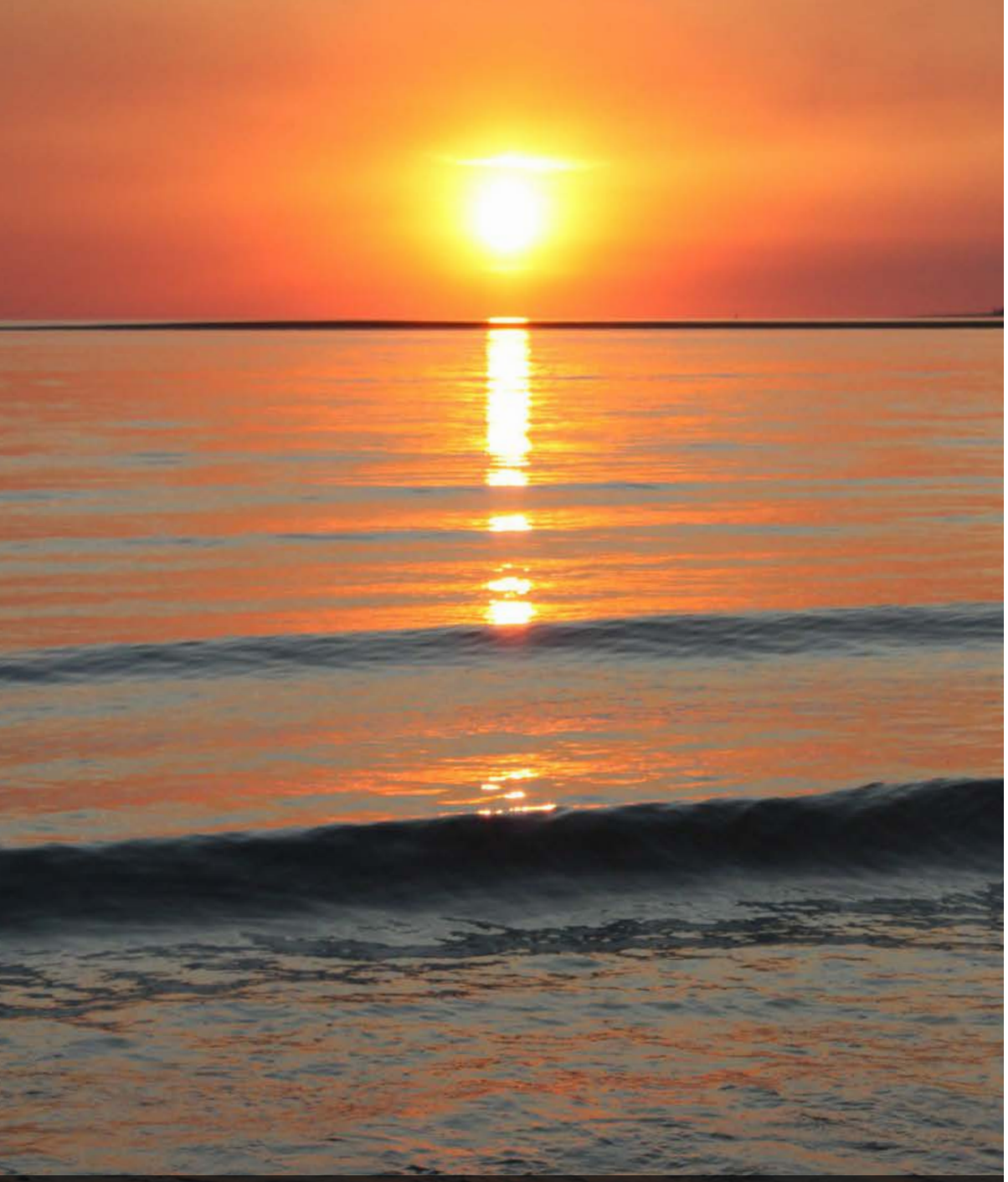


Sun Cable Pty Ltd

Australia – ASEAN Power Link Project

Environment Protection Act (NT) Referral

October 2020

754-MELEN232735

SUN CABLE

coffey

A TETRA TECH COMPANY

This page has been left intentionally blank

Environment Protection (NT) Referral - Australia-ASEAN Power Link

Prepared for
Sun Cable Pty Ltd

Prepared by
Coffey Services Australia Pty Ltd
Level 2, 80 Mitchell Street
Darwin
NT 0801 Australia
t: +61 8 8901 1200
ABN 55 139 460 521

October 2020

Quality information

Revision history

Revision	Description	Date	Originator	Reviewer	Approver
v12 draft	Final client review	09/09/2020	Sun Cable	Sun Cable	Sun Cable
vA final	Revised to address final client review	16/09/2020	V Keating	T Halliday	T Halliday
vB	Revised to address EPA informal review	6/10/2020	V Keating	T Halliday	T Halliday

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Draft v12	1	Word	Mark Branson, David Griffin – Sun Cable	30/10/2019 09/09/2020
Final vA	1	Word/PDF	Mark Branson, David Griffin – Sun Cable NT EPA	16/09/2020
Final vB	1	Word/PDF	Mark Branson, David Griffin – Sun Cable NT EPA	6/10/2020

Abbreviations

Abbreviation	Definition
AAPA	Aboriginal Areas Protection Authority
AAPL	Australia-ASEAN Power Link
AARC	AustralAsia Railway Corporation
AC	Alternating current
AOI	Area of interest
ASEAN	Association of Southeast Asian Nations
ASS	Acid sulphate soils
BoM	Bureau of Meteorology
CLC	Central Land Council
Cwth	Commonwealth
DC	Direct current
DTBI	Department of Trade, Business and Innovation
DENR	Department of Environment and Natural Resources
DIPL	Department of Infrastructure, Planning and Logistics
DKIS	Darwin Katherine Integrated System
DoAWE	Department of Agriculture, Water and the Environment
EEZ	Exclusive economic zone
EIS	Environmental impact statement
EMF	Electromagnetic fields
EP	*Environment Protection Act 2019*
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
GW	Gigawatts
GWh	Gigawatt hours
ha	Hectare(s)
HDD	Horizontal directional drilling
HVAC	High voltage alternating current
HVDC	High voltage direct current
km	Kilometre
km^2	Squared kilometre
kV	Kilovolt
LDC	Land Development Corporation
m	Metre
m^2	Squared metre
ML pa	Megalitres per annum
MW	Megawatts
NLC	Northern Land Council
NM	Nautical miles
NR Maps	Natural resource maps
NT	Northern Territory
NTG	Northern Territory Government

Abbreviation	Definition
NVIS	National vegetation information system
OHTL	Overhead transmission line
OPGW	Optical ground wire
PASS	Potential acid sulphate soils
PMST	Protected matters search tool
PV	Photovoltaic
SoCS	Site of conservation significance
t	Tonne
TOs	Traditional owners
TPWCA	*Territory Parks and Wildlife Conservation Act*
VSC	Voltage source converter
WM Act	*Weeds Management Act (NT)*

Table of contents

Tables

Figures

Appendices

1. Proponent and proposed action details

This document has been prepared by Coffey Services Australia Pty Ltd (Coffey) on behalf of the proponent, Sun Cable Pty Ltd (Sun Cable), as a Referral of Proposed Action (the EP Referral) under the newly legislated *Environment Protection Act* (*EP Act*) *2019.*

Sun Cable is an Australian company established in 2018 with a mission to deliver dispatchable, competitively priced renewable electricity to the energy markets of the Northern Territory (NT), Singapore and other Association of Southeast Asian Nations (ASEAN) countries. The company vision is to establish a high-voltage direct current (HVDC) transmission network across the Indo-Pacific region supplied by large-scale solar and storage facilities utilising the abundant high-quality solar resource in northern Australia. Sun Cable is privately held by a number of Australian individuals and private investment funds and has offices in Australia, Singapore and Indonesia.

Sun Cable is developing the Australia-ASEAN Power Link (AAPL; the project), an innovative energy project, which proposes to generate, store, transmit and deliver reliable, competitively priced renewable energy to NT and ASEAN markets. The proposed action comprises five main components:

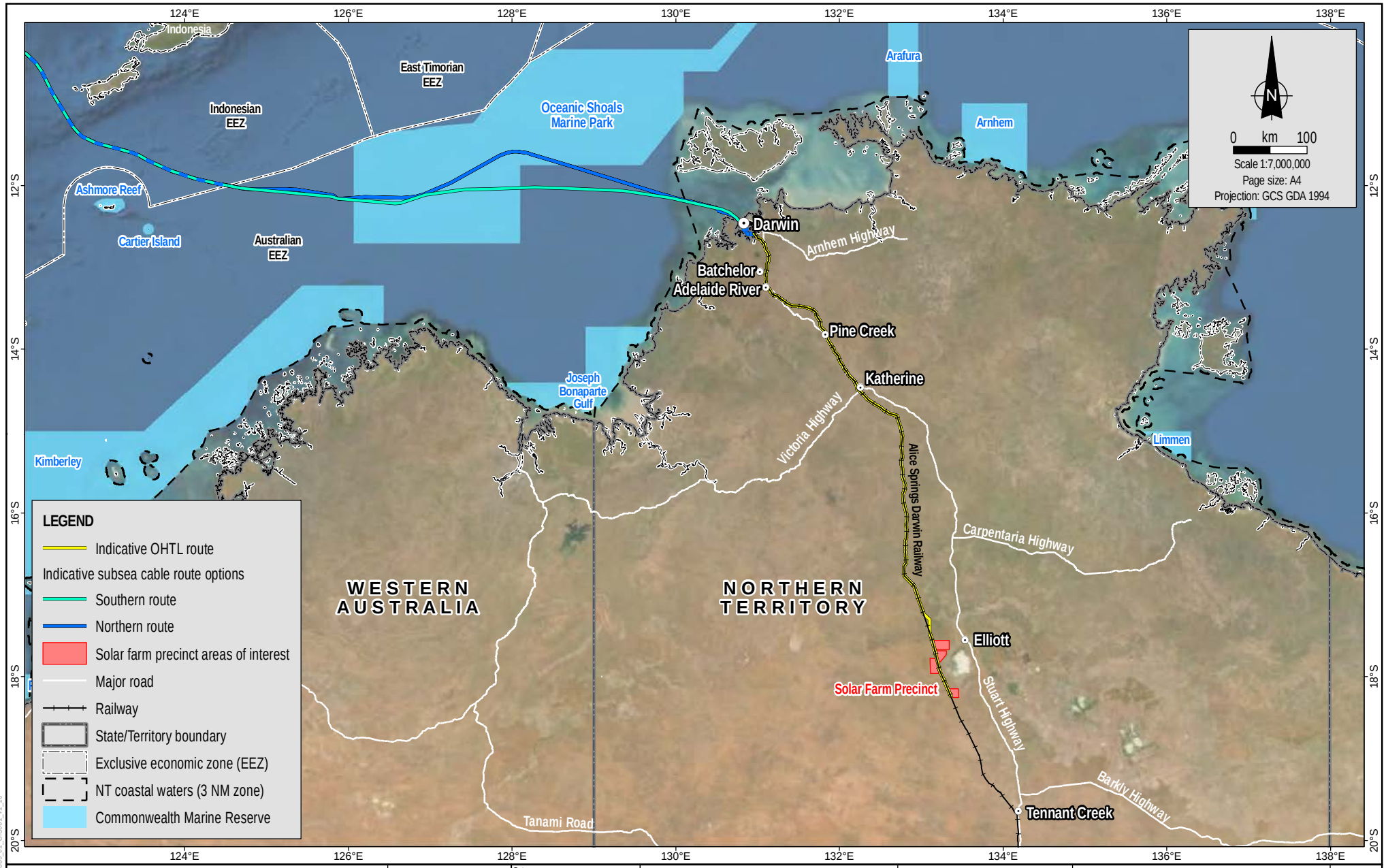
- A solar farm precinct (including energy storage, electrical and ancillary infrastructure) located near Elliott, NT;
- A HVDC overhead transmission line (OHTL) from the solar farm to Darwin;
- Voltage source converters (VSC) and battery in Darwin;
- A land sea joint station in Darwin; and
- A subsea HVDC and fibre optic cable network between Darwin and Singapore.

The Project will also include battery and electrical connection infrastructure in Singapore which are not discussed in this referral.

The project has the capacity to facilitate a material increase in energy supply to the Darwin-Katherine Integrated System (DKIS) and off-grid industrial loads, thereby enabling the development of new industrial developments, particularly in the Darwin region. It will also generate up to 20% of Singapore's energy supply from 100% renewable sources. The location of the project is shown in Figure 1.

A final investment decision on the project is planned for end of 2023. Construction is scheduled to extend from end of 2023 to end of 2027. Connection to the DKIS and industrial loads in the NT is planned for 2026 with the link to Singapore completed in 2027. Full supply to Singapore is planned to be operational by end of 2027.The project may be constructed and commissioned in stages.

The Proponent is submitting this Referral as a "Proponent Initiated EIS Referral" under Section 48 of the EP Act. This is based on the scale of the project which may trigger significant impacts on environmental, social and heritage values. Sun Cable is determined to ensure that the Project will deliver a net benefit to the environment and social values influenced by the Project. The company is focused on ensuring that the avoidance hierarchy is adopted and that wherever possible impacts are proactively avoided through design, minimised through innovative construction and operation methods and mitigated through informed and ongoing adaptive management. Sun Cable aims to maximise opportunities for Indigenous and non-Indigenous Territorians throughout all project phases and is developing a range of engagement plans to support this approach. The statement of reasons accompanying the Referral form outlines further detail on why an assessment by environmental impact statement (EIS) is the appropriate assessment pathway for the project.



Source:
Indicative routes and solar farm precinct from Sun Cable.
EEZ Zones from www.marineregions.org (v11). 3 NM zone from Geoscience Australia.
Marine parks from DEE.
Imagery from ESRI Online (image captured 08/09/16).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F001_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Project location

Figure No: 1

MXD Reference: 275539_01_GIS001_v1_10

1.1. Proponent details

1.1.1. Proponent

Contact details for Sun Cable are provided below in Table 1

Table 1: Proponent details

Proponent	Sun Cable Pty Ltd
Key contact person	Mark Branson, Development Manager – Land and Marine Access
Postal Address	Suite 78, Jones Bay Wharf 26-32 Pirrama Road, Pyrmont NSW 2009
Street Address	As above
Email	Mark.branson@suncable.sg

1.1.2. Consultant

Coffey have prepared this Referral on behalf of Sun Cable. All communications regarding the referral should be directed to the Proponent. Contact details for Coffey are provided below in Table 2.

Table 2: Consultant contact details

Company	Coffey Services Australia Pty Ltd (Coffey)
Postal Address	PO Box 717 Darwin NT0801
Street Address	Level 2, 80 Mitchell Street Darwin NT 0801
Phone/Fax	+61 8 8901 1200
Email	Darwin@coffey.com; tara.halliday@coffey.com

1.2. Approvals and Regulation

1.2.1. Northern Territory

The project is likely to trigger a range of assessment and approval requirements under NT legislation, a summary of which is provided in Table 3.

Table 3: Summary of relevant NT legislation

Legislation	Relevance
Electricity Reform Act 2000	An Act that governs the regulation of the electricity supply industry including licensing of the generation, storage and transmission of electricity and the provision of safety and technical standards.
Environment Protection Act 2019	In October 2019 the *Environment Protection Act 2019* (NT) replaced the *Environment Assessment Act 1982* (NT). The EP act and associated *Environment Protection Regulations 2020* sets out referral triggers, which require the proponent of a project to refer the project to the NT EPA for assessment. Referral can also be triggered if the project is likely to result in a significant impact. This is informed by the environmental objectives, declared by the NT Minister. It is likely, due to the complexity, size, and length of the project, that the highest level of assessment will be required in the NT. This referral has been prepared in accordance with the EP Act as a Proponent Initiated EIS Referral.

Legislation	Relevance
Planning Act 1999* and *Planning Amendment Act 2020	The *Planning Act 1999* (NT) and *Planning Amendment Act 2020* provide for the appropriate and orderly planning and control of land in the NT. Under section 75A of the act, it is an offence to clear native vegetation except in accordance with the planning scheme, interim development control order or a permit. Under the Planning Act the following permits may be required for the project: • Land clearing permit - required for any native vegetation clearing in the NT on zoned and unzoned land more than one hectare in aggregate land (including any area already cleared of native vegetation). • Development permit (Planning permit) – required if a building type or land use requires consent under the *Northern Territory Planning Scheme 2020*. If a development permit is needed it must be obtained before acquiring a building permit under the *Building Act 1999* (NT).
Heritage Act 2011	Protects places and objects of terrestrial and marine heritage significance, with detailed survey and approval required if sites are to be disturbed.
Northern Territory Aboriginal Sacred Sites Act 1989	Under the *Northern Territory Aboriginal Sacred Sites Act 1989* all sacred sites in the Territory are protected regardless of whether they are registered. Parties proposing to work on or use land in the NT may apply for Authority Certificates to the Aboriginal Areas Protection Authority (AAPA). The AAPA was established under the Northern Territory Aboriginal Sacred Sites Act and is responsible for assessing applications by consulting the relevant Aboriginal custodians.
Territory Parks and Wildlife Conservation Act 1976	*The Territory Parks and Wildlife Conservation Act (1976)* (TPWC Act) makes a provision for and in relation to the establishment of Territory Parks and other Parks and Reserves and the study, protection, conservation of wildlife in the NT. Wildlife management includes the classification of threatened species, general protection of wildlife and essential habitat areas, the management of feral animals and protection of biological biodiversity. Detailed assessment is required to confirm whether threatened flora and fauna species listed under TPWC Act are likely to be impacted by the project. A permit may be required under section 55 of the Act, to take or interfere with protected wildlife.

Other potentially relevant Northern Territory legislation for which permits may be necessary and/or with which compliance would be required includes:

- *Aboriginal Land Act 1978* (NT)
- *AustralAsia Railway (Special Provisions) Act 1999 (NT)*
- *AustralAsia Railway (Third Party Access) Act 1999 (*NT*)*
- *Bushfires Management Act 2016* (NT)
- *Control of Roads Act 1953* (NT)
- *Dangerous Goods Act 1998* (NT)
- *Fisheries Act 1988* (NT)
- *Marine Act 1981* (NT)
- *Mineral Titles Act 2010* (NT)
- *Mining Management Act 2001* (NT)
- *Pastoral Lands Act 1992* (NT)
- *Ports Management Act 2015* (NT)
- *Soil Conservation and Land Utilisation Act 1969* (NT)
- *Water Act 1992* (NT)
- *Waste Management and Pollution Control Act 1998* (NT)
- *Weeds Management Act 2001* (NT)

- *Work Health and Safety (National Uniform Legislation) Act 2011* (NT)

1.2.2. Commonwealth

Approvals from the Australian Government are likely to be required for potential impacts of the project on matters regulated by the Australian Government.

A summary of relevant Commonwealth legislation is provided in Table 4.

Table 4: Summary of relevant Commonwealth legislation

Legislation	Relevance
***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**	Australia's national environmental law, requiring assessment and approval of projects that are likely to result in a significant impact on matters of national environmental significance. A referral to the Minister for the Environment is being undertaken in parallel with this EP Act Referral. Due to the absence of a bilateral agreement at the time of writing, the Proponent is seeking an Accredited Assessment under the EPBC Act.
Aboriginal Land Rights (Northern Territory) Act 1976	The Act provides for the granting of inalienable freehold title to traditional Aboriginal owners of land in the NT, provides the establishment of Land Councils, and the establishment and management of Land Trusts to hold the Aboriginal land for the benefit of traditional owners of the land. Aboriginal land councils have the responsibility to consult with Aboriginal landowners in order to issue permits to travel across or enter Aboriginal land. The project may require the use of NT Aboriginal freehold land for sections of the OHTL. A lease on Aboriginal freehold land will be required to occupy or control assets on Aboriginal freehold land. If works are to be undertaken on Aboriginal freehold land, a sacred site clearance certificate will be obtained from the AAPA.
Native Title Act 1993	The *Native Title Act 1993* recognises the rights and interests of Australia's Indigenous peoples in land and waters according to their traditional laws and customs. Where it has been judicially determined, native title grants traditional owners' rights that can include, but are not limited to, the right to live and camp in an area, conduct ceremonies, hunt and fish, collect food, build shelters and visit places of cultural importance. Aboriginal people who hold, or have claimed, native title rights over land must be consulted about proposed activities on the land and formal agreement is for required for certain acts. Parts of the project area are located within areas subject to native title.
Sea Installations Act 1987	Prior to amendment in 2014, the *Sea Installations Act 1987* included the requirement to obtain a permit for the installation of subsea cables. With the repeal of this aspect of the act, there is no longer a requirement under Commonwealth legislation to obtain approval for the installation of a cable on the seabed.
Submarine Cables and Pipelines Protection Act 1963	The *Submarine Cables and Pipelines Protection Act 1963* implements Australia's obligations under the United Nations Convention on the Law of the Sea. This includes provisions for penalties for parties that break or injure a submarine cable within Australia's Exclusive Economic Zone (EEZ).
Underwater Cultural Heritage Act 2018	Replacing the *Historic Shipwrecks Act 1976*, the *Underwater Cultural Heritage Act 2018* provides protection for shipwrecks, sunken aircraft and other types of underwater cultural heritage within Australian waters. The act is relevant due to the extensive underwater cultural heritage values in Darwin Harbour. Protected zones declared under the act, prohibit certain activities within the zone to protect cultural heritage values. A permit is required for some activities within these zones, if the areas cannot be avoided.
Australian Jobs Act 2013	The *Australian Jobs Act 2013* requires proponents of major projects with capital expenditure of $500 million or more to provide opportunity for Australian industry to bid to supply key goods and services.

Other potentially relevant Commonwealth legislation for which permits may be necessary and/or with which compliance would be required includes;

- *Airports Act 1996*
- *Civil Aviation Act 1998*
- *Telecommunications Act 1997*

1.3. Location

The project comprises five main components in the Australian jurisdiction: a solar farm precinct (including energy storage, electrical and ancillary infrastructure) located near Elliott, NT; a HVDC OHTL from the solar farm to the Middle Arm peninsula of Darwin; two VSCs and battery at Middle Arm; a land sea joint station at Middle Arm; and a subsea HVDC and fibre optic cable network between Darwin and Singapore.

Within Australia, the AAPL will be located within the NT and Commonwealth jurisdictions (Figure 1). For the purpose of this Referral under the EP Act, the proposed action includes all proposed infrastructure and activities within the NT and associated coastal waters (3 nautical miles from the Territorial Sea Baseline/low water mark). An EPBC Act referral to the Australian Government Minister for the Environment is being undertaken in parallel with this EP Act Referral. The EPBC Act referral also addresses the full extent of the AAPL to the boundary of the EEZ.

An overview of the location for each of the project components and infrastructure is provided in the following sections.

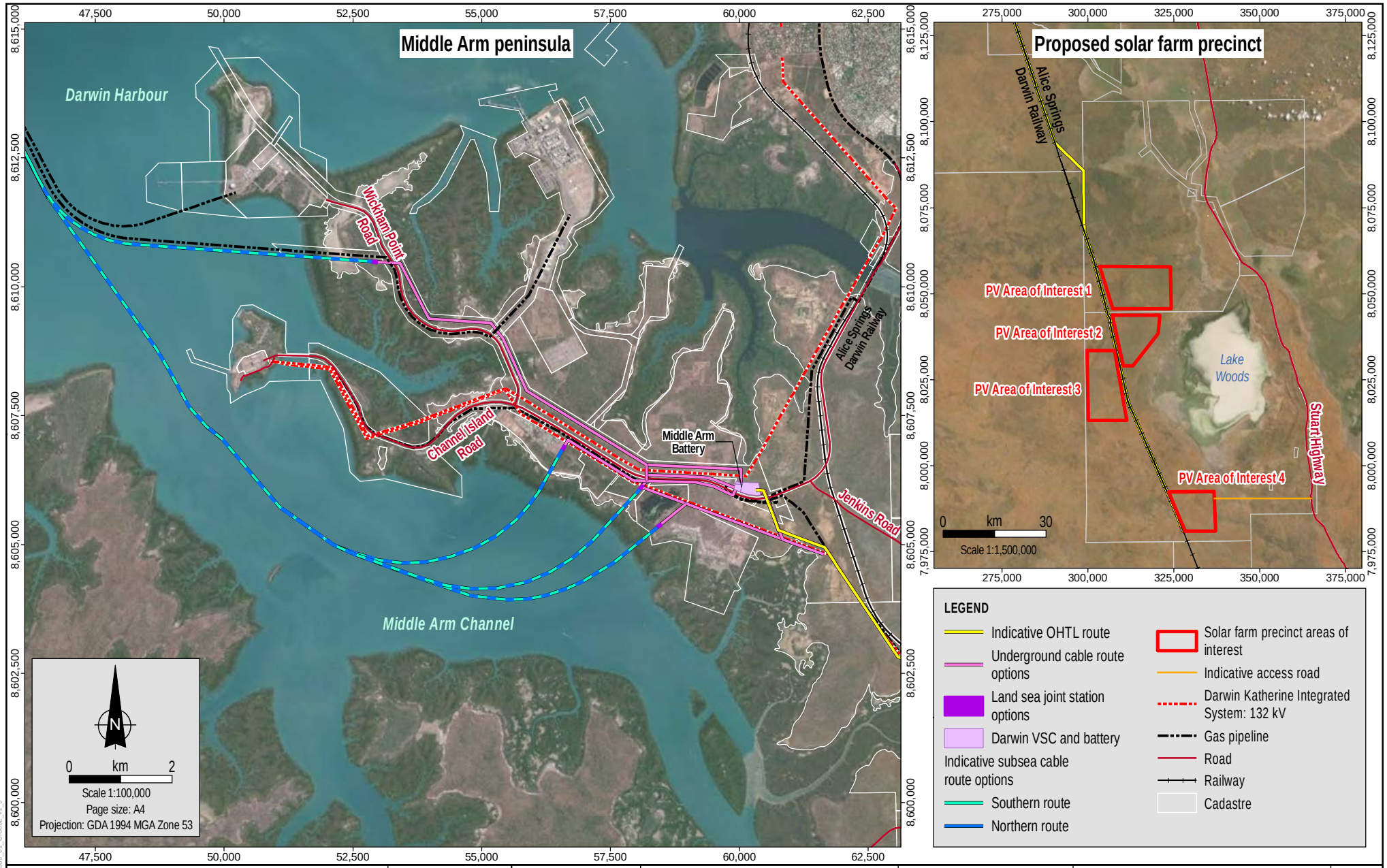
1.3.1. Solar farm precinct

The electricity for the project will be generated by a solar farm comprising pre-fabricated solar photovoltaic (PV) arrays, located in the Barkly region of the NT. The solar farm precinct is located across two Pastoral Lease parcels (NT Por 2093 Newcastle Waters and NT Por 2094 Powell Creek), approximately 40 km southwest of Elliott, west of Lake Woods, as shown in Figure 3. Four areas of interest (AOI) have been considered for the solar farm precinct following a regional review of prospective site options. The preferred location of the precinct will be confirmed following in-depth consultation with landowners, native title holders and custodians, and detailed environmental, cultural heritage and technical studies to be undertaken for the feasibility study and EIS.

The solar farm precinct will occupy up to 12,000 ha of land for the solar farm, battery and ancillary infrastructure (see Section 1.5). The site location has been selected due to a range of factors, including:

- High solar irradiance and low annual cloud cover metrics;
- A long history of ecological disturbance from pastoral activities;
- Low potential for disturbance to surrounding land uses and receptors;
- Proximity to the Adelaide to Darwin railway, which is proposed to be utilised for component delivery and the majority of the transmission easement for the OHTL; and
- Proximity to the Stuart Highway for vehicle access and fibre optic cable connection.

It is possible that additional or alternate solar farm sites will be identified during the development process, or that the solar farm could be separated into multiple sites as a result of findings within the feasibility study and EIS. If so, the case for any changes will be assessed and presented within the EIS.



LEGEND

- Indicative OHTL route
- Underground cable route options
- Land sea joint station options
- Darwin VSC and battery
- Indicative subsea cable route options
  - Southern route
  - Northern route
- Solar farm precinct areas of interest
- Indicative access road
- Darwin Katherine Integrated System: 132 kV
- Gas pipeline
- Road
- Railway
- Cadastre

Source:
Indicative subsea cable route and solar farm from Sun Cable.
Roads, railways, cadastre, pipelines and Aboriginal communities from DLIP.
Powerlines from GEODATA 250k.
Imagery from ESRI Online (image captured 8/9/2016).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F002_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Project areas

Figure No: 2

MXD Reference: 275539_01_GIS002_v1_9

1.3.2. Overhead transmission line

A new +/- 525 to +/- 600 kilovolt (kV), 3.2 GW HVDC OHTL will transfer power from the solar farm to a VSC station on Channel Island Road at Middle Arm peninsula of Darwin, approximately 750 km to the north. The OHTL is proposed to be located within the existing Adelaide to Darwin railway corridor. It will pass through the local government areas of: Barkly Region, Roper Gulf Region, Katherine Municipality, Victoria Daly Region, Unincorporated (Marrakai-Douglas Daly) Area, Coomalie Shire, and Litchfield Municipality.

The OHTL may divert to/from the rail corridor in sections in response to local conditions and community concerns which are uncovered in the environmental impact assessment and consultation process. Underground cables may also be adopted in sections where appropriate.

The OHTL will diverge from the rail corridor, near Jenkins Road approximately 8 km south of the proposed VSC location. The OHTL route in this section will join an existing utilities corridor that heads northwest on Crown Land connecting to the proposed VSC station site, adjacent to Weddell Power Station on the Middle Arm peninsula (see Figure 4). This portion of the OHTL is referred to as the 'utilities corridor.' The OHTL will terminate at the proposed Darwin VSC.

