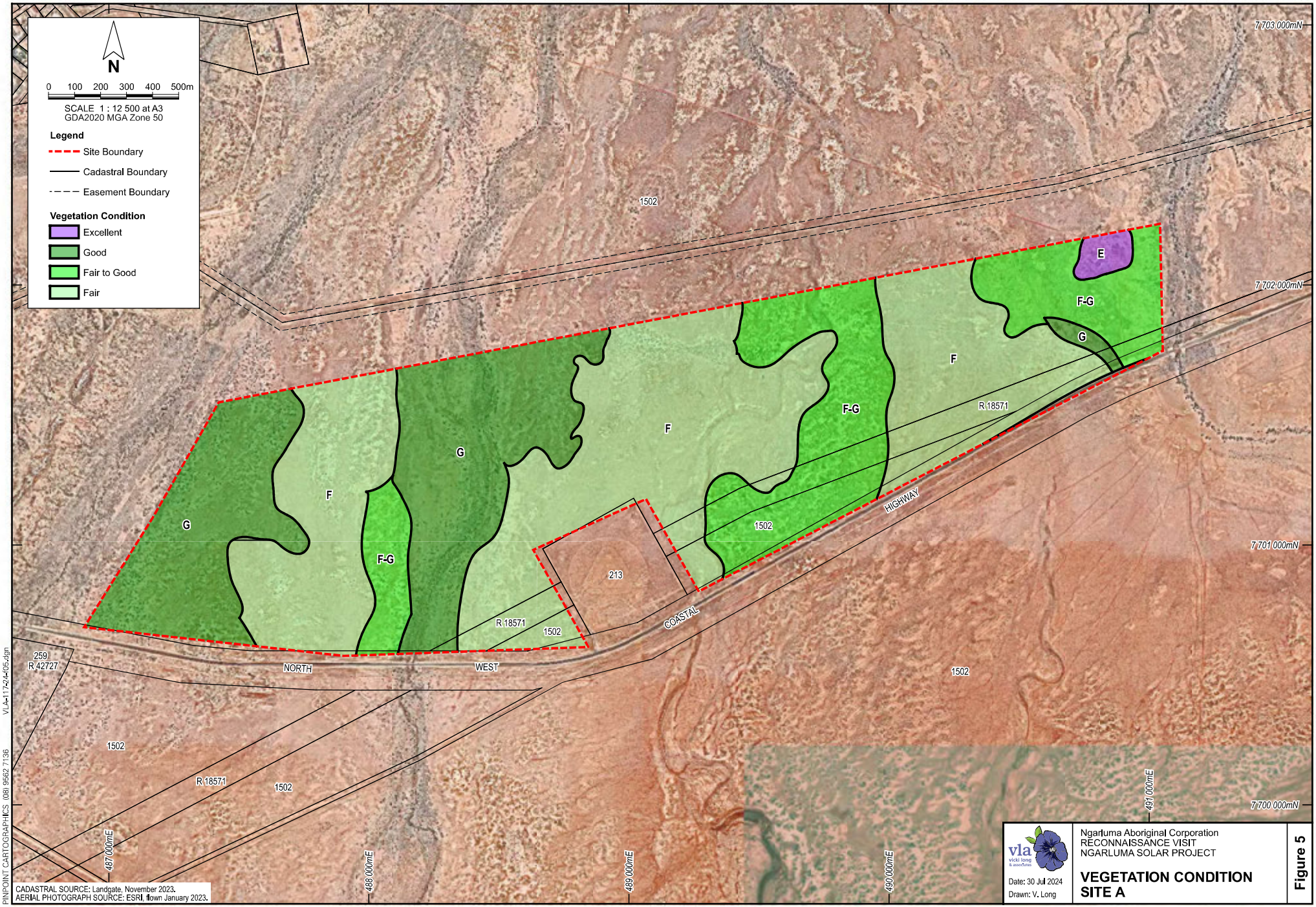
Ngarluma Aboriginal Corporation
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NGARLUMA SOLAR PROJECT

