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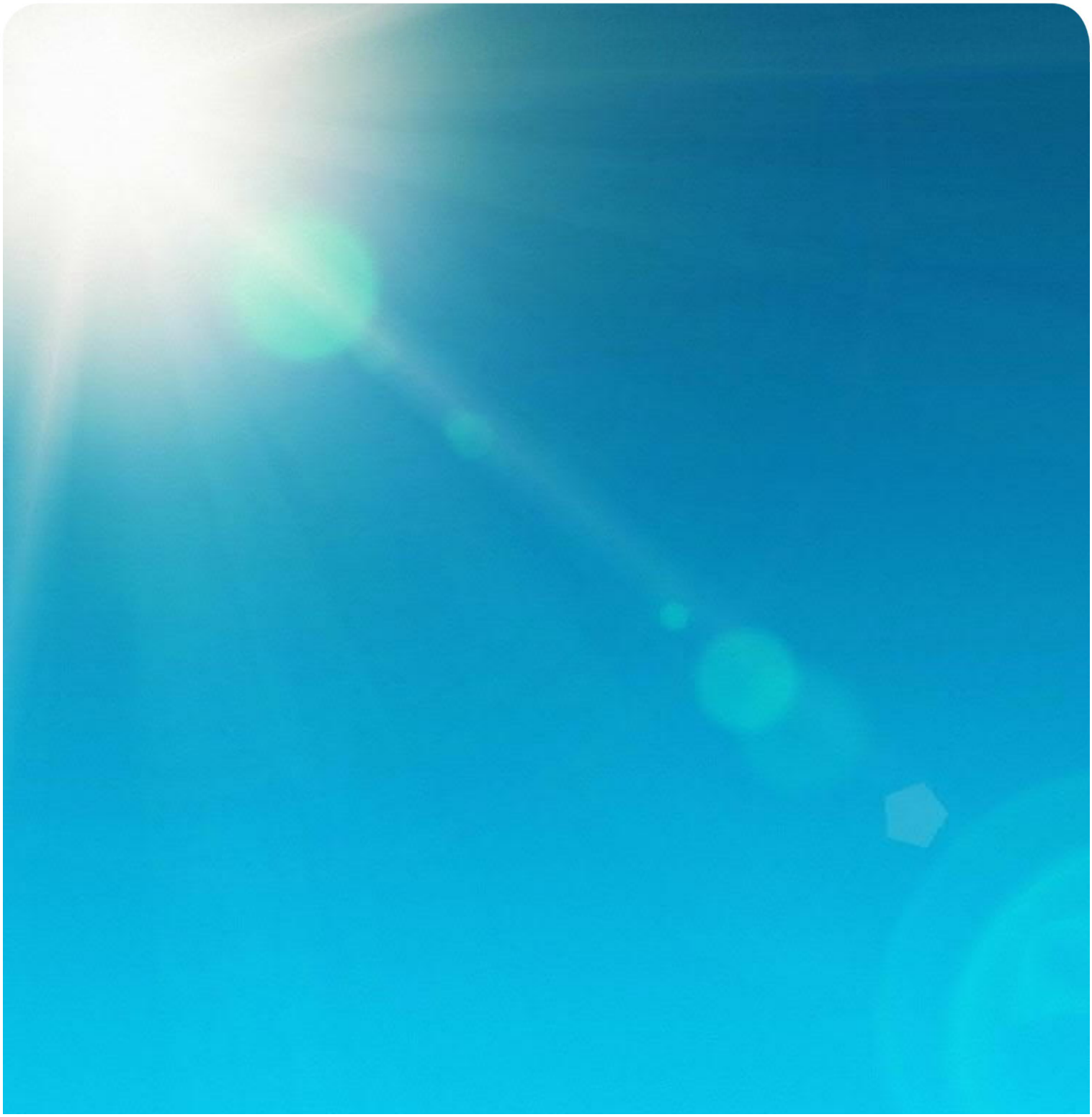
March 2022

Appendix W – Heritage Impact Assessment – OHTL KP722 to Murrumujuk

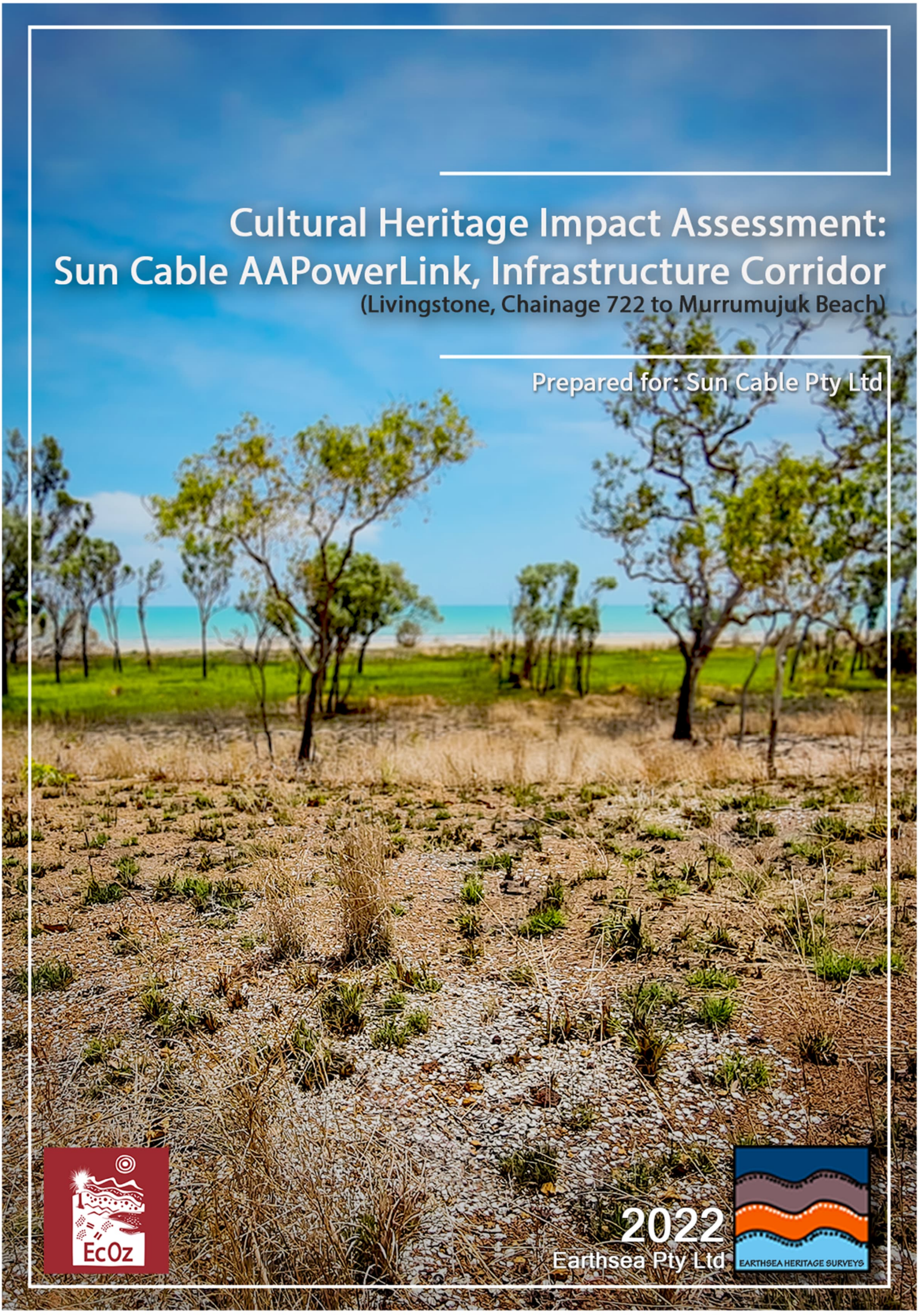
Australia-Asia PowerLink Environmental Impact Statement



Cultural Heritage Impact Assessment: Sun Cable AAPowerLink, Infrastructure Corridor

(Livingstone, Chainage 722 to Murrumujuk Beach)

Prepared for: Sun Cable Pty Ltd



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Earthsea Pty Ltd

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Cultural Heritage Impact Assessment
Sun Cable Australia-Asia PowerLink, Infrastructure Corridor
(Livingstone, Chainage 722 to Murrumujuk Beach, NT)

24 January 2022

Prepared for: **Sun Cable Pty Ltd**

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Survey Area: Infrastructure Corridor Livingstone to Murrumujuk

Table of Contents

Table of Figures

Tables

1 Introduction

Earthsea Pty Ltd (Earthsea) has been engaged by EcOz Environmental Consultants, on behalf of Sun Cable Pty Ltd, to undertake Heritage Impact Assessments (HIA) of their proposed Australia-Asia PowerLink (AAPowerLink) project components in the Northern Territory (https://aapowerlink.sg/). The Heritage Impact Assessment (HIA) studies form part of the Project's Environmental Impact Statement (EIS), which evaluates all proposed development components located within Australia (including offshore components within the Australian Exclusive Economic Zone (AEEZ)).

The HIA components of the EIS are being approached in the following four separate HIA documents, with each representing primary development zones:

(1) Powell Creek Solar Precinct (solar farm, ancillary facilities and associated access corridor).
(2) Overhead Transmission Line (OHTL) from the Solar Precinct to the Livingstone Infrastructure Corridor (OHTL Chainage 0 to 722).
(3) OHTL Infrastructure Corridor from Livingstone (Chainage 722) to Murrumujuk Beach, including the Darwin Converter Site and Cable Transition Facilities at Murrumujuk.
(4) Subsea Cable System within the AEEZ.

This report presents the HIA for the Infrastructure Corridor from Livingstone (Chainage 722) to Murrumujuk Beach, which comprises approximately 66km of the northernmost section of the OHTL, the Darwin Converter Site and Cable Transition Facilities at Murrumujuk.

In brief, Sun Cable propose to develop a Solar Precinct comprising large-scale solar arrays and battery storage facilities on the southern boundary of Powell Creek Station, approximately 750km south of Darwin. The Sun Cable AAPowerLink Project has been planned in response to high cost and gas reliant energy generation within Singapore and Darwin. Sun Cable aims to provide a more reliable and renewable electricity supply alternative through generating solar energy in the Northern Territory and exporting this through a 5,000km long high voltage direct current (HVDC) transmission system. Network connection will also be available for the Northern Territory.

An archaeological field assessment, coupled with a desktop study, was used to inform this HIA of any potential risks to archaeological resources and areas of cultural heritage significance within the proposed AAPowerLink Livingstone section of the OHTL, Darwin Converter Site and Cable Transition Facilities. Archaeologist Ben Keys undertook the field assessment between 9 and 17 September 2021, with the participation of two Larrakia/Wulna site custodians and two Tiwi site custodians.

1.1 Scope of the Study

The AAPowerLink is being assessed by the Northern Territory Environment Protection Authority (NT EPA), as an EIS under the *Environment Protection Act 2019* (EP Act). The NT EPA's Statement of Reasons considered 12 environmental factors as being at risk of the AAPowerLink development, including Culture and Heritage. The culture and heritage values included sacred sites, Aboriginal archaeological sites and historic sites in the project area as the significance of impacts to these features was uncertain.

This study and report centred on assessing the significance and potential impacts to archaeological sites of Aboriginal origin, historical features associated with the post-contact to modern period and areas which have intangible cultural heritage values. Sacred Sites, mandated as sites of significance in the Aboriginal Tradition by the Northern Territory Aboriginal Sacred Sites Act 1989, will be assessed

in full by the Aboriginal Areas Protection Authority (AAPA) through an Authority Certificate process prior to development. Notwithstanding this, during July 2021, Sun Cable met with AAPA to discuss proposed route. Sun Cable subsequently submitted two Request for Information applications through the AAPA to review the Authority Certificate Public Register which informed preliminary site selection process. An AAPA Sacred Sites Abstract of Records of the Livingstone to Murrumujuk Infrastructure Corridor was also completed in addition to the abovementioned Request for Information applications (see Appendix 1). The Abstract of Records outlines the potential risks to Registered and recorded Sacred Sites within the Livingstone section of the OHTL, Darwin Converter Site and Cable Transition Facilities.

In brief, the aim of this study was to develop a Heritage Impact Assessment (HIA) that identifies cultural heritage risks for the Project and establish management strategies to mitigate impacts on Aboriginal archaeological sites and other heritage places during construction and operation of the Livingstone section of the OHTL, Darwin Converter Site and Cable Transition Facilities.

To meet the specific information requirements in relation to Culture and Heritage as outlined in the NTEPA Terms of Reference for the AAPowerLink EIS (NTEPA ToR 12 January 2021, Section 3.11. Culture and Heritage, Table 14), the following objectives were used:

1. Identify archaeological, cultural heritage features and traditional land use areas within or proximal to the Project Footprint areas.
2. Identify and describe any archaeological research gaps relevant to the Project.
3. Identify any archaeological or cultural heritage constraints, potential impacts, and risks within the proposed Project Footprint areas.
4. Consult with the relevant stakeholders throughout the Project, including the Northern Land Council representatives, Traditional Owner site custodians, and Northern Territory Government Heritage Branch.[1]
5. Detail the Cultural and scientific significance of each archaeological feature identified and any agreed mitigation strategies through the HIA process.
6. Develop management strategies and measures to minimise harm to Aboriginal and historic cultural heritage features and other areas of cultural significance.

1.2 Project Location, Land Tenure & Native Title

1.2.1 Project Location and Land Tenure

This HIA Project Area encompasses the proposed AAPowerLink Livingstone section of the OHTL, Darwin Converter Site and Cable Transition Facilities at Murrumujuk (See Figure 1 below).

The proposed AAPowerLink OHTL exits the Railway Corridor at Livingstone (Chainage 722) to continue within a Northern Territory Government (NTG) designated future utilities corridor for 44km, that traverses the eastern outskirts of Darwin's rural area and passes through some extractive mineral title areas and the Black Jungle Conservation Reserve. The final 19km of the OHTL corridor runs parallel immediately to the west of Gunn Point Road corridor, with the alignment crossing Crown Land and the eastern section of the Shoal Bay Coastal Reserve.

[1] Principally to establish the location of previously recorded archaeological sites of Aboriginal origin and to access the Heritage Library held by this office.

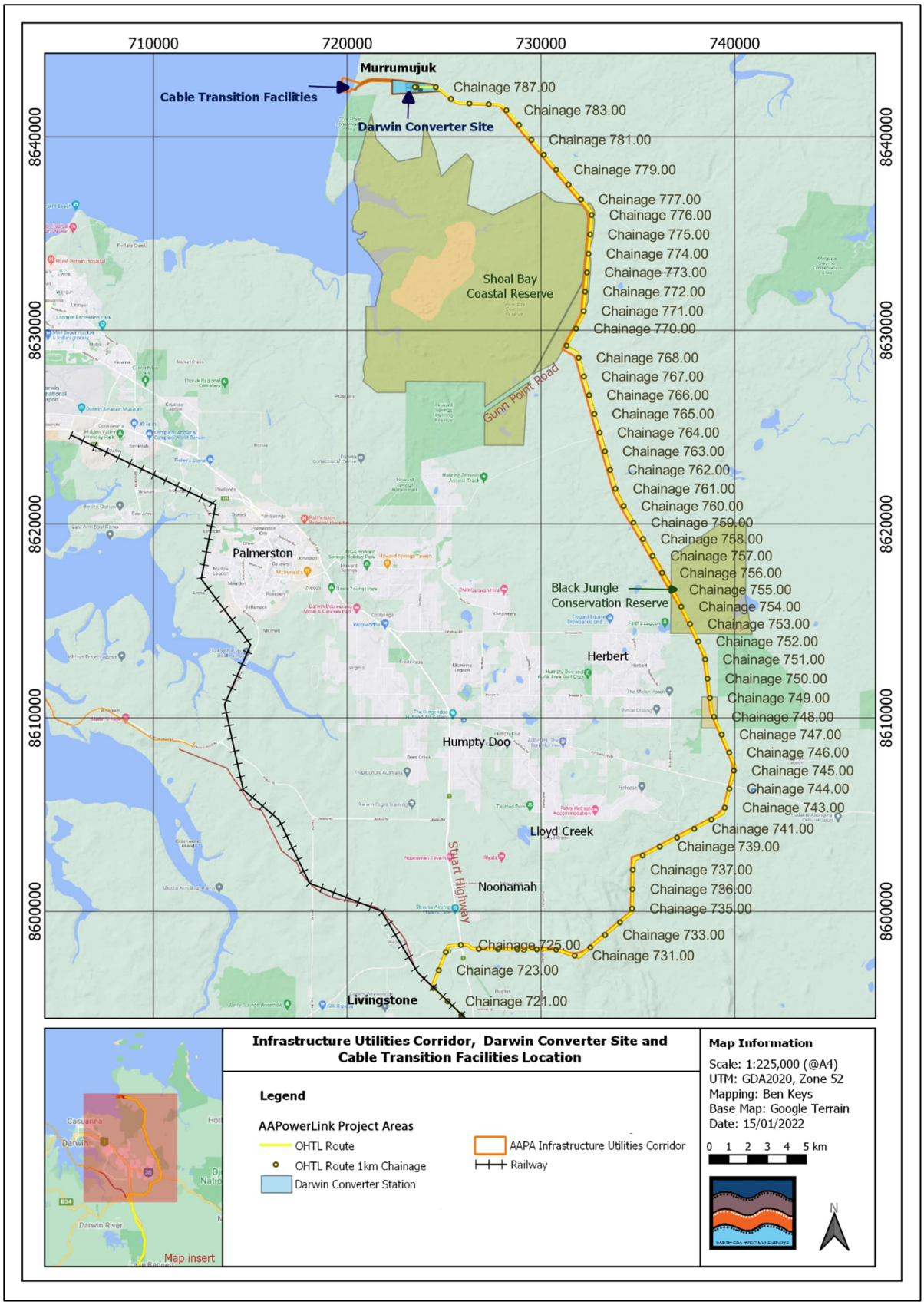

Figure 1: AAPowerLink Project Area location

The Darwin Converter Site is located at Murrumujuk, approximately 31km north-east of Darwin. The site is immediately to the south of the access road to Murrumujuk and Gunn Point Beach. The Darwin Converter Site and Cable Transition Facilities are located on Crown Land, which is subject to a Crown Lease in Perpetuity in favour of the NT Land Corporation.

Further Project description information is also outlined in the EIS' Chapter 2, Proposal Description.

The Project footprint was accessible via existing roads, pastoral tracks, fence lines and cross-country within the infrastructure corridor.

1.2.2 Native Title

No Native Title currently exists within the AAPowerLink Livingstone to Murrumujuk section of the OHTL, Darwin Converter Site or Cable Transition Facilities at Murrumujuk.

Notwithstanding this, it is acknowledged that the above Project Areas fall within the traditional lands of the Larrakia People who have occupied and used the lands surrounding Darwin since pre-European contact. The Wulna People of the Adelaide River floodplains also maintain traditional connections to some northern and western parts of the Infrastructure Corridor for hunting and gathering, ceremonial and recreational uses (Traditional Owner, personal communication, 2021). Similarly, the Tiwi People continue to have important customary use to the lands underlying the Project Areas at Murrumujuk.

Freehold tenure is held by Durduga Tree Point Aboriginal Association Inc. which formed Durduga Community, located 2.5km south of the Cable Transition Facilities at Murrumujuk. The Jampalampi Tiwi have a number of sacred sites, burial places and resource areas which extend along Gunn Peninsula (Traditional Owner, personal communication, 2021; see also Calnan, 2006).

1.3 Project Area Footprints

Construction of the AAPowerLink is projected to commence at Q1 2024 and take four to six years to complete. Network connection availability for the Northern Territory is to occur in 2026, with full supply to Singapore planned to be operational by the end of 2028. The Project will be constructed and commissioned in stages.

Table 1 below outlines the development footprint for the OHTL from Livingstone (Chainage 722) to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk.

Table 1: - Livingstone to Murrumujuk Construction Footprint

Project element & location	Component	Size/capacity (approximate)
OHTL - Livingstone to Murrumujuk (OHTL Chainage 722 to 788)	Access and maintenance corridor: The proposed easement width of the OHTL is 60m. On the ground, a 12m wide corridor will be required to house the OHTL structure foundations and an access track for inspection and maintenance activities through the life of the asset.	66km(l) x 12m(w)
	OHTL Pole/Tower locations: The OHTL will consist of segmented steel poles approximately 43m to 56m in height and spaced at a minimum of 200m (up to 450m) apart. Temporary construction pads of up to 60m wide by 100m long, will be established at each pole/tower location to provide space for laydown of materials, installation of foundations and assembly of the structures.	60m(w) x 100m(l) @ 200m/400m spacing x 66km.

Project element & location	Component	Size/capacity (approximate)
	A 12m x 6m pad will be retained around each structure for operational access and maintenance. In addition to the OHTL poles, an underground or overhead optic fibre link will be developed for the length of the OHTL. Up to six cables in total will be installed to accommodate the demand requirements of the AAPowerLink system.	
Darwin Converter Site	Darwin Converter Site is proposed to be situated on a 124ha site located at Murrumujuk. Within the site, approximately 55ha of land will be developed in stages.	55ha
Cable Transition Facilities	Underground Cable Corridor: Power leaving the Darwin Converter Site enroute to Singapore, will be transferred by underground HVDC cables to the Land Sea Joint Station (LSJ) via an Underground Cable Corridor approximately 2.7km long and 35m wide	2.7km(l) x 70m(w)
	Land Sea Joint Station: The LSJ Station will be a fenced 1ha site located approximately 300m inland from the beach near the junction of the access tracks to the adjacent beach and Tree Point Conservation Reserve. The LSJ Station will house multiple LSJ Bays, one for each cable excavated to dimensions of approximately 20 x 5m, to physically connect the onshore cables to the offshore cables.	2ha
	Shore Crossing Site: The Shore Crossing Site is where the subsea cables will be winched from a barge located offshore to the LSJ Station. For each cable, an open trench will be dug from the LSJ Station across the shoreline out to the low water mark. The construction corridor from the LSJ station, out to Shoal Bay will be 500m wide and approximately 500m long. Within the corridor an approximately 2m wide and 0.5 – 2m deep trench will be excavated for each cable.	500m(l) x 500m(w)

1.4 Consultation

Sun Cable has an Indigenous engagement and participation approach to developing the AAPowerLink Project, including works within the Livingstone section of the OHTL, Darwin Converter Site and Cable Transition Facilities. This has also included the internal engagement of an Aboriginal Affairs Manager and Aboriginal Engagement Manager, who liaise directly with the Northern Land Council (NLC), Tiwi Land Council and Traditional Owners.

As outlined in Table 2 below, Sun Cable have undertaken regular consultation with the NLC, AAPA and Traditional Owners that have included discussions related specifically to cultural heritage management. Consultation is aimed to continue for the life of the Project.