1.3.3. Darwin VSC stations

The VSC stations will be constructed within the Middle Arm peninsula in Darwin (see Figure 5). The Middle Arm peninsula is located in the local government area of Litchfield Council. The area occupied by the VSCs will be approximately 10 ha. It is proposed that the VSC stations will be co-located with the Middle Arm Battery owned by Sun Cable, adjacent to Weddell Power Station.

The ultimate configuration of the VSC stations will be determined following further site option analysis in consultation with the relevant agencies and stakeholders. At the VSC, part of the power supply (approximately 600 to 800 MW) will be converted to AC and connected to Power and Water Corporation's 132 kV DKIS network, via network connection infrastructure to be shared with the Middle Arm Battery.

The VSC location will also be used for additional battery capacity installation to support storage and distribution of power to DKIS and the subsea network. The majority of the power supply (approximately 2.2 GW) will be transferred to the land sea joint station via underground cables within the Middle Arm utilities corridor.

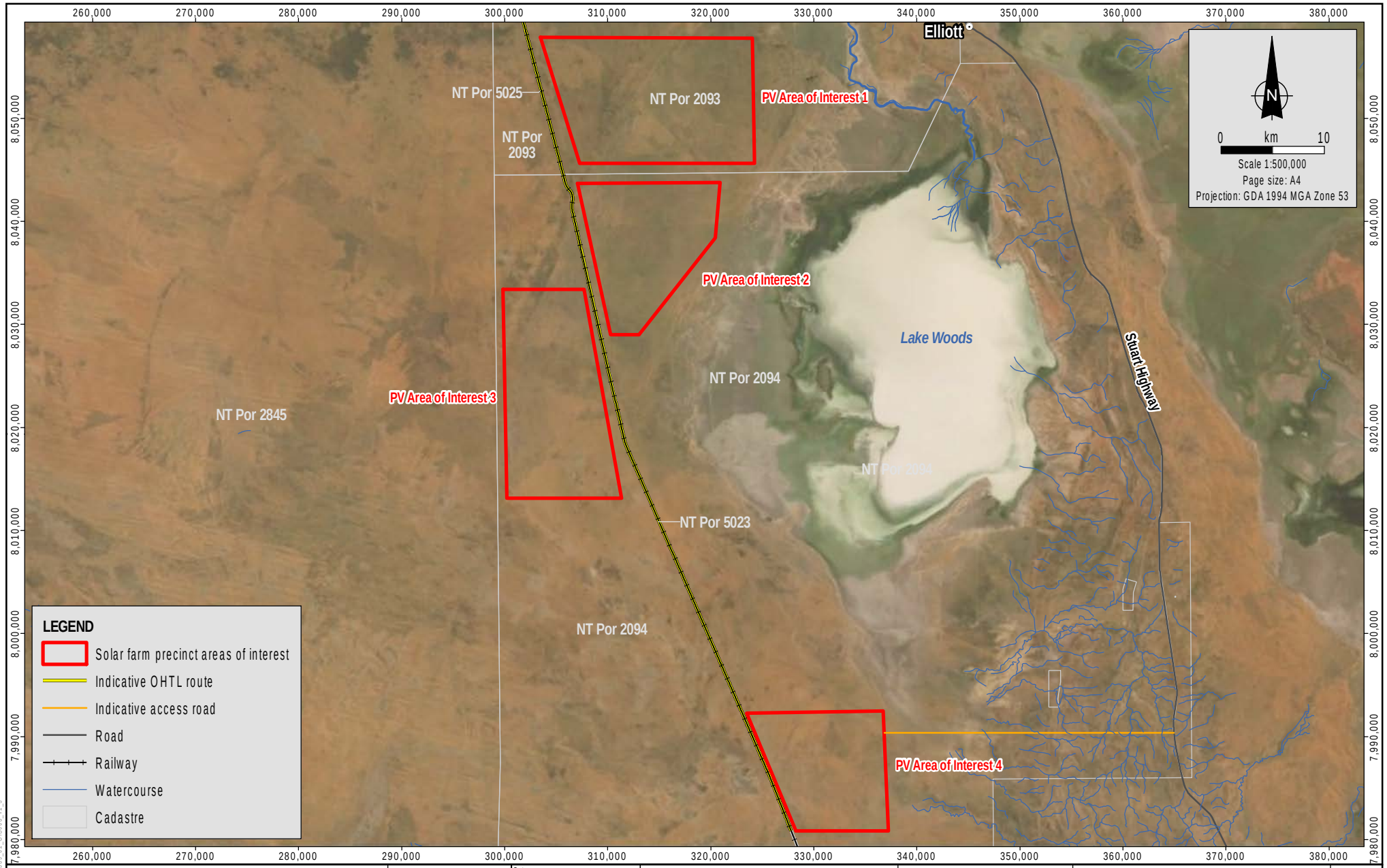
1.3.4. Land sea joint station

A land sea joint station at Middle Arm peninsula will facilitate the transition of the HVDC cables from onshore to offshore. The land sea joint station will be constructed at one of four possible locations on Middle Arm peninsula (see Figure 5). The ultimate location of the land sea joint station will be determined following further site option analysis and consultation.

1.3.5. Subsea cables

The HVDC subsea cable system will extend approximately 3,750 km from Darwin to Singapore, via Indonesia. This Referral deals only with the portion of the submarine cable route located within the NT coastal waters (three nautical miles from the Territorial Sea Baseline), which is a distance of approximately 106 km from the Middle Arm land sea joint station. The portion within Australian waters will be referred to the Commonwealth under the EPBC Act.

The subsea cable route will travel through Darwin Harbour into the Beagle Gulf within NT coastal waters and continue through the Australian EEZ before entering Indonesian EEZ and Archipelagic Waters, en-route to Singapore (see Figure 1). At the time of this referral, two subsea cable routes were being assessed, as shown in Figure 1. The southern route is shorter and would minimise cable length and associated impacts within the Oceanic Shoals Marine Park. The northern route would avoid the North Australia Exercise Area, part of the Australian Defence Force estate.



MXD Reference: 275539_01_GIS003_v1_5

Source:
Proposed solar farm and OHTL route from Sun Cable.
Cadastre, roads, railways and watercourses from DLIP.
Imagery from ESRI Online (Nov 2018).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F003_GIS

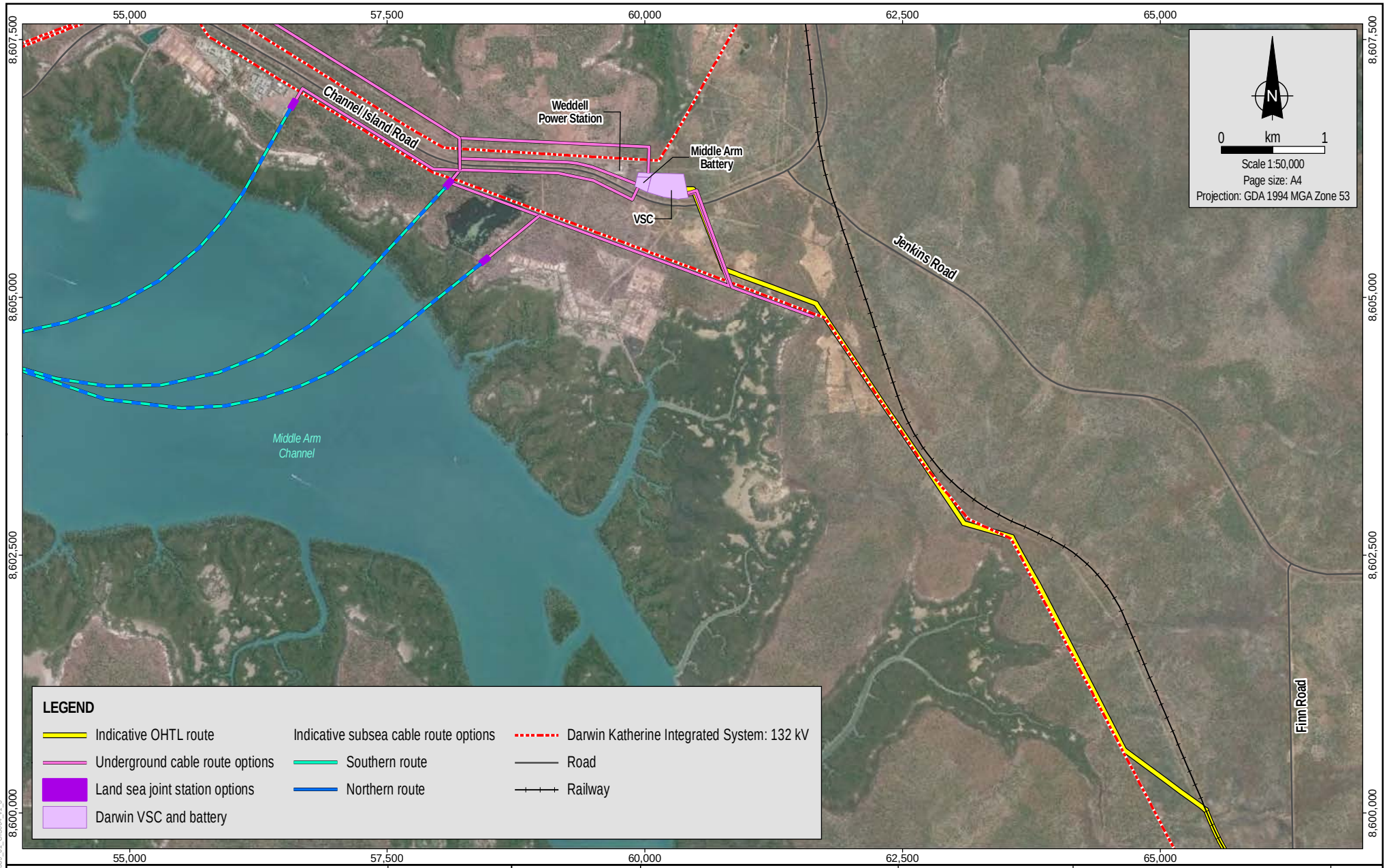
Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Close up of solar farm precinct locality

Figure No: 3



MXD Reference: 275539_01_GIS004_v1_5

Source:
Proposed routes from Sun Cable.
132kv, roads and railways from DLIP.
Imagery from ESRI Online (2018-2019).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F004_GIS

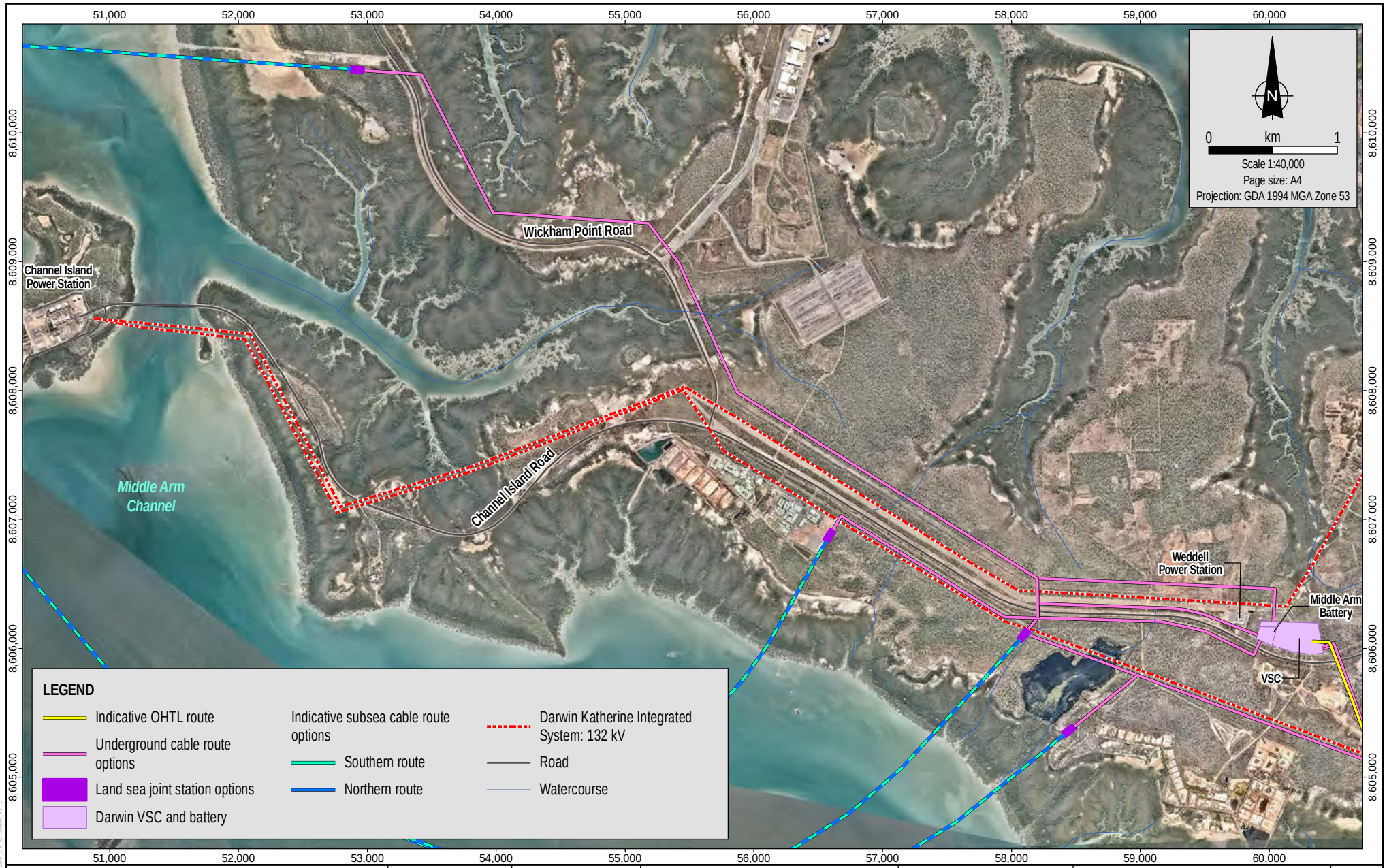
Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

VSC site and OHTL route in utilities corridor section, Middle Arm peninsula

Figure No: 4



Source:
Proposed routes from Sun Cable.
132kv, roads, railways and watercourses from DLIP.
Imagery from Nearmap (13 June 2019)

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F005_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

VSC and land sea joint station options

Figure No: 5

MXD Reference: 275539_01_GIS005_v1_5

The proposed route for the subsea cables through Port Darwin purposely aligns with the route of two existing gas pipelines in the vicinity (see Figure 2) running through the central-western portion of the harbour and into Beagle Gulf. The existing pipelines are protected infrastructure, and marine operators are aware of restrictions associated with this protected infrastructure under the *Submarine Cables and Pipelines Protection Act 1963* (Cth). Aligning the AAPL route with the existing pipelines facilitates protection of its infrastructure by association and minimises impact to activities in the Darwin Harbour. The subsea cable route will be determined following detailed marine survey and consultation with relevant agencies, custodians and other stakeholders.

1.4. Land use history

1.4.1. Solar farm precinct

The predominant land use of the region is for cattle grazing on native vegetation (Staben and Edmeades, 2017). The proposed solar farm precinct is located across two pastoral lease parcels: the Newcastle Waters and Powell Creek Stations (see Figure 3). Both pastoral lease parcels are owned by Consolidated Pastoral Company and operated as a single cattle station. The existing environmental conditions at each of the AOIs is summarised in Section 2.

There are no known sources of soil, surface water or groundwater contamination within or in proximity to the solar farm precinct. Further detailed ground surveys and project design will be undertaken to evaluate the preferred option which will be presented in the future EIS.

1.4.2. Overhead transmission line

The OHTL is located predominantly within the existing Adelaide-Darwin railway corridor. The railway corridor is listed as 'Railway Corridor' under the NT Planning Scheme.

The portion of the Adelaide-Darwin Railway line within which the OHTL will be located has been operational since 2004.

The railway line is nearly entirely located within corridor parcels, leased to the AustralAsia Railway Corporation. Land uses surrounding the railway corridor from the solar farm precinct through to Darwin include rural, pastoral, agricultural, and urban (NT Planning Scheme). All access to the railway corridor will be undertaken only with suitable permits.

The Adelaide-Darwin railway line services six intermodal freight services per week between Adelaide and Darwin, with additional bulk mineral transport services from customers in South Australia and the NT through to the East Arm Port in Darwin. Passenger services operate twice weekly, with the Ghan passenger train (AustralAsia Railway Corporation (AARC), 2019). Further consultation with AARC and relevant stakeholders will be required to consider potential opportunities and/or mitigation measures required to facilitate rail operations during project construction.

In the northern section of the OHTL, the route deviates from the railway corridor and follows an existing utilities corridor on Crown Land which extends approximately 8 km before joining the VSC location. Sun Cable are in consultation with Crown Land Estate regarding permits to construct the OHTL in this utilities corridor.

1.4.3. Darwin VSC and land sea joint station

The proposed VSC location and land sea joint station locations are within Darwin's Middle Arm peninsula, as shown in Figure 5. The Middle Arm peninsula currently supports a range of industrial land uses along with areas reserved for conservation. The area occupied by the VSC will be approximately 10 ha, which is proposed to be co-located with the Middle Arm Battery development, which is undergoing a separate approvals process. The Middle Arm Battery is scheduled for construction in 2021.

Sun Cable is in consultation with Land Development Corporation and other land holders to select the land sea joint station and VSC locations, as well as the transmission corridors so that they are consistent with the Middle Arm redevelopment plans.

1.4.4. Subsea cables

The proposed subsea cables route is shown in Figure 1 and Figure 2, and has been sited to generally align with the existing gas pipelines extending from Middle Arm peninsula through Darwin Harbour, thereby minimising impacts to other harbour users.

The Port of Darwin more broadly (comprising all areas of Darwin Harbour and extending out to the Beagle Gulf) in addition to providing a base for major port operations in the NT, supports a range of industrial, commercial and recreational maritime uses, including fisheries, tourism and recreational shipping/boating activities. Some sections of the intertidal area and seabed within Darwin Harbour have previously been disturbed as a result of historic uses during World War II and use of the site for marine services activities.

1.5. Description of proposed action

The project has five main components in Australia which are described in detail below. For the purpose of this Referral, the proposal scope is limited to the infrastructure within the NT, including coastal waters.

1.5.1. Primary project components

Solar farm precinct

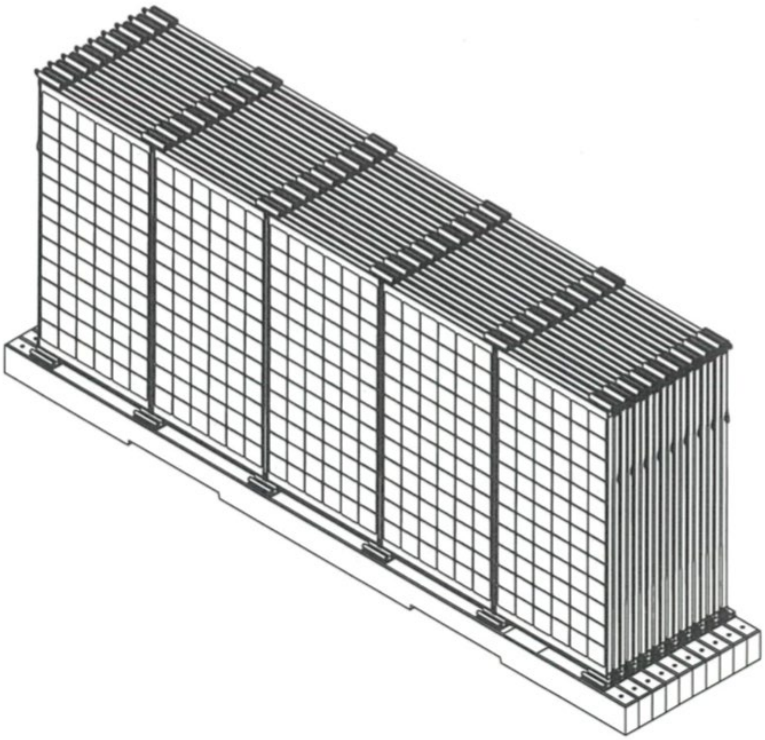
The solar farm precinct will be designed according to site conditions identified during further technical studies. Infrastructure and components are likely to include:

- PV module arrays with approximately 10,000 MW (10 GW) of generating capacity;
- Inverters;
- Intermittent substations;
- Above and below ground cabling including an electrode;
- Batteries with approximately 30 GWh of capacity;
- VSC (AC/DC) station;
- Operation and maintenance buildings;
- Rail siding, freight offloading and intermodal facility;
- Airfield and associated infrastructure;
- Groundwater supply, water treatment plant and storage tanks;
- Wastewater treatment system;
- Sealed and unsealed access roads, car parks;
- Weather stations, sky camera monitoring and forecasting equipment;
- Secure compounds;
- Security system, fencing, lighting and cleared firebreaks;
- Microwave communications tower;
- Underground or overhead fibre optic cable network;
- Hardstands, laydowns, warehousing and storage areas; and
- Accommodation camp for approximately 350 personnel during construction, reducing to approximately 100 personnel during operations.

The solar farm array will comprise prefabricated ground-mounted fixed-panel module technology. The pre-fabricated modules enable low cost of construction, ease of transport, rapid deployment and full modularisation of the solar farm. An example of such a solar array is provided in Figure 6 to Figure 10. Modules will be assembled in a factory, before being transported to site in containers using the AustralAsia Railway, most likely from Darwin. The modules will be unloaded and deployed using trucks and telehandlers on site and connected using underground and overhead reticulation.

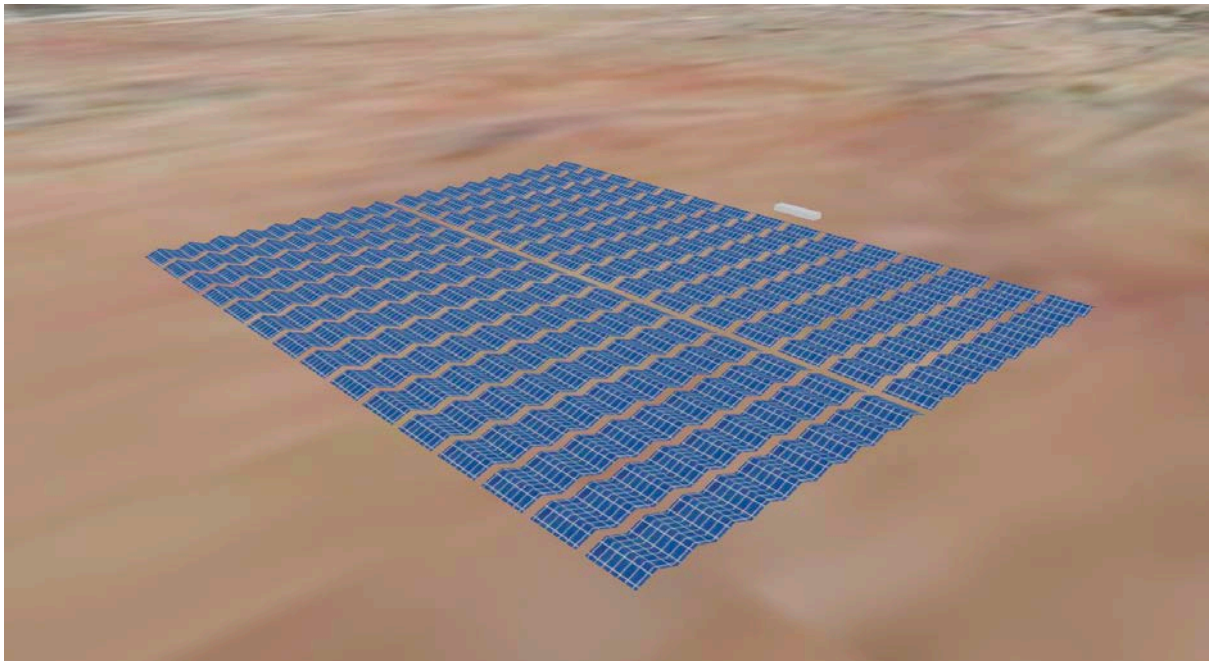
Source: 5B, 2020

Figure 6: Example of a pre-fabricated solar array, Port Bonython, SA



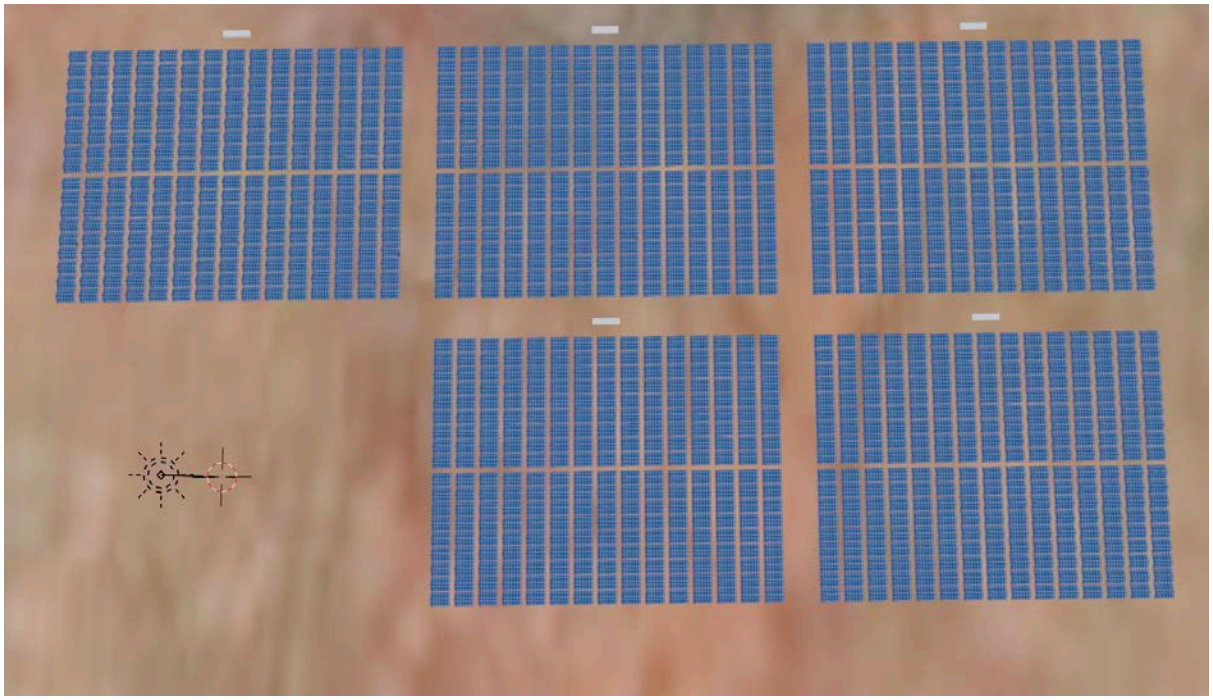
Source: Sun Cable, 2020

Figure 7: A schematic showing the prefabricated solar module ready for containerised transport



Source: Sun Cable, 2020

Figure 8: A concept layout of a 1.35 MW solar array with a 3 MWh battery pack



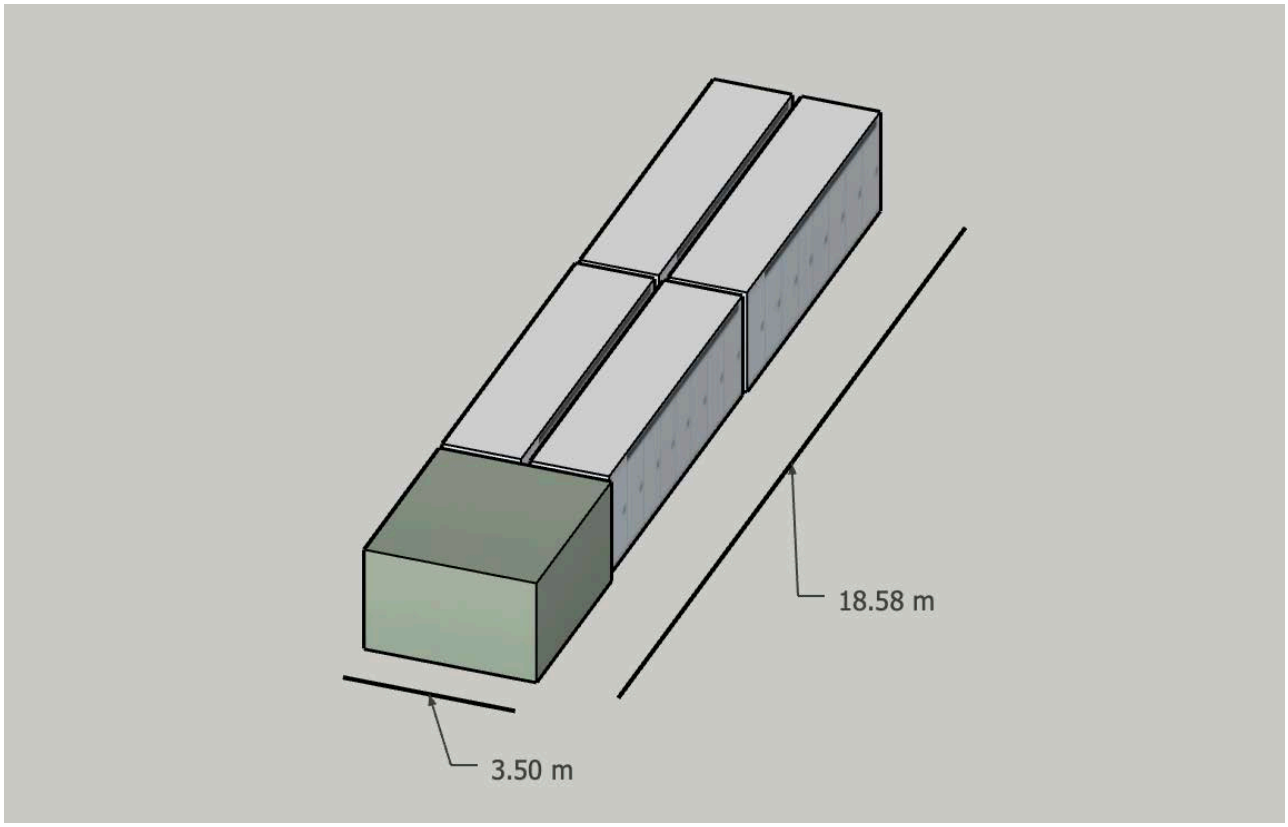
Source: Sun Cable, 2020

Figure 9: Solar arrays deployed in a modular arrangement

The total capacity of battery storage associated with the project is proposed to be approximately 30 GWh. However, this figure is subject to detailed engineering and system optimisation which is ongoing. Battery facilities will be co-located with the solar farm, as well as at each VSC to manage generation peaks, provide capacity reserve and deliver transmission system support and frequency control services. Battery technology will be selected following a comprehensive tender and is likely to comprise a modular lithium ion technology or equivalent. Electrolyte/flow batteries may also be considered for deployment. Further details on the preferred technologies and environmental management measures of each technology will be provided in the EIS.