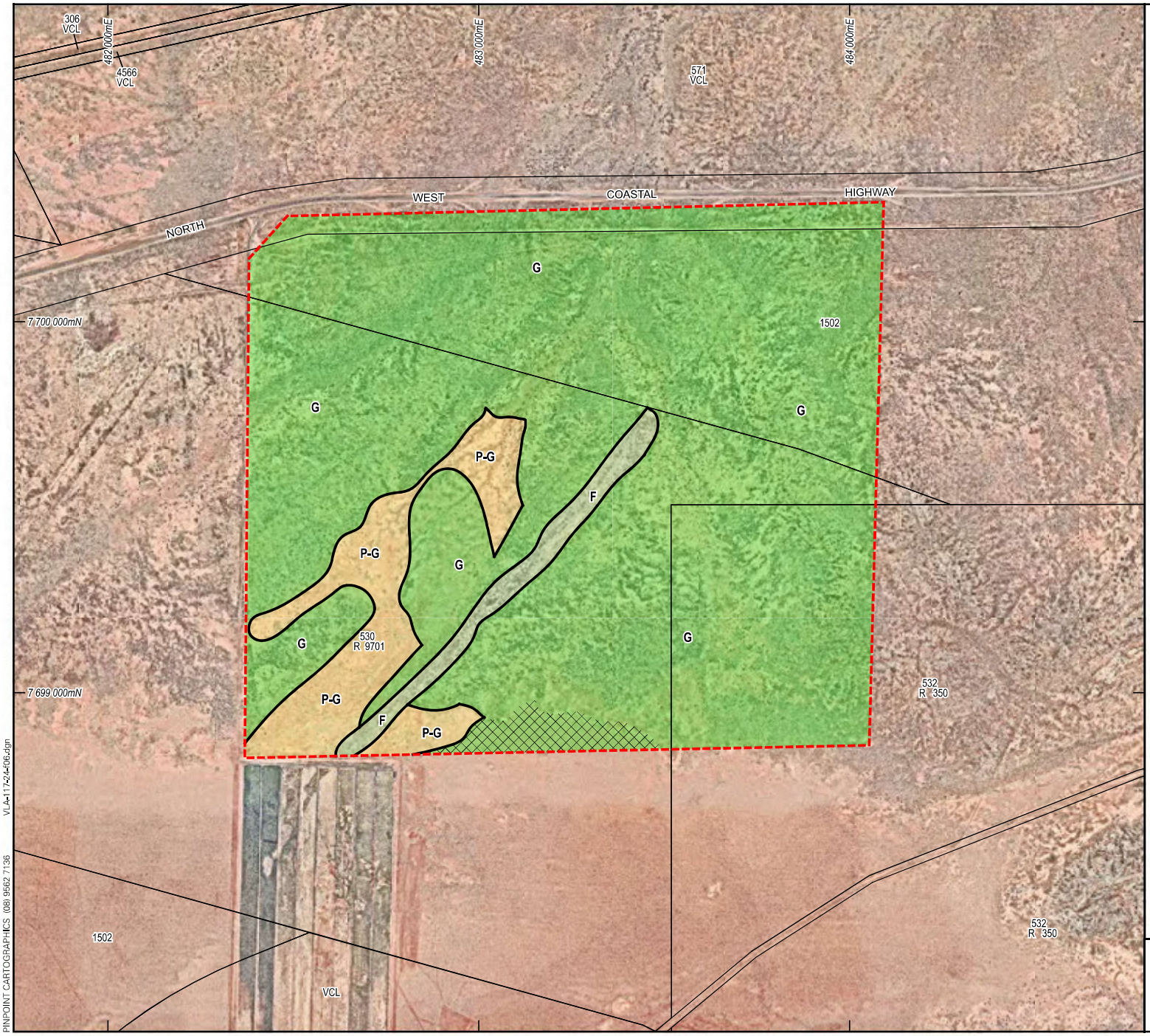
VEGETATION TYPES & PECs SITE B

Date: 30 Jul 2024
Drawn: V. Long

Figure 4

PINPOINT CARTOGRAPHICS (08) 9582 7136 VLA-117-24-F04.dgn


N
0 100 200 300 400 500m
SCALE 1 : 12 500 at A3
GDA2020 MGA Zone 50
Legend
Site Boundary
Cadastral Boundary
Easement Boundary
Vegetation Condition
Excellent
Good
Fair to Good
Fair
7 703 000mN
7 702 000mN
7 701 000mN
7 700 000mN
487 000mE
488 000mE
489 000mE
490 000mE
491 000mE
1502
R 18571
213
259
R 42727
HIGHWAY
COASTAL
NORTH
WEST
E
F-G
G
F
CADASTRAL SOURCE: Landgate, November 2023.
AERIAL PHOTOGRAPH SOURCE: ESRI, flown January 2023.
Ngarluma Aboriginal Corporation
RECONNAISSANCE VISIT
NGARLUMA SOLAR PROJECT
VEGETATION CONDITION
SITE A
Date: 30 Jul 2024
Drawn: V. Long
Figure 5
PINPOINT CARTOGRAPHICS (08) 9562 7136
VLA-117-24-05.dgn



N

0 100 200 300 400 500m

SCALE 1 : 10 000 at A3
GDA94 MGA Zone 50

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary

Vegetation Condition

- Good
- Fair
- Poor to Good

CADASTRAL SOURCE: Landgate, November 2023.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2023.

vla vicki long & associates

Date: 30 Jul 2024
Drawn: V. Long

Ngarluma Aboriginal Corporation
RECONNAISSANCE VISIT
NGARLUMA SOLAR PROJECT

VEGETATION CONDITION SITE B

Figure 6

PINPOINT CARTOGRAPHICS (08) 9582 7136 VLA-117-24-406.dgn

4.2.2 Flora

A total of 93 flora species from 22 families were recorded at Solar site A and 84 species from 28 families at Solar site B. The dominant plant families at both sites were Poaceae and Fabaceae, with Solar site A having 22 species and 19 species, respectively and Solar site B having 15 species and 17 species, respectively. *Acacia* was the most frequently recorded genus at both sites.

Species lists for both Solar site A and Solar site B are provided in Appendix C.

4.2.2.1 Conservation Significant Flora

The desktop assessment identified 22 Priority flora species which have been known to occur within a 40 km radius of the survey sites. Of these, six Priority 3 (P3) species could potentially occur in the area based on the presence of suitable habitat (Appendix B).