Table 2: AAPL Consultation Register for the Livingstone to Murrumujuk Project Areas

Date	Meeting Location / Stakeholder	Discussion / Agenda Summary
October 2020	Darwin/NLC	General Project discussions and Native Title. Potential role of cultural monitors to accompany project staff visiting their country.
20/05/2021	Darwin/ Larrakia Development Corporation (LDC)	Project Introduction. Discussion of potential Project opportunities
27/05/2021	Darwin CBD/ Larrakia Custodian	Discussion of Project and traditional ownership Project Areas.
29/05/2021	Palmerston/ Larrakia Custodian	Engagement with Larrakia directly important. NTG Corridor clearance surveys and site visits with Senior people. Black Jungle ILUA signatory.
July-August 2021	Phone/Email/ Wulna Senior Custodian	Various attempts to contact via email & phone. Consultation postponed until Q1/2022 as advised wet season is best to consult with Senior Custodian due to business commitments.
22/07/2021	Darwin/ Larrakia Development Corporation (LDC)	Project overview EIS pre lodgement meeting Discussion on opportunities to avoid sites and areas of significance. LDC highlighted Larrakia recreational use of Murrumujuk Discussions on Black Jungle Conservation Reserve.
07/08/2021	Palmerston/ Representatives of Durduga Tree Point Aboriginal Association Inc'	The area / zoned for development is away from conservation areas. Working with AAPA Site access for traditional land use and Tree Point access.
20/08/2021	Darwin/ Larrakia Nation Aboriginal Corporation (LNAC)	EIS variation briefing. Employment opportunities for Larrakia
9/09/2021	Noonamah/ Larrakia Rangers, Custodians – also Wulna decent	General Stakeholder presentation presented and discussed: Land clearing Dreaming near Murrumujuk Dolphins - Dr Carol Palmer expert Darwin Harbour research - nursing in the wet season @ Shoal Bay NT Land Corporation and historical issues Opportunities: Aspirations to manage land - consider joint land management Larrakia, Wulna and Tiwi
13/09/2021	TLC Office Darwin/ Mantiyupwi Clan Group (Darwin)	Project overview and proposal locations. AAPA and Cultural Heritage Management processes. Consultation on general matters for this area.
16/09/2021	Murrumujuk/ Tiwi Custodians	Discussion and field visit to Murrumujuk Project Areas. Rerecorded sites on NTG Archaeological Database and surveyed critical sections of the Darwin Converter Site and the Cable Transition Facilities to ensure known burials were outside these areas.
9/9/21 - 17/9/21	Infrastructure Corridor/ Larrakia Custodians, Rangers: also Wulna decent	Traditional Owners assisted with cultural heritage surveys of all accessible sections of the Livingstone to Murrumujuk Infrastructure Corridor.
23/09/2021	Tiwi Islands/ Mantiyupwi Clan Group (Darwin)	AAPA and Cultural Heritage Management processes. Consultation on matters for this area.
Ongoing 2021	Darwin/AAPA	Discussions on the Sacred Sites assessments and Authority Certificates.
25/02/2022	Darwin/Senior Traditional Owner	Discussions on Dog dreaming Spitfire swamp

1.4.1 Cultural Heritage Field Team

The Larrakia cultural heritage survey team representatives were nominated by Larrakia Nation Aboriginal Corporation (Larrakia Rangers) and through consultation with Traditional Owners. The two Larrakia People monitors included:

- Donna Jackson (Larrakia Senior Consultant)
    - Donna has more than 25 years undertaking cultural heritage assessments and research across Larrakia Country. She also provides cross cultural training to industry and was previously engaged as the Ranger Manager and Senior Ranger for Larrakia Nation Aboriginal Corporation.
- Aleana Talbert (Larrakia Ranger)
    - Aleana has been engaged as a Ranger with Larrakia Nation Aboriginal Corporation for more than 10 years, with the Murrumujuk area being a key part of their focus in the past. She has a strong cultural heritage background having also participated in cultural heritage activities and workshops during her time as a Ranger.

Both Larrakia representatives also identified as having shared descendance with Wulna People.

Tiwi People representatives were nominated by the Tiwi Land Council in consultation with Traditional Owners. The two Tiwi People monitors included:

- Philip Patlas (Senior Traditional Owner)
- Rachael Woody (Senior Traditional Owner)
    - Rachael and Philip are a Senior Tiwi Traditional Owners with a strong knowledge of cultural heritage features, Sacred Sites, resource areas and burial sites with the Murrumujuk area. They have visited and utilised the resources of Murrumujuk and the surrounding areas for much of their life.

During their field time, all four Traditional Owners provided cultural heritage significance information and advice regarding the appropriate management of cultural heritage features identified during the study under the governance of Traditional Law and knowledge.

1.5 Acknowledgements

Earthsea would like to acknowledge the assistance of the NT Heritage Branch (Department of Tourism, Sport and Culture) with their assistance in supplying background documents and reports for the AAPowerLink Project.

Earthsea would also like to acknowledge the assistance of Sun Cable, Larrakia Nation and Tiwi Land Council in facilitating field teams. Similarly, Earthsea wishes to extend sincere gratitude to the Traditional Owner field team for openly sharing sensitive information to assist in the management of culturally significant features.

1.6 The Authors

Principal Archaeologist: Ben Keys

Ben holds a Bachelor of Archaeology with Honours from Flinders University, South Australia. He has extensive experience in cultural heritage management and community consultation, coupled with the management of largescale developments such as mining projects in the Northern Territory. Ben also has a professional background in land access management and aspects of environmental management, including compliance. He has been a co-author of several published academic archaeological journal articles and has been invited to speak at mining industry conferences in the Northern Territory.

Principal Archaeologist: Richard Woolfe

Richard holds a Bachelor of Archaeology from the University of New England, a Grad Dip in GIS and Geomatics from Charles Darwin University and a Masters in Heritage Management and GIS from the University of New England. Richard has 19 years' experience in cultural heritage management consultancy in the Northern Territory and Queensland. Richard also has extensive experience in community consultation with Aboriginal groups and the wider community. Richard conducted the 2002-2003 review of the NT Heritage Conservation Act 1991 and co-drafted the original instructions for the *NT Heritage Act 2011*.

2 Legislative Context

2.1 Statutory Considerations

Northern Australia has a rich Indigenous cultural environment which includes a long history of human occupation and land use spanning at least at least 65,000 years (Clarkson et al. 2017) and a recent past of that includes contact with European explorers, settlers, miners and pastoralists from the 1820s onwards.

The significance of this material and cultural record varies substantially, depending upon one or a combination of its aesthetic, historic, scientific, social or spiritual values for past, present or future generations (Australia ICOMOS Burra Charter 2013). Through time, these values can change or be impacted upon by both natural mechanisms and human intervention. To ensure impacts to the potential cultural heritage values of a place or object are understood, protected or managed accordingly, in addition to Law, a range of Territory and Commonwealth legislation exists.

Legislation has occurred at the state, territory, and national level. This is the result of the evolution of the Australian constitutional framework, particularly the inclusion of new themes, such as Aboriginality, heritage and the environment into an existing regulatory framework. The result of this developmental change is that the Commonwealth retains responsibility for Indigenous issues, while the States and Territories retain control of land use and development approvals. Therefore, both Commonwealth and the Northern Territory Acts may apply in particular circumstances within the Northern Territory.

The following Sections are provided so that there is a robust understanding of the legislative framework which may pertain to heritage matters within the Project Areas.

2.1.1 Commonwealth Legislation:

***Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA).** This Act changed Aboriginal reserves within the Northern Territory to freehold title held in trust. The ALRA mandated the formation of Land Councils to act in the interests of Northern Territory Aboriginal people in the areas of land, access to lands, employment and the development of businesses. The ALRA also defined Sacred Sites as 'sites that are sacred, or otherwise significant, in the Aboriginal Tradition'. The ALRA protected these sites from damage, whether accidental or intentional.

The *NT Aboriginal Sacred Sites Act 1989* uses this definition of sacred in its purpose of protecting these sites outside of Land Trust lands. On Crown Lands or leaseholds, where the Livingstone section of the OHTL, Darwin Converter Site and Cable Transition Facilities are located, the general process is for the AAPA to conduct the Sacred Site surveys with the relevant Site Custodians, then issue an Authority Certificate under the *NT Aboriginal Sacred Sites Act 1989*.

***Native Title Act 1993* (NTA).** Native Title is "the communal, group or individual rights and interests of Aboriginal people and Torres Strait Islander people in relation to land and waters, possessed under traditional law and custom, by which those people have a connection with an area which is recognised under Australian law" (s 223 NTA) (National Native Title Tribunal 2016). The NTA establishes the processes to determine where native title exists, how future acts impacting upon native title land may be undertaken, and to provide compensation where future acts extinguish or are inconsistent with the existence or exercise of native title. The NTA gives Indigenous Australians who hold native title

rights and interests (including native title claims) the right to access and use traditional lands, be consulted and, in some cases, to participate in decisions about activities proposed to be undertaken on the land.

No Native Title currently exists within the AAPowerLink Livingstone to Murrumujuk section of the OHTL, Darwin Converter Site or Cable Transition Facilities at Murrumujuk.

***Aboriginal and Torres Strait Islander Heritage Protection Act 1984*.** This Act is intended as a last resort defence for significant sites, meaning that the Act is meant to provide emergency protection for Aboriginal and Torres Strait Islander heritage sites when all other avenues have been exhausted. Generally, an Aboriginal person or group of persons, must apply to the Minister to have protective covenants placed over an area or site (DAWE 2022). The power to provide such protection resides in Section 51 of the Constitution giving the Commonwealth powers on Aboriginal issues. Therefore, this Act may override all State and Territory cultural heritage acts.

To the knowledge of the Consultants, there are no known applications under this Act for any areas or features within the AAPowerLink Livingstone to Murrumujuk section of the OHTL, Darwin Converter Site or Cable Transition Facilities at Murrumujuk.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) commenced on 16 July 2000 with heritage amendments coming into effect on 1 January 2004. The EPBC provides for a National Heritage List of natural, historic and Indigenous places that are of outstanding significance to the nation. The EPBC also provides for a Commonwealth List that includes natural, historic and Indigenous places of significance that are owned or controlled by the Commonwealth. Ownership or control of these places allows the Commonwealth to protect or manage these places according to the significance of the place.

The Commonwealth Department of Agriculture, Water and the Environment administers the EPBC, including administration of the heritage lists and providing support to the Australian Heritage Council established under the *Australian Heritage Council Act 2003*. The Department maintains the Australian Heritage Database which includes places on both Commonwealth lists, all places on state registers and other places included in the former Register of the National Estate established in 1976.

2.1.2 Northern Territory Legislation:

***Aboriginal Sacred Sites Act 1989*.** The *NT Aboriginal Sacred Sites Act 1989* was enacted to complement the ALRA. Like the ALRA, the *Aboriginal Sacred Sites Act* protects sites that are 'sacred and otherwise of significance in the Aboriginal Tradition'. Sacred Sites are protected whether the location of the sites are known or not by any person or company seeking to do work on lands.

The *Aboriginal Sacred Sites Act* is administered by the Aboriginal Areas Protection Authority (AAPA). AAPA can issue an Authority Certificate indemnifying any proponent for an area upon application and payment of a fee. The Authority Certificate will contain conditions limiting or preventing works in and around registered and recorded Sacred Sites. The Authority Certificate will contain maps outlining any restricted work areas in the area of application.

A survey is usually undertaken by a representative of AAPA in order to ascertain the views of the Site Custodians for the subject land. A Site Custodian is an Indigenous person who has special responsibility for an area and may or may not be a local Traditional Owner or Indigenous Elder.

***Heritage Act 2011*.** The NT *Heritage Act* came into effect on 1 October 2012. The *Heritage Act* provides protection for the same classes of places as the previous *NT Heritage Conservation Act 1991*, with some changes. As under the previous Act, members of the community can nominate areas, places, sites, buildings, shipwrecks and heritage objects to the register. If the Minister agrees that these features are of special significance to the heritage of the NT, the place is added to the register and receives statutory protection. The *Heritage Act* allows for processes to approve works and maintenance for a heritage place.

The *Heritage Act* provides a 'blanket' or 'presumptive' protection for Aboriginal and Macassan archaeological places and objects until a decision by the Chief Executive of the Department of Tourism and Culture (or their delegate for smaller sites) is made to either permanently protect these places or permit their disturbance or destruction. This decision-making process is triggered by an *Application to Carry Out Work on a Heritage Place or Object*. A permit will generally only be issued if consultation with the relevant Traditional Owners or Custodians of the sites or their representatives has occurred. There are penalties for accidental or deliberate destruction of these sites.

2.2 Regulatory Organisations

Northern Land Council (NLC). The NLC is an independent statutory authority of the Commonwealth responsible under the ALRA and *Native Title Act* for assisting Aboriginal peoples in the Top End to acquire and manage their traditional lands and seas. This includes assisting in Land Rights and Native Title Claims, managing traditional lands and protecting sites of significance in the Aboriginal Tradition. The NLC is also responsible for promoting the economic interests of Aboriginal peoples in the Top End. They do this by advocating for Traditional Owners interests in the development of resources on Land Trust and Native Title lands.

Aboriginal Areas Protection Authority (AAPA). The AAPA is an independent statutory authority established under the *Northern Territory Aboriginal Sacred Sites Act 1989*. The Authority is responsible for the protection of Aboriginal sacred sites on land and sea across the Northern Territory. The AAPA seeks to implement a practical balance between sacred site protection and economic development.

Heritage Branch, NT Department of Families, Housing and Communities. Heritage Branch is the regulatory authority responsible for administering most sections of the NT *Heritage Act 2011*. Heritage Branch is also responsible for administering the NT Heritage Register, the NT Archaeological Database and providing logistical support for the NT Heritage Council.

2.3 Heritage and Sacred Site Register Searches

2.3.1 Northern Territory Heritage Registers

Heritage Register Database

As presented in Figure 2 below, a search of the NT Heritage Register notes that three Declared Heritage places are located within 500m of the AAPowerLink OHTL corridor between Chainage 724 and 726. These Declarations include the following features:

1. **WWII Noonamah Cricket Pitch & Oval.** Gazetted on 21 November 2007.
   - Distance to AAPowerLink OHTL corridor: 110m
2. **WWII Noonamah Railway Siding and Store Depot.** Gazetted on 21 November 2007.

- Distance to AAPowerLink OHTL corridor: 318m

3. **WWII Strauss Anti-Aircraft Gun Emplacement.** Gazetted on 26 September 2007.
    - Distance to AAPowerLink OHTL corridor: 485m

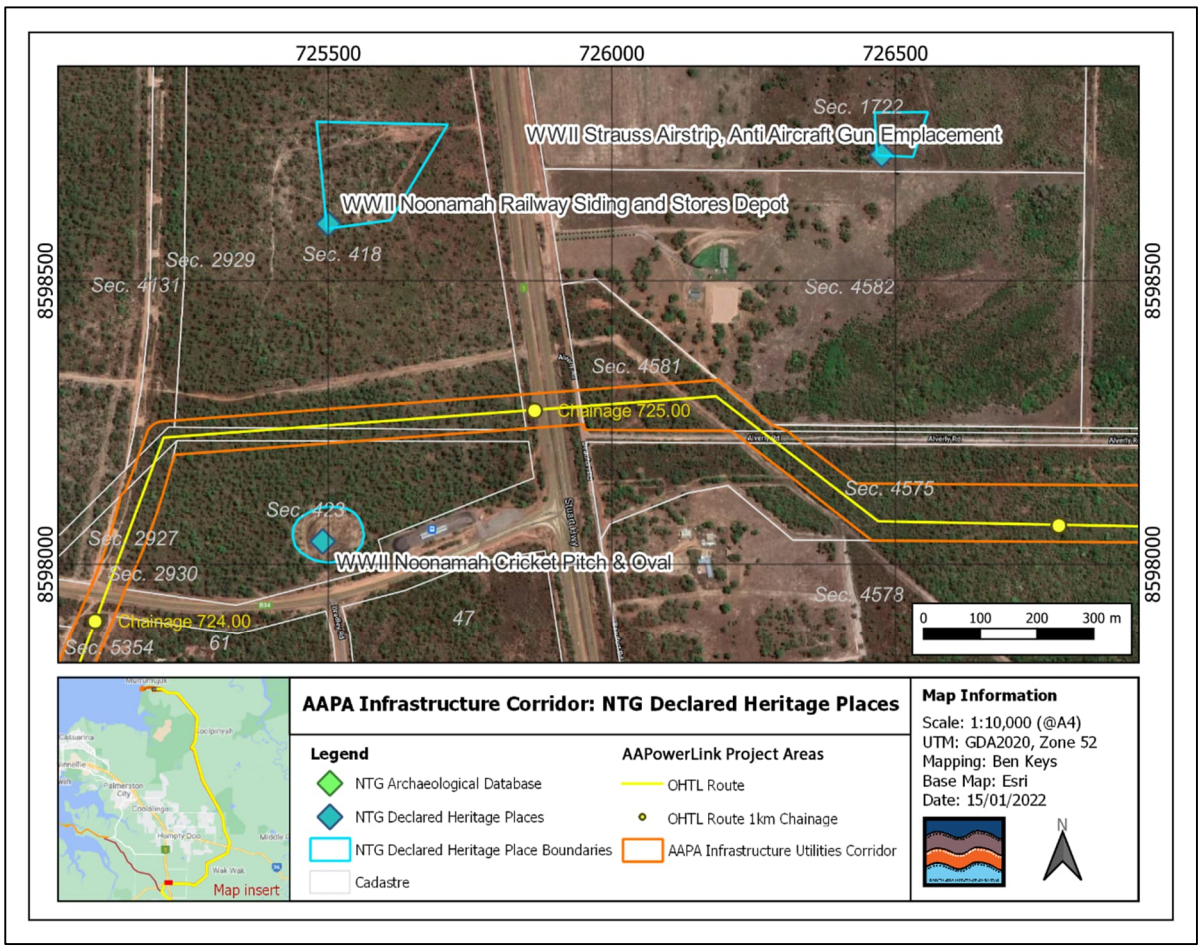

Figure 2: NTG Declared Heritage places adjacent to the AAPowerLink Infrastructure Corridor.

Archaeological Site Databases

As presented in Figure 3 below, the NT Archaeological Site Database maintained by the Heritage Branch, NT Department of Families, Housing and Communities, records two known archaeological sites within the proposal AAPowerLink Land Sea Jointing Station (LSJ Station), Cable Transition Facilities footprint at Murrumujuk. Another archaeological site is recorded as being located approx. 330m to the north of the same area. These sites include the following features:

1. **Shoal Bay 1**. Shell scatter and isolated artefacts.
    a. Distance to AAPowerLink Infrastructure Corridor: Within proposed corridor.
2. **Shoal Bay 2.** Shell scatter
    a. Distance to AAPowerLink OHTL corridor: 330m
3. **Shoal Bay 3.** Shell scatter
    a. Distance to AAPowerLink Infrastructure Corridor: Within proposed corridor.

The absence of records on the NT Archaeological Site Database does not necessarily reflect the lack of archaeological sites within the area, but rather a lack of archaeological survey.

This figure has been removed to respect and protect the cultural sensitivities of the area following consultation with Traditional Owners.

Figure 3: NTG Archaeological Database features, AAPowerLink Cable Transition Facilities

2.3.2 Aboriginal Sacred Sites Register

An Aboriginal Areas Protection Authority (AAPA) Abstract of Records was provided on 29 July 2021 for the AAPowerLink Darwin Converter Site and Cable Transition Facilities footprint at Murrumujuk (See Appendix 1).

The Abstract shows a number of Registered and Recorded sacred sites are located proximal to AAPowerLink Infrastructure Corridor, however none lie within the proposal footprint.

It should be noted that an Abstract of Records is not an exhaustive list of sacred sites in the area. There may be other sacred sites in the parcel of land of which the Authority is not yet aware which would be identified through the Authority Certificate process.

Sun Cable have lodged AAPA Authority Certificates for the Darwin Converter Site and Cable Transition Facilities footprint at Murrumujuk and are working with the AAPA and the NLC for Authority Certificates and Sacred Site Surveys, covering all AAPowerLink Project Areas.

2.3.3 Commonwealth Registers

A search of the Australian National Heritage Database and Commonwealth Heritage List notes there are no registered sites within or proximal to the AAPowerLink Infrastructure Corridor.

3 Physical and Environmental Setting

Understanding the cultural associations and significance of Country is critical for the management of features with tangible and intangible values that may be otherwise impacted by developments. Archaeologically, understanding the environmental context of a region is also vitally important when analysing past human settlement behaviour through interpreting archaeological features and site patterns.

Geomorphology, geology and hydrological variations, coupled with past land use practices can heavily influence the types of archaeological materials found, their condition, distribution patterns and predictability within a given land system. From a survey methodological perspective, these environmental factors may also obscure the visibility of the archaeological record and thus reduce the effectiveness of the surveyor's ability to identify a site, its contents or extent.

The following section outlines the environmental and physical background for the proposal footprint and surrounding areas to develop an understanding of the relationship between the environmental setting and archaeological resources recorded during the survey. This in turn may contribute to developing robust archaeological predictive models for the broader area. For additional environmental information refer to EIS Chapter 4, Terrestrial Environmental Quality.

3.1 Climate

The Livingstone to Murrumujuk section of the Project Area is located entirely within the humid zone. While the climate varies within this zone, it is distinctly dominated by a monsoonal wet season from November to April and a dry season from May to October.

The climate of the northern portion of the OHTL (along the Infrastructure Utilities Corridor), and the Darwin Converter Site and Cable Transition Facilities is represented by the Darwin Airport Bureau of Meteorology (BoM) weather station (BoM 2022). The long-term average annual rainfall, based on rainfall data from 1941 to 2022, is 1723.9 mm, and the average number of rainy days is 93.6 per year (BoM 2022). Rainfall can, however, be highly variable from year to year. For example, 1074mm was recorded in 2019 with 2197mm being recorded in 2017 (BoM 2022). Average rainfall and temperature data for Darwin Airport, sourced from BoM climate data, is displayed in Figure 4 below.

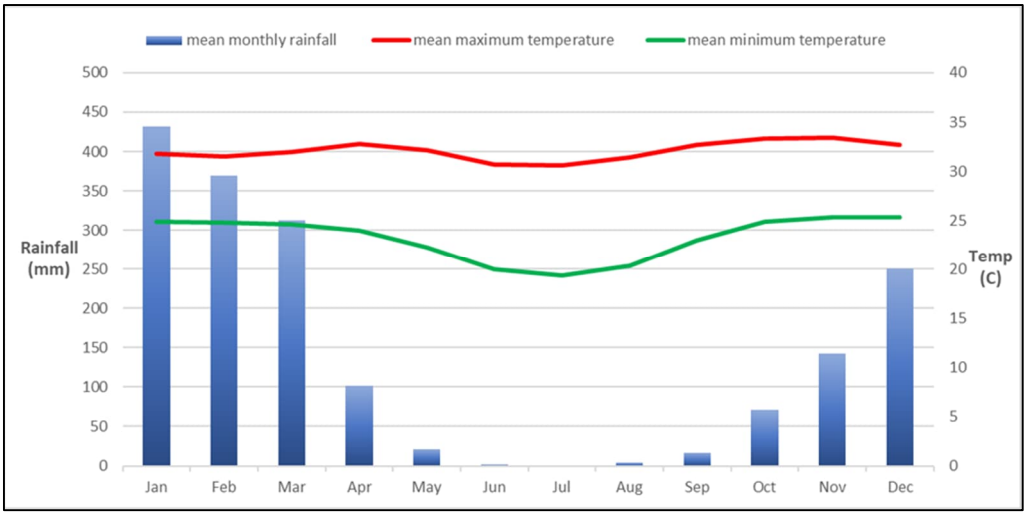

Figure 4: Mean monthly rainfall and temperature data for Livingstone to Murrumujuk Project Areas.

The coolest months are June/July, when the mean maximum temperature is approximately 30.7°C and the mean minimum temperature is approximately 20°C. Conversely the late spring months of October and November are hottest when mean maximum temperatures are 33.4°C and mean minimum temperatures are in the mid-20s.

3.2 Palaeoclimate

Local paleoclimate information is sparse. However, studies encompassing inland Australia and the Top End (Fitzsimmons et al. 2013; Hiscock & Wallis 2005; Megirian et al. 2002; Wyrwoll & Miller 2001; Reeves et al. 2013) offer a broad understanding of localised climatic conditions through time. These climate changes and the potential evidence of their remnant environmental influences were interpreted through the land systems information, hydrology, geomorphology, and satellite imagery across the Livingstone to Murrumujuk section of the Project Area. The assessment of these palaeoenvironmental features can assist to identify potential past Aboriginal occupation areas and archaeological features which may have persisted in the various land units through time, including those now obscured by sediments or other environmental features.

Climatic variability has increased in the Australasian region in the last few thousand years with northern Australia changing from low seasonality in the early Holocene to increased seasonality in the late Holocene (Brockwell et al. 2013). While there has been a trend towards increased aridity in the region in the late Holocene (Brockwell et al. 2013), the monsoon has had a varying influence on climate for at least 26,000 years. In nearby Litchfield National Park, Reynolds (2017) extracted a sediment core from Table-Top swamp and analysed a variety of palaeoenvironmental proxies through the core to reconstruct past conditions.

His study concluded that the monsoon was probably inactive until 26,000 years ago when very gradual monsoon strengthening commenced, as evidenced by the stable isotope and organic matter preservation records. Reynolds (2017) also stated that the greatest shift to increased monsoon strength occurred between about 10,000 to 8,500 years ago coinciding with flooding of the continental shelf and that maximum monsoon strength occurred at about 6,000 years ago, broadly coincident with the mid-Holocene sea-level high stand and peak southern hemisphere insolation.