Each battery facility will comprise a combination of the following components:

- Battery containers including energy storage and cooling systems;
- Electrolyte storage tanks and piping;
- Inverters;
- Switchgear, buildings and control compounds;
- Transformers;
- Earthing mats; and
- Above and below ground cabling.



Source: Sun Cable, 2020

Figure 10: A typical modular lithium ion battery pack layout

A permanent fence and gates including surveillance will be constructed around the solar farm, electrical infrastructure and secure compounds. During construction, facilities including construction hardstands, site offices, parking and laydown areas will also be established. Concrete batching plants, gravel borrow pits and rock quarries will be established for construction and continue to be utilised for maintenance during operation as required. A layout of the solar farm precinct is in Figure 11.

F11 **Concept Layout of Solar Farm Precinct**

Australia ASEAN Power Link
Environment Protection Act Referral

SUN CABLE

CAMBIUM GROUP

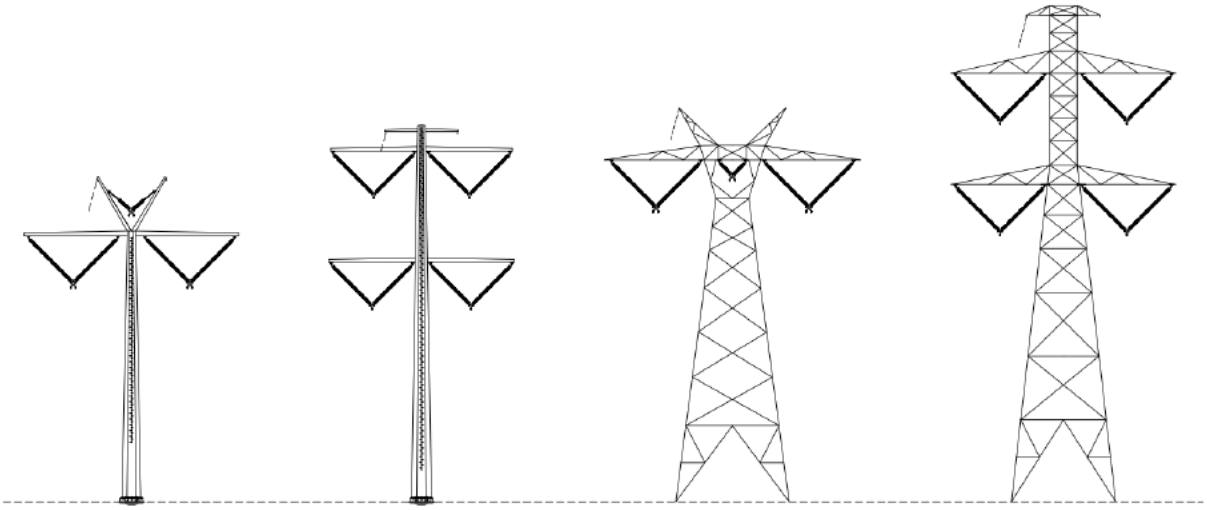
Overhead transmission line

The OHTL is proposed to extend approximately 750 km from the solar farm precinct to the proposed Darwin VSC station on Channel Island Road at Middle Arm peninsula. The OHTL easement is proposed to be located predominantly within the existing AustralAsia Railway corridor, with some deviations from the corridor to minimise impacts to social and environmental values or accommodate land constraints along the route. The easement will be approximately 60 m wide with approximately 300 to 400 m between poles and towers. Due to the height of the conductors, vegetation clearance will be limited to areas required for pole and tower installation, or where vegetation may interfere with conductors.

Transmission will occur via a +/- 525 kV to +/- 600 kV HVDC OHTL with a 3.2 GW transfer capacity, with a range of configurations under consideration including rigid bipole, or bipole with metallic return. The design of the transmission poles and towers may vary in response to the surrounding land use, local environmental conditions and geotechnical conditions at each tower and will be constructed according to industry design specifications and standards. An optical ground wire (OPGW) will be used to combat lightning strikes, usually installed between the tops of OHTL towers, providing a grounding function as well as possible housing for optical fibre cable.

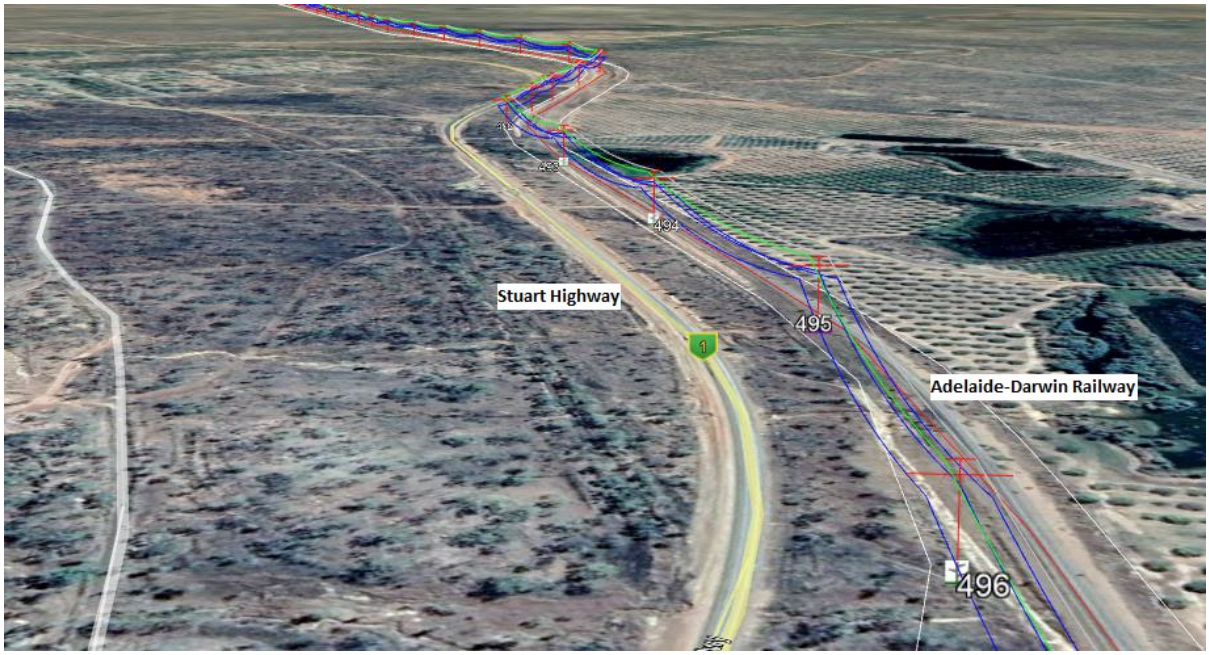
The preliminary concept design provides a suite of high voltage transmission structure types which are provided below, ranging from 35 to 45 m in height (see Figure 12 and Figure 13). Both poles and towers are expected to be used, in response to the surrounding land use, available corridor width, wind region, local environment and geotechnical conditions at each structure. In some sections the OHTL may deviate from the corridor, or undergrounding may be adopted in response to the local conditions.

Consideration is being given to building the poles and towers to facilitate future transmission capacity growth, with room for additional HVDC circuit.



Source: Lumen, 2020

Figure 12: Examples of HVDC transmission poles and towers for the OHTL



Source: Lumen, 2020

Figure 13: A concept layout of the OHTL (facing south) near the Stuart Highway, NT.

Further detail on the OHTL configuration and tower specification will be determined through the detailed engineering design stage and will inform further baseline and impact assessments as part of the EIS process.

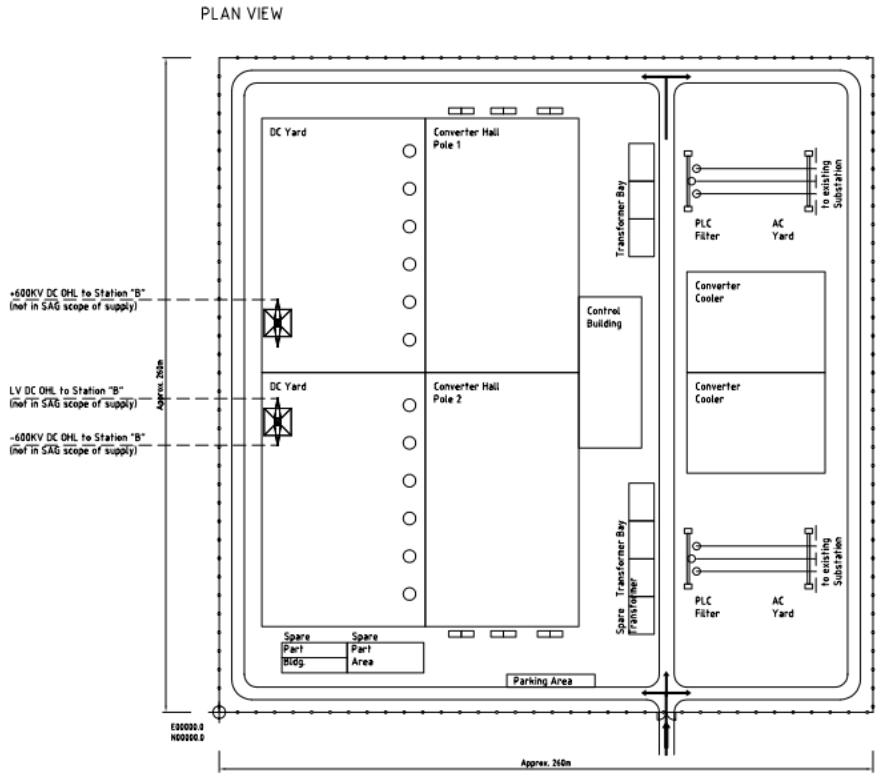
Darwin VSC station

The Darwin VSC station will have up to two VSCs constructed that will facilitate the conversion of the HVDC power delivered by the OHTL to high voltage alternating current (HVAC). The HVAC infrastructure will then be connected to the DKIS and the second face-to-face VSC. This VSC will re-convert the HVAC power to HVDC for transmission to Singapore via the subsea cables. The purpose of this configuration would be to enable isolation of each HVDC transmission component, creating two independent power networks (onshore and offshore). Final design will be subject to detailed engineering which is ongoing (see Figure 14 as an example VSC station).

Source: ABB, 2020

Figure 14: Caithness Moray Voltage Source Converter Station, Scotland

The VSC compound will be approximately 10 ha in size and will include VSC yards with electrical componentry, oil/water separation unit, substation bench, main transformers, earthing mat, drainage, lightning protection and ancillary infrastructure including control compounds and site offices, access and parking, security fencing and surveillance, security lighting, uninterruptible power supply, communications and ablutions (see Figure 16).



Source: Sun Cable, 2020

Figure 15: A schematic showing a concept HVDC configuration with a single VSC

A battery facility will be located with the VSCs, based on the configuration described above, and will share common infrastructure. The battery capacity will be around +/- 800 MWh and will connect to common infrastructure used by the Middle Arm Battery to be constructed in 2021.

Land sea joint station

A land sea joint station will facilitate the transition of the HVDC cables from onshore to offshore. Power will be transferred approximately 2 to 10 km from the Darwin VSC to the land sea joint station by underground cabling, using the existing utilities corridors on Middle Arm (see Figure 5). These routes are under discussion with the relevant utilities and government agencies. Cables will then transition from onshore to offshore either via conventional trenching or via conduits installed using horizontal directional drilling (HDD), depending on the local site conditions and environmental and heritage values.

The land sea joint station will be constructed at one of four possible locations in the Middle Arm peninsula in Darwin, as shown in Figure 5. Further site assessment will be completed to determine the final location and footprint of this infrastructure.

Construction of the land sea joint station involves excavation of jointing pits within which the land and sea cables are joined together. If site conditions permit, a cable trench will be excavated into the harbour to enable winching of the subsea cable from a barge offshore to the joint pit. If the selected location is in a sensitive coastal habitat (such as mangrove habitat) or has other heritage or environmental concerns, it may be necessary to use a HDD rig to bore a series of narrow tunnels from land to Darwin Harbour (see Figure 16). The HDD would emerge within Darwin Harbour at a location to be confirmed with the relevant maritime authorities. Conduits will then be installed within the tunnels typically by winching the conduit from offshore barges or larger vessels, through the tunnels to the land sea joint

station. The HVDC cables can then be winched through the conduit from an offshore cable laying vessel or barge once the integrity of the conduit is established.

The land sea joint station compound will require an area of approximately one hectare including provision for a HDD pit of approximately 50 x 50 m, and space to accommodate a HDD rig, excavators, generators, pumps, winches, surge arrestors, joint workshop, pipe storage, and ancillary infrastructure including site offices, lighting, fuel storage and amenities. A typical land sea joint construction compound including access, amenities, cable trenches and jointing structures is shown in Figure 17.

Subsea cables

The HVDC subsea cables will likely be the same voltage (+/- 525 to +/- 600 kV) as the OHTL, with a variety of configurations being considered including rigid bipole (two cables), or bipole with metallic return (three cables). Subject to final engineering and procurement, the cable system may involve two or three cables laid in parallel or bundled and may include fibre optics.

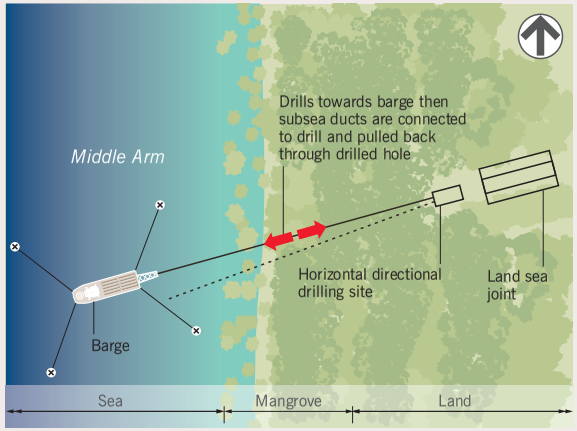
Fibre optics are a useful tool in monitoring cable performance, particularly distributed temperature sensing and/or distributed acoustic sensing, which rely on analysis of light pulses reflected down optical fibres to monitor changes in cable temperature and strain. Depending on the final transmission system configuration, fibre optic cables may be either bundled to the poles during laying or laid in parallel depending on the local geophysical / geotechnical conditions and Project requirements. Cable monitoring using fibre optics will be most vital in high risk and shallow areas, including the landfall locations. In addition to cable monitoring, fibre optic cables may be used for data transmission between Darwin and Singapore which would require dedicated fibre optic cables with repeaters installed at intervals along the route.

HVDC subsea cables will be installed using cable laying vessels and barges within Darwin Harbour from near the land sea joint station, travelling north through Port Darwin and west into the Beagle Gulf and Timor Sea, before travelling northwest through the Australian EEZ waters before entering the Indonesian Archipelagic and EEZ Waters, en-route to Singapore.

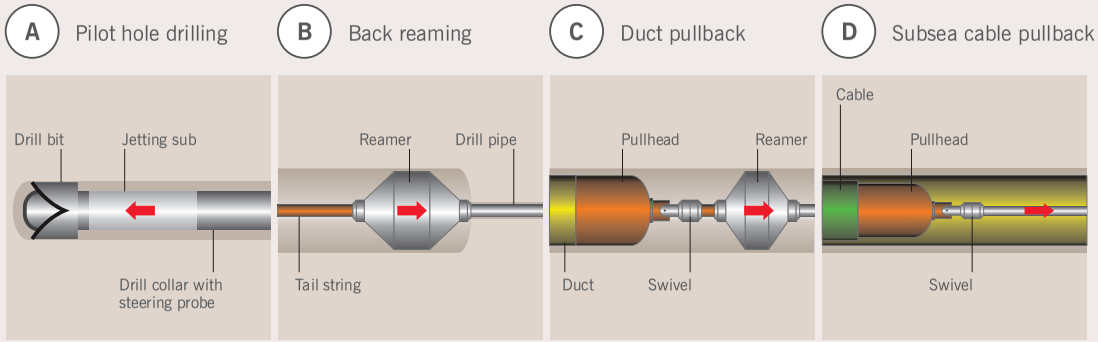
Cables will either be laid on the seafloor, or trenched into the seabed generally to a depth between 0.3 to 1 m (in certain circumstances it may be necessary to bury to 3 m depth), or protected with armouring as required, subject to various hazards and conditions along the route. Where possible, the submarine cables will be located adjacent to existing cable and pipeline corridors to minimize disruption and/or impacts to the seabed and marine use. The subsea cables will be installed and operated in accordance with the relevant subsea cable legislation, including international conventions.

F16 **HDD Indicative Layout**

Australia ASEAN Power Link
EPA Referral



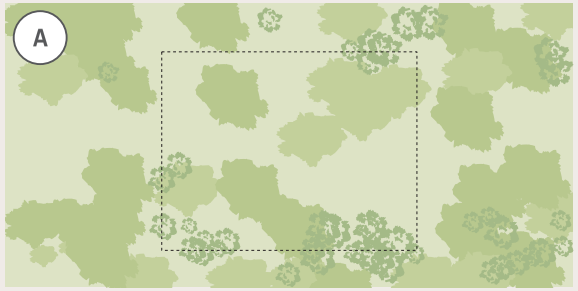
Land to sea horizontal directional drilling



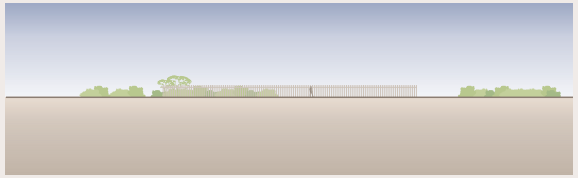
Horizontal directional drilling detail

- Fence
- Reception pit and horizontal directional drill entry
- Lighting
1. Recycling unit
2. Mud pump
3. Office
4. Amenities
5. Workshop
6. Fuel tanks
7. Drill pipe
8. Horizontal directional drill rig
9. Excavator
10. Sledge pump

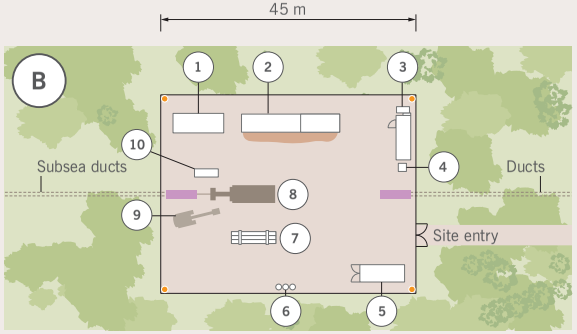
Horizontal directional drilling staging



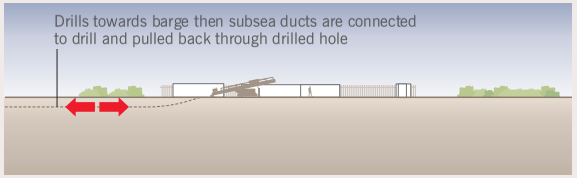
Site establishment



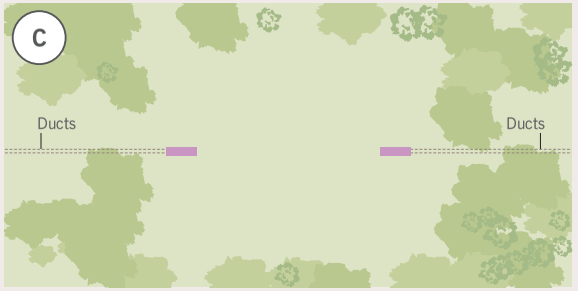
Section A-A



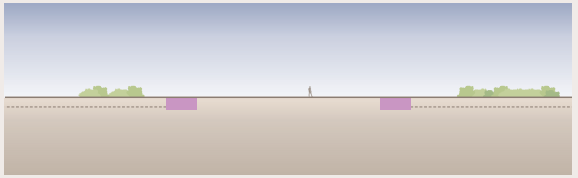
Horizontal directional drilling site layout



Section B-B



Completed ducts



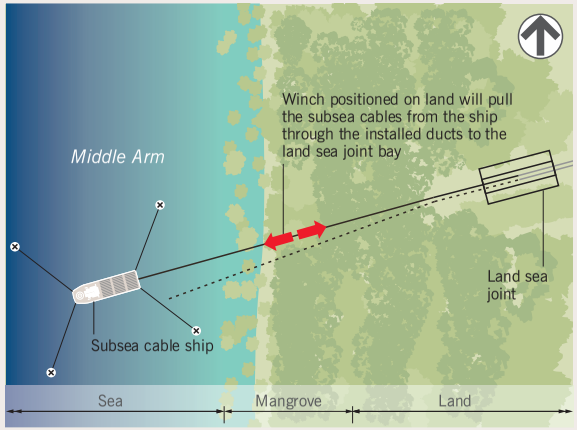
Section C-C

CAMBIUM GROUP

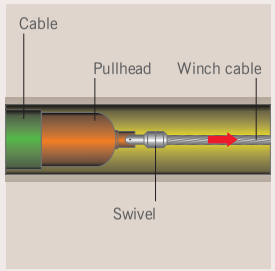
F17 **Land Sea Joint Staging**

Australia ASEAN Power Link
EPA Referral

SUN CABLE



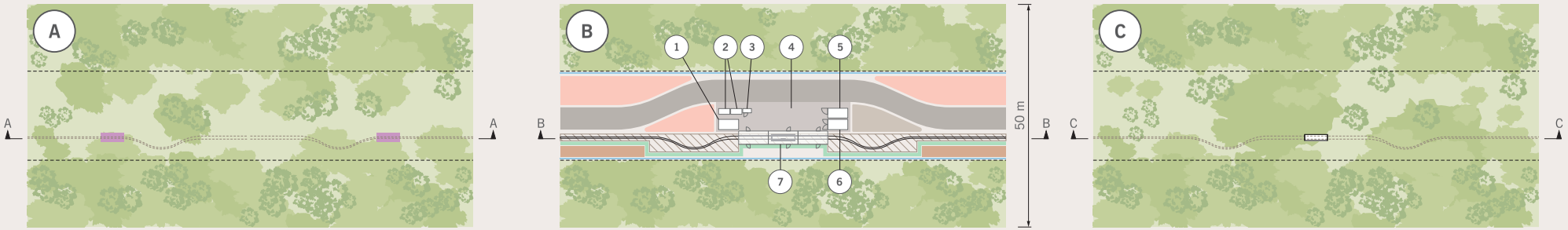
A Subsea cable pullback



Subsea cable pullback to land sea joint

- Fence
- Drain
- Cable
- Topsoil stockpile
- Subsoil stockpile
- Access road
- Footpath
- Reception pit and horizontal directional drill entry
- Cable trench
- 1 Air conditioning and generator
- 2 Power supply
- 3 Amenities
- 4 Hardstand
- 5 Changing room and kitchen
- 6 Store and workshop
- 7 Jointing shelters

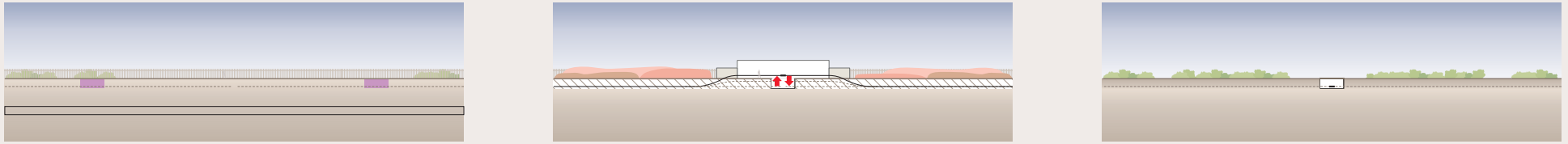
Land sea joint staging



Site preparation

Cable jointing

Rehabilitated site

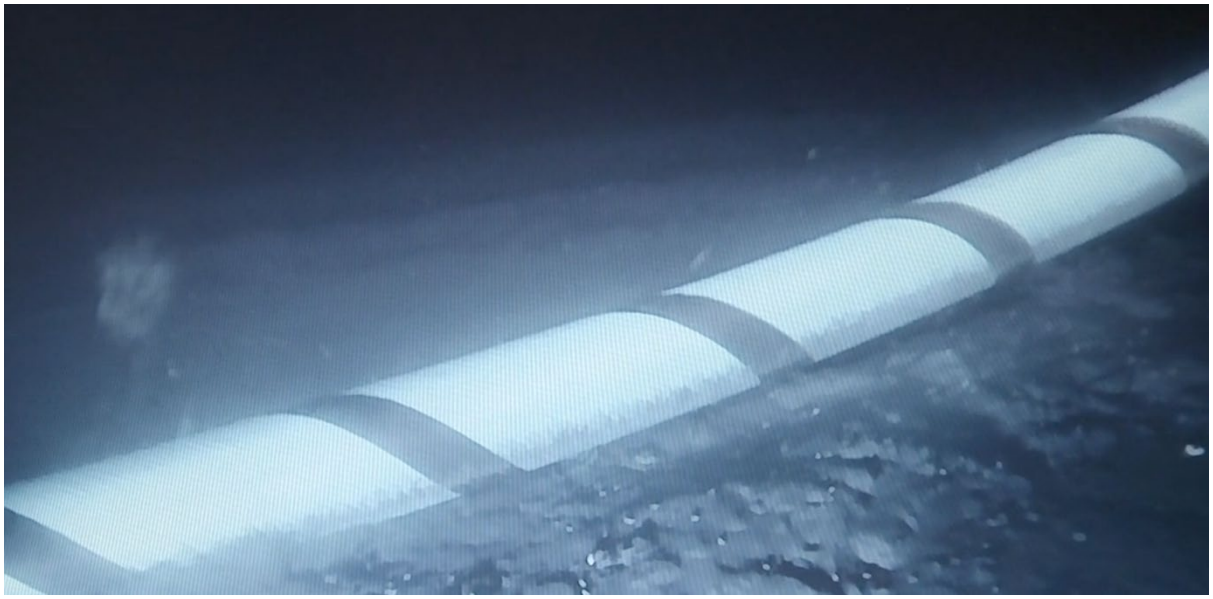


Section A-A

Section B-B

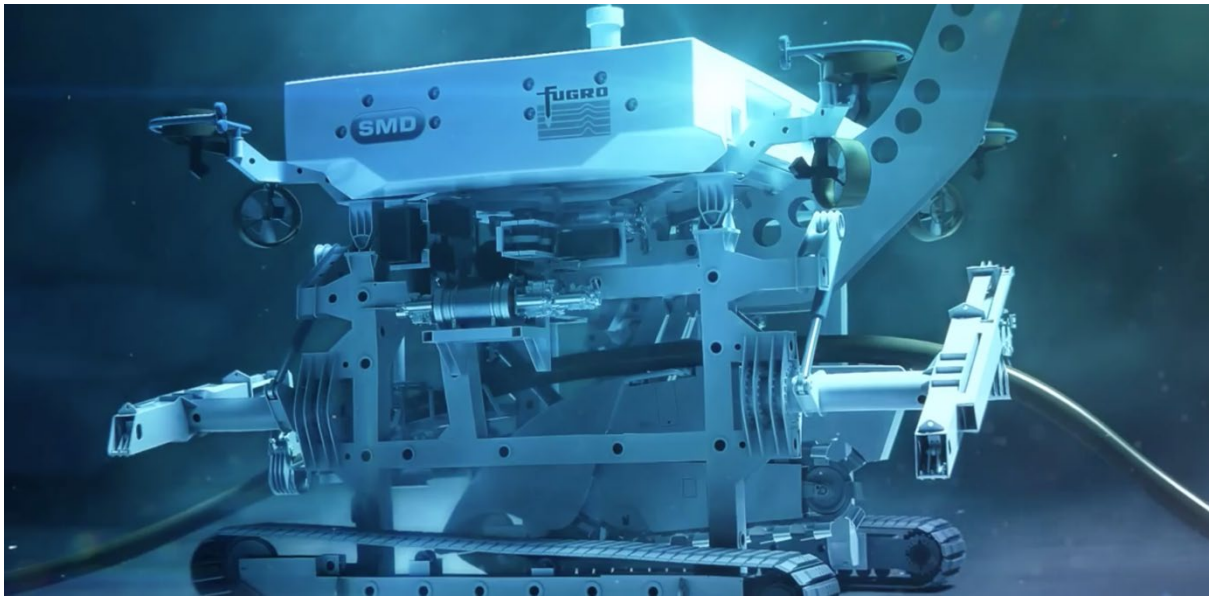
Section C-C

CAMBIUM GROUP



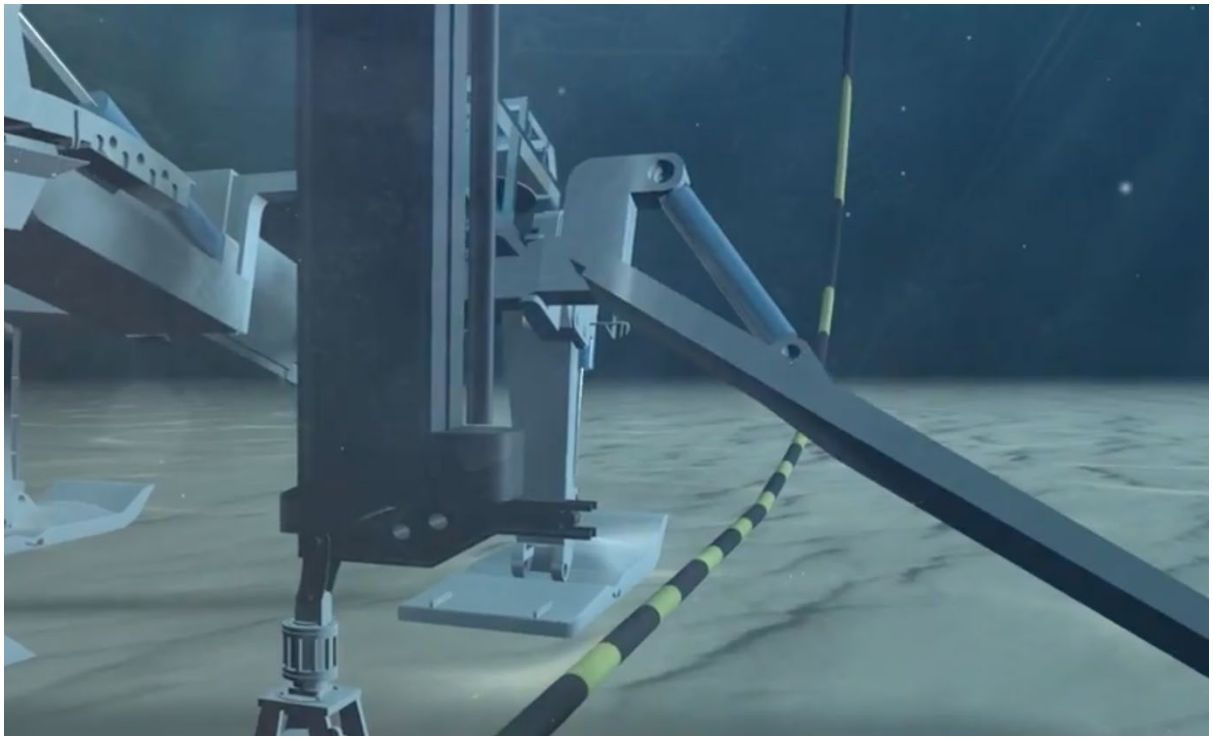
Source: https://www.smd.co.uk, 2020

Figure 18: A cable laid on the sea floor



Source: https://www.smd.co.uk, 2020

Figure 19: Example cable laying probe



Source: https://www.smd.co.uk, 2020

Figure 20: Example cable laying probe

Source: https://www.schottel.de, 2020

Figure 21: Example subsea cable laying vessel

1.5.2. Secondary project aspects

Workforce Accommodation

Sun Cable aims to develop the Project predominantly utilising a local Northern Territory and Australian workforce. The company is currently developing an Indigenous Engagement Plan, Territory Participation Plan and an Australian Industry Participation Plan that will outline the approach to employment, training and contractor engagement to maximise use of local Indigenous and non-Indigenous skills, labour and businesses. These strategies will be developed in consultation with the Northern Land Council, business and industry groups and the Northern Territory Government.