During the survey no conservation significant species were recorded at either site.

4.2.3 Introduced Flora

A total of seven weed species were recorded in Solar site A and Solar site B during the survey.

The five weeds recorded in Solar site A were:

- Buffel grass (**Cenchrus ciliaris*)
- Birdwood grass (**Cenchrus setiger*)
- Mimosa bush (**Vachellia farnesiana*)
- Stinking Passion Flower (**Passiflora foetida*)
- Awnless Barnyard grass (**Echinochloa colona*) was found in the P1 Roebourne Plains grassland area but was less than 1% of the grassland cover and therefore did not degrade the PEC status.

Buffel grass and Birdwood grass were recorded along drainage zones and creeklines where they tend to co-dominate the grassland.

Mimosa bush occurred as three small shrubs on a degraded plain (ShEx) and also in the shallow broad shallow drainage line (AcAb*Cc) and is not considered to be a concern.

Six large vines of **Passiflora foetida* were recorded within 15 m of the creek line in Solar site A which runs through the western region of the survey area at coordinates 488455E 7701647N. These vines will need to be removed if the site is to be used, to prevent further rapid spread of this species.

Buffel grass was also recorded in Solar site B in vegetation type AaAxTe, at less than 1% cover, but formed the dominant grassland along the low linear rockpile, where kapok was also recorded. The other two weeds recorded in Solar site B were:

- Kapok (**Aerva javanica*)
- Verano Stylo (**Stylosanthes hamata*)

About 10 -15 plants of kapok were recorded at one location on the western edge of the rock vein at 483209E 7699450N.

Verano stylo was recorded on the track along the Water Corporation's sewage overflow pond and is very dense at locations 482600E 7698818N and 482364E 7699217N. These weeds are adjacent to, but outside, the Ngarluma lease and eradication as such should be managed by the Water Corporation.