This period of intense monsoonal conditions has been termed the 'Big Swamp Phase' (Brockwell et al. 2013), which also coincides with the first evidence of Aboriginal occupation of the current coastal plains. River and riparian systems responded differently throughout the 'Big Swamp Phase', with some like Darwin Harbour becoming deep-water embayments (Brockwell et al. 2013, p. 4), whilst others such as the Adelaide River formed vast mangrove swamps through the processes of sedimentation (see Figure 5 below). The high sedimentation rates and inundation during this period potentially suggest that much of the evidence of human occupation along these environmental zones may be buried or lost through erosion and inundation.

Following the 'Big Swamp Phase', evidence suggests sea level stabilised and extensive coastal plains formed via sedimentation and coastal progradation (Brockwell et al. 2013, p. 6). By 4000 BP the vast mangrove swamp retreated towards coastal fringe and riverbanks. From 4000 to 2000 BP, paleochannels formed with the continued sedimentation and the plains contained an abundance of riparian zones, both freshwater and estuarine. Excavated test pits around some inland billabongs have noted 3000-year-old cultural materials at depths of 70cm, which indicates the extent of continued

sedimentation in some areas. The majority of riparian features and plains present today were largely formed by 2000 BP.

In considering the above dynamics of past land system evolution, any recorded archaeological surface features may only reflect a recent and very small portion of the potential archaeological record. This notion is particularly likely within colluvial and alluvial land units where sedimentation has been greatest.

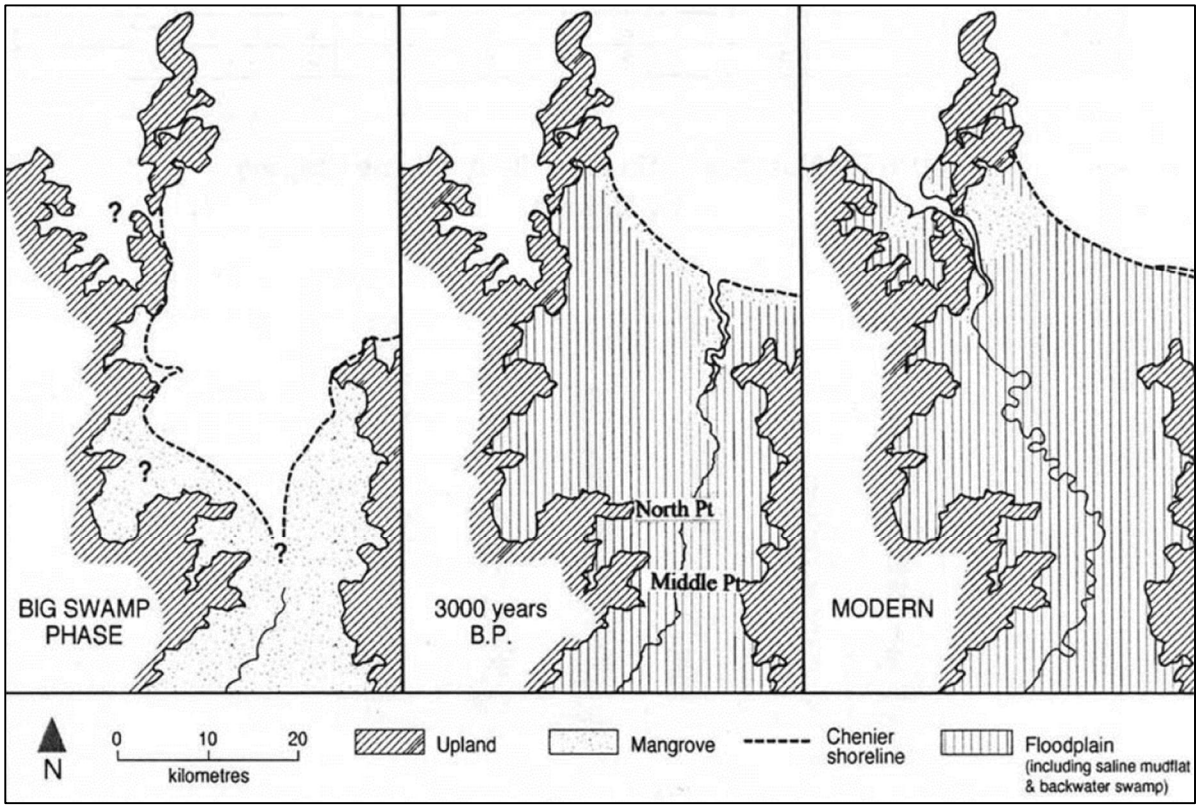

Figure 5: Developmental phases of the northern river floodplains (Brockwell et al. 2013, p. 6).

3.3 Hydrology and Environment

Previous archaeological studies undertaken by the consultants throughout the top-end of Australia have reported a high correlation between water and stone resources and the occurrence of 'open' archaeological site features (selected studies include: Earthsea Pty Ltd, 2019, 2018 a,b, 2017, 2016, 2007-2014, 2012, 2008). The size and type of the sites, in many cases, was reflected by the permanency of water and reliability of water networks.

The largest and more significant open sites were recorded where there were reliable water networks often coupled with substantial outcropping stone resources suitable for the manufacture of stone artefacts. It is also noted that some exceptions to the above observations have also been recorded, such as the location of ceremonial places located away from water and stone resources, and incidences of sites proximal to significant environmental resource zones rather than water permanency.

The Livingstone to Murrumujuk section of the proposed OHTL traverses several creeks, watercourses and swamp areas, many of which have permanent water (see Figure 6 below; refer also EIS Chapter 6, Hydrological Processes). The frequency of watercourse and drainage line crossings increases as the

OHTL moves north from the Solar Precinct towards Murrumujuk as the climate changes from arid to humid. Significant rainfall and flooding can occur during the wet season months (November to April) due to the monsoon driven weather events, such as cyclones.

At the Murrumujuk Cable Transition Facilities, a small watercourse is present on the southern side of the Infrastructure Corridor. This watercourse is likely fed through tidal inundation and sub-surface water draining south from a channel behind the beach foredune. A large ephemeral swamp is also located immediately to the south-west but outside of the Darwin Converter Site footprint.

These swamp, creek and river systems are culturally significant with traditional knowledge regarding their location and reliability being intensively handed down through successive generations. The watercourses and riparian areas have acted as important resource areas and corridors to cross country in the past and continue to be connected to Dreaming pathways and as food resource areas.

Subsistence strategies of Aboriginal peoples have always been a principal component of archaeological research. Northern Australia has been an important focus of ethnographic research on the subsistence strategies of Aboriginal groups. Ethno-historical accounts are heavily relied upon in explanations of past human behaviour (Meehan 1977, 1988; Schrire 1982). The following authors, Schrire (1982), Baker (1981), Meehan et al. (1985), Brockwell (1989) and Hodgson (1997) can provide more detailed descriptions of Aboriginal ecological ethnography.

The coastal habitats surrounding the Darwin Converter Site and Cable Transition Facilities remain as a diverse and ecologically rich interface between terrestrial and marine environments (Traditional Owners, personal communication, 2021). Murrumujuk Beach is a nursery environment, with shelter provided by fringing reefs and the mangroves communities from Gunn Point to Point Stephens.

The freshwater wetlands of Northern Australia are exceptionally diverse food resource areas. Wetland areas consist of creek systems, springs, black soil plains, swamps, sinkholes and lagoons. The black soil plains are seasonally inundated and are only accessible in the dry season. As the waters recede, wild rice (*Oryza rufipogon*) and the spike rush (*Eleocharis dulcis*) were utilised and several plants with edible tap roots or tubers are found on the plains (Jones 1980, p. 114; Brockwell 1989, p. 254) Goannas (*Varanus gouldii*) and long necked terrapins (*Chelodina* sp.) were hunted.

Freshwater areas attract large numbers of fauna, crocodiles, water snakes, turtles, fish and shellfish and waterfowl and terrestrial animals such as the agile wallaby (Finlayson et al. 1988). As these animals tend to congregate around diminishing water sources as the dry season moves on, this invariably presents easily caught prey (Jones 1980, p. 114; Jones and Bowler 1980, p. 18; Meehan 1988, p. 6; Brockwell 1989, p. 249). Plant resources, which were utilised in the wider region, include yams, water lilies from lagoons, fruits of the cycads, pandanus, *Terminalia* and *Eugenia* species and the shoots of young palms and bamboo (Dahl 1926, p. 17).

Baker (1981, p. 60) states that the ethnographic histories of Northern Australia stress the importance of plant foods in Aboriginal economies. Meehan et al. (1988) and Brockwell (1989) make these same inferences. *Seasonality* is the main ecological factor that is addressed by previous authors in their explanations of Aboriginal behaviour.

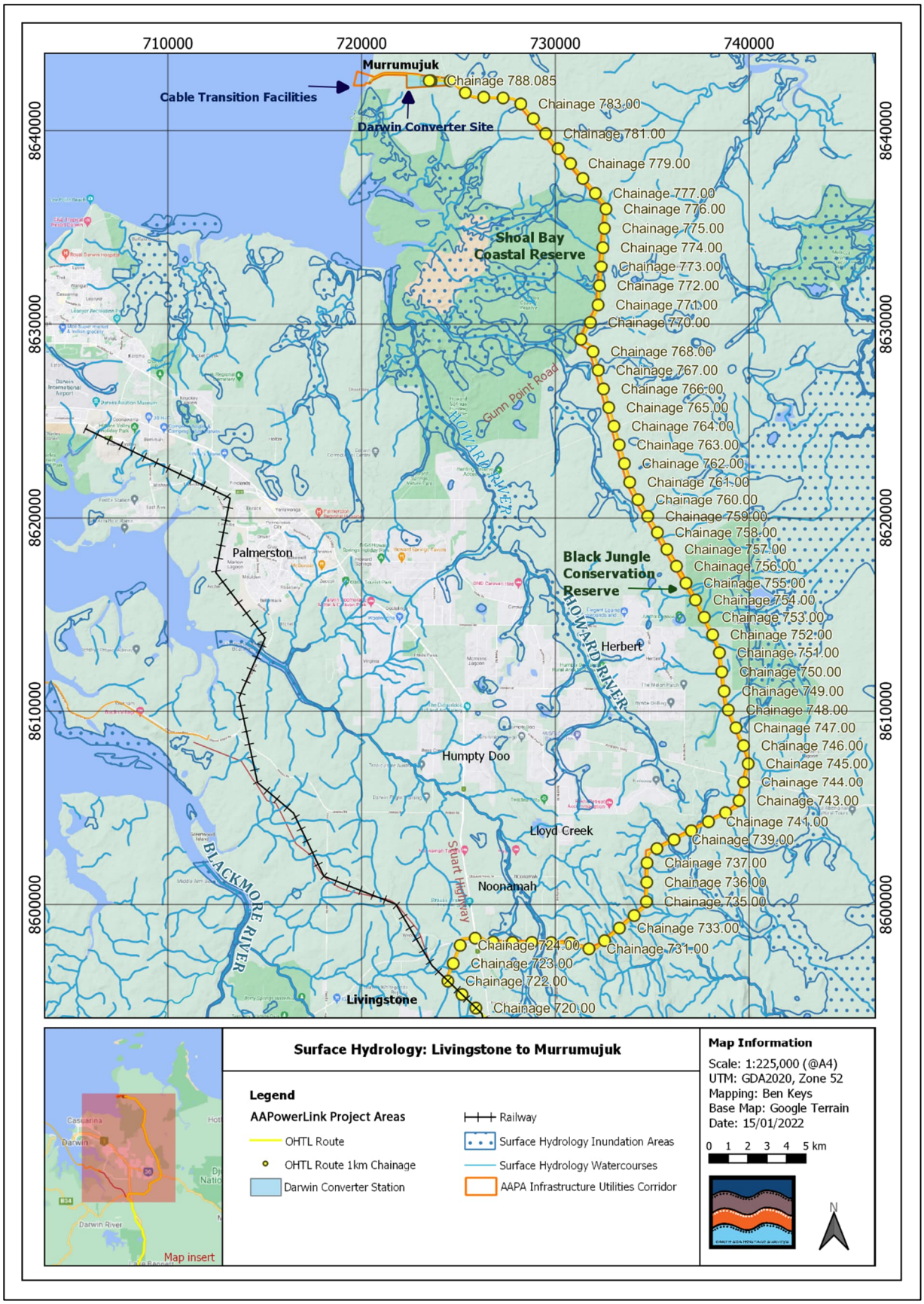

Figure 6: Surface Hydrology, Livingstone to Murrumujuk

3.4 Land System, Geology and Geomorphology

This study extensively uses land systems and geological land units to analyse variability within the regional archaeology of the Project Area. As outlined in the methodology, a sample system was developed based on the relative area of each land system within the area of interest, coupled with the ground visibility within that unit. These sample areas were then selectively distributed across the mapping area, targeting both land unit representativeness and areas known to have increased frequencies of archaeological sites such as watercourses and sinkholes.

This approach has the advantage that a large geographical area can be sampled using a relatively smaller number of criteria than would be possible if every vegetation type, landform or geomorphological feature were incorporated into the analysis. Some limitations of this approach can occur if considerable variability exists within each land system. However, this was not considered to be a significant constraint in the Livingstone to Murrumujuk Project Area.

Outcropping geology is included in this study as it is a useful indicator of the possible stone raw materials available within the project footprint. Outcrops of fine grained sedimentary and metamorphic rocks with isotropic and conchoidal fracture properties were utilised to manufacture flakes, points and other tools used for a variety of purposes. Fine to medium grained igneous rocks such as basalt and dolerites were used to manufacture flaked and ground edge stone axes. The flat surfaces on sand and siltstones were used to grind foods, sharpen implements and to produce rock art. Sandstone rock shelter surfaces were used for rock art of various types. Therefore, an understanding of the geology of a region is important in predicting the distribution of stone quarries, rock shelters, grinding surfaces and stone artefact scatters. Whilst a full geological assessment was not undertaken within project footprint, the below interpretations have been derived from field observations, coupled with regional outcropping geological information (see Figure 7 below).

The Darwin Converter Site, Cable Transition Facility and the most northern 47kms (i.e., north from Chainage 741) of the OHTL are located within the Money Shoal Basin geological region which is a pericratonic Basin extending from the northern coast of the Territory across the Tiwi Islands into the Timor and Arafura seas. South of Chainage 741, the remaining portion of the OHTL within the Livingstone section of the Project Area is located within the Pine Creek Orogen geological region which comprises variably deformed and metamorphosed Palaeoproterozoic metasedimentary and intrusive rocks and formations.

These broader geological regions are comprised of the eight geological units, with the most prolific throughout the Livingstone to Murrumujuk section of the Project Area being Quaternary sediments (silts, sands and clays), lateritic gravels and intact duricrust. These dominant units (Qcl, Czs, Czl, Kuw, Qa and Cz) are found within the Darwin Converter Site, Cable Transition Facility area down the OHTL to Chainage 735 and from Chainage 730 to 722. These are largely depositional formations having been heavily influenced from the paleoenvironmental conditions outlined in Section 3.2 Above.

In addition to the abovementioned, the Ppw and Ppa geological units are also present within the Livingstone to Murrumujuk section of the OHTL. Ppw is the Proterozoic Wildman Siltstone, which comprises a number of lithologies (e.g. fine quartzite, quartz, sandstone and dolomite) known to have exploited by Aboriginal for the manufacture of stone artefacts. The outcrop of Ppw within the OHTL corridor at Chainage 737, has largely been destroyed through past mining and extractive industries. A large area of Ppa occurs between Chainage 730 and Chainage 735. Ppa is the Proterozoic Acacia Gap Quartzite Member Geological Formation and comprises fine to medium quartzite, pyritic interbedded phyllite and silicified sandstone. Quartzite and sandstone, comparable to outcrops within the Ppa units were highly desirable source of raw material for flaked stone artefacts.

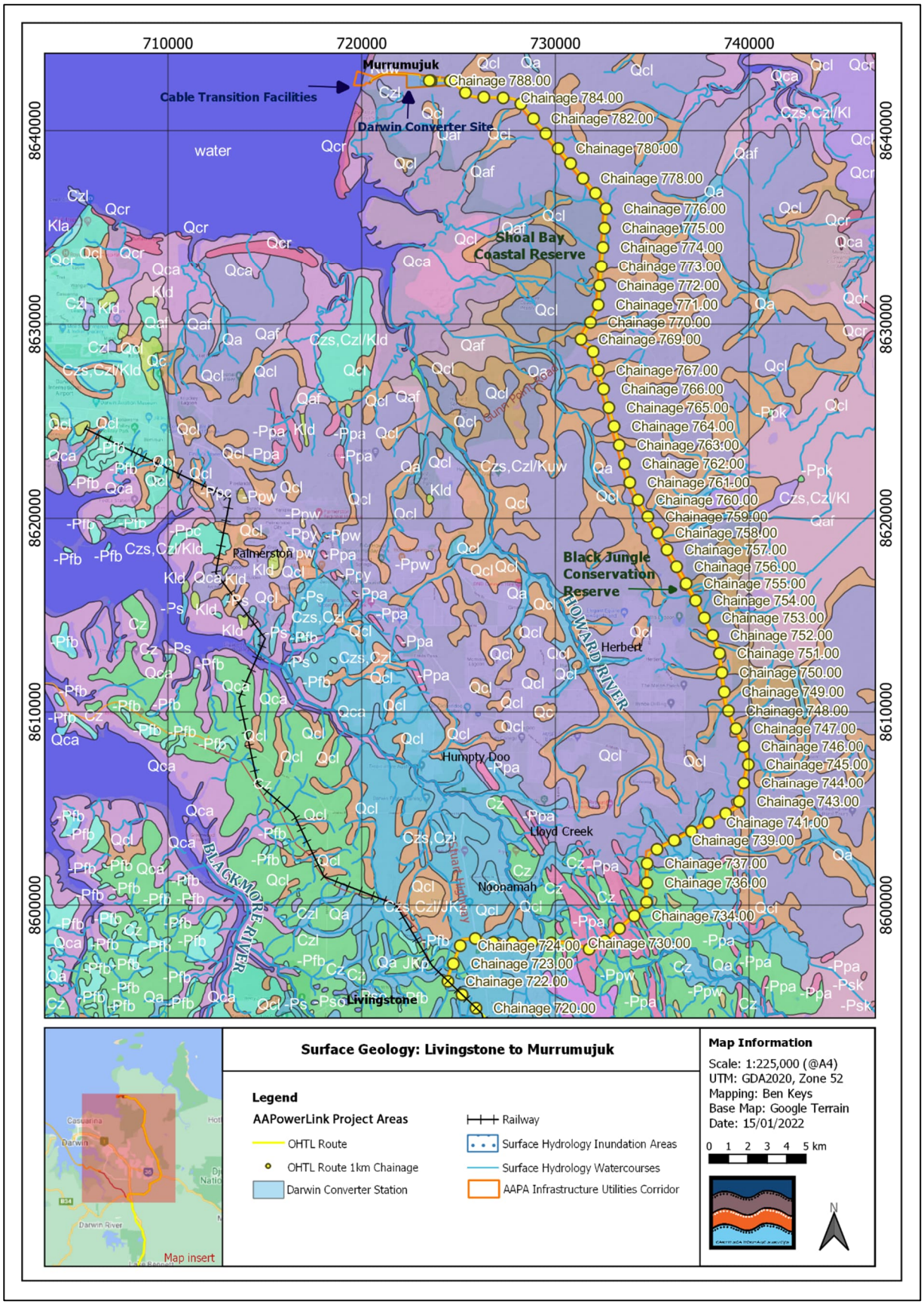

Figure 7: Surface Geology, Livingstone to Murrumujuk

3.5 Land Disturbance Factors

Land disturbance factors in the project footprint have made significant changes to the pre-contact environment, including:

1. Pastoral impacts. In brief, pastoral impacts within the Livingstone to Murrumujuk section of the Project Area and access corridor have been significant, with land cleared for property infrastructure, intensive grazing, stock watering infrastructure, fencing, permanent yards and changes to the traditional fire regimes. Early pastoral activities also had a significant impact on the traditional lifeways of Aboriginal People throughout Australia, including within the Project Area.

   Pastoral activities have occurred across the Northern Territory for over 150 years, after John McDouall Stuart's crossing of the country from Adelaide to Point Stuart, near Darwin, in 1861–62 (Stuart 1865).

2. Road and Railway construction and maintenance: The Project Area from approximately Chainage 722 to 724.5 overlies the old North Australian Railway (NAR) alignment, whilst in itself is significant, the related construction and maintenance works are likely to have heavily impacted any Aboriginal sites through this section.

   Similarly, the Project Areas north of 722 are also crossed by a number of gazetted roads, pastoral and mining access. Some of these roads have been rerouted, upgraded and maintained for more than 100 years. This disturbance tends to destroy or distort the archaeology in road and track corridors (i.e. gravel extraction from quarries then laid on road surfaces often contain artefacts from the extraction point).

3. Mining: Evidence of small extractive areas were noted throughout the Project Footprint from Livingstone to Murrumujuk, with borrow pits increasing in frequency in land units adjacent to public roads. Widespread mining and extractive industries are noted between Chainage 734 and 742 and underlying Chainage 763. These activities are likely to have destroyed or significantly impacted the preservation of archaeological features.

4. Enthusiasts and Collectors: Collectors, amateur ‘archaeologists’ and enthusiasts have sought out to selectively ‘collect’ components of the archaeological record throughout much of Australia. This has destroyed or skewed the remaining archaeological record in many instances, with items such as stone axes, grindstones, sacred items, and other tools being removed. Historic features and WWII sites have also been heavily impacted by collectors and enthusiasts across the Top End.

5. Recreational Users: The Livingstone to Murrumujuk section of the Project Area surrounds the most densely populated part of the Northern Territory. This increased urban development, and a larger population has likely led to people creating more access to areas and potentially disrupting the integrity of the archaeological record through the creation of vehicle tracks and changed fire regimens.

   This is particularly visible at Murrumujuk, where recreational visitors have significantly impacted the archaeologically sensitive beach zones with 4WDs and camping. The intensity and unregulated nature of visits has caused widespread erosions of tracks, severe fires and left a

proliferation of rubbish throughout the beach area. Indirectly, the archaeological record has also likely been impacted by curiosity of visitors taking ‘souvenirs’.

6. Invasive species such as cattle, water buffalo, horses and pigs disturb watercourses, introduce weed species and induce erosion in native environments. These factors impact on archaeological sites in several ways:

    a. Watercourses: Site and artefact densities generally increase closer to water bodies. Erosion of creek margins can impact on site integrity. Sub-surface sites are often discovered due to erosion caused by cattle and feral animals.

    b. Weeds: Change fire regimes and can sometimes change the composition of native vegetation.

    c. Introduced animals (including cattle) change the landscape by physical impact including wallows, nesting, pads, rooting and destabilisation of creek banks. This in turn promotes erosion and redisposition of sediment along creek lines. These impact on archaeological sites by either erosion or aggrading of artefact horizons making dating and accurate recording of sites difficult.

4 Archaeological and Historical Background

4.1 Ethnographic Background

The Larrakia language group are recognised as the Traditional Owners of the Darwin region, however it is also acknowledged that the Wulna People of the Adelaide River floodplains also maintain traditional connections to some northern and western parts of the Infrastructure Corridor for hunting and gathering, ceremonial and recreational uses (Traditional Owner, personal communication, 2021). Similarly, the Tiwi People also continue to have important customary use to the lands underlying the Project Areas at Murrumujuk, having traditionally travelled between Gunn Point Peninsula and the Tiwi Islands via the Vernon Islands on canoes (Traditional Owner, personal communication, 2021).

Larrakia people were present during the 'discovery' of Port Darwin and during the settlement and expansion of the town. Larrakia cultural and archaeological sites, were, and still are, located throughout the Darwin city region and around Darwin Harbour. The archaeology of Darwin Harbour and Shoal Bay provides evidence of complex adaptations and occupation by Aboriginal people on the margins of the present tropical savannah zone over the last 4,000 years. It is likely that the arrival of people into the Darwin region occurred well before this time, with occupation of areas 300km to the east extending back at least 65,000 years (Clarkson et al. 2017).