To facilitate construction of the solar farm, workforce accommodation and administration facilities will be required to house up to 350 people due to the remote location of the solar farm precinct. The facility will be scaled down during operations, reducing to a capacity of up to 100 people post construction. Construction workforce will operate on a roster basis and will source labour from Tennant Creek, Elliott, Katherine, Alice Springs and Darwin regions, as well as further abroad where specialist skills are required.

The workforce accommodation will be self-supported in terms of water, power and sewerage and will be subject to a design process in accordance with best practice workplace health and safety practices and environmental considerations.

Construction of the OHTL, VSC, land sea joint station and subsea cables will be operated out of intermediate work bases in the relevant locations. Some small temporary worker accommodation may be required in remote locations along the OHTL route, however mobile work crews are likely to utilise commercial accommodation where available throughout the NT.

Access

During construction, access will be required to the solar farm, construction corridor of the OHTL, VSC, land sea joint station, accommodation camps, water bores and borrow pits.

Transport of the bulk of components for the solar farm including prefabricated solar arrays, battery componentry, inverters, substation equipment, electrical componentry, cabling, machinery, parts and materials is proposed to be predominantly via rail. The solar farm precinct has been strategically located adjacent to the AustralAsia Railway to facilitate construction and a rail siding will be constructed for offloading and re-loading. The rail network will also be used to return transport containers to the port.

A new access road will be constructed from the Stuart Highway across the Pastoral Lease to the solar farm for labour and materials transport. The access will be adequately engineered to accommodate the largest loads and vehicle frequency predicted in accordance with a detailed transport assessment.

Current access to the proposed solar farm site is via road, with road access from Stuart Highway east of the site. A new access road from Stuart Highway would be constructed, subject to negotiations with the road authorities, pastoral leaseholder, the NLC and traditional owners (TOs). Materials and equipment for construction of the solar farm will be delivered to the site via rail and the Stuart Highway.

Construction of the OHTL, VSC and land sea-joint will require the use of existing and new access tracks. The following key considerations will be taken into account in the access track selection process:

- Existing tracks to be used where possible, although the establishment of additional new tracks will be necessary.
- Tracks will be developed in locations to minimise the distance travelled on public roads.
- The access corridor will be used in preference to a track in areas where high road maintenance is expected, such as sand and soft soil.
- Access will be provided to either side of a watercourse where practical, to enable construction traffic to reach both sides whilst avoiding the need for installing crossings.

Additional level crossings may be required within the easement to enable the OHTL construction and operations crews to gain access to both sides of the track.

Detailed transport requirements to support the construction and operation of the project are currently under development and will be subject to stakeholder engagement and further assessment.

Water requirements

Construction and operational water requirements are estimated at 80 megalitres per annum (ML pa) during construction, and 5 to 10 ML pa during operation, with this forecast to be further refined during the detailed design process. Most construction water requirements will be for road construction and concrete batching, as well as dust suppression. Operational water requirements will generally be limited to maintenance (i.e. cleaning) of the solar panels, road maintenance and dust suppression.

Potable water will be required for personnel camp operations and supply to the operations and maintenance facility (drinking water, cooking, showers and toilets). Water for firefighting purposes will be stored in tanks at the solar farm site, in line with the requirements under the *Bushfire Management Act 2016* (NT).

Investigations will be undertaken to determine the suitability of the solar farm site for the construction of a bore to service the water requirements for the site. If the onsite water supply is considered unsuitable (either non-potable or inadequate supply) then alternative/offsite delivery options or water treatment will be adopted. Rainwater will be captured and stored for use onsite.

Waste

Waste will be generated in varying amounts throughout all phases of the project, although it is expected that the majority of waste will be generated during construction and commissioning.

During the life of the project, waste will arise from three main waste streams: non-hazardous, liquid and hazardous. Non-hazardous wastes will include inert construction material, domestic putrescible waste including food scraps and packaging waste. Construction camps will be a source of non-hazardous waste.

Liquid waste will include sewage which will be treated on site and disposed of in accordance with statutory requirements. The type of sewage treatment to be implemented at the construction camps and along the OHTL (during construction) will be determined during detailed design.

Hazardous materials such as hydrocarbons (oil, fuel and lubricants) will be used during construction and to a lesser extent during operations.

A waste inventory will be developed during the design phase and the preferred treatment and disposal methods identified.

Power

Power for construction of the project will include a combination of temporary solar and storage mobilised to site, likely with some conventional generation during establishment and early works. Similar mobile systems will be adopted for the OHTL and VSC as required. Connections to existing mains may be established where available, including at the VSC and land sea joint locations.

Offshore cable installation will be powered by cable laying vessels with internal generation.

Light

The solar farm precinct is located in a remote, unpopulated area with no dwellings within 10 km. The OHTL is proposed within the existing railway corridor, and the VSC and sea land joint will be constructed in a utilities precinct.

During construction, submarine cable installation works are likely to operate on a 24/7 basis. Beach HDD works and cable pulls are time critical activities which need to operate in accordance with tides, however night activities will be rotated to reduce impacts and interruption to receptors.

Due to the scale and remote nature of the solar farm, construction of the solar farm precinct will operate on a roster basis, potentially involving 24/7 operations. Lighting will be required around the construction camp. The lighting of these facilities will be designed to ensure that the light levels are sufficient for safety and operations.

Minimal lighting is proposed during construction of the OHTL and VSC as night-time works are generally not conducted in built up areas.

1.6. Alternatives

Early in project development, Singapore and Darwin were identified as the primary markets with a need for wholesale electricity at the scale that can be generated by the project, with Indonesia presenting additional opportunities subject to confirmed load requirements. In order to meet these needs, Sun Cable has undertaken extensive reconnaissance across northern Australia to identify suitable generation sites. Key considerations were not only the ideal solar generation characteristics, but also potential OHTL routes, land sea joint stations and subsea cable options, giving due consideration to the environmental and social constraints of each alternative.

Sun Cable have identified the area around Elliott as being highly productive from a solar irradiance perspective, with high daily sunshine hours and low levels of cloud. Similar characteristics exist in other arid regions of northern Australia, however there are few existing utilities and access corridors extending from these regions to the coast, limiting the number of viable alternatives. Accordingly, the AustralAsia Railway corridor was identified as an opportunity to limit the impacts of OHTL construction and enable rail freight for project components and was therefore a key driver of solar farm precinct selection.

The selection of the solar farm precinct follows an extensive review of land opportunities in the Barkly region, using a range of project success metrics developed by Sun Cable. In broad terms the Newcastle Waters and Powell Creek pastoral station area was selected as the preferred alternative for the following reasons:

- High solar irradiance and low annual cloud cover metrics;
- A long history of ecological disturbance from pastoral activities;
- Low potential for disturbance to surrounding land uses and receptors;
- Proximity to the AustralAsia Railway which is proposed to be utilised for component delivery and the majority of the transmission easement for the OHTL; and
- Proximity to the Stuart Highway for vehicle access and fibre optic cable connection.

Four areas of interest have been considered for the solar farm precinct following a regional review of prospective site options. These AOIs are located within two pastoral lease parcels: NT Por 2093 and NT Por 2094, as shown in Figure 3. The existing environmental conditions at each of the AOIs is summarised in Section 2. Further detailed ground surveys and project design will be undertaken to evaluate the preferred option, which will be presented in the future EIS.

The current project design aims to avoid or minimise impacts to environmental, social and heritage values where possible, through informed consultation, detailed technical studies and iterative design. This principle has informed the evaluation of alternatives for each project component throughout development. For example:

- Using the existing rail and utilities corridors for the terrestrial OHTL component will significantly reduce ecological and cultural heritage impacts;
- Constructing the land sea joint station using a combination of trenching and HDD will avoid impacts to any identified important mangrove and shoreline habitats; and
- Aligning the subsea cables with existing gas pipelines through Darwin Harbour will significantly reduce the impact to marine ecology and maritime traffic.

As outlined in Section1.3.4, there are four locations for the planned land sea joint station being investigated within the Middle Arm peninsula in Darwin. These options are shown in Figure 5. Further detailed design is being undertaken to evaluate the preferred option which will be presented in the EIS.

Further baseline studies will be undertaken of the proposed OHTL route to inform the ultimate placement of the AAPL infrastructure (i.e. tower and VSC/joint station locations); however, this is likely to be aligned with the route shown in Figure 1 and Figure 2. A comprehensive description of alternatives will be presented in the EIS.

1.7. Consultation and engagement

The AAPL has been in feasibility planning since 2018 with consultation and engagement happening prior to lodgement of this Referral with a wide array of Australian Commonwealth and NT government agencies and representatives, Indigenous representatives, landholders, pastoral leaseholders, environment groups, industry groups, business and international government representatives. Despite this, consultation is at an early stage for a project of this scale, and Sun Cable is in the process of developing a broader campaign of consultation and engagement with communities, individuals and interest groups potentially affected by the development.

Sun Cable considers consultation and engagement to be instrumental to successful project development. The goal is to establish relationships, develop trust, and share information freely so that concerns may be raised, evaluated and resolved in the most effective manner. A stakeholder engagement strategy is being developed for the project which will identify all stakeholders potentially affected by the project and provide a guide for further engagement and consultation with these stakeholders throughout the EIS, design development and ultimately construction and operation of the project.

A summary of key stakeholders consulted in the initial design and planning of the project culminating in the submission of this Referral to date, is provided in Table 5.

Table 5: Stakeholder consultation to date

Stakeholder	Summary of Consultation
Australian Government	Consultation with Commonwealth agencies commenced in 2019 including direct correspondence and the following formal applications: • An EPBC Act Referral for the proposed Marine Survey for the AAPL project. • Research Licence application from Parks Australia for marine survey within the Oceanic Shoals Marine Park. • Application for Major Project Status with the Department of Agriculture, Water and Environment The project was awarded Major Project Status by the Australian Government in July 2020. An EPBC Act Referral will be submitted for construction and operation of the AAPL concurrent with this EP Referral.
NT Government	The project was awarded Major Project Status by the NT Chief Minister in July 2019. Accordingly, a Project Control Group (PCG) has been established to support the development of the project, and discuss key matters to be considered and addressed during planning and design. The PCG involves monthly meetings, and regular consultation outside of the meetings, with the following agencies: • Department of Trade Business and Innovation (DTBI) • Department of Industry, Planning and Logistics (DIPL) • Department of Environment and Natural Resources (DENR) • Environment Protection Authority (EPA) • Crown Lands • Power and Water Corporation

Stakeholder	Summary of Consultation
	• AustralAsia Railway Corporation (AARC) • Land Development Corporation (LDC) As part of a Crown Lands Occupation Licence, Crown Lands have widely consulted with agencies and departments within the proposed marine survey area on behalf of the Proponent.
Northern Land Council	Consultation with Northern Land Council commenced in 2019 and has involved entering a Deed Relating to Negotiation Protocols. The deed establishes the framework for consultation with Aboriginal landowners, native title holders, traditional owners and custodians of the land affected by the project. The deed includes a commitment to consider the following matters for inclusion within an Indigenous Land Use Agreement (ILUA): environmental management, cultural heritage and sacred sites protection, rights and interests in land, financial payments, employment and training, contracts and Indigenous business development. Consultation with NLC is ongoing in this regard. NLC were provided an opportunity to review a draft version of this referral prior to submission, and comments were received and addressed in this final version.
Landholders	The proponent has been engaged with specific private freehold landholders and leaseholders in relation to establishment of the solar farm precinct, OHTL corridor and VSC and land sea joint stations. Further extensive consultation with landholders that may be affected by the project will be undertaken as project development progresses.
AustralAsia Railway Corporation	The proponent has been directly engaged with AARC to evaluate the opportunity for OHTL infrastructure within the railway corridor. Detailed engagement is underway with the support of DTBI and Investment Territory.
OneRail	As the AARC rail operator, Sun Cable has commenced consultation with OneRail with regards to potential freight opportunities and the need for a rail siding at the project area. Further detailed engagement to address co-use of the corridor is planned as part of the consultation with AARC.
Land Development Corporation	LDC has been consulted in relation to land availability for Project and non-project infrastructure in the Darwin region to support the AAPL.
Utilities	The proponent has commenced consultation with other utility owners, including gas and electrical transmission asset owners that may be affected by the project.
Department of Defence	Consultation with Department of Defence has commenced with regard to the proposed subsea survey and cable route within the Defence Estate in the waters of the Beagle Gulf and Timor Sea.
Tiwi Land Council	Tiwi Council have been notified of the proposed marine survey planned to commence in September 2020 along the proposed cable route, however the cable route does not pass through the Tiwi Land Council boundary.

Consultation with all the above groups is ongoing and will become part of a broader stakeholder engagement program in the future (see Table 6).

Table 6: Identified stakeholders for future engagement program

Category	Stakeholders
Aboriginal groups	• NLC, as representative of native title holders (to develop a strong working relationship and adhere to engagement protocols with native title holders). • Native title holders (through the NLC). • Central Land Council. • Specific Aboriginal communities, homelands and outstations in the project footprint. • Broader regional Aboriginal community, in particular Tennant Creek. • Aboriginal landowners along the route of the transmission line. • AAPA.

Category	Stakeholders
	• Immediately affected pastoralists (to understand how they perceive impacts and get insights into any likely local issues).
Government and service providers	• All service providers to understand the capacity of regional social infrastructure and capacity to absorb increased demand (health, education, housing, police in particular). • Barkly Regional Deal leadership (Australian and Northern Territory Governments, Barkly Regional Council). • Northern Territory Government (both business, transport and environment departments in Darwin and Alice Springs and Tennant Creek regional service providers). • NTG Project Control Group. • NT Cattlemen's Association, Barkly region pastoralists and properties along the transmission line route, in particular Powell Creek and Newcastle Waters. Also, neighbouring properties affected by construction and transport activities. • AARC, LDC and Darwin Port. • Rail operators One Rail (freight) and The Ghan (Journey Beyond Rail Expectations). • APA Group (operators of the Amadeus Gas Pipeline). • NT EPA. • Power and Water Corporation and Territory Generation. • Business groups (Chamber of Commerce, ICN). • Members of Parliament (particularly the Member for Barkly). • Key towns and roadhouses along the route (Elliott, Mataranka, Larrimah, Katherine, Pine Creek, Adelaide River, Palmerston as well as Renner Springs, Dunmarra, Hi-Way Inn and Daly Waters). • Other local government along the route, including Katherine Town Council, Coomalie, Palmerston, Roper Gulf and Victoria Daly Region Councils. • Employment and training service providers (including CDP, Job Service providers). • For Darwin Harbour: Darwin Harbour Advisory Committee, Amateur Fishermen's Association of the NT, Heritage Advisory Council, environmental and planning groups. • Airservices Australia, aerial and aerodrome operators. • Department of Defence.
General	• Residents and communities along the route of the transmission line. • NT Media (Tennant & District Times, ABC, NT News in particular). • General public.

2. Existing environment

Coffey has undertaken a high-level desktop assessment of the existing environmental conditions for the whole project area in order to inform this referral. This has involved the review of publicly available regional datasets and existing survey reports for other major projects in the vicinity of the project area where available.

In addition to the high-level desktop review undertaken by Coffey, further ecological desktop and field reconnaissance assessment has been undertaken for targeted portions of the project area, in order to support preliminary site and route selection processes and to inform further detailed field surveys as part of the EIS. These additional ecological assessments have included:

- *Preliminary Ecological Assessment Report: Proposed Solar Farm, Newcastle Waters Station, Elliott NT* (Connect Environmental 2020a), attached as Appendix A.
- *Threatened Species Assessment Report: Part of Sections 1905, 1816, 1820, 1821, 1658 and 1605, Wickham, NT* (Connect Environmental 2020b), attached as Appendix B.

The Preliminary Ecological Assessment Report (Connect Environmental 2020a) covers the four AOIs for the solar farm precinct, and included a further review of publicly available data including fine scale

vegetation and habitat mapping, and a field reconnaissance survey of three of the four AOIs to ground-truth the desktop findings. The detailed assessment report by Connect Environmental (2020a) is provided as Appendix A.

The Threatened Species Assessment Report (Connect Environmental 2020b) covers the utilities corridor, where the OHTL leaves the railway corridor (approximately 8 km south of the proposed VSC location in Darwin) and traverses Middle Arm peninsula to the VSC adjacent to Weddell Power Station. This assessment also included a further review of publicly available data including fine scale vegetation and habitat mapping, to inform a preliminary likelihood of occurrence assessment for threatened species. A field reconnaissance survey was undertaken to target specific threatened flora species considered likely to occur within this section of the project area (detailed further in Section 2.1.2), to ground truth the desktop findings. The detailed assessment report by Connect Environmental (2020b) is provided as Appendix B.

2.1. Natural environment

The following sections summarise the key findings of the above assessments.

2.1.1. Climate

The climate in the Elliott area is highly seasonal and dominated by a ‘wet’ season from December to April and a ‘dry’ season from May to November. During the wet season, soils are periodically saturated and groundwater recharge fills local aquifers. Vegetation growth is substantial and streams flow during high rainfall periods. During the dry season, irrigation of landscaped areas is required to ensure continued plant growth.

The OHTL component of the project area traverses from the semi-arid conditions of Elliott into the more tropical conditions of Katherine through to Darwin. The tropical conditions are also dominated by a ‘wet’ season from December to April and a ‘dry’ season from May to November.

Climate statistics from the Bureau of Meteorology (BOM) site for Elliott (site number 015131), Katherine (site number 014932) and Darwin (site number (014015) are shown in Table 7 (BOM, 2020).

Climate conditions are being considered in the siting of project infrastructure and the design of project components including the solar modules and the OHTL towers and poles.

Table 7: Climate statistics for Elliott, Katherine and Darwin, NT (BOM 2020)

Aspect	Elliott	Katherine	Darwin
Mean maximum temperature (from 1908 to 2020)	34.5^{O}C	34.1 ^{O}C	32.1 ^{O}C
Mean minimum temperature (from 1908 to 2020)	19.1 ^{O}C	20.5 ^{O}C	23.2 ^{O}C
Average annual rainfall	586 mm	1,074.1 mm	1,722.8 mm
Mean number of days of rain >1 mm (from 1949 to 2020)	57 days	60.3 days	93.6 days

2.1.2. Terrestrial environment

Vegetation communities, flora and weeds

Regional context

Based on a high-level desktop review of the Interim Biogeographic Regionalisation for Australia (IBRA) data for the NT (Environment Australia 2000), the terrestrial project area (including the proposed solar farm precinct, OHTL, Darwin VSC and land sea joint station) is located across the following six bioregions (see Figure 22 and Figure 23).

- Tanami (TAN) - characterised by mainly red Quaternary sandplains overlying Permian and Proterozoic strata which are exposed locally as hills and ranges. The sandplains support mixed shrub steppes of *Hakea suberea*, desert bloodwoods, acacias and grevilleas over *Triodia pungens* hummock grasslands. Wattle scrub over *T. pungens* hummock grass communities occur on the ranges. Alluvial and lacustrine calcareous deposits occur throughout.

- Davenport Murchison Ranges (DMR) - characterised by low but rugged rocky hills, formed from folded volcanics and sandstone, siltstone and conglomerates, which contrast starkly with the generally flat sandplain surrounds of the Tanami bioregion. Vegetation includes hummock grasslands and low open woodlands dominated by Eucalyptus and Acacia species. Less than 10% of this bioregion is protected within conservation reserve.

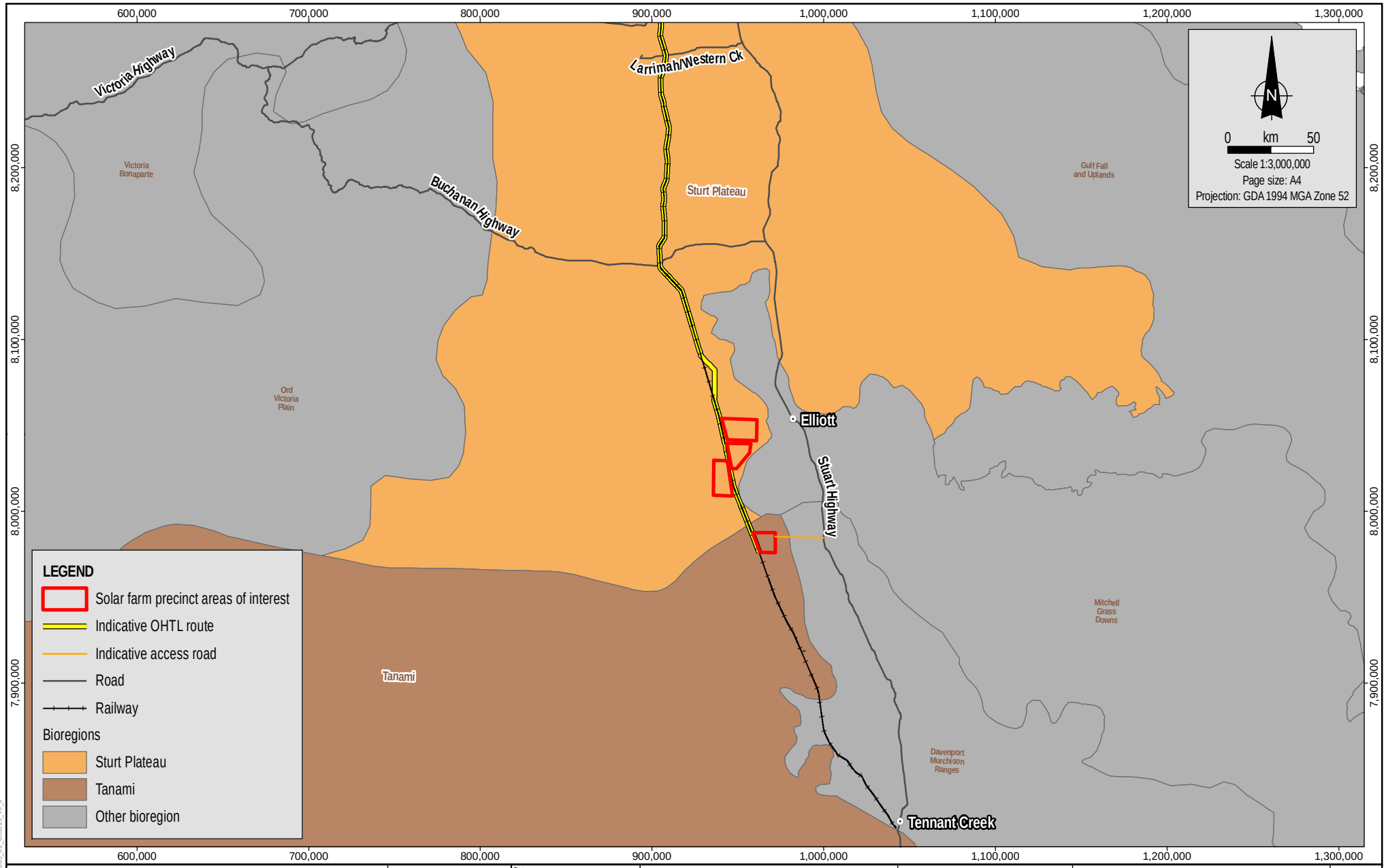
- Mitchell Grass Downs (MGD) - consists of largely treeless plains with some occasional ridges, rivers and gorges. The dominant vegetation type is Mitchell tussock grasslands. Land use is predominantly grazing by cattle (in the NT) or cattle and sheep (in Queensland). Major population centres are all in Queensland: Longreach, Blackall and Hughenden.

- Sturt Plateau (STU) - characterised by gently undulating plains on lateritised Cretaceous sandstones; neutral sandy red and yellow earths; variable-barked Bloodwood woodland with spinifex understorey. Less than 10% of this bioregion is protected within conservation reserve.

- Daly Basin Bioregion (DAB) - characterised by gently undulating plains and scattered low plateau remnants on Palaeozoic sandstones, siltstones and limestones; neutral loamy and sandy red earths; Darwin stringybark (*Eucalyptus tetrodonta*) and Darwin woollybutt (*Eucalyptus miniata*) open forest with perennial and annual grass understorey.

- Pine Creek Bioregion (PCK) - characterised by highly mineraliferous Pine Creek Geosyncline, comprising Archaean granite and gneiss overlain by Palaeoprotozoic sediments. The major vegetation types are eucalypt tall open forests, typically dominated by Darwin woollybutt (*E. miniata*) and Darwin stringybark (*E. tetrodonta*), and woodlands (dominated by a range of species including *E. grandifolia, E. latifolia, E. tintinnans, E. confertiflora* and *E. tectifica*), with smaller areas of monsoon rainforest patches, *Melaleuca* woodlands, riparian vegetation and tussock grasslands.

- Darwin Coastal Bioregion (DAC) – characterised by gently undulating plains on lateritised Cretaceous sandstones and siltstones; The most notable vegetation feature is the extensive and diverse floodplain environment associated with the lower reaches of the many large river systems. There are also substantial areas of mangroves, and rainforest and other riparian vegetation fringing the rivers. Inland from the coast, the dominant vegetation type is eucalypt tall open forest, typically dominated by Darwin woollybutt (*Eucalyptus miniata*) and Darwin stringybark (*Eucalyptus tetrodonta*).