5 SUMMARY

Both Solar Site A and Solar Site B have been historically impacted to some extent by historical grazing / overgrazing, pastoral activities and access, borrowing in particular areas and therefore would be suitable for placement of the proposed solar facility.

The preference would be to use Solar site B due to the very small area of PEC vegetation on the southern end which can be easily avoided. However, the majority of Solar Site A is degraded, with the good condition P1 PECs occurring predominantly along the northern boundary. If the Solar site A northern boundary was moved southwards 50 m, some of this PEC area could be avoided. Other vegetation types found on both sites are relatively widespread in the local and wider area.

At this stage, no flora of conservation significance were recorded on either site. There is one specimen currently awaiting identification at the WA Herbarium and will be included in the final report if identified as a Priority species. There were no other flora of local or regional significance identified in either site.

It should be noted that the Ngarluma people have yet to conduct an ethno-botanical survey over Solar site A and Solar site B. This will clarify whether any of the flora or the vegetation types present on these sites, have cultural significance. Snakewood (*Acacia xiphophylla*) was recorded on both sites and this species is regarded as a highly valued wood for hot cooking fires (Amanda Mowarin, pers comm).

Only a few weeds were recorded on both sites and these were generally localised in drainage features and the low linear rockpile area. A weed management plan should be prepared before disturbance occurs on either site to prevent rapid spread of some of these species.

6 REFERENCES

Australian Weeds Committee 2012, Weeds of National Significance 2012, Department of Agriculture, Fisheries and Forestry, Canberra.

Bureau of Meteorology 2024, Climate data online, <http://www.bom.gov.au/climate/data/index.shtml>.

Department of Biodiversity Conservation and Attractions (DBCA) 2024, NatureMap Database Search, <https://naturemap.dpaw.wa.gov.au/>.

Department of Primary Industries and Regional Development 2019, Western Australian Organisms List, https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol

Environmental Protection Authority 2002, Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement 3, Environmental Protection Authority, Perth.

Environmental Protection Authority 2016a, Environmental Factor Guideline – Flora and Vegetation, Environmental Protection Authority, Perth.

Environmental Protection Authority 2016b, Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment, Environmental Protection Authority, Perth.

Executive Steering Committee for Australian Vegetation Information (ESCAVI) (2003) Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0. Department of the Environment and Heritage, Canberra.

Landgate 2024, MapViewer Plus - Environmentally Sensitive Areas, Western Australian Land Information Authority https://www0.landgate.wa.gov.au/maps-and-imagery/interactive-maps/map-viewer

Trudgen, M.E. 1988. A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.

Vicki Long & Associates (VLA) 2020, *Detailed Wet Season Vegetation Surveys and Targeted Surveys for Conservation Significant Flora within the Southern Transmission Corridor, Solar PV and Power Plant Footprint*. Unpublished report prepared for Woodside Power Pty Ltd. Ref: vlal5620Brv01Rev1091120)

Vicki Long & Associates (as Astron Environmental Services) 2014 *Reserve 40879 Karratha Road* (now DeWitt Rd) *Mt Anketell* Level 1 Flora and Vegetation Survey. Unpublished report for ERM Australia

Vicki Long & Associates (as Astron Environmental Services) 2013 *Karratha Earthmoving M47/435, M4k7/127, M47/1421, M47/1401, M47/577, M47/455, M47/1491 Vegetation and Flora Survey.*

Vicki Long & Associates (as Astron Environmental Services) 2011, *Part Lot 258 Karratha-Tom Price Road, Cooya Pooya Shire of Roebourne Vegetation and Flora Survey.* Unpublished report prepared for Transpacific Industries Group 2011 (Cleanaway Facility)

Vicki Long & Associates (as Astron Environmental Services) 2011 *Nickol River Tenement M47/559 Vegetation and Flora Survey* . Unpublished report prepared for Louis Rinaldi.

Vicki Long & Associates (as Astron Environmental Services) 2008 *Karratha Power Station Flora and Vegetation Survey*. Unpublished report prepared for Strategen Environmental Consultants.