According to the long history of occupation, sites significant to the Larrakia, Wulna and Tiwi People within the wider Darwin and Murrumujuk regions include, but are not limited to:

- Dreaming and other sacred sites.
- Archaeological sites e.g. stone artefact scatters, quarries, shell middens, contact sites, occupation sites and rock art. There are more than 200 shell midden sites in the Shoal Bay area, 3.5km south of the Darwin Converter Site.
- Burial sites. Several Tiwi burial sites are noted along Gunn Peninsular, outside the AAPowerLink Project Areas.
- Sites important for historical reasons.
- Sites with culturally significant resources.

Parkhouse, the paymaster of South Australian railways at Port Darwin for some years, wrote "The territory of the Larrakia, in which Port Darwin is situated, embraces the seaboard from Shoal Bay to Southport, and extends inland to the forty-sixth mile on the railway line" (Parkhouse 1895, p. 638). He noted that the Larrakia were closely allied and intermarried with the Wulna people occupying the territory to the east and west of Adelaide River. Similarly, Goyder in the 1860s recognised that his surveys through the same areas transected the traditional lands of the Larrakia and Wulna (Woolna) People.

In the early days of European settlement ethno-historical documents describe the Larrakia as heavily dependent on fish, crabs and shellfish (Basedow 1907; Foelsche 1882). Fish and crabs were procured from reef pools or from constructed fish stone or wood traps using the tides, or from rivers, creeks and waterholes by spearing, netting or using certain poisonous barks or leaves to stupefy the fish (Basedow 1907, p. 23; 1925; Foelsche 1882). Dugout canoes were used for fishing and hunting of dugong and turtles (Basedow 1907, pp. 22-25; 1925 pp. 131,162-4), and bark and dugout canoes used to transport items such as turtles and shellfish (King 1969, p. 89).

The ethnographic and historical accounts reveal a rich material culture and ceremonial life practiced by the Larrakia and neighbouring groups (Basedow 1907; 1925 pp. 248-382; Foelsche 1882, pp. 4-7; 1886, p. 255; Parkhouse 1895). A variety of ceremonies were held to celebrate gatherings and battles with neighbouring groups, initiation of the young and funerals (Foelsche 1882, pp. 4-7; Spencer 1912, p. 19). The anthropologist Ronald Berndt (1951, p. 234) described the cyclical seasonal ritual and ceremonies such as the Kunapipi which were performed by NT groups including the Larrakia, in order to ensure continuation of the human species and a constant supply of food. Large quantities of food were required to feed people gathered for ceremonies. Major camping places were usually found where there were permanent sources of fresh water. Kangaroos and wallabies could be ambushed along well-used paths to waterholes, and ducks, geese and other birds, along with swamp plants such as waterlilies, could be obtained (Basedow 1907, pp. 19-27; Foelsche 1882, pp. 12-14).

Material culture objects obtained from Aboriginal locals at Port Darwin in the early years of the European settlement demonstrates extensive use of natural resources. Much of the material culture consisted of perishable items, such as body ornaments made of reed beads, feathers, bark or fur, bamboo and reed spears, nets and bags and wood implements (Basedow 1907, pp. 31-39; Foelsche 1882; Kerr 1971, p. 111). The most visible remains of subsistence and settlement activities in the region likely to be preserved in the archaeological record are mounds of shell. Preserved within these deposits are likely to be the skeletal remains of other animals that were exploited such as fish, crab, kangaroo, wallaby, snake and bird.

Other items of material culture likely to be preserved in the archaeological record include stone spear heads and knives, stone axes, stone pestles (pounding stones) and grinding stones (mortars), hearths made from stone or lumps of termite nests, and stone or shell tools used for cutting or scraping (Foelsche 1882; Basedow 1907). Reports describe Aboriginal people along the NT coast, including Larrakia, using heated stones and termite nest material in ovens in the ground to cook kangaroo and some plant foods such as yams, cycad palm nuts, wild rice and water lilies (seeds), which were gathered in the late dry from freshwater swamps and processed by grinding with mortars and pestles and cooked in earth ovens (Basedow 1907, p. 27; Foelsche 1882, pp. 12-14).

Also likely to survive are pieces of ochre, used to decorate implements, weapons or message sticks (Basedow 1907, pp. 36, 46), or mixed with emu fat to paint youths for initiation ceremonies, warriors preparing for ceremonial battles, and also the bodies of the dead (Basedow 1925, pp. 184, 208, 249-250; Foelsche 1882, p. 11). It is also possible that human skeletal remains may be found in sandy beach ridges or near shell mounds. Foelsche (1882, pp. 5-6) recorded that the Larrakia buried their dead in shallow graves.

The ethnographic information indicates that subsistence strategies would have been focused around certain landscape features, and these are likely to contain archaeological material. This includes localities in close proximity to sources of water and to sources of raw material suitable for stone artefact manufacture, such as creeks, waterholes, ridges and hills. In coastal areas the junction between tidal areas or the mangrove zone, dune systems and the adjacent higher ground would be expected to have high archaeological potential.

4.2 European Settlement and Background History

Initial European Settlement-1865

There were four settlements attempted by Europeans along the coast of what is now the Northern Territory. The first three were commissioned directly from the British Colonial Office: Fort Dundas (1824-1829), Fort Wellington (1827-1829) and Victoria (1839-1849). All of these settlements failed for a variety of reasons including lack of reliable fresh water, absence of trading opportunities, scurvy and malaria.

In 1863, South Australia annexed what is now known as the Northern Territory. The South Australian Parliament commissioned B.T. Finniss, a former British Army officer, to lead an expedition of forty men to survey and settle the north. The expedition chose to ignore Port Darwin and headed to the mouth of the Adelaide River (Powell 2010, p. 117), 16km northeast of the closest AAPowerLink OHTL section (Chainage 777). The initial settlement site in 1865 was on the Adelaide River floodplain, later moved to Escape Cliffs on Adam Bay north of the river mouth.

This settlement decision was plagued with many issues, with Finniss's team significantly impacted by scurvy despite cures being well documented by this time. Poor and aggressive relationships with the Traditional Owners of the area led to conflict. It has been noted that Finniss killed a number of Wulna People and destroyed several hundred of their camps during his expedition leadership (Horton 1994, p. 1196; Heritage Branch 2011). Finniss's military leadership style also led to desertions by his men to Western Australia and to Singapore. As a consequence of numerous complaints, Finniss was recalled to South Australia in September 1865 to face an inquiry leading to substantial criticism of his poor management skills.

The Escape Cliffs site proved a poor choice for use as a port: shoaling rocks extended out hundreds of metres at low tide, meaning that ships had to stand off at least 500 metres to load or unload. By 1867, the settlement had been abandoned. All remnants of this initial settlement fall outside the AAPowerLink Project Area, however some artefacts, such as steel axes, were traded out to local Aboriginal clan groups in exchange for food resources.

The Settlement of Port Darwin - 1869

The last attempt to colonise the Northern Territory of South Australia was commissioned by South Australia between 1866 and 1868. A party led by South Australian Surveyor General George Goyder arrived in Port Darwin aboard the Moonta on 5 February 1869. Goyder's task was to survey the site for the future township, plus outlying settlements and agricultural lands, most of which had already been sold sight unseen in Adelaide and London (Powell 2010, pp. 116, 125).

Goyder's original camp was placed between Fort Hill and the escarpment of modern Darwin. The town was named Palmerston and streets were laid out on the pattern of Adelaide and named after the leading surveyors in the party. Goyder's teams then went on to survey Virginia, a village between Coolalinga and modern Palmerston, then Southport located 13km southwest of the AAPowerLink OHTL corridor (Chainage 722), now abandoned at the southern end of the harbour. Other towns, Daly and Elizabeth were surveyed and never developed.

A detailed history of the Southport settlement can be found in "Sites of the former Southport telegraph and police stations", prepared by the NT Heritage Branch, April 2011.

Overland Telegraph Line 1870

Construction of the Overland Telegraph Line (OTL) began in Darwin in 1870. The construction was undertaken in three separate geographic sections. Darwin to Tennant Creek was the northern most section constructed by a consortium of private contractors Dalwood and Derwent (Kent 2003, p. 4). The materials for the construction of the early line were shipped from England which included 6-gauge wire, insulators, pins, and iron poles (Kent 2003, p. 4). The northern section of the alignment was to be constructed from locally available timber. A second construction party would build the line from Port Darwin around the coast to Southport and then up the Blackmore River to Tumbling Waters, a distance of about 65kms. The line continued to be constructed to Adelaide River by December 1870.

The construction team reached the Katherine River by January 1871. The OTL became officially operational in October 1872. By 1883 all timber poles had been replaced with an "assortment of telescopic galvanised iron poles, manufactured at Manchester in England, under J Oppenheimer's patent" (Kent 2003, p. 6). The northern section of the OTL was realigned with the North Australia Railway from Darwin to Pine Creek in the early 1890s (Kent 2003, p. 6). This includes a section of the realigned OTL falling within the proposed AAPowerLink OHTL corridor from Chainage 722.1 to 724.3.

The original Overland Telegraph Line was realigned with the NAR bypassing the Southport Township. Given that this was one of the earliest redirections of the OTL, the exact location of this original alignment is not known. However, it is known that the OTL was constructed to Tumbling Waters on the Blackmore River 15km southwest of the OHTL Chainage 722 and then continued southwards to Adelaide River.

From 1938 to 1942 the military significantly upgraded the OTL to include multiple telephone lines to increase the capacity of communications in the north (Kent 2003, p. 6). Kent (2003) believes the OTL was decommissioned in the late 1970s as new technologies (i.e. microwave repeater towers and other cable technology) superseded the OTL.

OTL Oppenheimer poles have been highly sought by Territory locals as a source of building material. Therefore, there are very few extant poles left along the NAR. The unrestricted public access to the NAR corridor, which includes part of the Project Area from Chainage 722.1 to 724.3, has likely resulted in the removal of all OTL material from this section.

Mining - 1872

Intensive mining activity, however, did not eventuate until 1872, when there was a gold rush at Yam Creek near Pine Creek which marked the beginning of a two-year boom. In 1889, new gold discoveries were made at Mt Todd, approximately 40km to the north of Katherine. This was followed by the discovery of tungsten (Wolfram Hill), tin and copper in the same area (Jones 1997, p. 143). Mining has been a major economic feature of the Top End since the 1872 gold rush, with recurring boom and bust cycles based on transport costs and events far from Darwin and the source of the gold around Pine Creek (Powell 2009). Early mining ventures struggled with geographic isolation, severe climatic and environmental conditions, and mismanagement (Jones 1997, p. 7). Mining in the Pine Creek-Mt Todd area was one of the primary drivers of building the North Australia Railway commencing in 1883.

North Australia Railway - 1883

Following the success of the OTL, the South Australian Government planned to build a transcontinental railway linking Adelaide and Port Augusta with Port Darwin. In 1883, the SA Government authorised the construction of the first Top End section from Darwin to Pine Creek (Powell 2009, p. 74), which includes the proposed AAPowerLink OHTL corridor from Chainage 722.1 to 724.3. This Section was completed by Chinese and Indian labour in 1889. Extension of the line toward Katherine commenced in 1913 and reached Emungalan by 1917, when WWI commitments led to the suspension of construction works (NRETAS 2011). Port Darwin became the terminus for the new railway. The North Australia Railway was closed on 30 June 1976, following the loss of iron ore freight from Frances Creek due to damage to the Iron Ore Wharf by Cyclone Tracy in 1974. The remaining railway yards were demolished during the 1980s.

The NAR may have also been aligned with the previous "Old Coach Road" in sections, which served as the primary transport route south prior to the Railway. The precise location of the "Old Coach Road" running south from Darwin is not well understood and has not been subject to much research to date.

4.3 World War II History and Archaeology

The Defence of Northern Australia 1924 -1941

In 1919, Admiral of the Fleet Viscount Jellicoe visited Australia to assess the strategic situation and develop plans for the defence of the Pacific (McKenzie-Smith 1994, p. 3). Jellicoe's plan envisaged the establishment of a Royal Navy Far Eastern Fleet based in Singapore, supported by Australian bases at Port Stephens NSW, Cockburn Sound WA and Bynoe Harbour, west of Darwin. The British and Australian Governments initially rejected this plan as too costly, opting instead to continue using Thursday Island Naval Coaling Station (Alford 2011, p. 10).

The substance of Jellicoe's plan was then adopted at the 1923 Imperial Conference and is now known as the 'Singapore Strategy'. Darwin's part in the Singapore Strategy was to become a naval refuelling depot protected by two batteries of 6" naval guns on East Point and Emery Point (Alford 2011, p. 10). In 1932, a military committee was established to make recommendations on the building of Darwin's coastal defences to support the Stokes Hill NFI. Their report recommended the building of two 6" guns on Emery Point in Darwin Harbour and two 6" guns on East Point. They also recommended that two 9.2" guns be installed, also at East Point (McKenzie-Smith 1994, p. 4). In September 1932, the first party of the Darwin Detachment arrived in Port Darwin to commence building the gun positions.

The Darwin Detachment was reinforced in September 1933 and renamed the Darwin Garrison (McKenzie-Smith 1994, p. 4). This group continued with building the coastal defences and in April 1934 commenced work on the new Larrakeyah Barracks. In February 1933, the Chief of the General Staff allocated funds for a Queensland force to be raised to defend Darwin (McKenzie-Smith 1994, p. 5).

Between 1935 and 1938, mobilisation of military forces to Darwin accelerated. Proposals included (McKenzie-Smith 1994, p. 9):

1. Development of a RAAF station in Darwin (now also Darwin Airport);
2. Development of additional air bases in the Top End;
3. Transfer of a small anti-aircraft detachment to Darwin;

4. Changes to the Darwin Garrison and raising the Darwin Mobile Force using similar structures to the experimental mechanisation carried out for parts of the British Home Army.
5. Completion of the 9.2" battery at East Point (not completed until 1944).

During the period 1939 to 1941, the pace of military expansion further increased. The Darwin Mobile Force arrived in April 1939 along with 12 Squadron RAAF. 13 Squadron was formed in Darwin during July 1939. 1940 saw the creation of the 7th Military District as a new command structure. The Darwin Mobile Force became the cadre for the establishment of the Darwin Infantry Battalion and the 18th Field Artillery Battalion (McKenzie-Smith 1994, p. 17). Plans were made to augment this force to a full brigade size starting in 1941. Plans were also made to construct permanent facilities for battalion sized units at Adelaide River and Batchelor to protect airfields there and support Darwin in the event of a Japanese attack. These forces were further reinforced during 1941 with the arrival of the 23rd Infantry Brigade, naval units and aircraft reinforcements.

When war came on 7 December 1941, Darwin was already a major military base, with forces thought capable of defending the Top End from Japanese attack. What came as a real surprise to Australia was the fall of Singapore, Malaya and then the Japanese attack on the Dutch East Indies. War was now very close to Australian shores while the best three Australian Imperial Force (AIF) divisions were still engaged in the Middle East. Most of another AIF Division (the 8th) was trapped in Singapore and destined to go into captivity.

The Australian Government reacted by organising the evacuation of most of the Darwin civilian population and sending reinforcements to Timor in case of a Japanese landing (McKenzie-Smith 1994, p. 40). The convoy carrying these reinforcements were turned back by air attacks and arrived in Darwin Harbour on 18 February 1942.

WWII Darwin Air Raid - 19 February 1942

The attack by the Japanese on Darwin in February 1942 had a profound effect on the lives of people living in the Northern Territory. Along the main axis of supply, the Stuart 'Highway' and the track that is now called the Barkly Highway, Allied transport services moved hundreds of thousands of troops and millions of tons of supplies from southern ports to Port Darwin, a major stepping stone into South East Asia. Darwin and the Top End hosted squadrons from the US Army Air Force, the Royal Airforce and the Royal Australian Airforce flying out of over 40 airfields supporting operations into the South West Pacific Theatre (Netherlands, East Indies, Papua and New Guinea, Rabaul, Timor and the Philippines).

The initial Japanese air raid on Darwin commenced at 09:58 on 19 February 1942. Alford's (2011, p. 29) research shows that the aim of the attack was to locate and destroy any convoy that may be reinforcing or resupplying Allied troops in Timor. This they did, finding 47 ships in the harbour, 9 US P40E Kittyhawk fighter aircraft, 2 Squadron RAAF Hudson bombers and a number of other transport and bomber aircraft. The Japanese force, launched from the same aircraft carrier group that bombed Pearl Harbour, consisted of 36 Zeke (Zero) fighters, 71 Val dive bombers and 81 Kate torpedo bombers fitted with standard bombs rather than torpedoes.

This force destroyed all but one of the P40s within minutes then attacked ships in the harbour sinking 11 and damaging a further 12. The RAAF Station, the Darwin township and the Stokes Hill Jetty were

also bombed, with devastating consequences for the MV Neptuna. At 11:58 a group of 54 level bombers from Ambon appeared over the RAAF station and township. They were able to fly at low level, bombing individual targets at will (Alford 2011, p 35).

The second wave of Japanese bombers arrived over the RAAF Station (the modern Darwin Airport) at 11:58 on the same day. This raid consisted of 54 land-based twin engine level bombers Mitsubishi G3Ms and G4Ms. Due to a lack of opposition over the town and the RAAF Station, these bombers were able to roam at low level picking individual targets at the RAAF Station: parked aircraft, hangars, offices, magazines, barracks, fuel tanks and the runway were all targeted (Alford 2011, p 31).

4.3.1 World War II Sites adjacent to the Project Area

Strauss (27-Mile/Humpty Doo) Airfield Historic Site

The Strauss Airfield also formerly known as the '27-Mile' or 'Humpty Doo' Strip is located 27 miles or approximately 60km south of Darwin and approximately 1km north of Chainage 725. It was named in honour of Captain Allison W Strauss who is inferred to have been killed when the P40E spun into Fannie Bay while defending the RAAF Darwin base from the Japanese (NRETAS 2011). The US 808th Engineer Battalion constructed the airfield between March 19 and April 27, 1942. The airfield comprised a single unsealed 1,524 x 30m runway with several unsealed taxiways that allowed for planes to be concealed underneath camouflage netting in the adjacent vegetation (NRETAS 2011). It is highly likely that there would be materials that are associated with the activities of the Strauss Airfield within the Livingstone section of the OHTL.

Hughes (32-Mile) Airfield

The Hughes Airfield is within the locality of Hughes 32 miles south of Darwin and is located 1km south of Chainage 725. The airfield was named after the Director of Mines Northern Territory WA Hughes. This airfield was constructed by the US 808th Engineer Battalion between March 10 and April 13, 1942 and was used to support RAAF Hudson bombers of the Nos. 2 and 13 Squadrons (NRETAS 2011). It has a 1,900 x 30m and is known to still contain gun emplacements, drums and ammunition boxes in the surrounding vegetation. Although it is closed to the public, it is now used to support aerial firefighting operations around rural outer areas of Darwin.

Noonamah

The Australian military commenced its occupation of the Noonamah area near the Strauss '27-Mile' Airstrip described above. Initially, the site was officially called Firdan, after the Middle East location that the 2/2 Railway Construction Company AIF were posted to previously. During the war, Firdan was more commonly referred to as Noonamah - an Aboriginal word meaning 'plenty of tucker and good things' (NRETAS 2010).

Noonamah Railway Siding was a large depot site supplied by road convoys and a railway siding complex located at the Strauss '27 Mile' Airstrip built by the 27-Mile by 2/2 Aust Railway Construction Company. Noonamah Railway Siding, located 300m north of OHTL Chainage 724.5, was an additional siding constructed on a spur line two miles to the south but leading east from the main line (NRETAS 2010). The Noonamah spur line was constructed in early 1942 as a part of the military activity in the area and to support development of the surrounding airfields. Throughout the war, the siding was used to service the supply depot and ancillary units at Noonamah (NRETAS 2010).

Strauss Cricket Pitch

A cricket pitch was constructed by a small group of 27 Battalion personnel, located 100m immediately south of OHTL Chainage 724.5. The pitch was constructed from concrete, mixed from cement with laterite aggregate. The oval surrounding the pitch formed through clearance of the surrounding native vegetation. A pair of flagpoles, large rock with a memorial plaque were also installed by Strauss family members and the Commander of the USAAF 8th Squadron 49th Fighter Group on April 25, 2004. The cricket pitch was used by various RAAF and RAF squadrons for the remainder of World War II and was significant for improving the morale and physical fitness of troops. Following the war, the cricket pitch fell into disrepair and was obscured by soil and vegetation until it was rediscovered in 2002 and used for an Anzac Day cricket match involving local clubs and military units from Darwin (NRETAS 2010).

4.4 Archaeological Studies in the Darwin Region

An overview of previous archaeological studies in the Darwin Harbour and hinterland provides a context for evaluating the archaeological significance of any sites and artefacts found in the Project Area. A search of the NT Archaeological Site Database for all recorded features within a 5km radius of the Livingstone to Murrumujuk section of the Project Area reveals 66 entries. Of these, 62 are of Indigenous origin and four are recorded as historic features. Of the 62 Indigenous sites, 50 (80%) include shell middens and mounds. 20 (32%) sites were recorded as containing stone artefacts, however seven of these (11%) were recorded as solely stone artefacts, quarries or knapping locations. Eight (13%) sites were noted as earth mounds or containing earth mounds.

Many of the previously recorded pre-contact sites are clustered around the fringes of Shoal Bay, located 3.5km south of the Darwin Converter Site (outside the Project Area). Radiocarbon dates have been obtained on mounds and middens around Shoal Bay and Darwin Harbour (Bourke 2015; Bourke & Hua 2009; Bourke & Crassweller 2006; Earthsea 2008b). Earthsea Heritage Survey's excavation in Hudson Creek returned calibrated dates of between 1994 years before present (BP) and 2,163 years BP based on Accelerator Mass Spectrometry (AMS) radiocarbon testing of ark cockle (*Anadara granosa*) and carbon samples. These dates are typical for the Darwin Harbour shell middens and mounds, confirming Bourke (2005, 2015) and Bourke and Crassweller's (2006) dates between 2000 years BP and 600 years BP.

To the knowledge of the consultants, only one recorded occurrence of rock art for the Darwin region has been recorded on the southern coastline of the Middle Arm Peninsula (Bourke 1994, 2005; Bourke and Mulvaney 2003; Hiscock & Hughes 2001; Richardson 1996). The rock art (petroglyph) sites were described by Bourke (1994), and Bourke and Mulvaney (2003) as part of larger surveys of midden sites along the Middle Arm Peninsular.

4.5 Archaeological Predictive Model

Based on the studies outlined above and the experience of the Consultants across the Top End, the following predictive model statements can be made for the Project Area:

1. Artefact typology variability and site densities are higher near fresh water sources, beaches or former fresh water sources. All water courses or bodies of water have a high potential for sites with archaeological materials, including ephemeral sources.
2. There may also be complete absence of artefactual material in land units without water.

3. Sites recorded in the land units away from more permanent water sources are likely to be small with limited diversity in raw materials and artefact types.
4. Stone artefact quarries occur where suitable rock is available on the land surface. In the Darwin region and the wider Project Area, raw material such as chert, quartzite, quartz and tuff were the primary materials used for flaked stone tools. Therefore, any related outcropping geology containing these raw materials should be regarded as having a high potential for lithic scatters, including, quarry sites and secondary reduction sites nearby.
5. Outcropping sedimentary rock, such as sandstones, have been used by Aboriginal people in the past for manufacturing grindstones, painting and engraving (petroglyphs). Both types of rock art have been previously recorded in the wider region. Areas where this stone is present are highly likely to contain some archaeological materials and should be subject to a 100% sample survey.

Contact artefacts are likely to persist throughout the Project Areas due to the intensity of European occupation of Darwin and surrounds following the 1860s.

5 Survey Methodology

Cultural Heritage management is based on a number of regulatory, cultural, social and economic principles, including the recognition of competing interests in society and the need to attain balanced outcomes. This section outlines a methodological approach to heritage assessments based on the Burra Charter, what constitutes 'heritage' and the survey methodology to locate, describe and assess the significance of heritage within the proposal footprint and surrounding areas.

5.1 Heritage Assessment Strategies.

This study employed a *heritage assessment* strategy to assess the likelihood of finding archaeological and/or heritage sites within Livingstone to Murrumujuk section of the Project Areas. The *heritage assessment* survey strategy selected representative parts of the proposal footprint based on Traditional Owner consultation, site distribution patterns from regional studies, geophysical and hydrological modelling as outlined in Section 3 this report. These areas were then surveyed during September 2021, ensuring that all representative land units and high-risk[2] environments within the proposal footprint were adequately assessed.