Source:
Indicative OHTL route and solar farm from Sun Cable.
Roads and rail from DENR.
Bioregions from DEWHA (IBRA v7).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F022_GIS

Sun Cable Pty Ltd

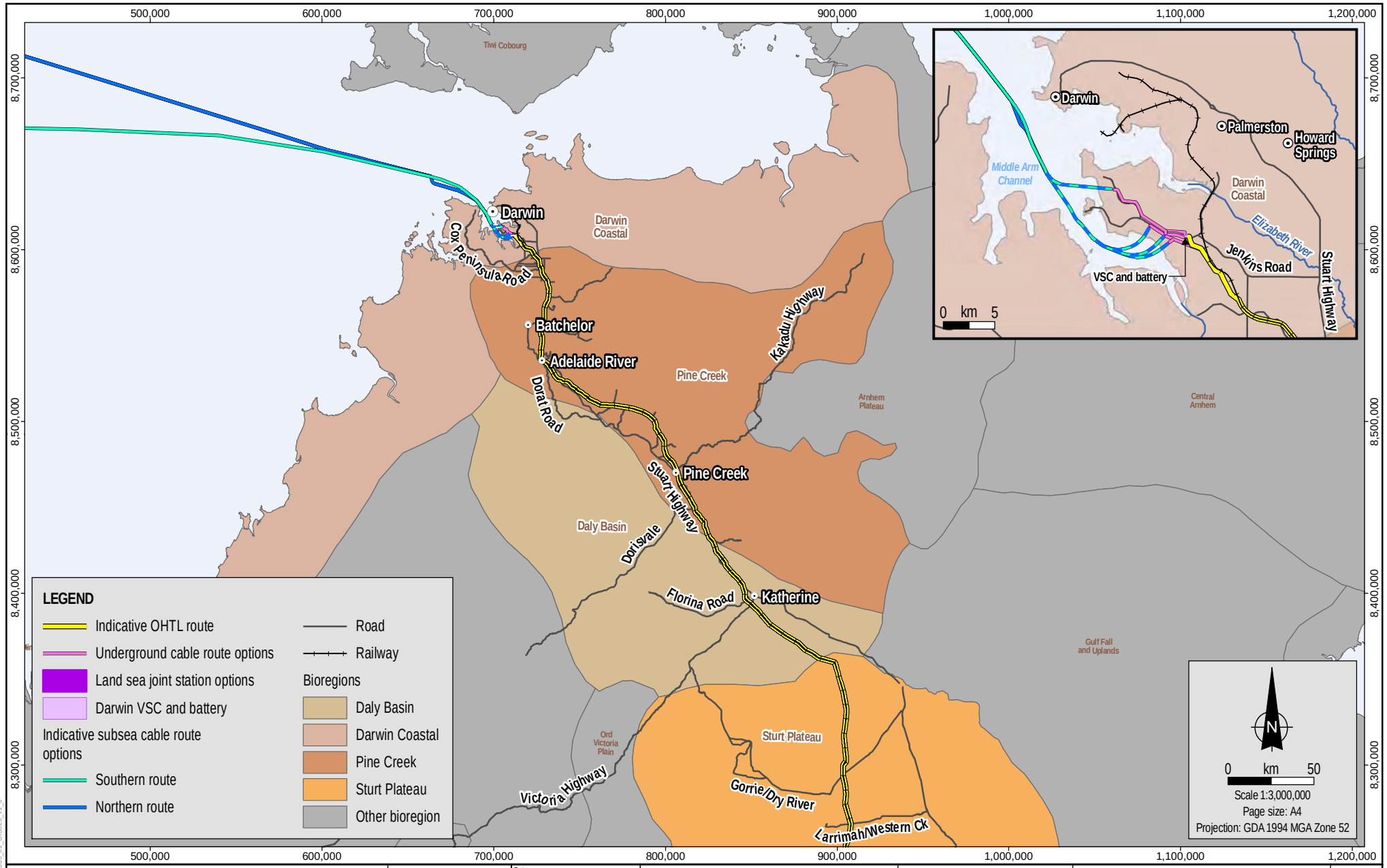
Australia-ASEAN Power Link

SUN CABLE

Bioregions southern project extent

Figure No: **22**

MXD Reference: 275539_01_GIS019_v0_3



Source:
Indicative OHTL route and solar farm from Sun Cable.
Roads and rail from DENR.
Bioregions from DEWHA (IBRA v7).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F023_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Bioregions northern project extent

Figure No: **23**

MXD Reference: 275539_01_GIS020_v1_3

Vegetation Communities

Solar farm precinct

As outlined in the Preliminary Ecological Assessment Report in Appendix A (Connect Environmental 2020a), the vegetation within the proposed solar farm precinct is consistent with the Tanami bioregion, further defined as an open hummock grassland, with scattered trees and shrubs vegetation community as shown in Figure 24.

Vegetation communities are further defined by various National Vegetation Information System (NVIS) level 4 vegetation community descriptions (DENR, 2019). Vegetation within the four AOIs of the solar farm precinct are detailed in Appendix B, and are generally consistent with the NVIS categories as summarised in Table 8.

Table 8: Vegetation and associated environmental descriptions (Connect Environmental 2020a)

Veg. ID	Vegetation description	Environment description
393	Macropteranthes low woodland: *Macropteranthes kekwickii* (Bulwaddy) and *Acacia shirleyi* (Lancewood) low woodland over *Panicum mindanaense* and *Evolvulus alsinoides* low open tussock grassland and low open forbland	Lateritic sandstone outcrops, plateaux, breakaways to north/rises and plains to south; gravelly lithosols, some shallow red, yellow and black earths; well drained
394	Macropteranthes (mixed) low woodland: *Macropteranthes kekwickii* (Bulwaddy) and *Acacia shirleyi* (Lancewood) low woodland over *Chrysopogon fallax*, *Paspalidium rarum* and *Mnesithea formosa* mid open tussock grassland	
395	Acacia low woodland: *Acacia shirleyi* (Lancewood), *Macropteranthes kekwickii* (Bulwaddy) low woodland over *Eragrostis cumingii*, *Mnesithea formosa*, *Paspalidium rarum* low open tussock grassland	
1032	Triodia low open hummock grassland: *Corymbia opaca*, *Eucalyptus gamophylla*, *Acacia ligulate* low open woodland over *Acacia coriacea*, *Hakea macrocarpa*, *Acacia adsurgens* mid sparse shrubland over *Triodia pungens*, *Triodia schinzii*, *Eragrostis eriopoda* low open hummock and tussock grassland	Gentle undulating plains, red earthy sand soils
1041	Eucalyptus low open woodland: *Eucalyptus microtheca, Lophostemon grandifloras, Ventilago viminalis* low open woodland over *Acacia holosericea, Atalaya hemiglauca* and *Ventilago viminalis* mid sparse shrubland over *Eulalia aurea, Chrysopogon fallax, Astrebla* spp. low tussock grassland	Low lying flat plains, fringing water courses and swamps. Light to heavy grey and brown clays, some loamy soil
1042	Eucalyptus low open woodland: *Bauhinia cunninghamii*, *Corymbia opaca*, *Eucalyptus pruinosa* low open woodland over *Carissa lanceolata*, *Acacia lysiphloia*, *Atalaya hemiglauca* mid open shrubland over *Triodia pungens*, *Chrysopogon fallax*, *Enneapogon polyphyllus* low tussock and hummock grassland	Gentle undulating plains, deep sandy yellow earths, lateritic red earths, or deep sands

Connect Environmental (2020a) indicated that areas of *Acacia shirleyi* (Lancewood) and *Macropteranthes kekwickii* (Bulwaddy)) may occur within the solar farm precinct AOIs in areas of 25 ha or greater. During the field reconnaissance survey however, Bulwaddy (*Macropteranthes kekwickii*) was not observed. Spinifex (*Triodia spp.)* was observed by the side of the accessible tracks. The *Triodia* was the dominant grass, with Bootlace Oak (*Hakea lorea*) and *Acacia spp*. and *Bauhinia cunninghamii* present. There were also patches with a dense *Eucalyptus pruinosa* overstorey (Connect Environmental, 2020a). Vegetation within the solar farm precinct has the potential to support several threatened species, as outlined further below.

Overhead Transmission Line

Based on a desktop search using the NR Maps online database tool, the majority of the proposed OHTL traverses extensive areas of woodlands, open woodlands, mid-closed forest and open forests communities, which are further defined by various NVIS level 4 vegetation community descriptions (DENR, 2019), as shown in Figure 25 to Figure 27.

In the NT, significant or sensitive vegetation types are defined under the NT *Land Clearing Guidelines* (DENR 2019). Sensitive vegetation includes ecosystems easily impacted by neighbouring or adjacent land use or management. Significant vegetation may form spatially restricted habitat types of importance to a relatively large number of wildlife species (DENR 2019). These vegetation types include:

- Rainforests.
- Monsoon vine forest or vine thicket sandsheet heath.
- Riparian vegetation.
- Mangroves.
- Vegetation containing large trees with hollows suitable for fauna.

It is possible that the OHTL will impact on areas of sensitive and/or significant vegetation and further detailed field surveys will be required to understand the extent of values and potential impacts within the project area, and how such impacts can be mitigated.

The Commonwealth listed threatened ecological community ‘Arnhem Plateau Sandstone Shrubland complex’ (DoAWE, 2020) potentially occurs within the northern-central extent of the OHTL corridor, associated with the Western Arnhem Plateau site of conservation significance (discussed in Section 2.2).

Vegetation communities within the utilities corridor (where the OHTL diverges from the railway corridor south of Darwin) have been assessed further by Connect Environmental in the Threatened Species Assessment Report (Appendix B). Existing regional vegetation mapping analysed as part of Connect Environmental’s desktop assessment was verified in the field using a series of ‘check sites’ which indicated vegetation was generally consistent with the NVIS data shown in Figure 28.

A total of 23 detailed vegetation communities were identified by Connect Environmental (2020b) within the utilities corridor including cleared areas for roads, tracks and extractive activities. For further detail on these results please refer to Appendix B.

Darwin VSC and land sea joint station

Vegetation on the Middle Arm peninsula and inland of Darwin is consistent with the Darwin Coastal Bioregion, classified as a various closed forest and woodland communities, dominated by mixed acacia forest and eucalyptus woodlands (NVIS, 2007) as shown in Figure 28. Lowland vegetation types include paperbark (Melaleuca spp.) forest, grassland and heathlands (Inpex 2010). The findings of the Threatened Species Assessment Report (Appendix B) are generally consistent with this review of existing publicly available data.

Extensive mangroves occur in Darwin Harbour, as shown in Figure 28, covering approximately 20,450 ha within the inner Darwin Harbour (Inpex 2010). Mangrove vegetation is discussed further in Section 6.2.1.

The VSC and land sea joint are in areas of woodland, and closed forest, and potential mangroves (discussed further in Section 2.1.3).

Flora

Solar farm precinct

No threatened flora species, populations or communities were found in database searches for the proposed solar farm precinct (NT Flora Atlas, Atlas of Living Australia and EPBC Act Protected Matters Report).

Vegetation within the solar farm precinct was found to be generally consistent with the NVIS classifications outlined above, and no threatened flora species were found during the field reconnaissance survey (Connect Environmental 2020a, Appendix A).

OHTL, Darwin VSC and land sea joint

A records search using the NT Flora Atlas was conducted by Coffey on October 11, 2019, based on a 1 km search area on both sides of the existing railway corridor centreline, as the majority of the proposed OHTL route will be constructed within the existing railway easement. A total of 626 individual native flora occurrences are recorded in the NT Flora Atlas within the proposed OHTL and Middle Arm peninsula terrestrial search areas. Only one species, *Cycas armstrongii* was listed under the *Territory Parks and Wildlife Conservation Act* (TPWC Act) as vulnerable.

Based on a search of the Department of Agriculture, Water and the Environment (DoAWE) Protected Matters Search Tool (PMST) database there are three listed threatened flora species that may or are likely to occur within the project area (DoAWE, 2019):

- *Atalaya brevialata*, listed as critically endangered.
- *Helicteres macrothrix*, listed as endangered.
- *Stylidium ensatum*, listed as endangered.

All three are known to occur in proximity to the northern extent of the OHTL, close to Darwin. The results of the PMST database search (DoAWE 2019) are attached as Appendix D.

In addition to the above high-level desktop assessment by Coffey, a further detailed desktop review and field survey for threatened species was undertaken by Connect Environmental (2020b) of the utilities corridor from Jenkins Road to the VSC site. Based on the desktop component of this assessment, two listed threatened flora species were noted as likely to occur within the utilities corridor survey area:

- *Cycas armstrongii* – TPWC Act listed vulnerable
- *Typhonium praetermissum* – TPWC Act listed vulnerable

The field survey for this assessment (Appendix B) targeted and confirmed the presence of these two listed threatened flora species within the utilities corridor survey area. A total of 406 individuals of suspected *Typhonium praetermissum* were located within the utilities corridor survey area in five discrete sub-populations / patches / localities (see Appendix B and Appendix C). *Cycas armstrongii* densities were recorded within the utilities corridor survey area, with a medium to low density occurring across approximately 65% of that survey area. Further detail is provided in Appendix B.

In addition, several threatened flora species (listed under the EPBC Act and/or TPWC Act) were identified as potentially occurring within the utilities corridor survey area (Connect Environmental 2020b). These species are wetland dependent, and include:

- *Atalaya brevialata* – EPBC Act listed critically endangered
- *Cleome insolata* – TPWC Act listed vulnerable
- *Stylidium ensatum* – EPBC Act and TPWC Act listed endangered
- *Typhonium taylori* – EPBC Act and TPWC Act listed endangered
- *Utricularia dunstaniae* – TPWC Act listed vulnerable
- *Utricularia singeriana* – TPWC Act listed vulnerable

Targeted flora surveys will be completed as part of the EIS to inform the likely presence or absence of significant threatened flora species and ecological communities within the project area, and to determine the level of potential impact from the project.

Weeds

Declared weeds are plants that have been identified for control, eradication or prevention of entry into the NT under the NT's *Weeds Management Act 2001* (WM Act). They are classed according to how difficult they are to control and how much harm they can cause. If a weed is declared under the WM Act, all land holders, land managers and land users must comply with the classification. There are three categories of declared weeds:

A - to be eradicated.

B - growth and spread to be controlled.

C - not to be introduced to the NT.

All Class A and Class B weeds are also Class C weeds.

Weeds of national significance are those listed by the Australian Government as plants that potentially cause detrimental impacts worth billions of dollars to the sustainability of Australia's productive capacity and natural ecosystems and as such a National Weeds Strategy exists for them.

Solar farm precinct

A search of NR Maps (DENR, 2020) indicated that there are no declared weeds known to occur within 10 km of the solar farm precinct.

The PMST results indicate there are seven Commonwealth listed invasive plant species likely to occur within the solar farm precinct (DoAWE 2020).

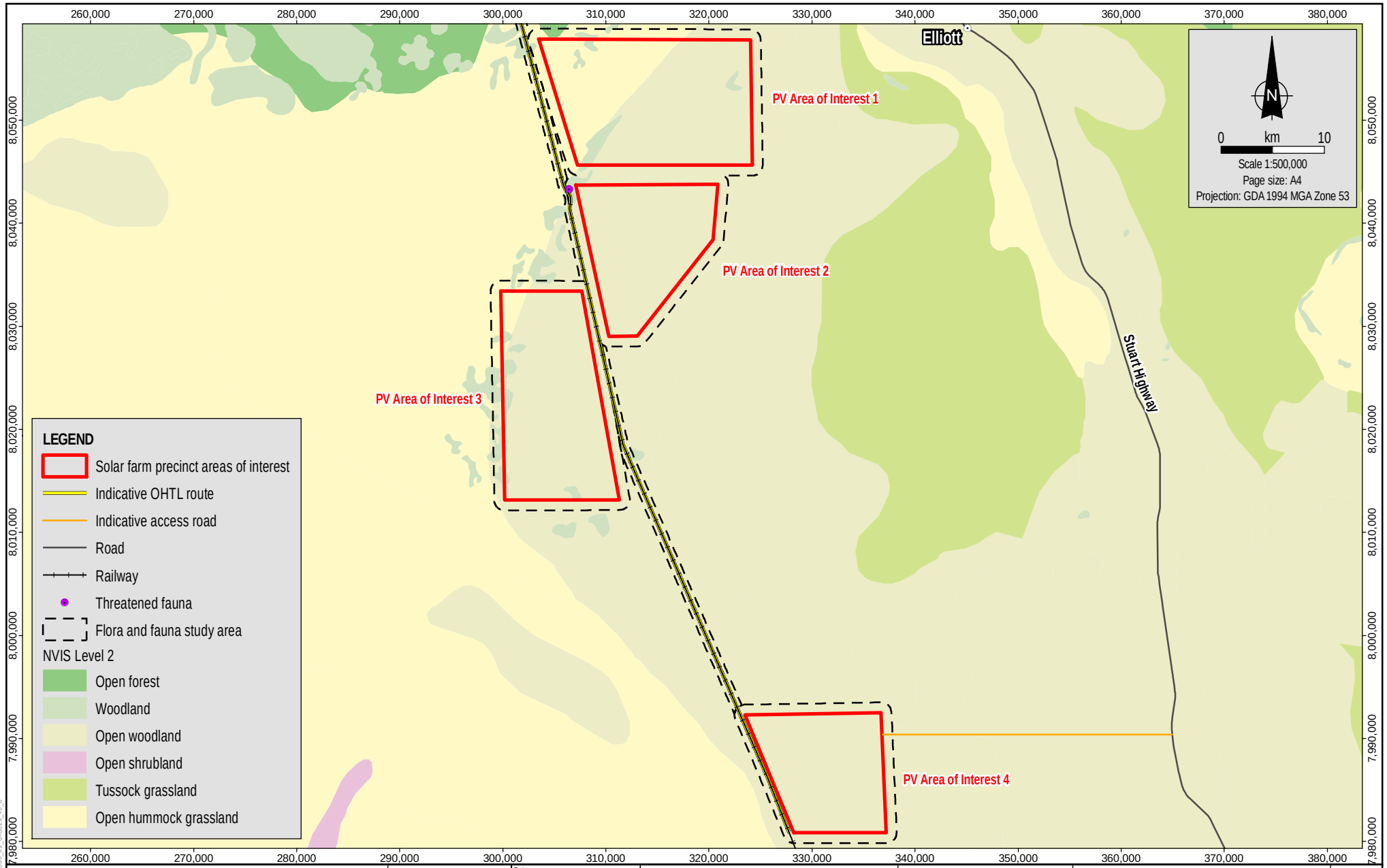
Further field investigations will be needed to confirm the presence (if any) of invasive weed species or pathogens.

OHTL, Darwin VSC and land sea joint

A total of 1,422 occurrences of weed species are recorded in the NT Flora Atlas weed dataset within the Middle Arm peninsula and proposed OHTL search area. In accordance with the *Weeds Management Act 2001* (NT) 10 species were declared as Class A (to be eradicated), nine species as Class B (growth and spread to be controlled) and 857 species declared as Class A and Class B (Fauna Atlas N.T., 2019b).

Further to the above, 14 invasive plant species are listed in the PMST results as likely to occur within the project area (DoAWE 2019).

Weed control and management measures will be assessed as part of the EIS for the project and appropriate mitigation implemented during project construction and operation to avoid or reduce the spread of weed species as much as possible.



Source:
Proposed solar farm and OHTL route from Sun Cable.
Flora, fauna and NVIS from DENR.
Roads and railways from DLIP.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F024_GIS

Sun Cable Pty Ltd

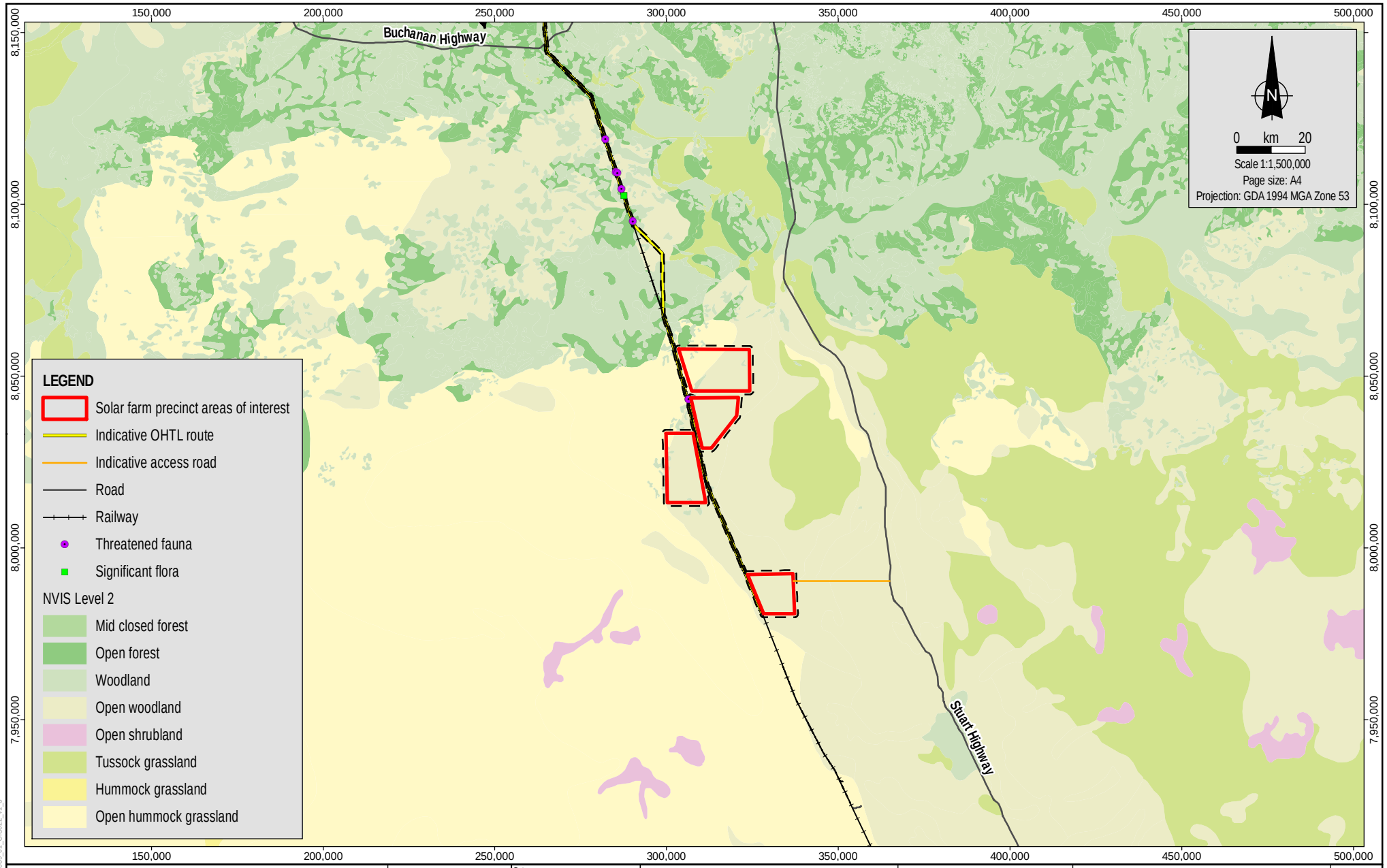
Australia-ASEAN Power Link

SUN CABLE

Flora and vegetation solar farm

Figure No: 24

MXD Reference: 275539_01_GIS021_v0_3



Source:
Proposed solar farm and OHTL route from Sun Cable.
Flora, fauna and NVIS from DENR.
Roads and railways from DLIP.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F025_GIS

Sun Cable Pty Ltd

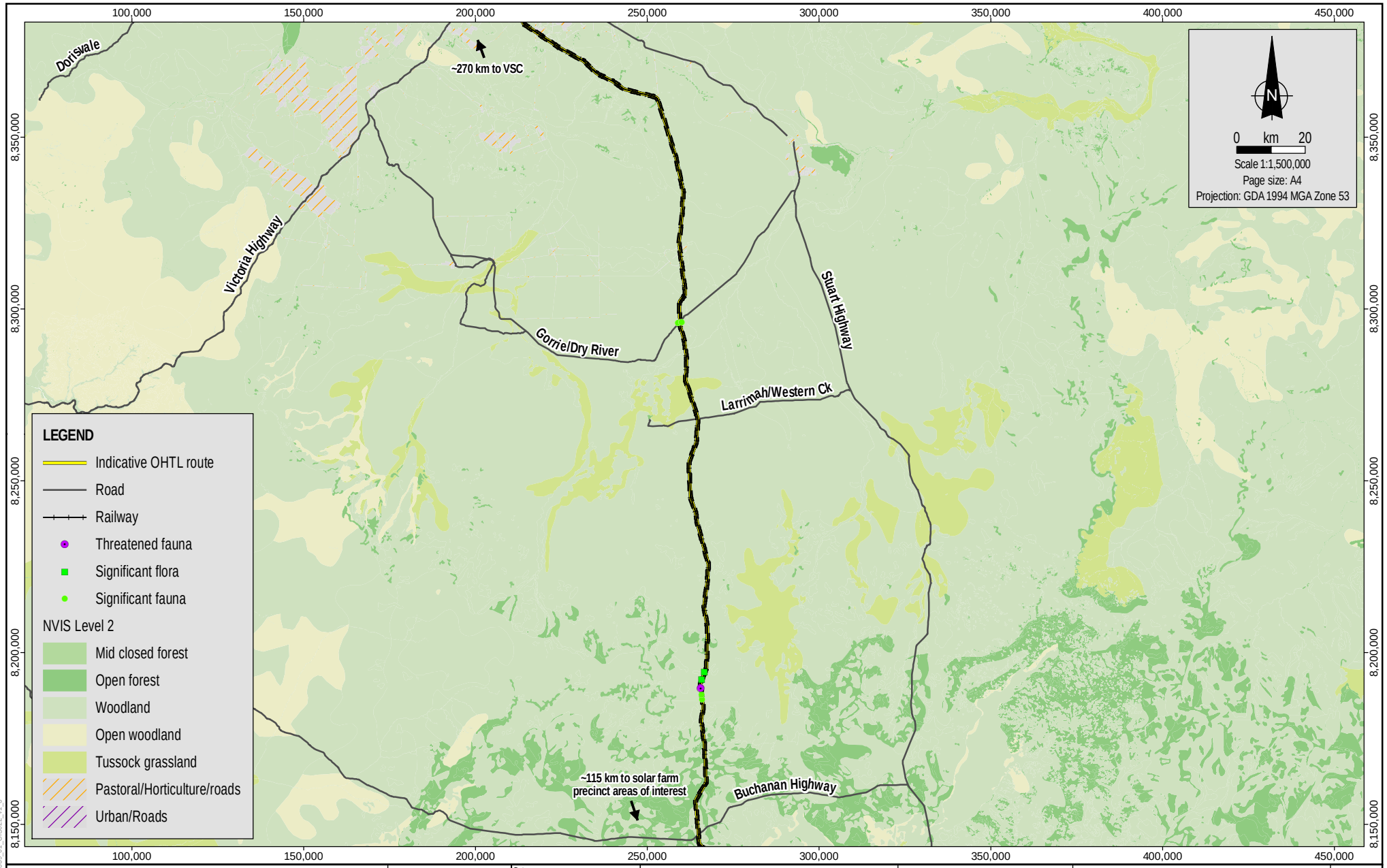
Australia-ASEAN Power Link

SUN CABLE

Flora and vegetation
OHTL Part 1

Figure No:
25

MXD Reference: 275539_01_GIS022_v1_3



MXD Reference: 275539_01_GIS022_v1_3

Source:
Proposed solar farm and OHTL route from Sun Cable.
Flora, fauna and NVIS from DENR.
Roads and railways from DLIP.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F026_GIS

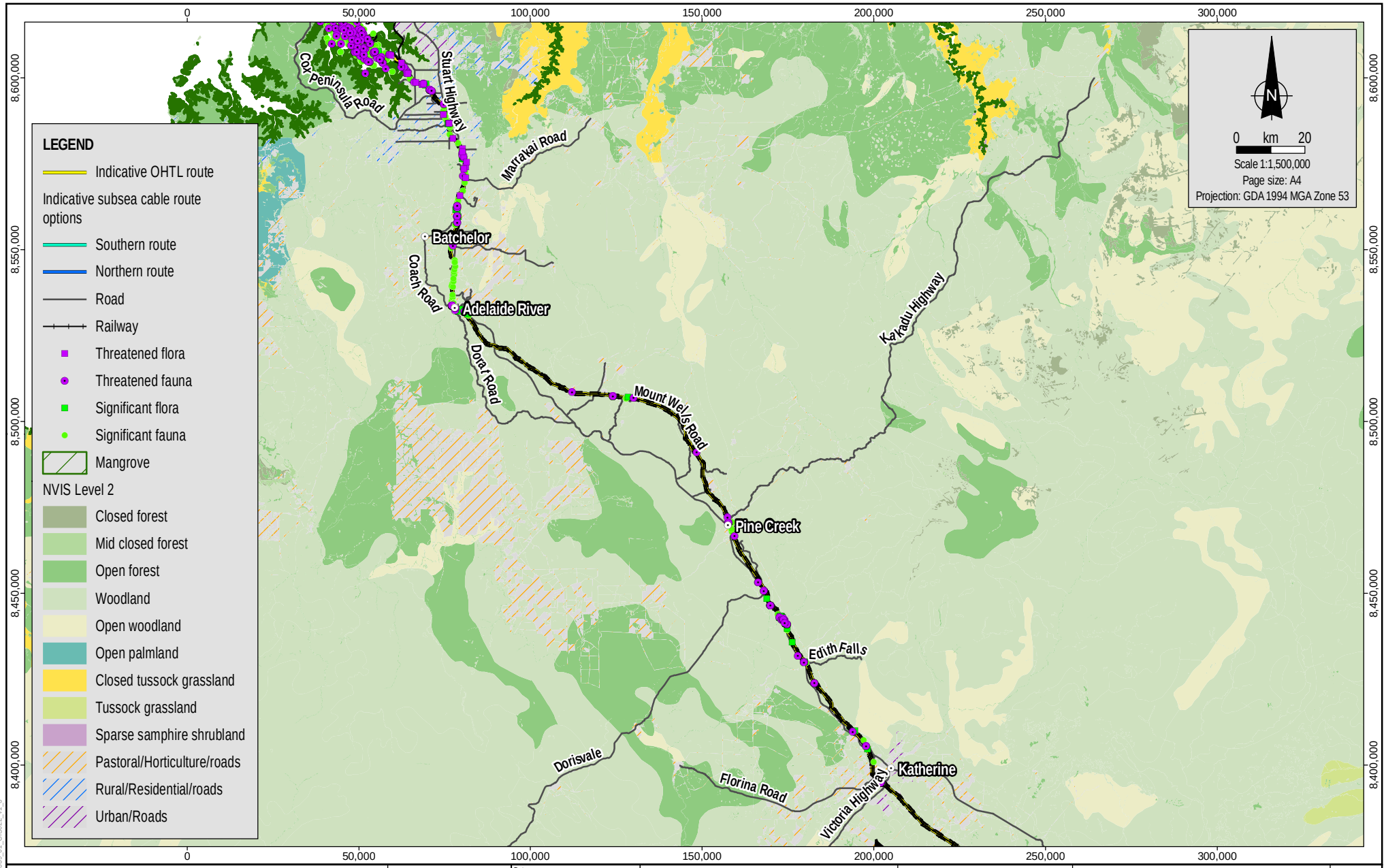
Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Flora and vegetation
OHTL Part 2

Figure No:
26



Source:
Proposed solar farm and OHTL route from Sun Cable.
Flora, fauna and NVIS from DENR.
Roads and railways from DLIP.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F027_GIS

Sun Cable Pty Ltd

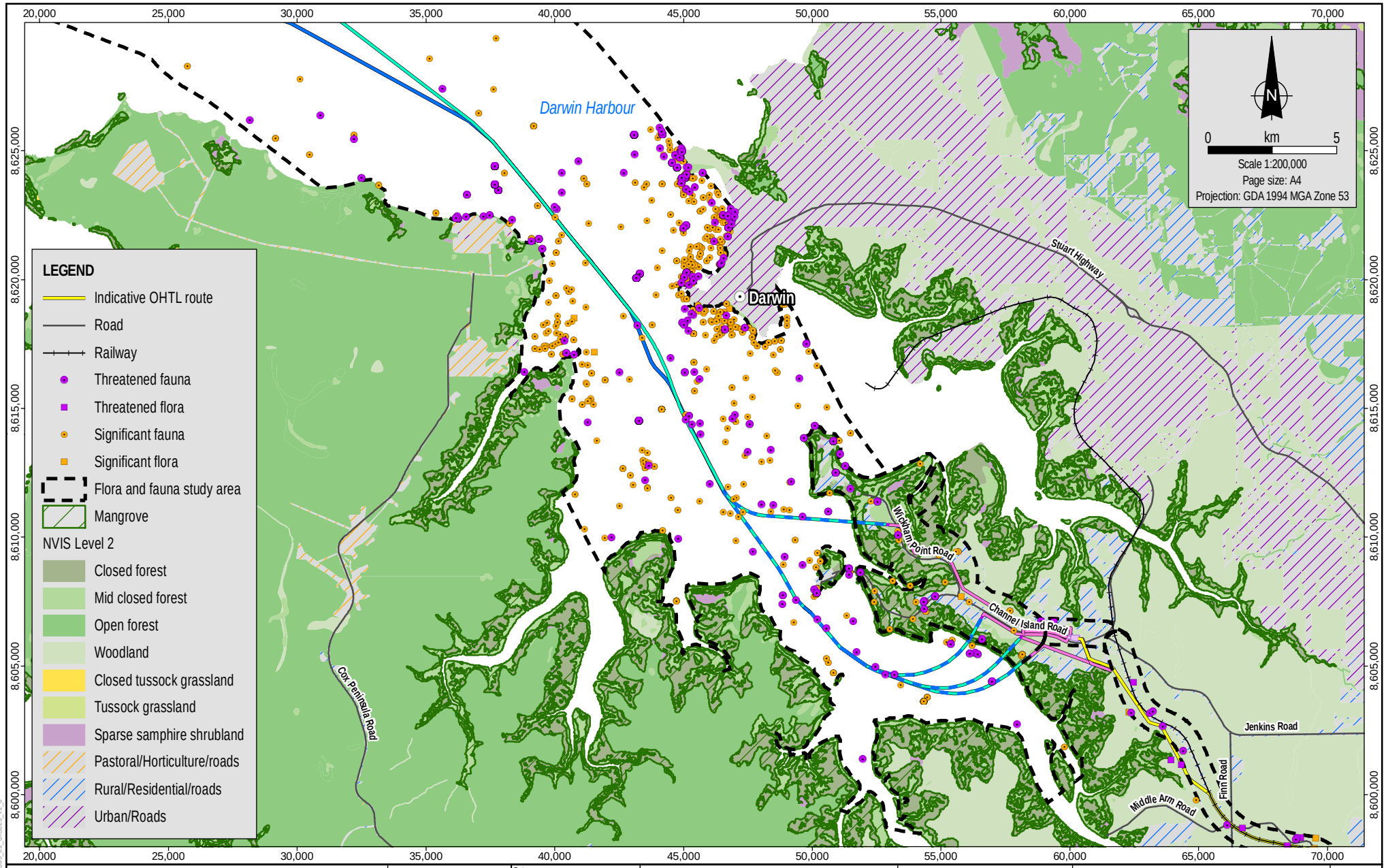
Australia-ASEAN Power Link

SUN CABLE

Flora and vegetation
OHTL Part 3

Figure No:
27

MXD Reference: 275539_01_GIS022_v1_3



Source:
Proposed solar farm and OHTL route from Sun Cable.
Flora, fauna and NVIS from DENR.
Roads and railways from DLIP.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F028_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Flora and vegetation
Darwin Harbour

Figure No: 28

MXD Reference: 275539_01_GIS025_v1_3

Fauna

Solar farm precinct

The Preliminary Ecological Assessment Report (Connect Environmental 2020a) in Appendix A outlines the desktop and field reconnaissance surveys that have been completed for the solar farm precinct. A field reconnaissance survey was undertaken for three of the four AOIs for the solar farm precinct during the 2020 dry season (Appendix A).

Based on the outcome of the desktop component of the assessment, Connect Environmental identified 'focus' habitats as indicators for several potentially occurring threatened fauna species to be targeted during the field reconnaissance survey. This was also based on the preliminary threatened species likelihood of occurrence detailed in Appendix A.

Table 9: Summary of findings from the field reconnaissance survey for the solar farm precinct

Aspect	Solar farm precinct
Focus habitats for potentially occurring threatened species	
Semotrachia euzyga (land snail) – Sandstone outcrops with *Ficus platypoda*	No signs of sandstone outcrops were observed, nor were any rises not dominated by sand noticed in the distance. Unlikely to be sandstone outcrops in areas not surveyed (though cannot confirm until a more detailed assessment is conducted).
Painted honeyeater – stands of mature Acacia or Eucalyptus dominated open forests	Not observed, but possible in non-surveyed areas.
Princess parrot - Triodia dominated sandy dunes which contain Acacia shrubs	No signs of mature *Triodia* dominated sandy dunes with *Acacia spp.* were observed, although still possible in unsurveyed areas.
Greater bilby - Acacia and Melaleuca shrubs on rocky outcrops, laterite rises, or low-lying drainage systems with *Triodia basedowii*, *T. pungens* and/or *T. schinzii*	No signs of rocky outcrops or laterite rises. Low-lying drainage systems with *Triodia spp*. possible in unsurveyed areas.
Brush-tailed mulgara and night parrot - sand dunes with mature hummock grasslands of spinifex, especially *Triodia basedowii* and *T. pungens*	No sand dunes with mature spinifex observed, though they are possible in unsurveyed areas.
Plains death adder - cracking clay soils on the edge of floodplains	No cracking clay habitat was noted, the black-soil plains are further east.

Areas of *Triodia* hummock grasslands, particularly containing old-growth hummocks, are important for many cryptic arid fauna species. There is the possibility that there is healthy old-growth spinifex on loose soils within the solar farm precinct which, if not degraded by cattle, could potentially be habitat for the greater bilby (*Macrotis lagotis*), night parrot (*Pezoporus occidentalis*)[1], princess parrot (*Polytelis alexandrae*) and brush-tailed mulgara (*Dasycercus blythi*) (Connect Environmental 2020a).

A list of the species observed or heard during the survey are included in the Preliminary Biodiversity Assessment report, attached in Appendix A.

[1] The night parrot has not been recorded in the NT in nearly 100 years and is therefore unlikely to occur within the project area

OHTL, Darwin VSC and land sea joint

A high-level desktop search of the Fauna Atlas N.T. was conducted by Coffey on October 11, 2019, based on a 1 km search area from each side of the existing railway corridor centreline, for the proposed OHTL, VSC and possible land sea joint station sites within the Middle Arm peninsula. In total, individual recordings of 1,663 birds, 118 mammals, 134 reptiles and 115 amphibians were found (Fauna Atlas N.T., 2019b).

From the number of species listed, six species are listed under TPWCA, including:

- Eastern curlew (*Numenius madagascariensis*) – vulnerable
- Northern brush-tailed phascogale (*Phascogale pirata*) – endangered
- Greater bilby (*Macrotis lagotis*) – vulnerable
- Ghost bat (*Macroderma gigas*) – vulnerable
- Yellow-spotted monitor (*Varanus panoptes*) – vulnerable
- Mertens' water monitor (*Varanus mertensi*) – vulnerable.

The Fauna Atlas N.T. also contained records of introduced species including; cane toad (*Rhinella marina*), feral cat (*Felis catus*), horse (*Equus caballus*), black rat (*Rattus rattus*), pig (*Sus scrofa*) and the Asian house gecko (Fauna Atlas N.T., 2019b).

In addition to the above, several EPBC Act listed fauna species potentially occur in the search area, including:

- 18 bird species, including (but not limited to):
  - Partridge pigeon (*Geophaps smithii*) – vulnerable
  - Greater sand plover (*Charadrius leschenaultii*) – vulnerable, marine, migratory
  - Masked owl (*Tyto novaehollandiae kimberli*) – vulnerable
  - Gouldian finch (*Erythrura gouldiae*) – endangered
  - Eastern curlew (*Numenius madagascariensis)* – critically endangered, marine, migratory
- 13 mammal species, including (but not limited to):
  - Ghost bat (*Macroderma gigas)* – vulnerable
  - Greater bilby (*Macrotis lagotis)* – vulnerable
  - Northern quoll (*Dasyurus hallucatus)* – endangered
- Eight reptile species, including seven turtle species

The results of the DoAWE PMST search are provided as Appendix D.

In addition to the above desktop assessment a threatened species assessment has been undertaken by Connect Environmental (2020b) on the utilities corridor from Jenkins road to the VSC site (Appendix B), which included a further desktop review and a likelihood of occurrence assessment based on the outcomes of the desktop review.

Based on the desktop component of this assessment, a range of threatened fauna species have the potential to occur within the utilities corridor survey area (Connect Environmental 2020b). These species are generally consistent with the high level desktop review outlined above. Full detail is provided in Appendix B. Targeted field surveys will be completed to inform the likely presence or absence of significant threatened terrestrial fauna species and to determine the level of potential impact from the project.

Landforms

Solar farm precinct

Information captured during the desktop assessment (Connect Environmental 2020a), mapped the landforms within the solar farm precinct as: lateritic plains and rises, characterised by deeply weathered profiles including sand sheets and earth soils; and desert sandplains, characterised by level to undulating sandplains with red sands. Landforms for the solar farm precinct are shown in Figure 29.

OHTL, Darwin VSC and land sea joint

A desktop search using NR Maps was completed to define the NT Land Systems Landscape classes for the remaining project areas. The proposed OHTL and existing railway easement crosses many landform systems: sandstone plains and rises, lateritic plains and rises, sandstone hills, alluvial floodplains, granite plains and rises, limestone plains and rises and desert sandplains (DENR, 2019).

The Middle Arm peninsula area is defined by tidal flats and lateritic plains and rises landforms (Figure 30). Tidal flats are characterised by tidal mudflats and coastal floodplains with channels and estuaries; subject to tidal inundation with soil origins typically saline muds and grey cracking clays. The lateritic plains are associated with deeply weathered profiles including land sheets and other depositional products, sandy and gravelly yellow earth soils (DENR, 2019).

One of the landform considerations for coastal components of the project will be the disturbance of potential acid sulfate soils (PASS). There is common occurrence of acid sulphate soils (ASS), on tidal flats, coastal floodplains and coastal sandplains areas (refer to Figure 27) (NT Government, n.d.[a]). According to acid sulfate soils of the Darwin Region (2008) survey map, the existing railway and pipeline easement areas have not been assessed for the occurrence of ASS (Northern Territory of Australia, 2009).

The EIS will further investigate the potential for ASS, particularly in the coastal areas of the project and will include appropriate mitigation and management measures for addressing potential impacts.

Hydrology

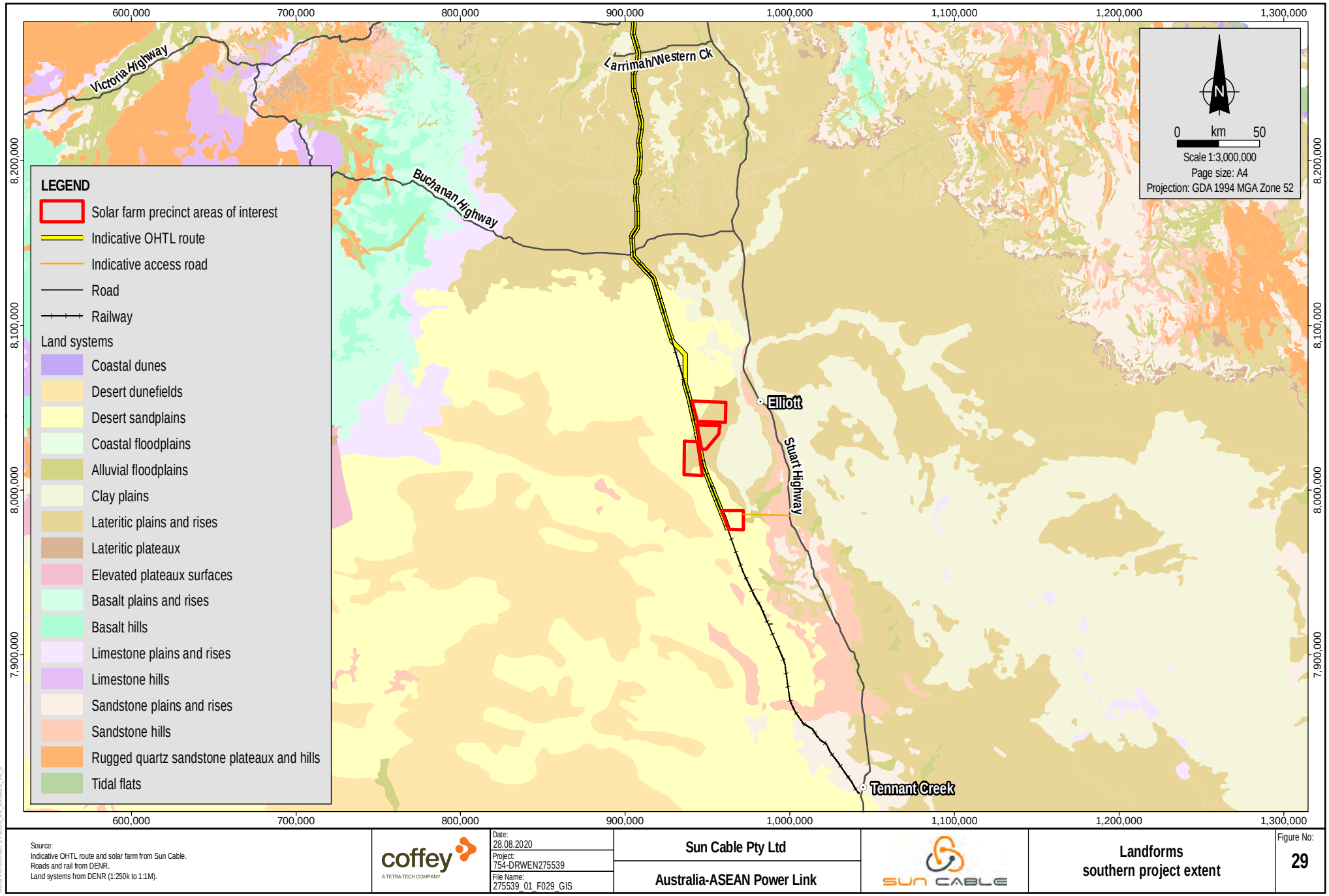
Surface water

Solar farm precinct

Based on the desktop assessment undertaken by Connect Environmental (Appendix A), the nearest mapped drainage line is approximately 9 km east of AOI 4 (see Figure 3). Hydrological conditions in the area consist of numerous ephemeral drains and creeks discharging into Lake Woods (Figure 3). No streams, or minor or major drainage lines are mapped within the AOIs of the solar farm precinct (DENR 2020), however further hydrological assessment will be required to determine the surface water and runoff characteristics of each AOI, along with stormwater management planning for the development.

Lake Woods is an ephemeral freshwater lake within the Newcastle Waters and Powell Creek Stations (within which the solar farm precinct is located). It is one of the largest temporary freshwater lakes in the NT and is considered internationally important as a migration and breeding site for waterbirds. This site is listed as a NT Site of Conservation Significance. Additional information on Lake Woods is provided in Appendix E.

There are two near-permanent waterholes along Newcastle Creek to the north of Lake Woods (see Figure 3), identified as South Newcastle and Longreach waterholes; these waterholes merge with Lake Woods during major floods, creating a large expanse of open water to the northeast of the solar farm precinct. Lake Woods is primarily fed by Newcastle Creek from a large catchment to the north-east, and is considered a terminal drainage system. While inflows can be variable Newcastle Creek is known to flow in most years (Appendix E, DNREAS 2008).



MXD Reference: 275539_01_GIS026_v0_3

Source:
Indicative OHTL route and solar farm from Sun Cable.
Roads and rail from DENR.
Land systems from DENR (1:250k to 1:1M).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F029_GIS

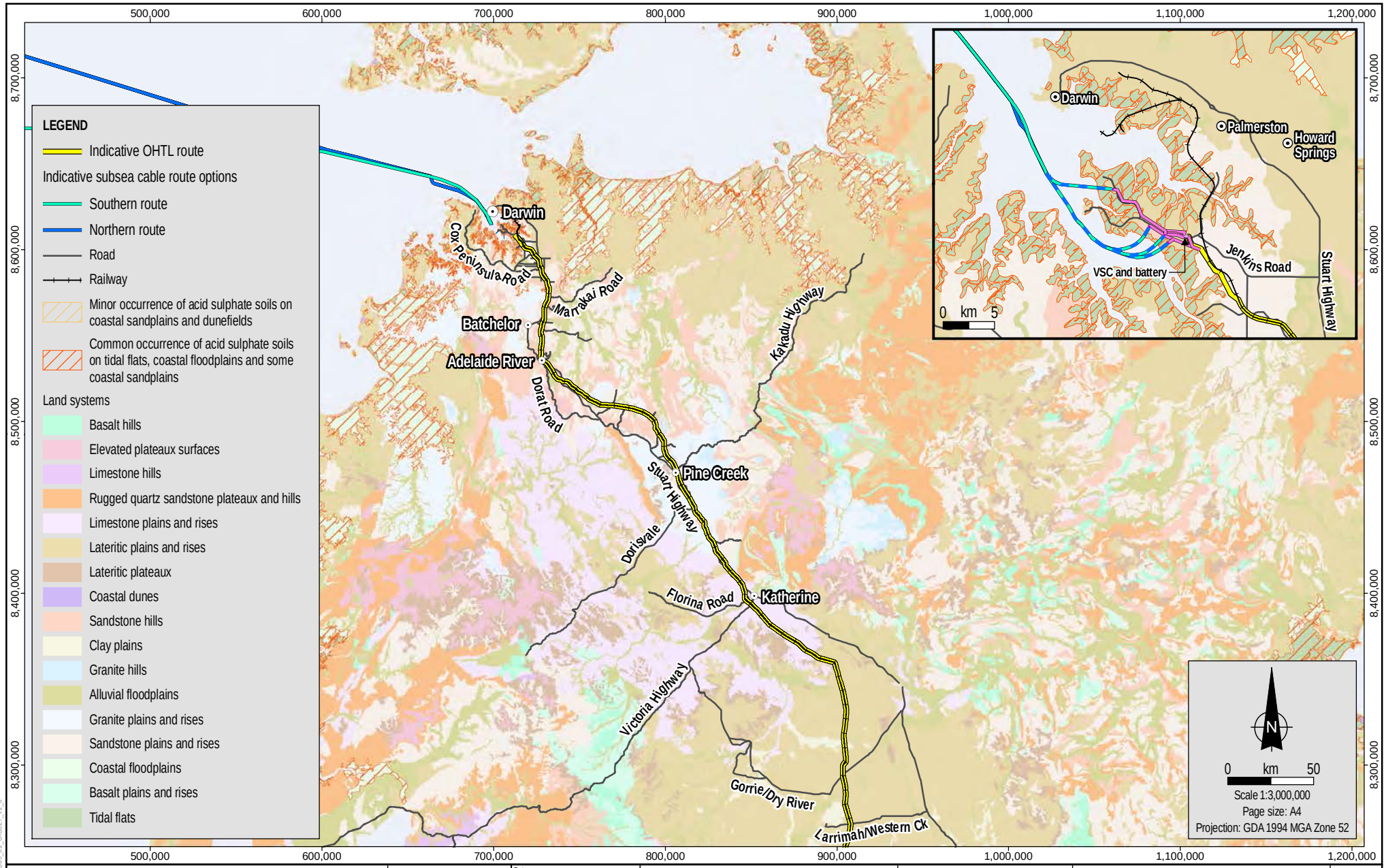
Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Landforms
southern project extent

Figure No:
29



Source:
Indicative OHTL routes from Sun Cable.
Roads and rail from DENR.
Landsystems and acid sulfate soils from DENR (1:250k).

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F030_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Landforms
northern project extent

Figure No: 30

MXD Reference: 275539_01_GIS027_v1_3

The basin of Lake Woods supports open lignum shrubland and open woodland of coolibah, gutta-percha and belalie. River red gums occur around the waterholes to the north of Lake Woods. It is also a significant inland site for waterbirds and migratory birds (Environment Australia, 2001). The solar farm precinct AOIs are sited to the west and southwest of Lake Woods (see Figure 32) and do not encroach on the wetland or conservation area.

OHTL, Darwin VSC and land sea joint

Major rivers that the proposed OHTL will likely cross include; Adelaide River, Margaret River, Edith River and Katherine River (DENR, 2019).

The Middle Arm peninsula area is part of the Finnis River regional catchment area. The proposed OHTL corridor is within the following catchment areas; Adelaide River, Daly River, Roper River, ending within the Victoria River-Wiso catchment for the proposed solar farm precinct (DENR, 2019).

According to the Directory of Important Wetlands in Australia, the Middle Arm peninsula area where the VSC, battery and land sea joint station are proposed, are located within Port Darwin wetland; an important wetland of national significance (DENR, 2019). Port Darwin wetland meets all six criteria for a wetland of importance and includes A1, A2, A3, A6, A7 and A9 marine and coastal zone wetland types (Environment Australia, 2001).

No other significant wetlands occur in proximity to the project area. A search of the PMST indicates no wetlands of international importance are impacted by the project, with the closest wetland of this significance located in the Kakadu National Park, approximately 32 km east of the OHTL (north of Pine Creek).

Groundwater

The NR Maps (DENR 2020) shows several current bores in place across the two pastoral lease properties. Groundwater in the Lake Woods area averages from 25 m to 75 m below ground level, with the underlying aquifer ranging from 50 m to 125 m below ground level (Tickell, 2003).

Further detailed groundwater studies will be undertaken as part of the project feasibility and design process, to better understand the existing groundwater conditions throughout the project area.

Cultural heritage

Heritage places are protected by the *Heritage Act 2011* (Heritage Act). Based on a preliminary search of the NT Heritage Register, there are 19 declared heritage places within 1 km of the project area, primarily in the northern portion of the project search area (north of Katherine), and over 300 archaeological sites occur within the search area. In addition to protections under the Heritage Act, all sacred sites in the NT are protected under the *Northern Territory Aboriginal Sacred Sites Act (1989)* regardless of whether they are registered.

The proponent has initiated consultation with the NLC in relation to areas of indigenous land impacted by the solar farm precinct, transmission line corridor and the coastal transition between the OHTL and the subsea cables, including the intertidal zones. A stakeholder identification process has commenced with the intention of engaging with traditional owners, native title holders and custodians to evaluate cultural heritage values across the project area.

The Proponent intends to avoid damage to sacred sites and negotiate appropriate protocols for their protection. The Proponent will consult with local people to understand the location and sensitivity of any Aboriginal and non-Aboriginal cultural heritage sites and avoid them where possible, unless by agreement.

The Proponent is engaged with AAPA and is conducting searches for registered and recorded sacred sites potentially impacted within the project area identified under the Northern Territory *Aboriginal Sacred Sites Act 1989*. Sacred site clearance certificate(s) and Authority Certificates will be secured for the project as required with the AAPA and relevant land council.

Further detailed desktop assessments and site-specific archaeological and anthropological surveys will be required to confirm the nature, extent and significance of Aboriginal heritage sites and the potential impacts on nearby aboriginal communities and cultural heritage values within the project area. A search of the NT Heritage Register and the Archaeological Sites Database by the Heritage branch of Department of Environment and Natural Resources indicated that there are a number of nominated, proposed or declared heritage places located within a 1 km buffer of the OHTL.

There are several non-Aboriginal historic sites throughout the project area, including Elliott and Newcastle Waters as well as on the Middle Arm peninsula, relating to the settlement of the region and establishment of pastoral uses, as well as sites related to World War II activities, etc. World War II sites on the Middle Arm peninsula include anti-aircraft searchlight batteries and the remains of a commando training camp (Inpex 2010).

Potential impacts on Aboriginal communities (both positive and negative) and European heritage sites from the AAPL project will be further assessed as part of the EIS process and will consider aspects such as historical Aboriginal cultural heritage, archaeological and sacred sites, traditional values and recreational uses of land (including hunting and ceremonial use). Places and objects of non-Aboriginal historical heritage significance will be assessed as part of the EIS for the project, with applications for approval under the Heritage Act to be requested, where declared sites are likely to be disturbed.

2.1.3. Marine environment

Flora and vegetation

A records search using the Flora Atlas NT was conducted by Coffey based on 3-nautical mile buffer from the proposed subsea cable route option (within NT coastal waters). A total of 120 known occurrences of marine flora species are recorded. Of these, no species were listed as threatened under TPWCA (NT Flora Atlas, 2019a). Based on a search of the Commonwealth Protected Matters Search Tool (PMST) (DoEE 2019), one EPBC listed endangered flora species (*Stylidium ensatum*) may occur within the search area.

Significant seagrass beds have not been recorded in Darwin Harbour, however sparse occurrences of *Halodule uninervis* and *Halophila decipiens*, neither of which are NT or Commonwealth listed threatened species, were found around Wickham Point during baseline survey for the Darwin LNG Plant (Inpex, 2010).

Further assessment of likely presence or absence of significant threatened marine flora species within the proposed subsea cable corridor will be undertaken to determine the level of potential impact from the development of AAPL, particularly in and around the cable landing location.

Darwin Harbour is surrounded by mangroves (Figure 28). Mangroves are a significant natural resource as they protect the coastline from erosion, storms and cyclones; filter water; provide vital nurseries for fish stock; support a range of terrestrial, freshwater and estuarine environments and provide habitat for several fauna species (NT Government, n.d.[a]).

The mangrove environment around the Darwin Harbour has a very high floristic diversity, with approximately 41 different flora species found in the area. Large patches of rainforest areas also exist throughout the Darwin Harbour area, with vine-thicket habitat occurring on the Middle Arm peninsula and surrounding hinterland islands.

Vine-thicket communities are fire sensitive and have become well developed within the Darwin Harbour habitat due to the protection provided by the surrounding mangroves. These habitats support highly specialised bird, terrestrial, and marine fauna species of international significance (discussed below).

Large portions of the mangrove areas within the Darwin Harbour are also defined by the NT as a wetland of national significance (see section 6.4.2) (Environment Australia, 2001). There are no wetlands of international significance in proximity to the solar farm precinct (DoAWE, 2020). Potential impacts to the Darwin Harbour vegetation, including mangroves and wetlands will be assessed during the EIS to ensure impacts to mangroves are appropriately managed.

The subsea cables are planned to align with the Inpex and Bayu-Undan pipelines within Darwin Harbour to minimise impacts to marine flora during cable installation.

Fauna

A record search using the Fauna Atlas N.T. was conducted. In total, 547 marine bird, nine marine mammal, two marine reptile occurrences are recorded in the NT Fauna Atlas. Of these, the following species are listed as threatened under TPWCA (Fauna Atlas N.T., 2019b):

- Greater sand plover (*Numenius madagascariensis*) – vulnerable.
- Lesser sand plover (*Charadrius mongolus)* – vulnerable.
- Eastern curlew (*Numenius madagascariensis)* – vulnerable.
- Great knot (*Calidris tenuirostris*) – vulnerable.
- Bar-tailed godwit (*Limosa lapponica*) – vulnerable.