Recommendations for appropriate heritage management strategies were then made based on the likelihood and types of sites occurring within a given land system. If, for example, no cultural heritage features were located during the survey of a given Land System and consultation with Site Custodians also supported this notion, the methodology was then extrapolated to suggest there is a very low risk of impacting sites protected under the *Northern Territory Heritage Act 2011*.

5.2 Desktop Assessment

The desktop assessment section of this Study, as outlined in Section 3 and 4 above, aimed to identify areas likely to hold Aboriginal archaeological sites or historical features, which could then assist the field surveys in prioritising key risk areas. This assessment included mapping and assessment of existing site databases, previous heritage studies, historical mapping, surface geology, hydrology and any pre-existing ground disturbance. The results of this assessment are summarized in Table 3 below.

Table 3: Summary of Physical Environment factors predicting Aboriginal archaeological site distribution

Desktop Assessment Type	Data Summary	Conclusions	Survey Methodology
Existing Site Databases	There are approximately 66 recorded sites within a 5km radius of the proposed Project Footprint.	The existing databases are not comprehensive enough to draw conclusions on artefact densities, artefact types or sub surface potential or predictable distribution patterns within given land systems, except for riparian and tidal zones and	Systematic sampling of all land systems.

[2] *High-risk environments* are those which have a high potential for containing cultural heritage features. These environments are identified following comprehensive background research and consultation.

Desktop Assessment Type	Data Summary	Conclusions	Survey Methodology
		outcropping geological units with raw material potential.	
Land Systems	Land System data is often a very useful tool in analysing the potential for archaeological materials in a Project Area. The Desktop Study for this project found that there was insufficient information available to draw robust conclusions based on Land Systems vs previously recorded archaeological features, other than most previous sites fell within Land Systems adjacent to coastal, mangrove and riparian zones.	Individual Land Units within Land Systems were identified as having archaeological potential and were define from mapping in most instances. Individual land Units and Landforms were sometime better identified in the field for survey.	Survey identified Land Units/Forms (i.e. drainage depressions, watercourses and topographic highs) at 100%.
Surface Geology	The are eight dominant geological units throughout the Livingstone to Murrumujuk Project Areas. Two of these units (i.e. the Ppw and Ppa units) held the highest potential for raw materials suitable for the manufacture of stone artefacts. These included lithologies and features such as sandstone, quartz, dolerite and quartzite.	Based on previous regional studies with similar underlying geology, all units which contain materials suitable for the manufacture of stone arefacts had the potential to contain archaeological features. There was no clear pattern to suggest this could be refined from the desktop study.	Map rock outcrop units (Formation Data courtesy of the NT Geological Survey Department). Survey 100% of prospective rock outcrop units.
Hydrology	The Livingstone to Murrumujuk Project Areas transect a high number of watercourses, swamps and Murrumujuk Beach. The watercourses vary in size from small seasonal gutters to the large named creeks such as the Elizabeth River, Berry Creek and tributaries of the Adelaide River. Similarly, the swamp areas range from small ephemeral depressions to large permanent billabongs such as those within parts of the Shoal Bay Coastal Reserve.	Past archaeological studies across the Top End show a strong correlation between water resources and Aboriginal archaeological site distribution.	The surveys should aim to sample every accessible watercourse and swamp up to 200m on either side and transect representative drainage depression.
Pre-existing ground	The Livingstone to Murrumujuk Project Areas are transected by	There is no clear correlation between ground disturbance	Given the scale of disturbance through

Desktop Assessment Type	Data Summary	Conclusions	Survey Methodology
disturbance factors	numerous tracks and roads, approx. 2km of the NAR, fence lines, WWII Defence infrastructure and extensive mining and extractive areas.	and the absence of sites, with the potential exception of the mineral extraction areas where the disturbance has been widespread over an 8km section of the OHTL from Chainage 734 to 742.	the mining and extractive areas, there should be no requirement to undertake surveys other than surveying representative riparian zones.

5.3 Cultural Heritage Site Definition

Assessment of the cultural heritage resources within the Livingstone to Murrumujuk Project Areas was approached holistically to include an understanding of both cultural and archaeological contexts.

Culturally, the Larrakia, Wulna and Tiwi have a wide distribution of sites including Dreamings, campsites, quarries, ceremony places, burials, resource areas and travel routes across their traditional lands. The knowledge, location and extent of these features is governed by Traditional Law however the senior Traditional Owners representatives accompanying the surveys reinforced the importance of including this information where possible to ensure its appropriate management.

Notwithstanding this, sacred sites and other sites with intangible cultural significance will be captured during the AAPA Authority Certificate process. The Authority Certificate should be used as the principal documents guiding construction works around these features.

From an archaeological perspective, *the NT Heritage Act 2011* (Division 2, p. 7) defines archaeological features relevant to this study as follows:

6 Meaning of *archaeological place* and *Aboriginal or Macassan archaeological place*

(1) An ***archaeological place*** is a place that:

(a) relates to the past human occupation of the Territory; and

(b) has been modified by the activity of the occupiers.

(2) An ***Aboriginal or Macassan archaeological place*** is a place that:

(a) relates to the past human occupation of the Territory by Aboriginal or Macassan people; and

(b) has been modified by the activity of those people.

7 Meaning of *object*

(1) An ***object*** is a natural or manufactured object that is moveable.

(2) An ***object*** includes an archaeological object but does not include a place.

8 Meaning of *archaeological object* and *Aboriginal or Macassan archaeological object*

(1) An ***archaeological object*** is a relic that:

(a) relates to the past human occupation of the Territory; and

(b) is in an archaeological place.

(2) An ***Aboriginal or Macassan archaeological object*** is a relic that:

(a) relates to the past human occupation of the Territory by Aboriginal or Macassan people; and

(b) is:

(i) in an Aboriginal or Macassan archaeological place; or

(ii) stored in a place in accordance with Aboriginal tradition, including, for example, in an Aboriginal keeping place.

9 Meaning of *relic*

(1) A ***relic*** is:

(a) an artefact or thing given shape by a person; or

(b) human or animal skeletal remains; or

(c) something else prescribed by regulation.

(2) An artefact or thing can be of any material.

Examples for subsection (2)

1 A secret or ceremonial object.

2 A log or bark coffin.

3 Human remains.

4 Rock or wood carvings or engravings.

5 Stone tools.

(3) However, an artefact or thing made for sale is not a relic.

(4) In addition, a thing prescribed by regulation is not a relic.

For recording archaeological features and sites, according to McDonald (2005, p. 172), a contiguous landscape approach, where multiple features are present, is current best-practice and represents a progression which recognises archaeological and cultural landscapes as an appropriate management scale. Where there are high densities of cultural materials, according to McDonald (2005, p. 172), there is no choice but to define management units beyond the level of the isolated artefacts and sites. This study interprets this approach as meaning that artefacts, sites, continuous scatters and site complexes are related over the landscape, however definitions of each of these categories are necessary to provide an adequate management system for the archaeology of a survey area.

Following this approach, this study uses the following definitions of site type:

1. **Lithic or stone artefact scatters** containing flaked, ground stone artefacts and possibly hearthstones. Contact sites of Aboriginal origin may also include metals or flaked ceramics used for cutting. Artefact scatters may occur as surface scatters of material or as stratified deposits where there have been repeated occupations. Some lithic scatters are called camp sites which are high density lithic scatters with hearths and sometimes grindstones. Therefore, camping is the implied activity indicated by the archaeological record in these places.
2. **Stone Quarry** or primary reduction site. A site where stone for flaked or edge-ground artefacts have been extracted from an outcropping source of stone. This is a broad definition a stone quarry and there are further subdivisions of this site type. According to Hiscock and Mitchell (1993) most surface hard stone quarries have associated reduction sites.
3. **Knapping location**, consisting of one or more knapping floors, are discrete scatters of artefacts, anywhere in the landscape, resulting from stone being worked or reduced at that spot. The criteria for a knapping floor are that the original block of stone can be at least partially reconstructed from scattered flaked stone pieces (Hiscock & Mitchell 1993). A knapping floor can exist as a feature within the context of an open site or archaeological deposit. However, there are certain methodological problems in identifying such features arising from post-depositional processes.

4. **Stone Arrangements** can range from simple cairns to more elaborate arrangements. Some stone arrangements were used in ceremonial activities and represent sacred or totemic sites. Other stone features were constructed by Aboriginal people as route markers, territory markers, and walls of huts, animal traps, hides, or seed traps. Stone arrangements also exist as a result of historical activity, such as mineral tenement markers or isolated grave sites.
5. **Hearths** are a common feature in arid and semi-arid Australia, often comprising a number of stones arranged into a square or round formation. These were used as heat retaining rocks when cooking food. Rocks in hearths will show evidence of heating and are sometimes fragmented. There is often a diversity of raw materials within the hearth. Some, or all, of the rocks may have been brought to the area from a distance.
6. **Rock Art sites** include two main types of rock art, engravings and pounding's where the pattern is one of relief and the pictures were apparently produced by removing material from the rock surface and drawings, stencils and paintings where the material was added to the rock surface. Bees wax designs have also been recorded in the wider region.
7. **Rock shelter occupation sites** contain a deposit of cultural material that has built up over time containing flaked or ground stone artefacts, faunal material and other various items of Aboriginal material culture including ancestral human skeletal remains, wax designs, rock art, grinding hollows, and caches of material culture objects.
8. **Site complexes** are groups of sites in similar landscapes where the cultural materials are effectively continuous. Bird and Hallam (2006, p. 11) described these as integrated cultural landscapes with which have local variations in artefact densities with artefact distributions being effectively continuous.
9. **Culturally modified trees (CMT)** typically result from a sectional removal of bark (and sometimes timber) from a tree trunk or limb. CMTs range from small (15cm x 5cm) lenticular apertures such as those resulting from sugarbag procurement, to large canoe CMTs which can present a scar several meters in length.
10. **Aboriginal Wells** have resulted from water procurement activities. These sites can vary in size and form, from hand dug depressions to natural features such as sink holes or drainage depressions. Sources of water across the arid landscape were vitally important in the seasonal land use patterns of Aboriginal people. As the only water source in some areas, wells were carefully curated, often with rocks placed over the entrance to a well to prevent fouling by animals. Rock art (e.g. petroglyphs), grinding groves, stone artefact scatters and sometimes burials are often located in association with wells.
11. **Burial** practises differ considerably throughout cultural groups in Northern Australia, and skeletal material can vary from highly fragmented bones to large burial complexes containing many individuals.
12. **Shell middens** are deposits containing shells (and sometime other artefactual materials) occurring somewhere in the open, near a beach or estuary or rocky shoreline, or an inland lake or river. These shells have been accumulated in these deposits by humans exploiting marine resources. Middens may take the form of a thin veneer of shell over the land surface or a thick mound of shell.
13. **Grinding hollows, grooves, and patches** are the physical evidence of grinding and processing materials on basement rock. Grinding hollows and patches where utilised to grind food and plant materials (i.e. wild rice, seeds, nuts, tubers, bulbs), as well as ochre for painting. Grinding patches and grooves may also have been utilised to prepare edge ground axes during production and maintenance.

14. **Historic/Contact sites** include sites of primarily Aboriginal cultural origin that include 'modern' materials to manufacture flaked artefacts. Sites that include foreign materials, such as glass, ceramics or metal that exhibit modification by Aboriginal people are regarded as *contact sites.*

5.4 Identifying stone artefacts

A requirement for successful Aboriginal archaeological heritage assessment involves the accurate identification of archaeological materials. Since the identification of stone artefacts is basic to the accurate recognition and measurement of the archaeological record, it is imperative that people undertaking archaeological surveys be able to differentiate between natural objects and artefacts. Principles of artefact identification employed in this survey follow those recommended by Hiscock (1984), Holdaway and Stern (2004) and Andrefsky (1998).

In summary, each time sufficient force is placed on the surface of an isotropic rock, it will fracture into two pieces. The fragment that has been struck contains the ring-crack, where fracture was initiated, and is called the flake. The flake is usually the smaller of the two pieces of stone. The larger fragment, from which the flake has been removed, is called the core. On both the flake and the core the surface that is struck is called the platform. Flakes are identified by the distinctive surface created when they are removed from the core. The classification of artefacts in this survey was based on identifiable characteristics outlined by Hiscock (1984). For an object to be classed as a flaked artefact, it needed to possess one or more of the following characteristics:

1. A positive or negative ring crack;
2. A distinct positive or negative bulb of percussion;
3. A definite eraillure scar in an appropriate position beneath a platform;
4. Remnants of flake scars (dorsal scars and ridges).

These characteristics indicate the application of an external force to a core. Artefact morphologies will be described by using the four types of artefacts as defined by Hiscock (1984, pp. 128-129):

1. Flake: Flakes exhibit a set of characteristics that indicate they have been struck from a core. The most indicative characteristics are ring-cracks, which show where the hammer hit the core. The ventral surface may also be deformed in particular ways, for example a bulb or eraillure scar.

2. Core: A piece of stone with one or more negative flake scars, but no positive flake scars.

3. Retouched Flake: A flake that has had flakes removed from it, identified by flake scars on or deriving from the ventral surface.

4. Flaked Piece: This is a chipped artefact which cannot be classified as a flake, core, or retouched flake. This category is used only when an artefact was definitely chipped but could not be placed in another group.

Other artefacts and implement types that have been identified in Northern Australia are listed below following characteristics as outlined by McCarthy (1976), Cundy (1989), Kamminga (1982) and Holdaway and Stern (2004):

1. Unifacial Points are flakes that have been retouched along the margins from one surface (either dorsal or ventral) to give or enhance its pointed shape. These unifacial points are sometimes symmetrical or leaf shaped.

2. Bifacial Points and axes are retouched onto both ventral and dorsal surfaces of a flake to enhance or give the artefact its point shape. These points and axes may have the platform removed and the proximal end rounded. Distribution largely in the Top End and Kimberley. Some bifacially flaked implements extend east to Cloncurry and south into Central Australia.

3. Tulas are a specialised adze like tool common in the arid zones of Central Australia. The tula was a composite tool usually hafted into woomeras or other timber handles. The Tula was characterised by a particular reduction sequence and a flake width broader than length. The Tula was resharpened continually until the remaining blade length was too small for further reuse. At this stage it was commonly replaced in its hafting. The remaining blade is known as a Tula Slug.

4. Edge ground axes. Classified primarily by the shaping process of flaking, pecking and polishing. These generally have only one working edge that has been ground to a sharp margin but there are also examples with two leading edges.

5. Grindstones are characterised by a worn and abraded surface(s). The surface may either have a concave depression or a convex surface.

6. Hammerstones show use wear on the surface in the forms of abrasion, pitting and edge fracturing with some negative scarring from the process of producing stone tools.

7. Pounders are artefacts that are used primarily for processing food and plant materials.

8. Anvils are characterised by abraded and peck surfaces that are the result of using the surface for bipolar reduction of cores.

5.5 Marine Shell Species in the Northern Territory

Shell species consumed by Indigenous societies in the past are diverse and abundant. Meehan (1982) identified up to 22 different species of bivalves alone consumed at the Anbarra mounds near Maningrida. Similarly, test pit excavations by Earthsea (2008b) noted 15 different species represented a small midden site that was in use for a 300-year period after 1895±76 BP. Archaeological evidence of marine exploitation is in general found in open shell middens, shell scatters, shell mounds, or shell midden deposits formed in rock shelters (Bourke 2000; Clarke 1994; Roberts 1994; Bourke and Guse 2007; Bourke 2015).

Shell middens and scatters are commonly found in coastal areas of the Northern Territory. Therefore, like stone artefacts, it is important to be able to identify and recognise shell species. Table 4 below

lists the most frequently occurring shell species that have been identified in archaeological assemblages in the Northern Territory.

Table 4: Common Shell Species in North Australian Shell Middens and Scatters (adapted from Bourke & Guse 2007).

Name	Family	Species	Habitat*	Reference
Granular Mud Ark	*Arcidae*	*Anadara granosa*	Mud, associated with mangroves, in intertidal zone	Bourke (2000) Clarke (2000)
Oysters	*Ostreidae*	*Ostrea echinata (aka Saccostrea Cucculata)*	Rocks, intertidal zone	Bourke (2000) Clarke (2000)
Venus Cockles	*Veneridae*	*Tapes hiantina* *Marcia hiantina* *Tapes turgid*	Sand	Clarke (2000) Mitchell (1994)
Horse Mussel	*Mytilidae*	*Modiolus sp*	Flat areas in Intertidal zones	Clarke (2000)
Nerite	*Neritidae*	*Nerita* sp	Middle, upper intertidal zone on rocky shores	
Murex	*Muricidae*	*Chicoreus* sp	On rocks in the intertidal zone	Bourke (2000)
Cockle	*Veneridae*	*Marcia hiantina*	Mangrove mud, 30 to 90 cm deep.	Bourke (2000)
Mud	*Potamididae*	*Telescopium* *Telescopium*	Intertidal muddy habitats & mangroves	Bourke (2015) Bourke (2000)
Creepers		*Terebralia semistriata* *Terebralia palustris* *Cerithidea obtuse*		
Pearl Oysters	*Pteriidae*	*Pinctada* sp	Rocky substrate of intertidal zone to depths up to 30m	
Mud Cockle	*Corbiculidae*	*Polymesoda erosa* (aka: *Geloina coaxans*)	Muds on inshore fringes of mangrove forests	Bourke (2000)
N/A	*Melongenidae*	*Volema cochlidium*		Bourke (2000)

5.6 Defining Site Boundaries

It is necessary to define site boundaries for the description of heritage places and the mitigation of impacts on these places. Boundaries of sites are often based on geographic features, such as rock shelters and shell middens, which are defined by easy to distinguish geographic features. Other sites, such as stone artefact scatters, groups of culturally modified trees, culturally significant areas are more difficult to define.

For the purposes of this study, cultural materials are defined as sites, background scatters and isolated artefacts when the following criteria are met:

1. Sites should have average artefact densities more than five times the average density of the background scatter in the same area and exceed five artefacts in a ten-metre diameter area.
2. A site boundary exists where the artefact densities are diminished sufficiently to be equal to the background density level or an environmental feature defines a boundary, such as a creek bed.
3. A background scatter is an area where the average artefact density is higher than the average background density but does not exceed five artefacts in a ten-metre diameter area. Effectively, a background scatter is small and or low-density scatter that does not constitute

a site. This is an arbitrary definition to aid recording in the field, particularly where artefact densities are high enough to make recording individual artefacts impractical but are not high enough to define as a site.

4. Isolated artefacts are single or multiple artefacts that do not satisfy the criteria for a site or a background scatter.
5. The extent and location of culturally significant landscape features was guided by Traditional Owners during the field assessment.

5.7 Site Recording and Survey Methodology

The survey employed a pedestrian sampling methodology for Livingstone section of the OHTL, Darwin Converter Site and Cable Transition Facilities, which centred on targeting all accessible watercourses, swamp margins and representative land units. Areas with geology identified to potentially contain artefact bearing raw materials were targeted as priority survey areas.

Approximately 80% of the overall Project Areas were sampled. Corridor sections which were excluded from the surveys included: approx. 5km of areas which had been subjected to significant mining activities which had no original ground surfaces in-situ, several road crossings, 1.6km across NT Section 572 which was not permitted for access at the time of survey, and 3km through parts of Black Jungle Conservation and the adjoining Sec. 1603 owing to limited access at the time for surveys, fires, and density of vegetation. The residual cultural heritage risks of these areas are presented in Section 6.3 below.

The employed survey methodology aimed to identify archaeological features and key cultural heritage risk areas which have the potential to contain archaeological features, to minimise impacts on these values for the construction and operation of the AAPowerLink infrastructure.

Using the methodological approaches outlined above, the following protocols were adopted to adequately record sites and artefacts:

1. The proposed Project Areas were mapped using a GIS (using both ArcGIS 10.5 and QGIS). Geology and hydrology layers were added to the GIS to indicate areas likely to hold cultural sites/archaeological materials based on the desktop predictive modelling, outcropping geology, and past regional surveys.
2. Consultation with Traditional Owners was also used to further refine target areas.
3. The proposed survey areas were uploaded to an Android Tablet using MAPPT software.
4. The sample areas were transacted at approx. 10–20 metre separation by the field team consisting of the people outlined in Section 1.4.1 above.
5. All sites, heritage features and isolated artefacts were recorded using a set of standard recording forms linked to the mobile GIS.
6. The location of all sites was recorded using datum GDA2020. The Tablet had an accuracy of 2-3 metres in open canopy terrain.
7. The tracks of all transects were recorded using the tracking feature on the Tablet, with land characteristics and images recorded using MAPPT software.
8. Artefacts and historical features were photographed during the course of the survey recording.

The following characteristics are recorded of each site and some isolated artefacts:

1. Location using the UTM coordinate system MGA2020 on Datum GDA2020.
2. Environment: basic details of land unit, geomorphology, vegetation etc.
3. Site boundaries are recorded for each site using the MAPPT software. Boundaries beyond the limits of the survey areas not recorded unless they were readily identifiable. In some instance it was likely the site boundaries extended hundreds of meters beyond the boundary of survey areas.
4. Site contents: basic details of types of artefacts, estimated density ($1m^2$ sample counts), raw materials etc.
5. Ethnographic origin: Aboriginal, European historical, etc.
6. Cultural and archaeological significance.
7. Disturbance factors, such as animal activity, erosion or road works.
8. Site visibility: estimate of how much of the ground surface was visible on site and in the surrounding area.
9. Estimation of the potential for sub-surface artefacts.
10. Site and artefact images. Images of artefacts in larger sites are a representative sample.

The results of this survey, along with a map of transects completed are presented in the next section.

6 Survey Results

The following discussions outline the results of the field investigations undertaken between 9 and 17 September 2021, along with general descriptions of the anthropological and archaeological sites identified during the survey. The proposal footprint included the area of interest for the OHTL from Livingstone (Chainage 722) to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk (including surveys of parts of the intertidal zone at Murrumujuk). Detailed Project footprint information is presented in Section 1.3 of this report. The complete description of each archaeological site is presented in Appendix 2 and site location maps are provided in Appendix 3.

A clearance survey of the whole footprint was not considered necessary or practical given the size of the area, the site distribution patterns and safety constraints arising from the density of vegetation in many sections. As noted in Section 5 above, the survey was based on a stratified sampling strategy that included all accessible land units and systems, creek crossings, swamp margins and representative geological outcrops.

The results of the survey included the recording of 47 archaeological features, which consisted of 17 historic features, 13 Culturally Modified Trees (CMT), 11 isolated artefacts, 3 shell middens, 2 artefact scatters and 1 stone arrangement of unknown origin (see Table 5). In addition, 1 Banyan tree of cultural significance to the Larrakia Traditional Owners was also recorded during the surveys. Other cultural resources areas were also recorded and are presented in Table 6 and Section 6.3 below.

Traditional Owners have also noted that Dreaming sites, Dreaming corridors and other sites of cultural significance exist within the OHTL Project Areas. It is noted that these sites will be captured during the AAPA Authority Certificate process and through ongoing consultation with Traditional Owners for development of the CHMP.

Table 5: Archaeological Site and Isolated Artefacts Recorded

Name	Chainage	Site Type	Site Size	Site description
AAPL_LM001	722.5	Historic object/place	20m x 2m	1887 high level, medium duty bridge structure.550 x 230mm fabricated riveted girders, supported by concrete abutments either end with two intermediate pier trestles with 230 x 140mm "I" section uprights. Uprights have Butterley Derbyshire Patent.
AAPL_LM002	722.3 to 723.2	Historic object/place	950m	1887 remnants of the remnant of the North Australia Railway. Embankments section of railway crossing tributary of Berry Ck and surrounding flood land. Blue metal gravel construction rising to approx. 3m above the surrounding ground at Chainage 723.
AAPL_LM003	722.4 to 723.2	Historic object/place	3m wide	Potential remnants of the Old Coach Road. Road is built up approx. 30cm and constructed of compacted earth and gravel in places.
AAPL_LM004	723.7 to 723.9	Historic object/place	200m x 6m	1887 Railway cutting. Likely hand excavated cutting through laterite and shale bedrock. 200m in length to a maximum 3m depth. Hand pick marks remain visible in some places.
AAPL_LM005	723.8	Historic object/place	5m x 10m	WW2 dump. 5 x 44-gallon drums, broken bottles, mechanical parts and a riveted section of aircraft panelling.

Name	Chainage	Site Type	Site Size	Site description
AAPL_LM006	723.9	Historic object/place	25m x 25m	WW2 MAA Emplacement. 44-gallon drum gabions, covered with earth and concrete. Location likely for protection of trains/vehicles within cutting.
AAPL_LM007	724.15	Historic object/place	2m x 2m	WW2 Ammunition box, pile of WW2 or railway riveted bolts and steel pieces.
AAPL_LM008	724.28	Historic object/place	2m x 3m	Concrete pad 2.5m x 3m. Orientated north. Concrete appears to have been laid within a corrugated iron building. Potential WW2 or railway association.
AAPL_LM009	724.32	Historic object/place	15m x 15m	WW2 Potential MAA Emplacement. 44-gallon drum gabions. Gabions were 2 drums high with upper layer having collapsed outward. 52 drums along three sides of a 7m x 7m area. Opening faces 100 degrees.
AAPL_LM010	724.33	Historic object/place	15m x 15m	WW2 Potential MAA Emplacement. 44-gallon drum gabions. Gabions were 2 drums high with upper layer having collapsed outward. 42 drums along three sides of a 6m x 6m area. Opening faces 230 degrees.
AAPL_LM011	724.44	Historic object/place	7m x 1m	WW2 Potential latrine, 7 drums wired together and open at both ends. 7m length. Cones entering drum line from one edge.
AAPL_LM012	724.46	Historic object/place	15m x 3m	WW2 Buried drums (start) over an approx. 15m length. Drums are perforated suggesting potential ablution or greywater drainage. Site is orientated 190 degrees.
AAPL_LM013	724.5	Historic object/place	4m x 4m	WW2 concrete rubble. Building foundations. Concrete aggregate is comparable to other WW2 features within the area. Original building is unknown.
AAPL_LM014	724.5	Historic object/place	5m x 3m	Earth mound with corrugated iron shoring. 5m x 3m x 0.3m ht. Ramped earth "path" on one side orientated 165 degrees.
AAPL_LM015	724.5	Historic object/place	1m	CMT. Steel axe cut marks on living ironwood tree. Scar HAG = 142cm, Scar L = 12cm, W = 18cm. Tree diam @ 1m = 190cm. Likely WW2 association given absence of sugarbag opening.
AAPL_LM046	724.5	Historic object/place	16m x 16m	Recorded as a potential bomb crater in (Jung, S. 2017. Strauss Water Treatment Plant archaeological survey report. Power and Water, Darwin, NT).
AAPL_LM016	724.65	CMT	5m	CMT. Steel axe marks won fallen ironwood. Log partially burnt with lower portion of scar remaining. Scar HAG = 350cm, W= 16cm. Log diam @ 1m = 180cm. Likely sugar bag scar.
AAPL_LM017	724.9	Historic object/place	8m x 8m	WW2 rubbish dump containing food and beverage containers (cans and bottles). Likely associated with adjoining WW2 infrastructure use.
AAPL_LM018	729.7	Isolated Artefact	2m x 2m	Four quartz flakes recorded within outcropping quartz complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.
AAPL_LM019	730.57	Isolated Artefact	1m x 1m	Bifacial quartz point recorded within outcropping quartz complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.
AAPL_LM020	731.05	Isolated Artefact	1m x 1m	Broken quartz flake recorded within outcropping quartz complex. Potentially part of wider

Name	Chainage	Site Type	Site Size	Site description
				background scatter. Poor ground surface visibility at the time of survey.
AAPL_LM021	731.2	Isolated Artefact	1m x 1m	Broken quartz flake recorded within outcropping quartz complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.
AAPL_LM022	732.12	Isolated Artefact	1m x 1m	Whole quartzite flake recorded within outcropping quartzite complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.
AAPL_LM023	733.25	Isolated Artefact	1m x 1m	Whole quartzite flake recorded on top of low-lying flat ridge top. Moderate ground surface visibility at the time of survey.
AAPL_LM024	737.2	Stone arrangement	Could not determine due to low GV	Circular stone arrangement on small laterite hill. Origin could not be determined due to 0% ground surface visibility.
AAPL_LM025	737.23	Artefact scatter	10m x 10m	Low density scatter on outcropping laterite/sandstone rise. 30 artefacts were recorded however poor ground surface visibility restricted defining the extent of the site.
AAPL_LM026	738.6	Isolated Artefact	1m x 1m	Quartzite whole flake on laterite ground surface adjacent to watercourse.
AAPL_LM028	738.8	Artefact scatter	4m x 4m	2 quartzite flake and 1 quartz flake. Located on sandy bank of watercourse, potential for some subsurface deposits. Likely part of a larger background scatter than extends down the eastern margin of the watercourse.
AAPL_LM027	738.8	Isolated Artefact	1m x 3m	Low density artefact scatter of flakes and flaked pieces. 8 artefacts were recorded. Artefact attributes were not clearly defined in some instances however materials are inconsistent with surrounding geology.
AAPL_LM029	738.8	Isolated Artefact	1m x 1m	Isolate quartzite artefact with medial fracture. Located on sandy bank of watercourse. Likely part of a larger background scatter than extends down the eastern margin of the watercourse.
AAPL_LM030	746.4	Isolated Artefact	1m x 1m	Broken chert flake on laterite ground surface. Good ground surface visibility at the time of survey.
AAPL_LM031	758.45	Isolated Artefact	1m x 1m	Whole chert flake on laterite ground surface. Good ground surface visibility at the time of survey.
AAPL_LM032	758.9	CMT	3m x 1m	Sugarbag scar on fallen iron tree (dead). Steel tomahawk marks. Scar HAG = 90cm, Length = 34cm, W =13cm, Cir = 64cm. Orientation 180 degrees.
AAPL_LM033	759.7	CMT	1m x 1m	CMT stump (ironwood). No log in situ. Stump HAG = 103cm, Cir = 93cm.
AAPL_LM034	767.35	CMT	6m x 1m	CMT fallen dead tree with sugar bag scar (ironwood). Scar HAG = 137cm, Ht = 21cm, W = 7cm. Tree circumference = 87cm.
AAPL_LM035	768.6	CMT	6m x 2m	CMT stump and log with sugar bag scar (ironwood). Stump HAG= 148cm, circumference = 56cm. Sugar bag scar L = 38cm, W = 13cm.
AAPL_LM036	769	CMT	5m x 2m	CMT stump and log (ironwood). Steel axe marks Stump circumstance = 74cm. Stum HAG = 96cm. Scar length = 40cm, width = 19cm.
AAPL_LM037	769	CMT	1m x 1m	CMT stump (ironwood). No log in situ. Stump HAG = 104cm, Cir = 74cm.

Name	Chainage	Site Type	Site Size	Site description
AAPL_LM038	769	CMT	5m x 2m	CMT stump and log (ironwood). Stump HAG = 75cm. Stump circumstance = 70cm. No scar on log.
AAPL_LM039	769.15	CMT	6 x 1m	CMT log and sugar bag scar (ironwood). Steel axe marks. Scar HAG = 81cm, L = 80cm, W =30cm. Active sugar bag in scar.
AAPL_LM040	771.46	CMT	5m x 3m	CMT stump and log with sugar bag scar (ironwood). Steel axe marks. Stump HAG = 100cm. circumstance = 77cm. 2 x sugar bag scars. Scar 1 height above cut = 177cm, L = 39cm, W = 15cm. Scar 2 scar on separate log piece. Scar 2 L = 12cm, W = 11cm.
AAPL_LM041	771.9	CMT	3m x 1m	CMT log with sugar bag scar (ironwood - burnt). Scar HAG = 98cm, L = 51cm, W = 24cm. Log diam = 26cm.
AAPL_LM042	772	CMT	1.5m x 1m	CMT log with sugar bag scar (ironwood - burnt). Scar HAG = NA, L = 32cm, W = 17cm. Log diam = 24cm.
AAPL_LM044	777.2	CMT	5m x 2m	CMT stump and log (ironwood - burnt). Steel axe marks. Stump HAG = 125cm, circumstance = 53. Burnt log with no visible sugar bag scars.
AAPL_LM045	Murrumujuk Infrastructure	Shell midden	16m x 13m	Low density shell scatter comprised of Telescopium, Marcia hiantina, Polymesoda erosa, Terebralia palustris. Shells are partly buried in laterite ground surface.
Shoal Bay 1	Murrumujuk Infrastructure	Shell midden	25m x 30m	Low to medium density shell scatter comprised of Marcia hiantina (dominant), Telescopium, Anadara sp., Polymesoda erosa, Terebralia palustris. Shells are partly buried in laterite ground surface. Recorded on NTG Archaeological database.
Shoal Bay 3	Murrumujuk Infrastructure	Shell midden	1.5m x 1.5m	Low density shell scatter comprised of Marcia hiantina located between road and erosional area. Likely some of the site has been impacted by road works and erosion. Site at high risk of being lost due to erosion. Recorded on NTG Archaeological database.

Table 6: Cultural Landscape Features Recorded

Name	Chainage	Site Type	Site Size	Artefact types	Notes
AAPL_LM043	772.5	Cultural feature	30m x 30m	Tree	Banyan Tree.
CHRA_LM_OHTL028	782.5 to 783.2	Cultural feature	NR	Swamp	Culturally important resource area. Moderate to high potential for isolated artefacts and CMTs.
CHRA_MUR_CTA_Gen001	Murrumujuk Infrastructure	Cultural feature	NR	Swamp	Culturally important resource area. Moderate to High potential for isolated stone artefacts, low density scatters and CMT in surrounding trees.
CHRA_MB-02	Murrumujuk Infrastructure	Cultural feature	NR	Creek/resource area	Culturally important resource area. Potential for shell middens and subsurface heritage features. Burial site located to south of area.

6.1 Indigenous Archaeological Sites

As a whole, the surveyed areas contained 29 Indigenous archaeological features. Site types and distribution patterns were analogous to those identified in other areas across the Top End of Australia and the consultants understanding of past land use patterns within the monsoon tropics (see Section 4). There was a clear correlation between archaeological features, raw material sources (including ironwood trees) and their proximity to watercourses and swamps. Conversely, there was a distinct absence of archaeological materials across Land Systems without water and/or raw materials suitable for the manufacture of stone artefacts and ironwood trees.

Flaked stone artefacts dominated the archaeological site assemblages with 13 features recorded (including isolated arefacts). The stone artefacts scatters were largely small with limited diversity of raw materials and artefact types. However, it is noted that visibility was constrained in several locations (see Section 6.3 below). Stone artefact raw materials present included quartzite, quartz, chert and tuff. Quartzite and quartz were the most common raw material types. The source of this material is likely -Ppa geological units between OHTL Chainage 730 and 735. The cherts and tuff were likely transported or traded into the area, however without further study at a regional level it would be difficult to assess the origin of all materials.

CMTs were the second most common archaeological feature, with 12 sites recorded. The CMTs likely all reflected the traditional procurement of sugarbag, with varying stages of site preservation left in the archaeological record. Stumps and logs were the most common CMT attributes remaining, with evidence of fire having a significant impact on the preservation of these features. All axe scar marks were noted as being either steel axes or steel tomahawks. The latter are distinguishable due to the smaller cut marks.

For the above analysis, CMT identified as ‘stumps only’ have been classified as sugarbag features. The premise is that stumps are generally the remains of stump/log CMTs where the log has burned out. There were also a small number of stumps that have resulted from timber harvesting activities. These were not recorded in the field when identified. These included any that were obviously cut by chainsaws, and those where some parts of the log were removed, but the upper sections remained.

The distribution pattern of CMTs centred on the margins of watercourses and swamps, in land units with higher densities of ironwood. The frequency of CMTs increased closer to areas with good access and in historically important hunting and resources zones, such as the swamps along the margins of Gunn Point Road.

Three midden/shell scatters were recorded, with two of these (i.e. Shoal Bay 1 and Shoal Bay 3) being previously recorded on the NTG Archaeological Database. All three sites showed a diversity of shell species present including, *Marcia hiantina* (dominant), *Telescopium*, *Anadara sp.*, *Polymesoda erosa,* and *Terebralia palustris*. Site AAPL_LM045 located on the ridge brow leading down to Murrumujuk Beach was dominated by *Telescopium* and noted as appearing more weathered (older) than Shoal Bay 1 and Shoal Bay 3.

In general, the three midden sites were in a poor to fair state of preservation from human intervention, erosion, and road development/maintenance.

Site AAPL_LM024 was recorded as a small stone arrangement of unknown origin. The site consisted of a circular arrangement of stones 2m in diameter on a low-lying laterite hill, however further analyses was not possible due to the 0% ground surface visibility at the time of survey. The arrangement was located approximately 30m from a low-density artefact scatter (site ID: AAPL_LM024) at OHTL Chainage 737.2.

6.2 Historic Features

17 historic features were recorded between Chainage 722 and 725. These features included remnants of the NAR WWII sites and potentially part of the Old Coach Road.

NAR Sites, including the Old Coach Road

The three NAR sites included a railway bridge, railway embankment and railway cutting. The Railway bridge (site ID: AAPL_LM001) dates from 1887 and is a high level, medium duty structure. It was built from 550mm x 230mm fabricated riveted steel girders, supported by concrete abutments at either end, with two intermediate pier trestles with 230mm x 140mm "I" beam section uprights. Uprights have an embossed Butterley Derbyshire Patent. The bridge was fabricated by James Martin & Co of Gawler, South Australia (Kent 2004). The bridge structure is complete and is in excellent condition.

Site AAPL_LM002 are the 1887 remnants of a railway embankment built to span the Berry Creek tributary and surrounding floodplain. The embankment stretches almost 1km in length from OHTL Chainage 722.2. The embankment was constructed from gravel likely imported from other sections of the NAR construction (Kent 2004, p. 14) and reaches a maximum height of approximately 3m. Whilst the tracks and sleepers have been removed, the site remains in relatively good condition. A number of related artefacts are strewn across the length of the embankment, including parts of sleepers and tracks. Some adjoining pastoral fence posts have been constructed from repurposed NAR sleepers.

AAPL_LM004 is an 1887 railway cutting through a low-lying laterite rise, which extends for approximately 200m. The cutting has a maximum depth of 3m. Whilst some sections of the walls have eroded, others clearly show the original hand pick marks.

Running parallel along the western side of the railway embankment (site ID: AAPL_LM002) lies the remnants of an early road (site ID: AAPL_LM003), which may constitute part of the Old Coach Road. This feature is built up approximately 30cm higher than the surrounding landscape and appears to be constructed of compacted earth, stone, and gravel in places. Only small sections of the feature are visible, with most being overgrown and in a poor state of preservation. Whist little information is available on the Old Coach Road, it is known to predate the 1887 railway construction and follow the same alignment in places.

WWII Sites

Thirteen WWII features were recorded during the surveys. Three of these sites were recorded as being Medium (40mm “Bofors” Gun) Anti-Aircraft (MAA) Emplacements comprising of earth filled 44-gallon drum gabions. Two of these MAA Emplacements (AAPL_LM009 and AAPL_LM010) originally had two drum high walls, however at the time of survey the upper layers had been pushed or had collapsed outward. Both emplacements were likely associated with defending the Noonamah Siding and surrounding airfields.

The third emplacement (AAPL_LM006) appeared to follow construction methods and layout adapted from the 1944 US Field Fortification Manual.[3] This emplacement consisted of earth filled 44-gallon drum gabions and corrugated iron reinforcing, covered with mounded earth and dressed with concrete. Ammunition niches were also constructed into the walls. The number 60 was painted on the northern wall, but it is unknow what it referenced. This emplacement was positioned beside the railway cutting and may have been used to defend trains positioned in the cutting.

[3] https://milepegsnt.com/site/improvised-ww2-anti-aircraft-sites-in-the-northern-territory/ viewed on 10 January 2022.

The majority of remaining WWII features recorded were potentially associated with a camp or similar type environs, which included: footings (AAPL_LM008 and AAPL_LM014), concrete rubble from a building slab (AAPL_LM013), buried ablution drainage system (AAPL_LM012), a latrine (AAPL_LM011) and a rubbish dump containing food tins and bottles (AAPL_LM017). Parts of this complex had been previously recorded by Silvano (2017) for the proposed Strauss Water Treatment Plant.

Additional WWII features recorded included a CMT (AAPL_LM015) cut into a living ironwood tree. Its WWII association was based on the absence of a sugarbag opening in the tree. A military ammunition or toolbox was recorded in an area with other dumped metal components (AAPL_LM007). Proximal to AAPL_LM007 lies a depression approximately 16m wide which was considered by Silvano (2017) as being a bomb crater (AAPL_LM046). Aerial photos taken around Noonamah during WWII show a number of bomb craters of similar size from Japanese air raids.

6.3 Cultural Heritage Risk Areas

Following the results of the surveys, 33 Cultural Heritage Risk Areas were identified (see below). These locations are classified as potential risk areas on the basis that they have either not been subject to sufficient investigations to confidently identify all archaeological features, were recommended as key risk areas by Traditional Owners, or were not included in the sampling strategy but have subsequently been identified as areas which have a higher potential for containing archaeological features.

Survey limitations at some of these locations included, poor ground surface visibility, resource rich areas which couldn't be surveyed in their entirety with the time available, their remoteness limiting survey time and/or limited access.

Table 7: Cultural Heritage Risk Areas

Area ID	Chainage	Feature	Cultural Heritage Potential
CHRA_LM_OHTL001	722.4 to 722.6	NAR Railway	Number of NAR railway features through area and potential for isolated artefacts and background scatters adjacent to watercourse (including subsurface).
CHRA_LM_OHTL002	724.1 to 724.6	WW2 Infrastructure site	Potential for buried WW2 artefacts and UXO's.
CHRA_LM_OHTL003	726.7 to 727.5	Swamp/Paleo drainage area	Moderate to low potential for isolated artefacts. Some potential for shallow subsurface deposits along watercourse banks.
CHRA_LM_OHTL004	728.3 to 728.8	Elizabeth River crossing	Moderate to low potential for isolated artefacts and background scatters. Some potential for shallow subsurface deposits along watercourse banks.
CHRA_LM_OHTL005	729.6 to 729.7	Rock outcrop	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL006	730.5 to 730.8	Rock outcrop	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL007	731 to 731.2	Rock outcrop	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL008	731.3 to 731.5	Rock outcrop	High potential for isolated artefacts and low-density scatters along rock outcrops.

Area ID	Chainage	Feature	Cultural Heritage Potential
CHRA_LM_OHTL009	732 to 732.2	Rock outcrop	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL010	737.1 to 737.3	Small rise	High potential for isolated artefacts and artefact scatters on rock out crop. Area also contains a stone arrangement that needs additional assessment after improved GSV
CHRA_LM_OHTL011	738.6 to 738.8	Watercourse & adjoining banks (unnamed)	High potential for isolated artefacts and low-density scatters along creek margins
CHRA_LM_OHTL012	734.3 to 734.6	Creek (unnamed)	Moderate to low potential for isolated artefacts. Some potential for shallow subsurface deposits along creek bank.
CHRA_LM_OHTL013	742.6 to 743	Laterite plateau proximal to drainage areas	Moderate potential for isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL014	746.4 to 746.8	Watercourse & adjoining banks (unnamed)	Moderate potential for isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL015	748 to 748.5	Watercourse & adjoining banks (unnamed)	Moderate potential for isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks
CHRA_LM_OHTL016	749.8 to 750	Watercourse & adjoining banks (unnamed)	Moderate potential for isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks
CHRA_LM_OHTL017	751.3 to 751.6	Watercourse & adjoining banks (unnamed)	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks
CHRA_LM_OHTL018	752.5 to 755.6	Black Jungle Conservation Reserve	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks
CHRA_LM_OHTL019	757.4 to 757.8	Watercourse & adjoining banks (unnamed)	Moderate potential for isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL020	758.5 to 759.1	Swamp margins ironwood woodland	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL021	760.9 to 761.5	Swamp/watercourse margins ironwood woodland	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL022	764 to 764.3	Swamp	Moderate potential for isolated artefacts and background scatters across swamp high bank area.
CHRA_LM_OHTL023	764.5 to 767.5	Swamp complex & dense ironwood woodland	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water. Poor ground surface visibility at the time of survey

Area ID	Chainage	Feature	Cultural Heritage Potential
CHRA_LM_OHTL024	768.5 to 769.9	Swamp complex & dense ironwood woodland	Moderate potential for isolated artefacts, low density scatters and CMTs around swamp margin. Area is proximal to registered sacred site
CHRA_LM_OHTL025	771.3 to 773.1	Swamp complex	Moderate potential for isolated artefacts, low density scatters and CMTs around swamp margin.
CHRA_LM_OHTL026	773.5 to 778	Swamp high bank	Moderate potential for isolated artefacts, low density scatters and CMTs around swamp margin. Area is proximal to registered sacred site.
CHRA_LM_OHTL027	775.7 to 778.1	Dense ironwood woodland	Moderate potential for CMTs through ironwood dense area.
CHRA_LM_OHTL028	782.5 to 783.2	Swamp	Culturally important resource area. Moderate to high potential for isolated artefacts and CMTs.
CHRA_MB-01	Murrumujuk Infrastructure	Sand Dune	High. Burials and shell middens noted in similar dune systems nearby. High potential for subsurface deposits.
CHRA_MB-02	Murrumujuk Infrastructure	Creek/Resource Area	High. Potential for shell middens and subsurface heritage features. Burial site located to south of area.
CHRA_MB-03	Murrumujuk Infrastructure	Low lying hills	Moderate potential for isolated artefacts and shell middens/scatters.
CHRA_MB-04	Murrumujuk Infrastructure	Low lying rise	Moderate potential for isolated artefacts and shell middens/scatters.
CHRA_MUR_CTA_Gen001	Murrumujuk Infrastructure	Swamp	Culturally important resource area. Moderate to High potential for isolated stone artefacts, low density scatters and CMT in surrounding trees.

7 Cultural Heritage Significance Assessment

The significance assessments provided in this section were undertaken on recorded sites in accordance with the accepted guidelines and principles described below.

7.1 Significance Assessment Guidelines

Cultural heritage management in Australia is underpinned by legislation, coupled with the ethics and principles established by heritage management practice. In addition to statutory law, several guidelines have been developed to support the protection and management of Indigenous heritage places on Commonwealth land. These include but are not limited to:

- Ask First, A guide to respecting Indigenous heritage places and values (2002).
- Engage Early, Guidance for proponents on best practice Indigenous engagement for environmental assessments under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (2016).
- Practice Notes for the Australian ICOMOS Burra Charter 2013 (hereafter referred to as the "Burra Charter").

Legislative basis for the protection and conservation of Indigenous archaeological places and objects within the study is discussed in Section 2.

The cultural heritage values of sites and objects recorded during the survey followed key Indigenous heritage management and significance assessment principles from the Burra Charter Practice Note, 'The Burra Charter and Indigenous Cultural Heritage Management, 2013' (see also The Burra Charter and Archaeological Practice, 2013). These are summarised below for reference:

Place	*Includes locations that embody spiritual value (such as Dreaming places, sacred landscapes and stone arrangements), social and historical value (such as massacre sites), as well as scientific value (such as archaeological sites). In fact, one place may be all of these things or may embody all of these values at the same time.*
Cultural Significance	Is very broadly defined to *include 'aesthetic, historical, scientific, social or spiritual value for past, present or future generations'. This definition captures places of cultural significance to Indigenous cultures. It also includes places that provide a physical location that is integral to the existence, observation and practice of intangible heritage. The Burra Charter definition of cultural significance encompasses all forms of spirituality, regardless of the culture from which it emanates. Similarly, aesthetic value is not limited to a 'western' perception of aesthetics.*
Knowledge and expertise of Indigenous peoples	*It is critical that assessments of cultural significance for Indigenous heritage places reflect the views and input of the relevant Indigenous knowledge-holders.*

Precise Assessments	*Practitioners must define the location and form of a place, and the values that it embodies, with sufficient clarity to inform an assessment or the development of policy.*
Changing Values	*Assessments of significance need to be responsive to the dynamic nature of Indigenous cultures.*
Defining Site Boundaries	*Assessments of significance that concentrate on the visual characteristics of a place and use those characteristics to establish a 'boundary' for the place, may fail to appreciate its broader cultural or spiritual setting.* *Importantly, heritage practitioners must not inappropriately privilege tangible places and objects over the intangible aspects of heritage.*
Maintenance, preservation, restoration, reconstruction and appropriate 'change' can be culture dependent	*Practitioners may identify conservation needs and responses that are at odds with those identified by the traditional owners of a place, with the potential for misunderstanding and conflict.*

These principles outlined in the Burra Charter are generally those by which most cultural heritage practices in Australia are determined, including the assessment of significance of individual heritage places and objects.