Further to the above, as search of the DoAWE PMST indicates the following number and type of Commonwealth listed fauna species (under the EPBC Act) potentially occur within the marine search area:

- 13 listed threatened bird species.
- 11 listed threatened mammal species.
- Seven listed threatened reptile species.
- Six listed threatened shark species.

Further to the above, there are many migratory and marine species (including cetaceans) that may or are known to occur within the project area, including dugongs and saltwater crocodiles (DoAWE, 2020). The results of the PMST searches are attached as Appendix B.

Commonly recorded cetaceans within Darwin Harbour are three coastal dolphins: the Australian snubfin (*Orcaella heinsohni*), the Indo-Pacific humpback (*Sousa chinensis*) and the Indo-Pacific bottlenose (*Tursiops aduncus*) (Inpex 2010). While none of these species are listed as threatened under either NT or Commonwealth legislation, all cetaceans are protected in all Australian waters under the EPBC Act. All three are also listed as migratory under the EPBC Act.

In addition to the above, extensive corals, sea whips, sponges, crustaceans, molluscs, echinoderms, jellyfish, and fish populate the Darwin Harbour, in what is considered a complex marine environment, with diverse patterns of habitat (Inpex 2010).

An analysis of marine fauna will be completed to inform the likely presence or absence of significant threatened marine fauna species and to determine the level of potential impact from the development of the project.

Hydrology

The waters of Darwin Harbour comprise three main arms; East, Middle and West, which converge into the Beagle Gulf. The Darwin river and Blackmore river flow into the Middle Arm (NT Government, n.d). The ‘Middle Arm peninsula’ refers to the terrestrial component of Middle Arm.

Darwin Harbour has semidiurnal macro-tides, meaning two high and two low tides each tidal day. The tides spread into the harbour as a progressive wave. The waters are moderately turbid; with a high turbidity area inside the mouth of each arm in both the dry and wet seasons. (Williams, et al. 2006).

The subsea cables are intended to enter the harbour via Middle Arm, before travelling north through the harbour into the Beagle Gulf.

As outlined in Section 6.2.1, the Darwin Harbour area is recognised by the NT as the Port Darwin wetland of national significance. This area supports significant areas of mangroves that protect the coast from storm surges (DoEE, 1993). Major surface inflow to Middle Arm occurs from Berry Creek,

Darwin River and Blackmore River, which each occur west of the OHTL (see Figure 3) and originate up to 27 km south of Middle Arm (DoEE, 1993). These waterways do not connect to Middle Arm in proximity to the project area, as shown in Figure 31.

Cultural heritage

NT maritime heritage is protected under the Heritage Act and includes, but is not limited to, the following values (NT Government 2019):

- Aboriginal occupation of the NT coastline.
- Evidence of visits by the Macassan people who sailed from present-day Indonesia.
- Shipwrecks.
- Submerged aircraft and submarines.
- Jetties, lighthouses and wharves built during European settlement.
- Underwater historical infrastructure such as telegraph cables.

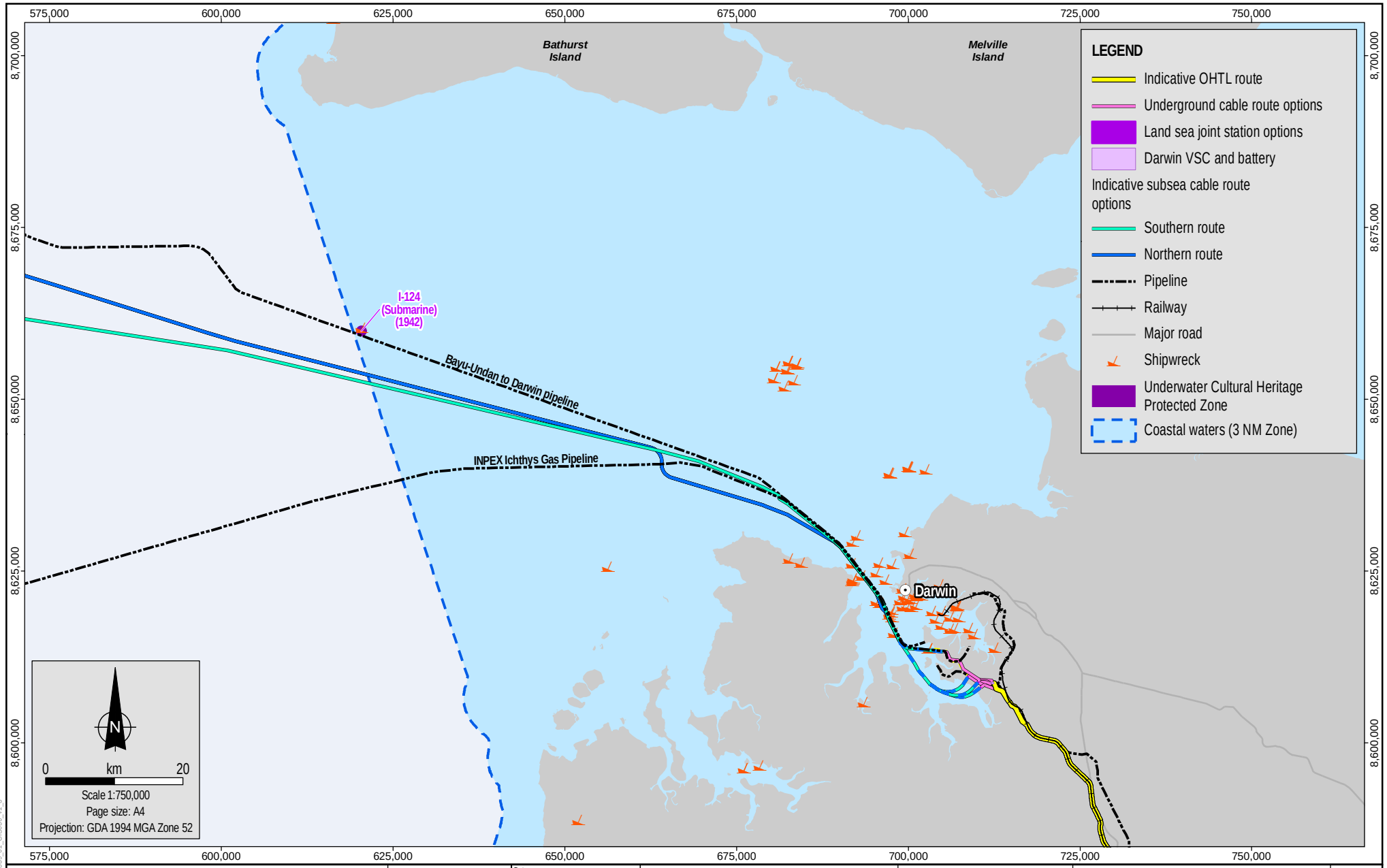
Notable marine historic places are located in Port Darwin including various shipwrecks and aircraft wreck sites as shown in Figure 31.

As outlined in Section 6.2.5, all Aboriginal sacred sites are protected by the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT). Sacred sites are places within the landscape that have a special meaning or significance under Aboriginal tradition. Hills, rocks, waterholes, trees, plains, lakes, billabongs and other natural features can be sacred sites. In coastal and sea areas, sacred sites may include features which lie both above and below the water (AAPA 2020).

The AAPA identifies six sacred sites in the Darwin Harbour (Inpex 2010), four of which may be in the vicinity of the subsea cable. Those sacred sites in the vicinity of the project area include three rocky areas or shoals on the western side of the Darwin Harbour, and an underwater sand and rock bar outside the mouth of the Harbour, north of the Cox Peninsula (Inpex 2010).

The subsea cable will avoid known heritage sites through design and is aligned with the existing gas pipelines through the harbour where possible, thereby avoiding impacts to marine heritage where possible, including sacred sites.

Further marine archaeological assessment of both Aboriginal and historic marine heritage values and potential impacts will be assessed as part of the EIS process.



MXD Reference: 275539_01_GIS030_v1_3

Source:
Indicative routes from Sun Cable.
12NM Zone from www.marineregions.org. 3NM Zone from Geoscience Australia.
NT parks/reserves, major watercourses and sites of conservation significance from DENR.
Roads, rail and pipelines from DLIP.
Underwater Cultural Heritage Protected Zones from DEE.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F031_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Marine archaeology

Figure No: **31**

2.2. Important sites or features

The NT Department of Environment and Natural Resources (DENR) has identified key conservation significant sites across the NT, with the aim of providing a more comprehensive approach to biodiversity conservation in the NT (see Figure 32 to Figure 34).

The recognition of these 'sites of conservation significance' does not provide specific regulatory or legislative protection above what is already applicable. However, each site of conservation significance is recognised by the DENR as needing further protection and should therefore be considered for projects potentially impacting on identified significant sites.

The solar farm precinct AOIs are sited to the west and southwest of Lake Woods (see Figure 2), which is a wetland of national significance in the NT. As outlined in Section 2.1.2, Lake Woods is an ephemeral freshwater lake within the Newcastle Waters and Powell Creek Stations (within which the solar farm precinct is located). It is one of the largest temporary freshwater lakes in the NT and is considered internationally important as a migration and breeding site for waterbirds. This site is listed as a NT Site of Conservation Significance. Additional information on Lake Woods is provided in Appendix E.

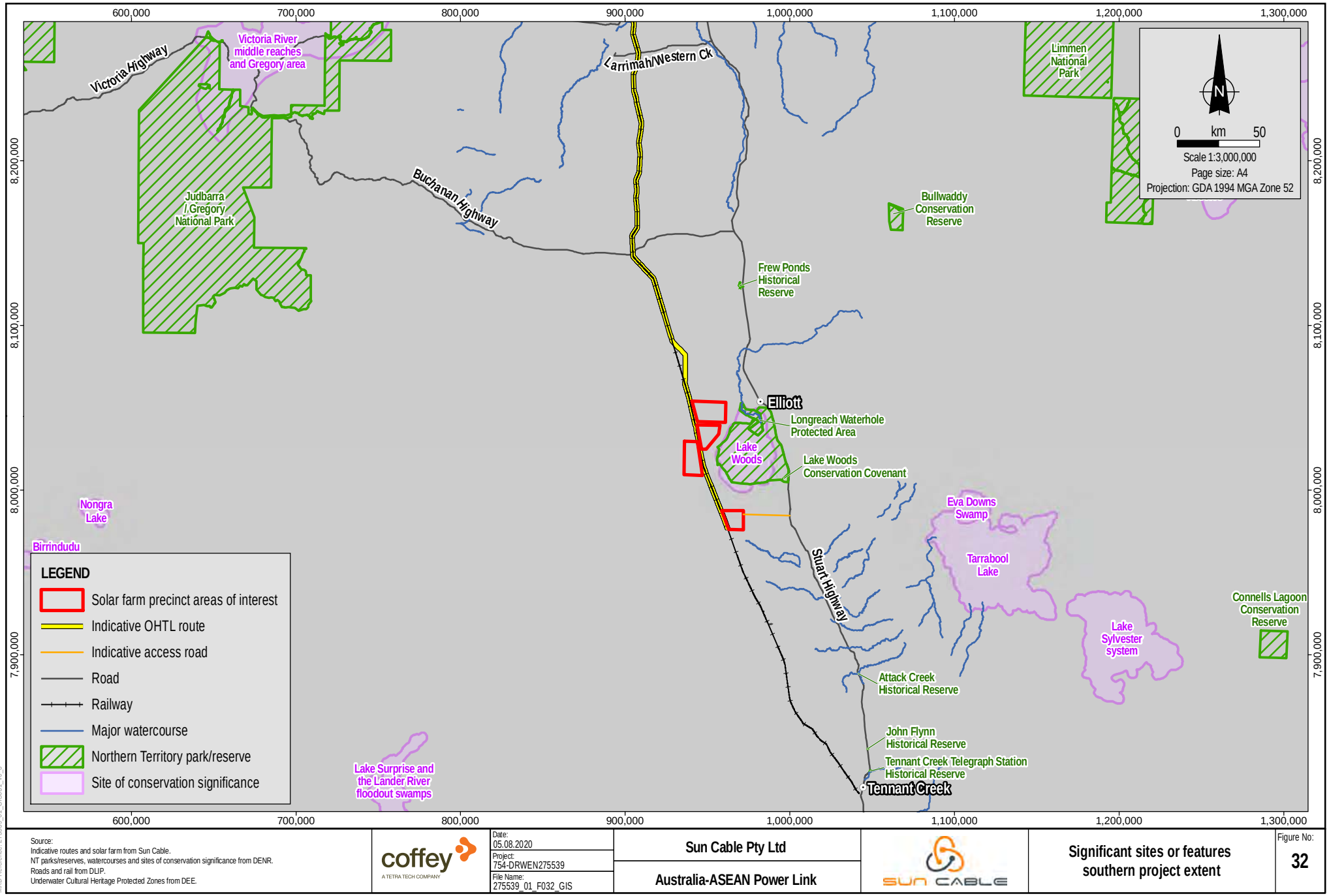
The Middle Arm peninsula area, where the VSCs, battery and land sea joint station are proposed, is located within the Darwin Harbour, a NT Government Site of Conservation Significance (Figure 34). However, the peninsula is also identified as a utilities precinct and is the focus of future gas and industrial development under NT Government strategy. Darwin Harbour is listed as a significant site as the shoreline is dominated by undisturbed mangroves and rich coastal environments which support many marine and bird species (NT Government, 2009[a]). The AAPL has the potential to impact on the values in Darwin Harbour Site of Conservation Significance during construction and operation. This is discussed further in Section 4.

Current management priorities for the Darwin Harbour site of conservation significance are fire, feral animals and weeds, as well as impacts to the harbour from nutrient discharge from urban development impacting on water quality and biodiversity values (including mangroves).

In addition to the above, the OHTL route (within the existing rail corridor) passes through the very edge of two other sites of conservation significance: Yinberrie Hills and Western Arnhem Plateau (see Figure 33).

The Yinberrie Hills site is an area of rolling hills approximately 40 km north of Katherine. It is known to be a key habitat site in northern Australia for the EPBC Act listed Gouldian Finch (NT Government, 2009[c]). The OHTL runs through the western extent of this site (Figure 33). Potential impacts to this site will likely be localised, limited to the transmission tower sites and within the existing rail corridor, however further assessment of values and site-specific impacts will be undertaken as part of the EIS.

The Western Arnhem Plateau site of conservation significance is an extensive sandstone plateau covering and area approximately 32,000 km^2. Its distinct geological, topographic and biodiversity features are so marked from the surrounding lowlands that it is recognised as its own separate bioregion (NT Government, 2009[b]). The OHTL route within the existing rail corridor passes through the very southwestern extent of this site, as shown in Figure 32. Potential impacts are therefore considered unlikely, however further assessment will be undertaken as part of the EIS.



MXD Reference: 275539_01_GIS031_v0_3

Source:
Indicative routes and solar farm from Sun Cable.
NT parks/reserves, watercourses and sites of conservation significance from DENR.
Roads and rail from DLIP.
Underwater Cultural Heritage Protected Zones from DEE.

coffey
A TETRA TECH COMPANY

Date: 05.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F032_GIS

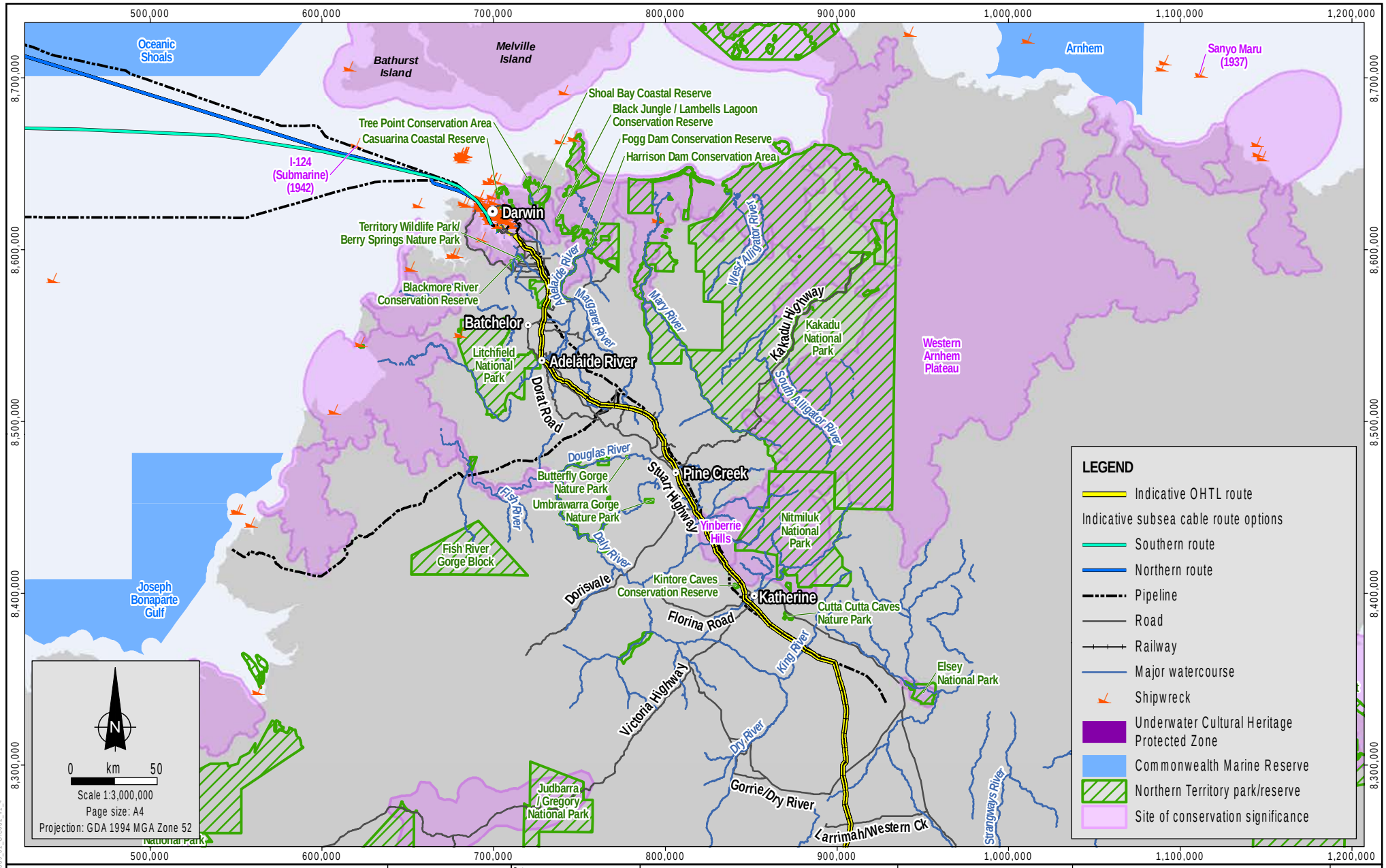
Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Significant sites or features southern project extent

Figure No: 32



Source:
Indicative routes from Sun Cable.
NT parks/reserves, major watercourses and sites of conservation significance from DENR.
Roads, rail and pipelines from DLIP.
Underwater Cultural Heritage Protected Zones from DEE.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F033_GIS

Sun Cable Pty Ltd

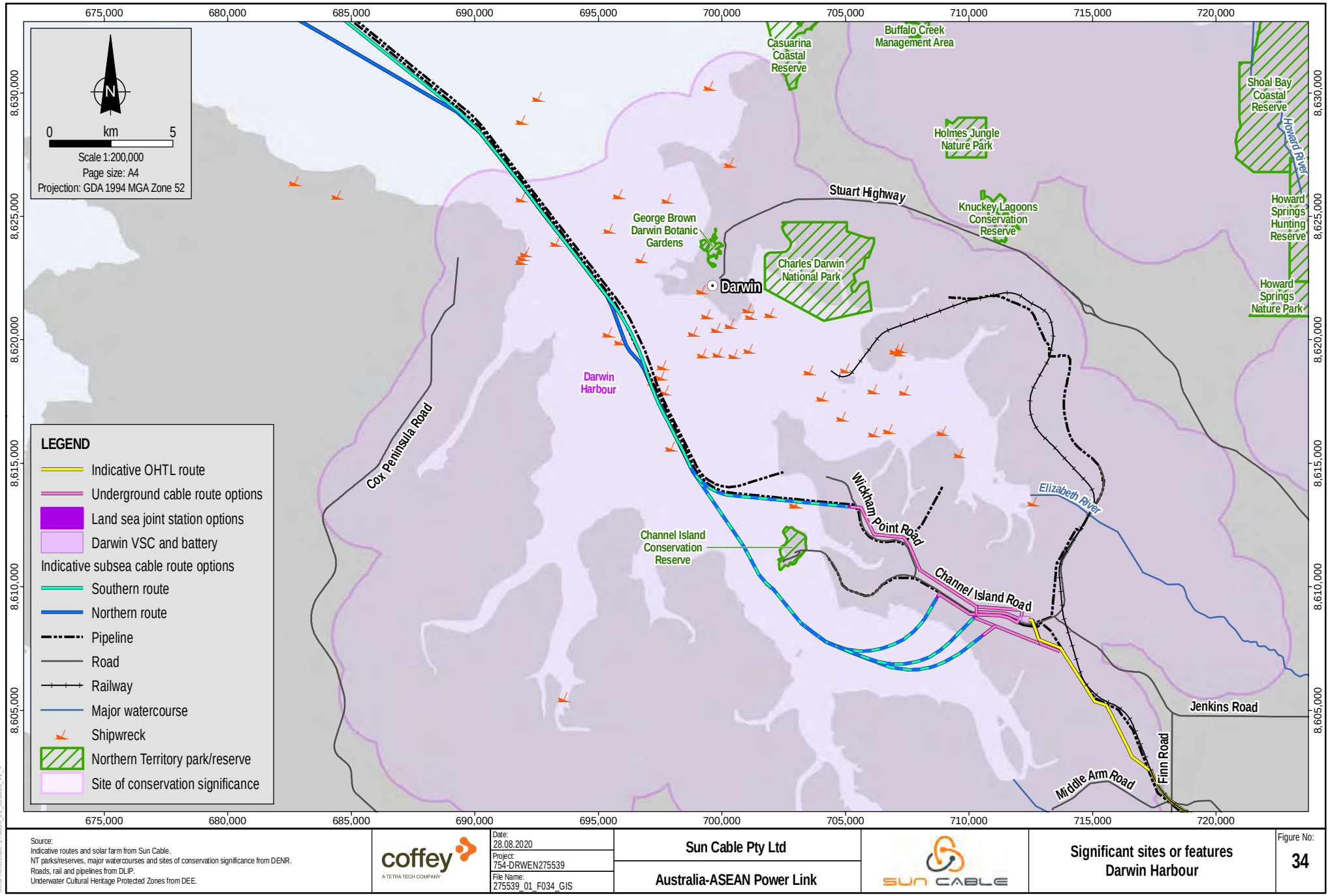
Australia-ASEAN Power Link (AAPL)

SUN CABLE

Significant sites or features northern project extent

Figure No: 33

MXD Reference: 275539_01_GIS032_v1_4



Source:
Indicative routes and solar farm from Sun Cable.
NT parks/reserves, major watercourses and sites of conservation significance from DENR.
Roads, rail and pipelines from DLIP.
Underwater Cultural Heritage Protected Zones from DEE.

coffey
A TETRA TECH COMPANY

Date: 28.08.2020
Project: 754-DRWEN275539
File Name: 275539_01_F034_GIS

Sun Cable Pty Ltd

Australia-ASEAN Power Link

SUN CABLE

Significant sites or features
Darwin Harbour

Figure No:
34

MXD Reference: 275539_01_GIS033_v1_4

2.3. Demography and economy

2.3.1. Social and economic environment

The NT is very sparsely populated compared to other Australian states and territories. Based on Northern Territory Government (NTG) Department of Treasury and Finance the total population as of December 2019 was estimated at 244,761. The NT economy has grown over the past 10 years as a direct result of major project developments. Almost 60% of the total NT population resides in the Greater Darwin Area (ABS, 2016).

The solar farm precinct is proposed to be located 40 km south-west of the town of Elliott, which has a total population of 339 (ABS, 2016) and about 200 km from the regional town of Tennant Creek, which services the Barkly Region. Tennant Creek has a population of about 3,000, about half of whom are Aboriginal people (ABS Census 2016). The proposed OHTL and existing railway passes by a number of towns including: Katherine, Pine Creek, Adelaide River and Batchelor (shown in Figure 1), which vary in population size from 328 (Pine Creek) to 6,303 (Katherine) (ABS, 2016). The proposed VSC and land sea joint sites will be located near Darwin, capital of NT; which has a population of 136,828 (Greater Darwin area, ABS, 2016).

The AAPL project aims to provide clean, reliable and competitively priced electricity to Darwin and Singapore.

It will be the largest solar farm in the world and is estimated to provide more than 1,200 construction jobs and around 150 operational jobs. Additional jobs will be created in the Darwin region to support the operation of the voltage source converters and battery, as well as the transmission line and submarine cables. Skilled jobs include electrical engineers, high voltage electricians, PV engineers, marine engineers, programmers, aerial and subsea surveyors, accountants, financing, logisticians, plant operators, and office management. A wide range of lower skilled jobs will also be created to support the construction and operation phases.

The NT government recently awarded the project Major Project Status, as it is considered to present a major opportunity for economic development of the NT (NT Government Newsroom, 2019).

Sun Cable proposes to assemble the solar farm hardware in Darwin for shipping via the Adelaide to Darwin railway link, subject to feasibility studies and relevant authorisations. The project requires production of 10 GW of the solar arrays over 5 years, requiring a manufacturing workforce of circa 150 people in Darwin. The AAPL will also generate significant long-term employment opportunities and will bring new industry, skills training and benefits for Indigenous Australians from Tennant Creek through to Darwin. However, the manufacturing facility does not form part of the proposed action.

The EIS will include a socioeconomic impact assessment that will assess likely social, cultural and economic change from the project and consequent positive and negative impacts on local, regional and Territory-wide values. This will include the demographic composition of the region, nearby towns, communities and homelands, and on all people and communities in the extended project footprint.

Issues to be explored will include the labour market and participation rates; housing and short-term accommodation; safety and wellbeing; current capacity and potential impacts on local and regional community and social infrastructure and services (health, housing, education, transport, essential services); potential impacts on community cohesion; impacts on recreation and visual amenity; changed land use; worker behaviour and traffic; the distribution of economic benefits from the project at various scales, including jobs and procurement; potential impacts on other economic sectors such as tourism and contribution to enabling economic infrastructure.

The impact assessment will include a consultation report, which will cover attitudes towards the project and issues raised.

A Social Impact Management Plan will be prepared as part of future environmental management plans, to outline how the project will manage its ongoing engagement and social performance. Sun Cable is also preparing the following plans, which will help to coordinate and identify the opportunities for jobs, industry engagement and bolstering economic growth:

- NT Industry Participation Plan
- Indigenous Engagement Plan
- Australian Industry Participation Plan
- Stakeholder Engagement Strategy.

The proponent has commenced consultation with the NLC with the intent to negotiate an Indigenous Land Use Agreement (ILUA) with the traditional owners, native title holders and custodians potentially affected by the proposed action.

The ILUA will give due consideration to environmental management, cultural heritage and sacred sites protection, rights and interests in land, financial payments, employment and training, contracts and Indigenous business development. The consultation process commenced in 2019 and is ongoing. Further consideration will be given within the social impact assessment to be undertaken as part of the EIS.

2.3.2. Native title

Significant portions of the project fall within areas subject to native title, or areas where claims are yet to be determined. The northern extent of the solar farm precinct falls within the Newcastle Waters – Murranji Determination area (associated with Pastoral Lease NT Por 2093, see Figure 3).

The OHTL traverses a number of areas subject to native title. Sun Cable has engaged with the NLC on the project and will engage with native title holders, traditional owners and custodians and their representatives once the anthropological identification process has been completed by NLC, as outlined in Section 1.7.

3. Environmental factors

There is potential for the project to result in impacts to a number of the NT EPA's environmental factors, as outlined in Table 10.

Table 10: Summary of NT EPA environmental factors with potential to be impacted by the proposed action

NT EPA Factor	Project infrastructure - potential to have a significant impact?				
	Solar Farm Precinct	OHTL	Voltage Source Converter	Land Sea Joint Station	Subsea Cables
Landforms	No	No*	No	No	No
Terrestrial environmental quality	Yes	Yes	Uncertain	Uncertain	No
Terrestrial ecosystems	Yes	Yes	Yes	Yes	No
Hydrological processes	Uncertain	Uncertain	No	No	No
Inland water environmental quality	Uncertain	Uncertain	No	No	No
Aquatic ecosystems	Uncertain	Uncertain	No	No	No
Coastal processes	No	No	No	No	No
Marine environmental quality	No	No	No	Uncertain	Yes
Marine ecosystems	No	No	No	Uncertain	Yes
Air quality	Uncertain	No	No	No	No

NT EPA Factor	Project infrastructure - potential to have a significant impact?				
	Solar Farm Precinct	OHTL	Voltage Source Converter	Land Sea Joint Station	Subsea Cables
Atmospheric processes	Potential net positive impact				
Communities and economy	Yes				
Culture and heritage	Yes	Yes	No	Yes	Yes
Human health	Uncertain	Uncertain	Uncertain	No	No

*Visual impacts assessed under 'Communities and Economy' EPA Factor

4. Potential environmental impacts

These potential impacts are discussed further in Table 11.