In summary, cultural heritage landscapes, places, sites and objects can be significant in a number of ways:

1. Significant to a group or many groups of people due to their connection to the past.
2. Significant to a specific group of people because they have religious or spiritual significance to those people (Sacred Sites, Dreaming Sites or Story Places for example),
3. Significant to a group or many groups due to the relationship of place in the wider context of an ecological and cultural landscape.
4. Significant because of their research potential: their importance of the site in answering questions about past and in some instance's current human behaviour.
5. Significant due to their representativeness or uniqueness: sites or places that are rare or unique and are therefore conserved as a representative example.

Following the assessment of significance, the future conservation of a heritage place is decided by weighing up the level of assigned significance against the practicality of conserving the place. In terms of Indigenous site, these decisions should be made in direct consultation with Traditional Owners and guided by their views and input. To assess the practicality of conserving a heritage site, regulatory mechanisms are usually used to assess the condition of the place (whether it will survive for much longer) and the economic implications of deciding to apply permanent heritage protection.

7.2 Assessment Principles of Scientific and Research Significance

Scientific and research significance, including archaeological significance, is determined by assessing the ability of an object, site or area to add to the scientific knowledge of history or pre-history. This scientific knowledge for example, may include the ability of an object, site or area to provide an insight

into past social patterns (e.g. trade and exchange networks), technologies, substance patterns, timings of occupation, and/or paleoenvironmental conditions.

Accordingly, in general the more information an object, site or area can add to understanding the past, the higher its scientific significance. Notwithstanding this, some sites or objects may also have higher levels of scientific significance due to their aesthetics, rarity and representativeness rather than an ability to inform greater details about the past. Areas or sites so judged are often recorded in detail or conserved *in situ* because they may add to our understanding of the past. It also may involve conserving a place until all practical scientific observations can be made, for example, in the salvage of artefact scatters before a development commences.

Outside of research significance, cultural sites such as stone artefact scatters, camp sites and quarries can also have an educational role in helping non-Indigenous people understand some aspects of traditional Aboriginal lifeways.

7.3 Significance of Cultural Heritage Features within the Survey Area

Surveys of the OHTL from Livingstone (Chainage 722) to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk recorded a total of 47 archaeological sites. In addition, several landscape features of cultural significance to the Traditional Owners were also recorded during the surveys, which included: a small watercourse (CHRA_MB-02) at Murrumujuk Beach on the southern of the AAPowerLink Infrastructure Corridor, the swamp area (CHRA_MUR_CTA_Gen001) within the Darwin Converter Site, a swamp (CHRA_LM_OHTL028) located within the OHTL corridor at Chainage 783 and a Banyan Tree (AAPL_LM043) located at Chainage 772.5. Black Jungle Conservation Reserve (CHRA_LM_OHTL018) was also highlighted by Traditional Owners as an important men's place.

In general, the recording of the archaeological features was relatively brief but aimed to capture sufficient information to understand and assess the archaeological and cultural significance of the features within the footprint areas. Information recorded for each feature included: locational data, brief site descriptions, artefact sample counts, geomorphic and environmental contexts, condition, Traditional Owner comments and a photographic record. This information has been used to provide a significance rating for each archaeological site. Individual site significance assessments are presented in Table 8 (see also Appendix 2).

Traditional Owners consider the whole landscape underlying the Livingstone to Murrumujuk Project Areas as having cultural significance. This relationship with Country is demonstrated by the density of archaeological sites, sacred sites and culturally significant areas through and around the Project Areas.

Underpinning this notion, the significance assessment advice provided by senior Traditional Owners indicated that most archaeological sites recorded during this study were held with medium or low-medium cultural significance due to their connection to Old People. Isolated artefacts were considered of lower significance by the Traditional Owner field team. From an archaeological perspective, the majority of individual sites recorded were assessed as low or low-medium significance. The railway bridge (AAPL_LM001) was assessed as medium-high significance and one MAA site (AAPL_LM006) as medium significance.

All isolated finds were considered of low archaeological significance due to their abundance in the landscape and understanding that minimal scientific information would be lost if they were salvaged from their current in-situ locations.

Comparable to much of regional Australia, some substantial impacts to the significance of the sites were evident due to high bioturbation levels from a long history of cattle grazing, pastoral activities, recreational use, mining, Defence and civil infrastructure development across the region (see Section 3.5 above). Secondly, environmental factors such as fire and erosion have also had some impact to the retained archaeological significance of several sites.

Five sites were assessed as having low-medium or greater levels of archaeological significance due to their rarity, representativeness, and potential ability to provide valuable information on the past human occupation of the area.

All sites have archaeological significance ratings largely reflective of their scientific values or historic values with those given a higher rating based on their ability to better inform the past and/or are more representative of a particular site type. It is also possible that the significance rating of these sites could change to a lower or higher rating following additional investigations such as targeted archaeological surveys following improved ground surface visibility or wider regional studies.

In general, the significance assessments drew on the abovementioned Burra Charter guides and criteria outlined in the *NT Heritage Act*, which included the following considerations:

1. Whether the place or object is important to the course or pattern of the Northern Territory's cultural or natural history.
2. Whether the place or object possesses uncommon, rare or endangered aspects of the Northern Territory's cultural or natural history.
3. Whether the place or object has potential to yield information that will contribute to an understanding of the Territory's cultural or natural history.
4. Whether the place or object is important in demonstrating the principal characteristics of a class of cultural or natural places or environments.
5. Whether it is important in exhibiting particular aesthetic characteristics.
6. Whether it is important in demonstrating a high degree of creative or technical achievement during a particular period.
7. Whether it has a strong or special association with a particular community or cultural group for social, cultural, or spiritual reasons, including the significance of the place to the Aboriginal people as part of their continuing and developing cultural traditions.
8. Whether it has a special association to the life or works of a person or group of persons, of importance to the Northern Territory's history.

Broadly, all Indigenous archaeological sites were also assessed as having varying levels of potential attributes to provide information on a combination of the following key research areas:

1. Settlement patterns of Aboriginal people across the region.
    a. Why were certain locations selected or favoured?

i. Were there economies associated with certain resources in certain areas?
ii. Were certain locations significant due to environmental subsistence needs or other pressures?
iii. Were there different technological or raw material requirements of different settlement areas?

2. The connectedness of individual sites and/or land systems.
3. Are the contents of sites part of a complex or related sites or land systems?
4. Provenance of stone raw materials used in artefact manufacture.
    a. Was any stone raw material traded outward from this area and were any artefacts present made from raw materials that do not naturally occur in the region?
5. Lithic technologies.
    a. Were the same lithic technologies used throughout the region?
6. Temporality of human occupation and palaeoenvironmental conditions.
    a. What is the temporality of human occupation in the region?
    b. Were certain areas used more or less through time?
    c. What were the palaeoenvironmental conditions through time?
    d. Did artefact raw material types and sources change through time?

Table 8: Individual Site Significance Assessments

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
AAPL_LM001	722.5	Historic object/place	1887 high level, medium duty bridge structure.550 x 230mm fabricated riveted girders, supported by concrete abutments either end with two intermediate pier trestles with 230 x 140mm "I" section uprights. Uprights have Butterley Derbyshire Patent.	20m x 2m	Excellent	Moderate to High	NR	Within infrastructure corridor
AAPL_LM002	722.3 to 723.2	Historic object/place	1887 remnants of the remnant of the North Australia Railway. Embankments section of railway crossing tributary of Berry Ck and surrounding flood land. Blue metal gravel construction rising to approx. 3m above the surrounding ground at Chainage 723.	950m	Good in places	Low	NR	Within infrastructure corridor
AAPL_LM003	722.4 to 723.2	Historic object/place	Potential remnants of the Old Coach Road. Road is built up approx. 30cm and constructed of compacted earth and gravel in places.	3m wide	Poor	Low	NR	Within infrastructure corridor
AAPL_LM004	723.7 to 723.9	Historic object/place	1887 Railway cutting. Likely hand excavated cutting through laterite and shale bedrock. 200m in length to a maximum 3m depth. Hand pick marks remain visible in some places.	200m x 6m	Good	Low to moderate	NR	Within infrastructure corridor
AAPL_LM005	723.8	Historic object/place	WW2 dump. 5 x 44 gallon drums, broken bottles, mechanical parts and a riveted section of aircraft panelling.	5m x 10m	Fair	Low	NR	Within infrastructure corridor
AAPL_LM006	723.9	Historic object/place	WW2 MAA Emplacement. 44-gallon drum gabions, covered with earth and concrete. Location likely for protection of trains/vehicles within cutting.	25m x 25m	Good	Moderate	NR	Within infrastructure corridor

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
AAPL_LM007	724.15	Historic object/place	WW2 Ammunition box, pile of WW2 or railway riveted bolts and steel pieces.	2m x 2m	Poor	Low	NR	Within infrastructure corridor
AAPL_LM008	724.28	Historic object/place	Concrete pad 2.5m x 3m. Orientated north. Concrete appears to have been laid within a corrugated iron building. Potential WW2 or railway association.	2m x 3m	Fair	Low	NR	Within infrastructure corridor
AAPL_LM009	724.32	Historic object/place	WW2 Potential MAA Emplacement. 44-gallon drum gabions. Gabions were 2 drums high with upper layer having collapsed outward. 52 drums along three sides of a 7m x 7m area. Opening faces 100 degrees.	15m x 15m	Good	Low	NR	Within infrastructure corridor
AAPL_LM010	724.33	Historic object/place	WW2 Potential MAA Emplacement. 44-gallon drum gabions. Gabions were 2 drums high with upper layer having collapsed outward. 42 drums along three sides of a 6m x 6m area. Opening faces 230 degrees.	15m x 15m	Good	Low	NR	Within infrastructure corridor
AAPL_LM011	724.44	Historic object/place	WW2 Potential latrine, 7 drums wired together and open at both ends. 7m length. Cones entering drum line from one edge.	7m x 1m	Good	Low	NR	On northern edge of infrastructure corridor
AAPL_LM012	724.46	Historic object/place	WW2 Buried drums (start) over an approx. 15m length. Drums are perforated suggesting potential ablution or greywater drainage. Site is orientated 190 degrees.	15m x 3m	Fair	Low	NR	On southern edge of infrastructure corridor
AAPL_LM013	724.5	Historic object/place	WW2 concrete rubble. Building foundations. Concrete aggregate is comparable to other WW2 features within the area. Original building is unknown.	4m x 4m	Poor	Low	NR	Outside infrastructure corridor

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
AAPL_LM014	724.5	Historic object/place	Earth mound with corrugated iron shoring. 5m x 3m x 0.3m ht. Ramped earth "path" on one side orientated 165 degrees.	5m x 3m	Poor	Low	NR	Within infrastructure corridor
AAPL_LM015	724.5	Historic object/place	CMT. Steel axe cut marks on living ironwood tree. Scar HAG = 142cm, Scar L = 12cm, W = 18cm. Tree diam @ 1m = 190cm. Likely WW2 association given absence of sugarbag opening.	1m	Good	Low	NR	Within infrastructure corridor
AAPL_LM016	724.65	CMT	CMT. Steel axe marks won fallen ironwood. Log partially burnt with lower portion of scar remaining. Scar HAG = 350cm, W= 16cm. Log diam @ 1m = 180cm. Likely sugar bag scar.	5m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM017	724.9	Historic object/place	WW2 rubbish dump containing food and beverage containers (cans and bottles). Likely associated with adjoining WW2 infrastructure use.	8m x 8m	Fair	Low	NR	Within infrastructure corridor
AAPL_LM018	729.7	Isolated Artefact	Four quartz flakes recorded within outcropping quartz complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.	2m x 2m	Good	Low	Low	Within infrastructure corridor
AAPL_LM019	730.57	Isolated Artefact	Bifacial quartz point recorded within outcropping quartz complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.	1m x 1m	Good	Low	Low	Within infrastructure corridor
AAPL_LM020	731.05	Isolated Artefact	Broken quartz flake recorded within outcropping quartz complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.	1m x 1m	Good	Low	Low	Within infrastructure corridor

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
AAPL_LM021	731.2	Isolated Artefact	Broken quartz flake recorded within outcropping quartz complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.	1m x 1m	Good	Low	Low	Within infrastructure corridor
AAPL_LM022	732.12	Isolated Artefact	Whole quartzite flake recorded within outcropping quartzite complex. Potentially part of wider background scatter. Poor ground surface visibility at the time of survey.	1m x 1m	Good	Low	Low	Within infrastructure corridor
AAPL_LM023	733.25	Isolated Artefact	Whole quartzite flake recorded on top of low-lying flat ridge top. Moderate ground surface visibility at the time of survey.	1m x 1m	Good	Low	Low	Within infrastructure corridor
AAPL_LM024	737.2	Stone arrangement	Circular stone arrangement on small laterite hill. Origin could not be determined due to 0% ground surface visibility.	Could not determine due to low GV	Unknown	TBC	TBC	On edge of infrastructure corridor
AAPL_LM025	737.23	Artefact scatter	Low density scatter on outcropping laterite/sandstone rise. 30 artefacts were recorded however poor ground surface visibility restricted defining the extent of the site.	10m x 10m	Good	Low	Low-medium	Within infrastructure corridor
AAPL_LM026	738.6	Isolated Artefact	Quartzite whole flake on laterite ground surface adjacent to watercourse.	1m x 1m	Good	Low	Low	On edge of infrastructure corridor
AAPL_LM027	738.8	Isolated Artefact	2 quartzite flake and 1 quartz flake. Located on sandy bank of watercourse, potential for some subsurface deposits. Likely part of a larger background scatter than extends down the eastern margin of the watercourse.	1m x 3m	Fair	Low	Low	Within infrastructure corridor

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
AAPL_LM028	738.8	Artefact scatter	Low density artefact scatter of flakes and flaked pieces. 8 artefacts were recorded. Artefact attributes were not clearly defined in some instances however materials are inconsistent with surrounding geology.	4m x 4m	Fair	Low	Low-medium	Within infrastructure corridor
AAPL_LM029	738.8	Isolated Artefact	Isolate quartzite artefact with medial fracture. Located on sandy bank of watercourse. Likely part of a larger background scatter than extends down the eastern margin of the watercourse.	1m x 1m	Fair	Low	Low	On edge of infrastructure corridor
AAPL_LM030	746.4	Isolated Artefact	Broken chert flake on laterite ground surface. Good ground surface visibility at the time of survey.	1m x 1m	Good	Low	Low	Within infrastructure corridor
AAPL_LM031	758.45	Isolated Artefact	Whole chert flake on laterite ground surface. Good ground surface visibility at the time of survey.	1m x 1m	Good	Low	Low	Within infrastructure corridor
AAPL_LM032	758.9	CMT	Sugarbag scar on fallen iron tree (dead). Steel tomahawk marks. Scar HAG = 90cm, Length = 34cm, W =13cm, Cir = 64cm. Orientation 180 degrees.	3m x 1m	Good	Low	Low-medium	Within infrastructure corridor
AAPL_LM033	759.7	CMT	CMT stump (ironwood). No log in situ. Stump HAG = 103cm, Cir = 93cm.	1m x 1m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM034	767.35	CMT	CMT fallen dead tree with sugar bag scar (ironwood). Scar HAG = 137cm, Ht = 21cm, W = 7cm. Tree circumference = 87cm.	6m x 1m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM035	768.6	CMT	CMT stump and log with sugar bag scar (ironwood). Stump HAG= 148cm, circumference = 56cm. Sugar bag scar L = 38cm, W = 13cm.	6m x 2m	Poor	Low	Low-medium	Within infrastructure corridor

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
AAPL_LM036	769	CMT	CMT stump and log (ironwood). Steel axe marks Stump circumstance = 74cm. Stum HAG = 96cm. Scar length = 40cm, width = 19cm.	5m x 2m	Poor	Low	Low-medium	Outside corridor
AAPL_LM037	769	CMT	CMT stump (ironwood). No log in situ. Stump HAG = 104cm, Cir = 74cm.	1m x 1m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM038	769	CMT	CMT stump and log (ironwood). Stump HAG = 75cm. Stump circumstance = 70cm. No scar on log.	5m x 2m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM039	769.15	CMT	CMT log and sugar bag scar (ironwood). Steel axe marks. Scar HAG = 81cm, L = 80cm, W =30cm. Active sugar bag in scar.	6 x 1m	Good	Low	Low-medium	Within infrastructure corridor
AAPL_LM040	771.46	CMT	CMT stump and log with sugar bag scar (ironwood). Steel axe marks. Stump HAG = 100cm. circumstance = 77cm. 2 x sugar bag scars. Scar 1 height above cut = 177cm, L = 39cm, W = 15cm. Scar 2 scar on separate log piece. Scar 2 L = 12cm, W = 11cm.	5m x 3m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM041	771.9	CMT	CMT log with sugar bag scar (ironwood - burnt). Scar HAG = 98cm, L = 51cm, W = 24cm. Log diam = 26cm.	3m x 1m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM042	772	CMT	CMT log with sugar bag scar (ironwood - burnt). Scar HAG = NA, L = 32cm, W = 17cm. Log diam = 24cm.	1.5m x 1m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM044	777.2	CMT	CMT stump and log (ironwood - burnt). Steel axe marks. Stump HAG = 125cm, circumstance = 53. Burnt log with no visible sugar bag scars.	5m x 2m	Poor	Low	Low-medium	Within infrastructure corridor
AAPL_LM045	Murrumujuk Infrastructure	Shell midden	Low density shell scatter comprised of Telescopium, Marcia hiantina, Polymesoda erosa, Terebralia.	16m x 13m	Poor	Low	Medium	Within infrastructure corridor

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
			palustris. Shells are partly buried in laterite ground surface.					
AAPL_LM046	724.5	Historic object/place	Recorded as a potential bomb crater in (Jung, S. 2017. Strauss Water Treatment Plant archaeological survey report. Power and Water, Darwin, NT).	16m x 16m	NR	Low-moderate	NR	Within infrastructure corridor
Shoal Bay 1	Murrumujuk Infrastructure	Shell midden	Low to medium density shell scatter comprised of Marcia hiantina (dominant), Telescopium, Anadara sp., Polymesoda erosa, Terebralia palustris. Shells are partly buried in laterite ground surface. Recorded on NTG Archaeological database.	25m x 30m	Fair	Low-moderate	Medium	Within infrastructure corridor
Shoal Bay 3	Murrumujuk Infrastructure	Shell midden	Low density shell scatter comprised of Marcia hiantina located between road and erosional area. Likely some of the site has been impacted by road works and erosion. Site at high risk of being lost due to erosion. Recorded on NTG Archaeological database.	1.5m x 1.5m	Poor	Low	Low	Within infrastructure corridor
AAPL_LM043	772.5	Cultural feature	Banyan Tree.	30m x 30m	Good	NA	High	Within infrastructure corridor
CHRA_LM_OHTL028	782.5 to 783.2	Cultural feature	Culturally important resource area. Moderate to high potential for isolated artefacts and CMTs.	NR	Good	NA	High	Within infrastructure corridor
CHRA_MUR_CTA_Gen001	Murrumujuk Infrastructure	Cultural feature	Culturally important resource area. Moderate to High potential for isolated stone artefacts, low density	NR	Good	NA	High	Within Darwin Converter Site Area

Name	Chainage	Site Type	Site Description	Site Size	Site Condition	Arch Significance	Cultural Significance	Distance to proposal footprint
			scatters and CMT in surrounding trees.					
CHRA_MB-02	Murrumujuk Infrastructure	Cultural feature	Culturally important resource area. Potential for shell middens and subsurface heritage features. Burial site located to south of area.	NR	Good	NA	High	Within infrastructure corridor

8 Development Risks and Recommendations

The following section outlines the potential impacts that may be produced by the OHTL from Livingstone (Chainage 722) to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk on archaeological and culturally significant features during the construction and operational phases of the Project. These impacts are limited to the proposed Project works set out in Section 1.3 above. Potential impacts to sites protected under the *NT Aboriginal Sacred Sites Act 1989* will be captured through the AAPA Authority Certificate process and are not included in this report.

Recommendations are then presented that will assist in the protection and management of archaeological and culturally significant sites, including the mitigation of any impacts to ensure that Sun Cable carries out activities in compliance with the *NT Heritage Act 2011* and *NT Aboriginal Sacred Sites Act 1989* and within the expectation of Traditional Owners.

8.1 Potential Impacts on Aboriginal Archaeological Sites

8.1.1 Direct Impacts to Cultural Heritage Features

The proposal to construct the AAPowerLink OHTL from Livingstone (Chainage 722) to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk will require substantial ground disturbing activities as outlined in Section 1.3 above. Post construction and during operation, the Project will also require ongoing maintenance for its anticipated 70-year lifespan (including construction); the regularity or intensity of this work is unknown.

Accordingly, as presented in Table 9 below, within the current alignments, the OHTL from Livingstone (Chainage 722) to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk have the potential to directly impact 34 archaeological sites and 11 isolated artefacts. In addition to these archaeological sites, four culturally significant landscape features will be intersected by the road corridors and 33 Cultural Heritage Risk Areas will be disturbed overall.

Table 9: Number of cultural heritage features directly impacted by proposed AAPL activities

Project component	Archaeological Sites	Isolated Artefacts	Culturally Significant Landscape Features	Cultural Heritage Risk Areas
OHTL (Livingstone to Murrumujuk)	31	11	2	28
Darwin Converter Site	0	0	1	1
Cable Transition Facilities	3	0	1	4

From an archaeological perspective (based on the predictive model outlined in Section 4.5, survey results and other regional studies results) it is highly likely that further archaeological sites would be intersected if any attempt was made to realign the current footprints to avoid existing features. Notwithstanding this, Sun Cable has indicated that some realignments of access corridors may be possible to avoid discrete cultural heritage features. Recommendations for these localised realignments are presented in the following section.

In general, the potential direct impacts of the AAPowerLink OHTL from Livingstone to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk on the cultural heritage resources within the Project Area include, but are not limited to:

1. The clearing of surface archaeological remains, especially lithic material.
2. Destroying the integrity of a site complex when only a portion of the site has been surveyed and understood.
3. The unexpected revealing and/or destruction of subsurface material culture or human remains.
4. Removal of culturally significant artefacts by contractors, visitors and staff working on the Project.

8.1.2 Indirect Impacts to Cultural Heritage Features

Whilst this Report largely centres on the AAPowerLink development components, which have the potential to physically impact the cultural resources within its footprint, it should be noted that other indirect factors resulting from the Project's success may also risk further degradation to the area's cultural value. The potential indirect impacts of the AAPowerLink OHTL from Livingstone to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk on the archaeological and cultural heritage resources within the Project Area include, but are not limited to:

1. Increased access to culturally sensitive landscapes by public using the new road systems generated by the Project and wider public awareness of the Project Area.
2. Intergenerational impacts to the perception of a place's cultural value once it has been altered (both from within the underlying Estate Groups and neighbouring groups who share common cultural beliefs and ties).
3. Incremental destruction of places through increased development opportunities resulting from the Project.
4. Development variations to the Project Area due to changes in technologies or maintenance processes.
5. The construction design and method resulting in post-construction erosion of significant archaeological sites and cultural heritage features.
6. The submersion of significant surface archaeological remains by dust and sediments generated during construction.

8.2 Potential for Previously Undetected Aboriginal Cultural Heritage

All representative land units within the AAPowerLink OHTL from Livingstone to Murrumujuk, the Darwin Converter Site and the Cable Transition Facilities at Murrumujuk were sampled as part of the archaeological assessment. This subsampling was coupled with additional targeted surveys of watercourse crossings and areas with geology identified to potentially contain artefact bearing raw materials. Based on the results of this survey and the predictive modelling, it is likely unrecorded archaeological features remain in some unsurveyed land units throughout the Project Areas. It is also possible some undetected archaeological features may have been obscured by vegetation or sediment within the survey transects, however, these would be largely restricted to CMTs, additional isolated finds, concentrations of stone artefacts or shell scatters.

Additionally, there is a high potential for undetected buried archaeological features adjacent to watercourses and swamp margins along the OHTL and Darwin Converter Station. Similarly, there is also a high potential for buried archaeological features within and adjacent to the foredune system at Murrumujuk Beach.

Thirty-three areas were assessed as potentially containing undetected archaeological features. These areas, as presented in Table 10 below, have been categorised as Cultural Heritage Risk Areas, with varying risk potential from low to high. Conversely, in areas away from water resources or suitable outcropping geology there is considered to be a low residual risk of unrecorded/unidentified archaeological features.

Table 10: Cultural Heritage Risk Areas and Cultural Heritage Potential

Area ID	Chainage	Feature	Cultural Heritage Risks	Cultural Heritage Potential
CHRA_LM_OHTL001	722.4 to 722.6	NAR Railway	Moderate	Number of NAR railway features through area and potential for isolated artefacts and background scatters adjacent to watercourse (including subsurface).
CHRA_LM_OHTL002	724.1 to 724.6	WW2 Infrastructure site	High risk of impacting buried WW2 features.	Potential for buried WW2 artefacts and UXO's.
CHRA_LM_OHTL003	726.7 to 727.5	Swamp/Paleo drainage area	Low-Moderate	Moderate to low potential for isolated artefacts. Some potential for shallow subsurface deposits along watercourse banks.
CHRA_LM_OHTL004	728.3 to 728.8	Elizabeth River crossing	Low-Medium	Moderate to low potential for isolated artefacts and background scatters. Some potential for shallow subsurface deposits along watercourse banks.
CHRA_LM_OHTL005	729.6 to 729.7	Rock outcrop	Medium to high	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL006	730.5 to 730.8	Rock outcrop	Medium	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL007	731 to 731.2	Rock outcrop	Medium	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL008	731.3 to 731.5	Rock outcrop	Medium	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL009	732 to 732.2	Rock outcrop	Medium	High potential for isolated artefacts and low-density scatters along rock outcrops.
CHRA_LM_OHTL010	737.1 to 737.3	Small rise	High	High potential for isolated artefacts and artefact scatters on rock out crop. Area also contains a stone arrangement that needs additional assessment after improved GSV.
CHRA_LM_OHTL011	738.6 to 738.8	Watercourse & adjoining banks (unnamed)	Low-medium	High potential for isolated artefacts and low-density scatters along creek margins.
CHRA_LM_OHTL012	734.3 to 734.6	Creek (unnamed)	Low-medium	Moderate to low potential for isolated artefacts. Some potential for shallow subsurface deposits along creek bank.
CHRA_LM_OHTL013	742.6 to 743	Laterite plateau proximal to drainage areas	Low-medium	Moderate potential for isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL014	746.4 to 746.8	Watercourse & adjoining banks (unnamed)	Medium	Moderate potential for isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL015	748 to 748.5	Watercourse & adjoining banks (unnamed)	Low-medium	Moderate potential for isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks.

Area ID	Chainage	Feature	Cultural Heritage Risks	Cultural Heritage Potential
CHRA_LM_OHTL016	749.8 to 750	Watercourse & adjoining banks (unnamed)	Low-medium	Moderate potential for isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks.
CHRA_LM_OHTL017	751.3 to 751.6	Watercourse & adjoining banks (unnamed)	Low-medium	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks.
CHRA_LM_OHTL018	752.5 to 755.6	Black Jungle Conservation Reserve	Medium	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water. Potential for subsurface deposits within creek banks.
CHRA_LM_OHTL019	757.4 to 757.8	Watercourse & adjoining banks (unnamed)	Low-medium	Moderate potential for isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL020	758.5 to 759.1	Swamp margins ironwood woodland	Low-medium	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL021	760.9 to 761.5	Swamp/watercourse margins ironwood woodland	Low-medium	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water.
CHRA_LM_OHTL022	764 to 764.3	Swamp	Low-medium	Moderate potential for isolated artefacts and background scatters across swamp high bank area.
CHRA_LM_OHTL023	764.5 to 767.5	Swamp complex & dense ironwood woodland	Medium to high	Moderate potential for CMTs, isolated artefacts and background scatters across area due to proximity to water. Poor ground surface visibility at the time of survey.
CHRA_LM_OHTL024	768.5 to 769.9	Swamp complex & dense ironwood woodland	Medium to high	Moderate potential for isolated artefacts, low density scatters and CMTs around swamp margin. Area is proximal to registered sacred site.
CHRA_LM_OHTL025	771.3 to 773.1	Swamp complex	Medium	Moderate potential for isolated artefacts, low density scatters and CMTs around swamp margin.
CHRA_LM_OHTL026	773.5 to 778	Swamp high bank	Low-medium	Moderate potential for isolated artefacts, low density scatters and CMTs around swamp margin. Area is proximal to registered sacred site.
CHRA_LM_OHTL027	775.7 to 778.1	Dense ironwood woodland	Low-medium	Moderate potential for CMTs through ironwood dense area.
CHRA_LM_OHTL028	782.5 to 783.2	Swamp	High	Culturally important resource area. Moderate to high potential for isolated artefacts and CMTs.
CHRA_MB-01	Murrumujuk Infrastructure	Sand Dune	High	High. Burials and shell middens noted in similar dune systems nearby. High potential for subsurface deposits.
CHRA_MB-02	Murrumujuk Infrastructure	Creek/Resource Area	High	High. Potential for shell middens and subsurface heritage features. Burial site located to south of area.

Area ID	Chainage	Feature	Cultural Heritage Risks	Cultural Heritage Potential
CHRA_MB-03	Murrumujuk Infrastructure	Low lying hills	Moderate	Moderate potential for isolated artefacts and shell middens/scatters.
CHRA_MB-04	Murrumujuk Infrastructure	Low lying rise	Moderate	Moderate potential for isolated artefacts and shell middens/scatters.
CHRA_MUR_CTA_Gen001	Murrumujuk Infrastructure	Swamp	Moderate to High	Culturally important resource area. Moderate to High potential for isolated stone artefacts, low density scatters and CMT in surrounding trees.

8.3 Recommendations

This report makes recommendations on the cultural heritage recorded in this study according to its significance to Traditional Owners, its archaeological significance, the risk of impacts during construction of the AAPowerLink Project Areas and the condition of the site at the time of survey (see Cultural Heritage Significance Assessments, Section 7 above).

This report makes the following general recommendations:

1. Sun Cable should develop and implement a Cultural Heritage Management Plan (CHMP) in consultation with the Traditional Owners for the Project, prior to commencement of any ground disturbing activities (it is noted that Sun Cable have agreed to implementing a CHMP). This plan should include, but not be limited to:

    a. An outline of the Project Areas to which the CHMP applies.

    b. A summary of the cultural heritage features identified in this report, AAPA Authority Certificates (including Conditions) and any other relevant features identified by Sun Cable during consultation with Traditional Owners.

    c. Measures to protect and manage individual heritage places, during and post construction phases of the Project.
        i. Ensuring site mitigation and management strategies consider best industry practice, drawing on the archaeological and cultural values of each feature.

    d. Measures to manage and report inadvertent discoveries of cultural heritage finds, such as:
        i. Discovery of Aboriginal archaeological sites and objects; and
        ii. Discovery of human remains.

    e. Defined responsibilities for the protection and monitoring of cultural heritage features, including for areas that have been identified as Cultural Heritage Risk Areas and any other areas identified by Sun Cable during consultation with Traditional Owners.

    f. Traditional Owner liaison/consultation requirements regarding cultural heritage management and reporting of incidents.

    g. Protocols for Traditional Owners to access any areas immediately outside the Project Area during the construction phase of the Project, and the right to access cultural heritage features and areas of significance within the Project Area post construction (within the constraints of Occupational Health & Safety risks of the Project).

    h. A process for the management and availability of Cultural Heritage information (taking into consideration the confidentiality of culturally sensitive areas and any cultural protocols).

    i. Processes for Breach Investigation & Dispute Resolution, including timeframes for responses.

j. Outline the requirements for additional cultural heritage assessments of any new development areas or Project Footprint realignments prior to ground disturbance.

k. A review schedule for the Cultural Heritage Management Plan.

2. Sun Cable should aim to avoid impacts to heritage places, protected by the *NT Heritage Act* where practicable.
   a. Where impacts to heritage places are unavoidable, Sun Cable should seek for an approval to carry out work on a heritage place or object (a work approval) under s 72 of the *Heritage Act* and in accordance with the conditions set out in the CHMP.
   b. All site mitigation works should be undertaken well in advance of construction activities.

3. Sun Cable should implement workforce training and inductions, which include:
   a. Cultural awareness.
   b. Cultural heritage protection.
   c. Protocols for the management of Aboriginal archaeological Sites.
   d. Identification of Aboriginal archaeological Sites.
   e. Personnel responsibilities.

4. Sun Cable should ensure Traditional Owners/Site Custodians are engaged in heritage management decision making.

5. To minimise potential impacts to Sacred Sites, it is recommended that Sun Cable apply for a Sacred Sites Authority Certificate under the *Northern Territory Aboriginal Sacred Sites Act 1989 (NT)* prior to construction activities.
   a. The location of Restricted Works Areas and their conditions should be made available to all authorised personnel to ensure compliance with the Certificate.

6. Sun Cable should undertake clearance surveys of all Cultural Heritage Risk Areas outlined in Table 10 above, to ensure each area has been adequately inspected prior to construction.
   a. Clearance surveys should be undertaken well in advance of the construction phase to allow for appropriate mitigation strategies to be implemented.

7. Sun Cable should also undertake further consultation with Traditional Owners through the CHMP process to determine the most appropriate site protection measures for cultural significant areas which may not be protected under the *Heritage Act 2011* or *Northern Territory Aboriginal Sacred Sites Act 1989 (NT).*

9 References

Alford, R 2011, 'Darwin's Air War 1942-1945: An Illustrated History', Aviation Historical Society of the Northern Territory, Darwin.

Andrefsky, W 1998, Lithics, Macroscopic Approaches to Analysis, Cambridge Manuals in Archaeology, Cambridge University Press, Cambridge.

Australia ICOMOS Burra Charter 2013, The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, Australia ICOMOS, viewed 20 September 2021, <http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf>.

Baker, R 1981, 'The Aboriginal and Environmental History of the Chambers Bay Coastal Plains', Honours Thesis, Australian National University, Canberra.

Basedow, H 1907, 'Anthropological notes on the western coastal tribes of the Northern Territory of South Australia', Transactions and Proceedings and Report of the Royal Society of South Australia, vol. 31, pp. 1-55.

Basedow, H 1925, The Australian Aboriginal, F.W. Preece and Sons, Adelaide.

Berndt, R 1951, Kunapipi, F. W. Cheshire, Melbourne.

Bird, C & Hallam, S 2006, A Review of Archaeology and Rock Art in the Dampier Archipelago, National Trust of Australia, Western Australia.

Bourke, P 2015, 'Poor man's tucker' – historic and contemporary consumption of longbum shellfish around Darwin, Northern Territory Naturalist, vol. 26, pp.4-12.

Bourke, P 2005, Archaeological Survey for Indigenous Cultural Heritage Sites around Darwin Harbour, Heritage Conservation Services, Department of Infrastructure, Planning and Environment, NT Government Heritage Conservation Services Library, Darwin.

Bourke, P 2000, Late Holocene indigenous economies of the tropical Australian coast: an archaeological study of the Darwin region, PhD thesis, NTU, Darwin.

Bourke, P 1994, Mound over matter; origins of shell and earth mounds of North Australia, honours thesis, Department of Anthropology, NTU, Darwin.

Bourke, P & Crassweller C 2006, Radiocarbon dates from middens around Darwin Harbour: cultural chronology of a pre-European landscape, Australian Aboriginal Studies, vol. 2, pp. 116–119.

Bourke, P Guse, D 2007, Archaeological Survey of the Proposed Wickham Industrial Estate, Earthsea Pty Ltd, Darwin.

Bourke, P & Hoa, Q, 2009, 'Examining late holocene marine reservoir effect in archaeological fauna at Hope Inlet, Beagle Gulf, North Australia', in A Fairbairn, S O'Connor & B Marwick (eds.), New Directions in Archaeological Science, the Australian National University, Canberra, pp. 175-187.

Bourke, P & Mulvaney, K 2003, Archaeology of the first recorded petroglyphs for the Darwin region, The Beagle, vol. 19, pp. 1-6.

Brockwell, S, Marwick, B, Bourke, P, Faulkner, P & Willan, R 2013, 'Late Holocene climate change and human behavioural variability in the coastal wet-dry tropics of northern Australia: Evidence from a pilot study of oxygen isotopes in marine bivalve shells from archaeological sites', Australian Archaeology, vol. 76, pp. 21-33.

Brockwell, C 1989, Archaeological Investigations of the Kakadu Wetlands, Northern Australia, unpublished MA thesis, The Australian National University, Canberra.

Bureau of Meteorology (BoM) 2022, Climate Data Online: Darwin, Bureau of Meteorology, viewed 20 January 2022, <http://www.bom.gov.au/climate/data/index.shtml>.

Calnan, T 2006, Rainforest to reef just 40 km from Darwin: an assessment of the conservation values of the Gunn Peninsula/Vernon Islands area and the impact of the proposed Glyde Point heavy industry and residential estate. Darwin, N.T., Environment Centre of the Northern Territory and Australian Marine Conservation Society, Darwin.

Clarke, A 1994, Winds of Change: an archaeology of contact in the Groote Eylandt archipelago, Northern Australia, PhD Thesis, Australian National University, Canberra.

Clarkson, C Jacobs, Z Marwick, B Fullagar, R Wallis, L Smith, M Roberts, R Hayes, E Lowe, K Carah, X Florin, A McNeil, J Cox, D Arnold, L Hua, Q Huntley, J Brand, H Manne, T Fairbairn, A Shulmeister, J Lyle, L Salinas, M Page, M Connell, K Park, G Norman, K Murphy, T & Pardoe, C 2017, 'Human occupation of northern Australia by 65,000 years ago', Nature, vol. 547, pp. 306–310.

Cundy, B 1989, Formal Variation in Australian Spear and Spearthrower Technology, BAR International Series, Oxford.

Department of Agriculture, Water and Environment (DAWE) 2022, The Aboriginal and Torres Strait Islander Heritage Protection Act, Commonwealth of Australia, viewed 7 January 2022, <https://www.environment.gov.au/heritage/laws/indigenous>.

Earthsea Pty Ltd (Woolfe & Keys) 2019, Supplement Report to the EIS Archaeological Impact Assessment: KGL Resources Jervois Base Metals Project, Nitro Solutions Pty Ltd and KGL Resources Ltd, Northern Territory.

Earthsea Pty Ltd (Keys & Woolfe) 2018a, Archaeological Survey Results and Mitigation Report: Tanami Gas Pipeline Project, Australian Gas Infrastructure Group, Western Australia.

Earthsea Pty Ltd (Woolfe) 2018b, Northern Gas Pipeline Kalkadoon Section Cultural Heritage Survey Report, Jemena Northern Gas Pipeline Pty Ltd, Melbourne, Victoria.

Earthsea Pty Ltd (Woolfe & Keys) 2017, Willeroo Delamere Native Title Area, Victoria Highway Upgrade, FRK04400, Department of Infrastructure Planning and Logistics, Northern Territory Government, Darwin

Earthsea Pty Ltd (Keys) 2016, Cultural Heritage Survey Report: Indjalandji-Dhidhanu determination/former claim area section, Qld Northern Gas Pipeline, Jemena Northern Gas Pipeline Pty Ltd, Melbourne, Victoria.

Earthsea (Keys & Woolfe) 2007-2014, Archaeological Assessments and Cultural Heritage Management: Frances Creek and Yarram Operations, Territory Resources Ltd, Pine Creek.

Earthsea Pty Ltd (Woolfe & Martin-Stone) 2012, Archaeological and Heritage Assessment of parts of EL24712, Southwest Arnhem Land, Northern Territory. Uranium Equities Limited.

Earthsea (Raupp & Guse) 2008a, SPL403 RDA Expansion Additional Archaeological Survey Project, ALCAN Gove, Rio Tinto Alcan Technology Pty Ltd, Gove.

Earthsea (Keys & Raupp) 2008b, Hudson Creek Shell Midden Investigation, Earthsea Heritage Surveys, Darwin

Finlayson, C Baily, B Freeland, W & Fleming, M 1988, 'Wetlands of the Northern Territory', in Comb, A and P Lake (eds), The Conservation of Australian Wetlands, Surrey, Beaty and Sons, Norton.

Fitzsimmons, K, Cohen, T, Hesse, P, Jansen, J, Nanson, G. May, J-H. Barrows, T. Haberlah, D. Hilgers, A. Kelly, T. Larsen, J. Lomax, J & Treble, P 2013, 'Late Quaternary palaeoenvironmental change in the Australian drylands', Quaternary Science Reviews, vol. 74, pp. 78-96.

Foelsche, P 1882, 'Notes of the Aborigines of North Australia', Transactions of the Royal Society of South Australia, vol. 2, pp. 1-18.

Heritage Branch 2011, Sites of the former Southport telegraph and police stations: Background Historical Information, Heritage Branch, Department of Natural Resources, Environment, the Arts and Sport, Northern Territory Government, Darwin.

Hiscock, P 1984, 'A preliminary report on the stone artefacts from Colless Creek Cave, Northwest Queensland', Queensland Archaeological Research, vol. 1, pp. 120-151.

Hiscock, P & Hughes, P 2001, Prehistoric and World War II use of shell mounds in Darwin Harbour, Northern Territory, Australia, Australian Archaeology, vol. 52, pp. 41-45.

Hiscock, P, & Wallis, L 2005, 'Pleistocene settlement of deserts from an Australian perspective', in P Veth, M Smith and P Hiscock (eds), Desert Peoples: Archaeological Perspectives, Blackwell Publishing, pp. 34–57.

Hiscock, P & Mitchell, S 1993, Stone Artefact Quarries, and Reduction Sites in Australia: Towards a Type Profile, Technical Publications Series Number 4 (Australian Heritage Commission), Canberra.

Holdaway, S & Stern, N 2004, A Record in Stone: The study of Australia's flaked stone artefacts, Aboriginal Studies Press.

Horton, D 1981, Water and woodland: the peopling of Australia. Australian Institute of Aboriginal Studies Newsletter, vol. 16, pp. 21-27.

Horton, D (Ed.) 1994, 'The Encyclopaedia of Aboriginal Australia', The Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra.

Hodgson, R 1997, Aboriginal Use of Natural Resources in the Darwin Region – Past and Present, Unpublished Report to the Australian Heritage Commission and Museums and Art Galleries of the Northern Territory.

Jones, R & Bowler, J 1980, 'Struggle for the savanna: Northern Australia in ecological and prehistoric perspective', in R Jones (eds), Northern Australia: Options and Implications, Australian National University, Canberra, pp. 3–31.

Jones, R 1980, Hunters in the Australian coastal savannah, in D Harris (ed), Human Ecology in Savanna Environments, Academic Press, London, pp. 107–146.

Jones, T 1997, The Chinese in the Northern Territory, NTU Press, Darwin.

Kamminga, J 1982, 'Over the Edge: Functional analysis of Australian stone tools', Occasional Papers in Anthropology (St. Lucia, Queensland), no. 12, Anthropology Museum, University of Queensland.

Kent, M 2003, Overland Telegraph Line Part 2: Remaining infrastructure and relics report, Department of Infrastructure, Planning and Environment.

Kent, M 2004, Remnants of the North Australia Railway Vol.2. Appendices 3, Prepared for the NT Office of Environment and Heritage, Northern Territory Government, Darwin.

Kerr, M 1971, The Surveyors: The story of the founding of Darwin, Rigby, Adelaide.

King, P. P 1969, Narrative of a Survey of the Intertropical and Western Coasts of Australia: performed between the years 1818 and 1822, vol. 1, John Murray, London.

McCarthy, F 1976, Australian Aboriginal Stone Implements, Australian Museum, Sydney.

McKenzie-Smith, G 1994, Australia's Forgotten Army, Vol 2: Defending the Northern Gateways, Northern Territory and Torres Strait, 1938-1945, Grimwade Publications, Canberra.

McDonald, J 2005, Desktop Assessment of Scientific Values for Indigenous Cultural Heritage on the Dampier Archipelago, Western Australia, A report to the Heritage Division, Department of Environment and Heritage, Canberra.

Megirian, D, Murray, P, Latz, P & Johnson, K 2002, 'The Mygoora Local Fauna: a late Quaternary vertebrate assemblage from central Australia', The Beagle: Records of the Museums and Art Galleries of the Northern Territory, vol. 18, pp. 77–93.

Meehan, B 1977, 'Hunters by the Seashore', Journal of Human Evolution, vol. 6, no. 4, pp. 363-370.

Meehan, B 1982, Shell bed to Shell Midden, Australian Institute of Aboriginal Studies, Canberra.

Meehan, B 1988, Archaeology with Ethnography: An Australian Perspective, Department of Prehistory, Research School of Pacific Studies, The Australian National University, Canberra.

National Native Title Tribunal (NNTT) 2016, National Native Title Tribunal Glossary, Commonwealth of Australia, viewed 20 September 2021, <http://www.nntt.gov.au/Pages/Glossary.aspx>.

NRETAS, 2010, WWII Railway Siding, Stores Depot, Oval and Cricket Pitch, Noonamah: Background Historical Information, Heritage Branch, NT Department of Natural Resources, Environment, the Arts and Sport, Darwin.

NRETAS, 2011, WWII Strauss Airstrip: Background Historical Information, Heritage Branch, NT Department of Natural Resources, Environment, the Arts and Sport, Darwin.

NRETAS 2011, Emungalan Cemetery: Background Historical Information, Heritage Branch, NT Department of Natural Resources, Darwin.

Parkhouse, T.A 1895, 'Native tribes of Port Darwin and its neighbourhood', Australasian Association for the Advancement of Science, vol. 6, pp. 638-47.

Powell, A 2009, Far Country: A Short History of the Northern Territory, Charles Darwin University Press, Darwin.

Powell, A 2010, Northern Voyagers: Australia's Monsoon Coast in Maritime History, Australian Scholarly Publishing, Melbourne.

Reeves, J, Bostock, H, Ayliffe, L, Barrows, T, De Deckker, P, Devriendt, L, Dunbar, G, Drysdale, R, Fitzsimmons, K, Gagan, M, Griffiths, M, Haberle, S, Jansen, D, Krause, C, Lewis, S, McGregor, H Mooney, S, Moss, P, Nanson, G, Purcell, A & Van der Kaars, S 2013, 'Paleoenvironmental change in tropical Australasia over the last 30,000 years – A synthesis by the OZINTIMATE group', Quaternary Science Reviews, vol. 74, pp. 97–114.

Reynolds, W 2017, 'A Palaeo-history of moisture and vegetation change in the Top-End, Australia: Variability in the Australian monsoon during the late Quaternary', Master of Philosophy (Science) thesis, University of Wollongong, Wollongong.

Richardson, N 1996, Archaeological site survey and documentation - Darwin Region, unpublished report to the Australian Heritage Commission, Museums and Art Galleries of the Northern Territory, Darwin.

Roberts, A 1994, 'Cultural landmarks: The Milingimbi mounds', in M Sullivan, S Brockwell & A Webb (eds), Archaeology in the North, North Australian Research Unit, Australian National University, Darwin, pp.176-87.

Schrire, C 1982, The Alligator Rivers: Prehistory and Ecology in Western Arnhem Land, Terra Australis 7, Department of Prehistory, Research School of Pacific Studies, Australian National University, Canberra.

Spencer, W.B 1912, 'An introduction to the study of certain native tribes of the Northern Territory', Bulletin of the Northern Territory, no. 2.

Stuart, J 1865, Explorations in Australia, The Journals of John McDouall Stuart during the years 1858, 1859, 1860, 1861 and 1862, when he fixed the centre of the Continent and successfully crossed it from sea to sea, Project Gutenberg, viewed 7 January 2022, <https://www.gutenberg.org/files/8911/8911-h/8911-h.htm#j6>.

Wyrwoll, K, & Miller, G 2001, 'Initiation of the Australian summer monsoon 14,000 years 1168 ago', Quaternary International, vol. 83, pp. 119–128.