Table 11: Summary of potential impacts, and avoidance and mitigation measures

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
Land	**Terrestrial environmental quality** - Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Solar farm precinct, OHTL, VSC and land sea joint	• Direct disturbance of landforms and soils from earthworks during construction • Indirect disturbance from project construction, such as erosion/topsoil migration • Direct disturbance to the shoreline as a result of construction of the land sea joint /shore crossing and potential for disturbance to associated ecological and hydrological values during project construction and operation • Leaks of hazardous materials from batteries, transformers or other infrastructure installed at the solar farm precinct and Darwin VSC, or from vehicles.	• Project design and siting in Middle Arm peninsula – avoid trenching or construction works within areas of native vegetation/fauna habitat or utilise construction techniques that avoid clearing of habitat e.g. HDD instead of trenching. • Employ construction methods that minimise disturbance to shoreline and protect geophysical and hydrological processes. • Design and implement surface water drainage management as part of the project design and siting of infrastructure, to: ▪ Manage surface water runoff and discharge ▪ Manage erosion and sediment runoff ▪ Explore options for rainwater capture/reuse as part of operations • Further geophysical and geotechnical survey to inform the ultimate placement infrastructure within the solar farm precinct and tower locations • Prepare and implement dust management plan within suitable controls as part of project construction • Prepare and implement topsoil management plan with suitable controls as part of construction • Prepare a hazard and risk assessment as part of the EIS, including potential impacts from hazardous wastes associated with the project.	• Reconnaissance surveys have been undertaken for the Solar farm precinct, parts of the OHTL easement and VSC only, with desktop survey over the remainder of the project area. • Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative / proposed only at this stage, with further engagement and investigation work to be conducted to ground truth and confirm routes	• Ambient Air Quality NEPM 1997 and Air Toxins, National Environment Protection Measure (NEPM) 2004, 1996 • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020) • Erosion and sediment control plans for rural development (NT LRM, n.d.)	Refer to Section 1.7

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
		Darwin Harbour land	• Contamination of soils due to the disturbance of acid sulfate soils	• Conduct contaminated land and acid sulfate soil investigations to understand the potential for acid sulfate soils within the project area and optimise site locations • If required, prepare and implement an acid sulfate soils management plan with suitable controls as part of ground-disturbing works during construction	• Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project	• Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020) • Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • Contaminated Land Guideline (NT EPA 2017)	Refer to Section 1.7
	Terrestrial ecosystems - Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Native flora and vegetation, including listed threatened flora and ecological communities	• Direct loss of flora/ecological communities from vegetation clearing for solar farm precinct, OHTL towers, VSC and land sea joint station, and ongoing maintenance under transmission lines (e.g. fire and vegetation management) • Indirect disturbance or degradation to flora and vegetation, possibly resulting in a long-term decline or loss over time, for example from erosion, dust, weeds/pathogens, disturbance of acid sulfate soils, etc. • Introduction or increase of weed species due to construction, operation or maintenance activities • Changes in bushfire risk (fire frequency and intensity) due to vegetation clearing for solar farm precinct, OHTL towers, VSC and land sea joint station	• Selection and design of a solar farm precinct on the basis of preliminary study which considers terrestrial ecology and a range of other factors • Project design – the placement of transmission towers can be strategically located to avoid significant impacts where possible • Project design and siting in Middle Arm peninsula – avoid trenching or construction works within areas of native vegetation, or utilise construction techniques that avoid clearing of vegetation e.g. HDD instead of trenching • Alignment of the OHTL within existing linear infrastructure corridors/previously disturbed areas • Project design, i.e. overhead transmission instead of underground, reduces disturbance footprint to localised areas for tower construction • Complete detailed desktop assessment and site-specific ecological surveys of remaining project areas i.e. OHTL corridor and proposed VSC and land sea joint station to inform infrastructure locations to avoid impacts where possible	• Reconnaissance surveys have been undertaken for the Solar farm precinct, OHTL easement and VSC only, with desktop survey over the remainder of the project area. • Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative/proposed only at this stage, with further engagement and work to be conducted to ground-truth and confirm routes • Most of the disturbance associated with the OHTL will be restricted to the existing railway corridor, however impacts may extend out of this corridor where deviations, additional access or laydown areas are required to support construction	• Guidelines for Assessment of Impacts on Terrestrial Biodiversity (NT EPA, 2013) • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020) • Australian Weeds Strategy (NRMMC 2007) • Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • Land Clearing Guidelines, DENR, 2019	Refer to Section 1.7

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
		Native fauna and fauna habitat, including threatened and migratory species.	• Direct disturbance of fauna and fauna habitat as a result of clearing for the solar farm precinct, VSC and land sea joint station and cable trenching on the Middle Arm peninsula • Indirect impacts to fauna habitat due to changes to water quality, introduction or spread of weed or pathogens, fragmentation and edge effects • Indirect impacts to fauna as a result of reduced habitat availability or fragmentation • Direct impacts to fauna as a result of collision with overhead transmission lines • Direct impacts to fauna as a result of collision with vehicles or equipment • Changes to fauna behaviours as a result of noise or lighting from project areas, including potential solar glare from PV panels.	• Selection and design of a solar farm precinct on the basis of preliminary study which considers terrestrial ecology and a range of other factors • Further detailed and site-specific survey of remaining project areas i.e. OHTL corridor and proposed VSC and land sea joint station • Alignment of the OHTL within existing linear infrastructure corridors/previously disturbed areas • Project design, i.e. predominantly overhead transmission instead of underground, reduced impacts to localised areas for tower construction. If undergrounding cables would be trenched, which could result in greater ground disturbance • Project design – the placement of transmission towers can be strategically located to avoid significant impacts where possible • Project design and siting in Middle Arm peninsula – avoid trenching or construction works within areas of native vegetation/fauna habitat or utilise construction techniques that avoid clearing of habitat e.g. HDD instead of trenching	• Reconnaissance surveys have been undertaken for the Solar farm precinct, parts of the OHTL easement and VSC only, with desktop survey over the remainder of the project area. • Further detailed studies will be undertaken as part of the feasibility study and EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative/proposed only at this stage, with further engagement and work to be conducted to ground-truth and confirm routes • Most of the disturbance associated with the OHTL will be restricted to the existing railway corridor, however impacts may extend out of this corridor where deviations, additional access or laydown areas are required to support construction	• Guidelines for Assessment of Impacts on Terrestrial Biodiversity (NT EPA, 2013) • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020) • Land Clearing Guidelines, DENR, 2019 • Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • Mangroves in the Northern Territory (DIPE 2003)	Refer to Section 1.7
Water	**Hydrological processes** – Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	Surface water catchment, solar farm precinct	• Changes to the natural catchment from the creation of hardstand surfaces through construction and operation of the project • Localised erosion from ground disturbance and surface water flow changes	• Further detailed hydrological investigations to understand key site conditions/hydrological characteristics • Design and implement surface water drainage management as part of the project design and siting of infrastructure, to: ▪ Manage surface water runoff and discharge ▪ Manage erosion and sediment runoff ▪ Explore options for rainwater capture/reuse as part of operations	• Further detailed studies will be undertaken as part of the project feasibility and EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative/proposed only at this stage, with further engagement and work to be conducted to ground truth and confirm routes	• Erosion and sediment control plans for rural development (NT LRM, n.d.) • A Stormwater Strategy for the Darwin Harbour Region (NT EPA, 2014) • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	Refer to Section 1.7

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
	Inland water environmental quality - Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Waterways and wetlands, groundwater throughout project area	• Localised erosion from ground disturbance and surface water flow changes • Groundwater use and treatment	• Groundwater supply investigation as part of feasibility study to confirm source and supply sustainability and aquifer impacts. • Environmental and social assessment of implications of any groundwater abstraction.	• Further detailed studies will be undertaken as part of the project feasibility and EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative / proposed only at this stage, with further detail work to be conducted to ground truth and confirm routes	• Darwin Harbour Regional Management Strategicc Framework 2009 – 2013 (draft), DHAC • Land Clearing Guidelines, NT Planning Scheme, 2020 • A Stormwater Strategy for the Darwin Harbour Region (NT EPA, 2014) • Australia and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality (2000) • Erosion and sediment control plans for rural development (NT LRM, n.d.) • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	Refer to Section 1.7
	Aquatic ecosystems – Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Waterways and wetlands, freshwater aquatic flora and fauna	• Direct disturbance to waterways and/or wetlands and associated ecological and hydrological values during project construction and operation • Direct disturbance of aquatic flora and fauna habitat as a result of trenching on the Middle Arm peninsula • Indirect disturbance of aquatic ecosystems during construction of OHTL towers, where in proximity to waterways/wetlands, e.g. sedimentation, erosion, uncontrolled runoff	• Project design – the placement of transmission towers can be strategically located to avoid significant impacts where possible • Alignment of the OHTL within existing linear infrastructure corridors/previously disturbed areas • Utilisation of existing creek and river crossings where possible • Design and implement surface water drainage management as part of the project design and siting of infrastructure, to: ▪ Manage surface water runoff and discharge ▪ Manage erosion and sediment runoff	• Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative / proposed only at this stage, with further detail work to be conducted to ground truth and confirm routes • Most of the disturbance associated with the OHTL will be restricted to the existing railway corridor, however impacts may extend out of this corridor where additional access or laydown areas are required to support construction • Impacts to Lake Woods from the solar farm precinct will be avoided.	• Darwin Harbour Regional Management Strategicc Framework 2009 – 2013 (draft), DHAC • Land Clearing Guidelines, NT Planning Scheme, 2020 • A Stormwater Strategy for the Darwin Harbour Region (NT EPA, 2014) • Australia and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality (2000) • Erosion and sediment control plans for rural development (NT LRM, n.d.) • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	Refer to Section 1.7

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
Sea	**Marine environmental quality** - maintain the quality and productivity of water, sediment and biota so that environmental values are protected	Marine water, including Darwin Harbour, coastal waters	• Temporary impacts to fishing, recreation, industry use of the harbor during project construction • Installation of subsea cables causing increased sedimentation in water column, negatively impacting upon harbour water quality and aquatic environments, including productivity – impact considered temporary, limited to construction/installation of subsea cable • Land sea joint station development has the potential to produce site run-off, with impacts on water quality in the adjacent harbour	• Consultation with key stakeholder groups including harbour managers and users • Further investigation of nearshore and offshore marine ecology to understand key values and potential impacts • Review water quality monitoring data occurring for other developments in the East Arm/Middle Arm areas of Darwin Harbour, to inform further monitoring requirements • Design and implement surface water drainage management as part of the project design and siting of infrastructure, to: ▪ Manage surface water runoff and discharge ▪ Manage erosion and sediment runoff	• Survey to date has been in desktop format only, based on publicly available data that may not always be accurate or site-specific • Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative / proposed only at this stage, with further engagement and work to be conducted to ground truth and confirm routes	• Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020) • A Stormwater Strategy for the Darwin Harbour Region (NT EPA, 2014) • Australia and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality (2000) • Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • The Framework for Marine and Estuarine Water Quality Protection (no date), DEWHA	Refer to Section 1.7
		Benthic habitat	• Direct disturbance/loss from cable laying (including anchoring, vessel manoeuvrers and trenching if required) and HDD for subsea cable installation • Indirect disturbances – sedimentation/erosion from surface runoff	• Project design and siting – alignment of the subsea route with existing subsea infrastructure where feasible to minimise significant expansion of impact areas • Project design – consider burying and trenching on a site-specific basis according to conditions • Further investigation of nearshore marine ecology to understand key values and potential impacts	• A marine geophysical and geotechnical study will be used to inform submarine cable installation design • Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative/proposed only at this stage, with further engagement and work to be conducted to ground truth and confirm routes	• Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • A Stormwater Strategy for the Darwin Harbour Region (NT EPA, 2014) • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	Refer to Section 1.7
	Marine ecosystems – protect marine flora and fauna so that biological diversity and ecological integrity are maintained	Marine fauna	• Indirect impacts to fauna habitat due to changes to marine environment, introduction or spread of contaminants or pest species. • Direct impacts to fauna as a result of collision with vessels or survey and/or construction equipment • Changes to marine fauna behaviours as a result of electromagnetic fields (EMF), noise, thermal emissions or lighting from project areas	• Project design and siting – alignment of the subsea route with existing subsea infrastructure to minimise significant expansion of impact areas • Project design – configure subsea cables to prevent EMF incursion into the water column where possible, by: ▪ Using HVDC to minimise / negate EMF; ▪ Placing the cables closer together where feasible–	• The favourable routes outlined in this Referral are indicative/proposed only at this stage, with further detail work to be conducted to ground truth and confirm routes • Smaller species are considered to be mobile and generally able to avoid existing impacts from vessel traffic etc. within the harbour.	• Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020) • Guidance on Adaptive Management (NT EPA, 2018) • A Strategy for the Conservation of Marine Biodiversity in the Northern Territory of Australia, Parks and Wildlife Commission of the NT (PWCNT), 2000	Refer to Section 1.7

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
				which can cause mutual cancellation of EMFs • Further investigation of nearshore and offshore marine ecology to understand key values and potential impacts • Implement marine mammal management measures outlined in EPBC Act *Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (DoEE, 2008) during construction works to mitigate potential impacts from the cable vessel on cetaceans		• Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • Sites of Conservation Significance: Darwin Harbour (no date), DENR • EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales (DoEE, 2008)	
		Mangroves	• Direct loss of mangrove vegetation (including significant fauna habitat) in Darwin Harbour from cable trenching	• Project design and siting in Middle Arm peninsula – avoid trenching or construction works within areas of native vegetation, or utilise construction techniques that avoid clearing of vegetation e.g. HDD instead of trenching • Complete detailed desktop assessment and site-specific survey of the mangrove areas possibly impacted to understand key values • Use HDD for cable landing where it is technically and economically feasible to do so	• There are few feasible landing locations for the cable at Middle Arm and none which can entirely avoid mangrove habitat • The routes outlined in this Referral are indicative/proposed only at this stage, with further engagement and work to be conducted to ground truth and confirm routes	• Guidelines for Assessment of Impacts on Terrestrial Biodiversity (NT EPA, 2013) • Preparation of an Environmental Management Plan (NT EPA, 2015) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020) • Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • Land Clearing Guidelines, DENR, 2020 • Mangroves in the Northern Territory (DIPE 2003)	Refer to Section 1.7
Air	**Air quality** - Protect air quality and minimise emissions and their impact so that environmental values are maintained	Sensitive receivers within and in proximity to the project area	• Reduction in local air quality due to the emission of dust and/or diesel exhaust during construction and/or operation of the project	• Further assessment of potential point source emissions and location of sensitive receivers in proximity to the project area • Prepare and implement dust management plan within suitable controls as part of project construction	• Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative / proposed only at this stage, with further detail work to be conducted to ground truth and confirm routes	• Ambient Air Quality NEPM 1997 and Air Toxins, National Environment Protection Measure (NEPM) 2004, 1996 • Guidelines for the preparation of an economic and social impact assessment (NT EPA 2013) • Guideline: Recommended Land Use Separation Distances (NT EPA 2017) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	Refer to Section 1.7
	Atmospheric processes - Minimise greenhouse gas	Global environment, NTG targets	• Direct GHG emissions due to Scope 1 and Scope 2 emissions	• Further assessment of potential greenhouse gas	• Further detailed studies will be undertaken as part of the EIS	• Ambient Air Quality NEPM 1997 and Air Toxins, National	Refer to Section 1.7

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
	emissions so as to contribute to the NT Government's aspirational target of achieving net zero greenhouse gas emissions by 2050, and adapt to a changing climate to protect ecological integrity and maintain the welfare and amenity of people.		(e.g., land clearing, diesel exhaust/etc. during construction and operation), and relevant indirect emissions related to proposal lifecycle. • Improvements in the supply of renewable energy and meeting NT renewable energy targets	emission point sources within the project area during construction • Further analysis of the net benefits of the project to meeting the NT emissions targets	to support the understanding of the existing environment and impacts of the project	Environment Protection Measure (NEPM) 2004, 1996 • Guidelines for the preparation of an economic and social impact assessment (NT EPA 2013) • Guideline: Recommended Land Use Separation Distances (NT EPA 2017) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	
People	**Communities and economy** - Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians.	Current and future Territorians, landholders, traditional owners, local communities, Australians.	• Change to population, employment market and businesses and indirect impacts to housing market, community and social services and infrastructure and local economics • Social integration of construction personnel during construction • Direct and indirect impacts to recreational and commercial areas and industries including Darwin Harbour • Changes or restrictions on railway access by local traffic due to transmission line corridor during construction, operation and maintenance • Changes or restrictions to local traffic due to development of new roads and intersections and construction vehicles resulting in delays or inconvenience to local communities and other road users • Visual impact of project infrastructure • Employment opportunities in regional NT and Darwin region • Economic benefits locally, regionally and nationally. • Impacts to aviation/flight paths	• Align linear infrastructure with existing rail/utilities corridor/s where possible. • Locate electrical infrastructure in utilities precincts such as Middle Arm to minimise social impacts. • Undertake stakeholder engagement to inform communities of project, key construction milestones, possible impacts etc. • Prepare a socioeconomic impact assessment as part of the EIS • Prepare a visual impact analysis of OHTL for sensitive receivers • Further desktop assessment of impacts to aviation from project infrastructure	• A desktop review based on publicly available data has been completed to date and may not be accurate or site-specific • Further desktop studies and field-based investigations will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project • The routes outlined in this Referral are indicative / proposed only at this stage, with further engagement and detailed work to be conducted to ground truth and confirm routes	• Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • Guidelines for the preparation of an economic and social impact assessment (NT EPA 2013) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	Refer to Section 1.7
	Culture and heritage - Protect sacred sites, culture and heritage.	Solar farm precinct, OHTL route, and land sea joint and subsea cable route	• Direct and indirect disturbance to significant Aboriginal cultural heritage sites and values (e.g. artefact scatters, shell middens, earth mounds, quarries, stone arrangements, petroglyphs, rock shelters, rock art, etc) during project construction, operation, and maintenance activities including vegetation clearance,	• Engage with relevant land councils regarding Aboriginal and historic heritage values within or in close proximity to the project area • Engage with relevant land councils regarding access to Aboriginal Lands • Establish an ILUA for the benefit of traditional owners,	• Survey to date has been in desktop format only, based on publicly available data that may not always be accurate or site-specific • Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing environment and impacts of the project	• Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC • Guidelines for the preparation of an economic and social impact assessment (NT EPA, 2013) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact	Refer to Section 1.7

Proposal factor	NT EPA factor and objective	Receiving environment	Potential impacts	Avoidance and Mitigation	Assumptions	Policy/Guidelines	Outcomes of preliminary consultation
			topsoil stripping and subsoil excavation • Direct and indirect disturbance to traditional and/or contemporary values and traditional and/or contemporary Aboriginal uses of land (e.g. hunting and ceremonial use) due to construction, operation or maintenance activities • Direct and indirect disturbance to non-Aboriginal cultural heritage sites and values during project construction, operation, and maintenance activities including vegetation clearance, topsoil stripping and subsoil excavation • Change or permanent land use restrictions in areas of project infrastructure • Tangible and intangible impacts to cultural values and landscapes due to potential disturbance to flora and fauna, ecosystems, landscapes and landforms from construction, operation or maintenance activities	native title holders and custodians • Sacred site assessment and ssecure of an Authority Certificate from AAPA for registered and recorded sacred sites. • Design of infrastructure to avoid identified Aboriginal and non-Aboriginal heritage sites • Further detailed desktop assessments and site-specific archaeological and anthropological surveys to confirm the nature, extent and significance of Aboriginal and non-Aboriginal heritage sites and the potential impacts on nearby communities and cultural heritage values within the project area. • Prepare cultural heritage management plan (or similar) as part of future construction phase which will outline management measures to avoid, minimise or offset impacts to high-risk cultural values	• The favourable routes outlined in this Referral are indicative/proposed only at this stage, with further detail work to be conducted to ground truth and confirm routes	Assessment Guidance (NT EPA, 2020)	
	Human health – Protect the health of the Northern Territory population.	Sensitive human receptors, nearby residences, communities etc.	• Noise and dust emissions from construction works • Human exposure to EMF	• Project design – configure cable and tower design (e.g. height and location of towers) to reduce exposure to nearby human receptors • Prepare and implement dust management plan within suitable controls as part of project construction • Prepare and implement noise management plan with suitable controls as part of project construction • Undertake stakeholder engagement to inform communities of project, key construction milestones, possible impacts, et • Keep landowners and local residents up to date on progress of the project to help mitigate any potential social impacts	• Review of existing research into EMF impacts on human health • Further detailed studies will be undertaken as part of the EIS to support the understanding of the existing social environment and impacts of the project	• Ambient Air Quality NEPM 1997 and Air Toxins, National Environment Protection Measure (NEPM) 2004, 1996 • Guidelines for the preparation of an economic and social impact assessment (NT EPA 2013) • Northern Territory Noise Management Framework Guideline (NT EPA 2018) • Guideline: Recommended Land Use Separation Distances (NT EPA 2017) • Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2020)	Refer to Section 1.7

Overarching elements of the EIS

Some of the overarching or generic elements that will form part of the impact mitigation approach for the EIS will include:

- Development of an environmental management framework, which will set the framework for future environmental management systems and management plans. The framework will include management targets and priorities for elements during construction and/or operations, including (but not limited to):
  - Waterway management.
  - Weed and pathogen management.
  - Bushfire risk management.
  - Fauna and flora management and monitoring requirements.
  - Erosion and sediment management and control.
  - Biting insect management.
  - Acid sulfate soil management.

- Conducting extensive engagement with stakeholders, including:
  - Relevant authorities in relation to environmental offsets, including consideration of best practice principles.
  - Native title holders and traditional owners as key stakeholders for the project and the subject land.
- Preparation of a hazard and risk assessment, including potential impacts from hazardous waste storage and handling.

Potential cumulative impacts:

Cumulative impacts will be considered as part of the EIS process for the project. Potential cumulative impacts that have been identified include:

- Socio-economic, employment and amenity impacts in the solar farm precinct region (and Darwin region to a lesser extent) if the development of the project occurs concurrently with other developments (e.g., gas developments) that may occur in the area.
- Impacts to groundwater and/or groundwater dependent ecosystems if the development of the project occurs concurrently with other developments (e.g., gas developments) that may occur in the area.
- Regional land use changes and construction disturbance impacts in the solar farm precinct region if the development of the project occurs concurrently with other developments (e.g., gas developments) that may occur in the area.
- Increased industrialisation of the Darwin Harbour environment due to the presence of Middle Arm infrastructure for this project and other existing and potential developments in the area.
- Impact of linear infrastructure (OHTL and sea cable) in same corridors as existing linear infrastructure (e.g., the rail line and gas pipelines).

Consideration of ecologically sustainable development (ESD) principles to the project:

The project is in its early stages of planning and is yet to complete feasibility and detailed design. However, many fundamentals of ESD have already been considered in the project concept and initial design and route selection including:

- The project concept is fundamentally about sustainable use of energy by greater adoption in Northern Australia and ASEAN markets of renewable energy sources. It is therefore also about the

promotion of and delivery of intergenerational and intragenerational equity. Furthermore, it provides economic and development opportunities in an area that otherwise has quite limited opportunities.

Through detailed design and the environmental assessment process the principles of evidence-based decision making, conservation of biological diversity and ecological integrity and the principle of improved valuation, pricing and incentive mechanisms will be applied to where possible avoid adverse impacts, and if they can't be avoided mitigate and manage them. These principles will also be applied to optimise the project design and implementation.

Expected residual impact:

Residual impacts of the project will be considered as part of the EIS process for the project. The project involves the establishment of a long-life infrastructure asset. During the life of the asset the residual impacts are expected to include:

- The physical footprint of the infrastructure (i.e., solar farm, OHTL, ancillary facilities, VSC and subsea cable) and the change in land use and function associated with this.
- Minimal and localised emissions to the environment (surface water runoff via appropriate surface water controls, dust from roads, EMF, emissions from vehicles used during operations, domestic waste from accommodation camp etc),
- Sustainable levels of groundwater abstraction to support the solar farm precinct.
- Ongoing visual impact from the visible aspects of project infrastructure.
- Improvements in the NT renewable energy consumption rates.
- Operational level socio-economic benefits including direct and indirect employment.

5. Commonwealth government approvals / Matters of National Environmental Significance

Based on a search of the Commonwealth Protected Matters Search Tool (PMST), the following Matters of National Environmental Significance (MNES) as listed under the EPBC Act are potentially impacted by the project:

- Listed threatened species and ecological communities.
- Migratory species.
- Commonwealth Marine Area.

The project will be referred to the Commonwealth Minister for the Environment to consider whether further assessment is required. It is considered likely that assessment and approval of the project will be required under the EPBC Act due to the potential impacts in the Commonwealth marine area as well as potential impacts to listed threatened species and ecological communities in both the Commonwealth marine area and the NT.

Based on recent advice from DoAWE, the AAPL project will likely be deemed a "whole of environment" assessment under the EPBC Act due to its scale and passage through the Commonwealth marine area. This means all impacts to the environment, including State matters will be considered under the Commonwealth's assessment process.

In the event of a controlled action decision, the proponent will seek to establish an accredited assessment process between the Commonwealth and the NT government to streamline the assessment process and remove any unnecessary duplication.

6. References and data

6.1. Reference list

AustralAsia Railway Corporation, 2019. Rail Operator. http://www.aarail.com.au/railway/operations/. [25 October 2019]

Connect Environmental, 2020a. *Threatened Species Assessment*. Unpublished report prepared for Coffey on behalf of Sun Cable Pty Ltd.

Connect Environmental, 2020b. *Preliminary Ecological Assessment*. Unpublished report prepared for Coffey on behalf of Sun Cable Pty Ltd.

Department of Environment and Energy (DoEE), 1993. Directory of Important Wetlands in Australia – Information Sheet: Port Darwin. Available from: http://www.environment.gov.au/cgi-bin/wetlands/report.pl?smode=DOIW;doiw_refcodelist=NT029. [29 October 2019].

Department of Environment and Energy (DoEE), 2019. Protected Matters Search Tool. Available from: https://www.environment.gov.au/epbc/protected-matters-search-tool. [28 October 2019].

Department of Environment and Natural Resources (DENR), 2019a. Flora Atlas N.T. Available from: https://nrmaps.nt.gov.au/nrmaps.html. [11 October 2019].

Department of Environment and Natural Resources (DENR), 2019b. Fauna Atlas N.T. https://nrmaps.nt.gov.au/nrmaps.html. [11 October 2019].

Department of Environment and Natural Resources (DENR), 2019c. *Land Clearing Guidelines.* NT Government, Darwin

Department of Environment and Natural Resources (DENR), 2019. Natural Resources Maps (NR Maps) Northern Territory. Northern Territory Government, Department of Environment and Natural Resources. Available from: https://nrmaps.nt.gov.au/nrmaps.html. [1 October 2019].

DENR, 2020. *The NT Water Data WebPortal*, The Northern Territory Government, https://water.nt.gov.au/Data/DataSet/Chart/Location/RN022174/DataSet/DepthToWater/Publish/Interval/Latest

Environment Australia, 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1: Summary Report*. Environment Australia, Canberra.

Environment Australia, 2001. *A Directory of Important Wetlands in Australia, Third Edition*. Environment Australia, Canberra.

Inpex Browse Ltd, 2010. Ichthys Gas Field Development Project: draft environmental impact statement. Inpex Browse Ltd, Perth.

Liddle, D.T., Gibbons, A. and Taylor, R., 2008. *Recovery plan for the threatened plants of the Tiwi Islands in the Northern Territory of Australia 2008 - 2013*. Northern Territory Department of Natural Resources, Environment and the Arts, Darwin, Australia.

Lumen, 2020. Sun Cable Overhead Transmission Line Concept Design. 2020.

Northern Territory Government, 2013. *Northern Territory Land Suitability Guidelines*. Darwin, Australia.

Northern Territory Government, 2019. *Arts, culture and heritage: Maritime heritage*. Available from: https://nt.gov.au/leisure/arts-culture-heritage/visit-a-cultural-or-heritage-site/maritime-heritage. [21 October 2019].

Northern Territory Government Newsroom, 2019. *Media statement: Major Project Status Awarded to Sun Cable*. Available from: http://newsroom.nt.gov.au/mediaRelease/31259. [20 October 2019].

NT Government, 2009[a]. *Sites of Conservation Significance: Darwin Harbour, fact sheet*. NT Government. Darwin, Australia.

NT Government, 2009e[b]. *Sites of Conservation Significance: Western Arnhem Plateau, fact sheet*. NT Government. Darwin, Australia. Available from: https://territorystories.nt.gov.au/jspui/bitstream/10070/254290/1/16_westarnhem.pdf

NT Government, 2009[c]. *Sites of Conservation Significance: Yinberrie Hills, fact sheet*. NT Government. Darwin, Australia. Available from: https://territorystories.nt.gov.au/jspui/bitstream/10070/254301/1/30_yinberrie.pdf

Tickell, S.J. (2003*). Water resource mapping: Barkly tablelands*. Darwin NT: Northern Territory Department of Infrastructure, Planning and Environment.

Water Quality Australia, no date. *Issues affecting water quality: Acid sulfate soils*. Available from: https://www.waterquality.gov.au/issues/acid-sulfate-soils. [21 October 2019].

Williams, D., Wolanski, E., and Spagnol, S, 2006. 'Hydrodynamics of Darwin Harbour' in *The Environment in Asia Pacific Harbours*, *eds E. Wolanski* (Dordrecht:Springer) pp. 461-476.

6.2. Data

The following project location data is provided as geo-referenced GIS files:

- Solar farm precinct areas evaluated in the Preliminary Ecological Assessment (Connect Environmental 2020a)
- OHTL route
- VSC location and easement options
- Land sea joint location options
- Subsea cable route
- Project area