REFERRAL UNDER THE ENVIRONMENTAL PROTECTION ACT 2019 (NT)

Tiwi H2 Project

Green Hydrogen Production and Export

PROVARIS

30 June 2022

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ACKNOWLEDGEMENTS

Provaris acknowledges that

> *Twenty years ago, Tiwi leaders decided that they would use up to 10% of their land to create an economy, with real jobs for their children and grandchildren… Tiwi leaders determined to establish a number of commercial businesses and enterprises in order to create jobs and income for their people. (TPC 2022)*

Provaris hopes that the Tiwi H2 Project will help meet this vision, creating jobs and income for the Tiwi people.

Provaris thanks the Munupi Clan for granting permission for Provaris to undertake initial scoping work in relation to environmental surveys that allowed this Referral to be prepared and lodged with the NT EPA, including over (i) the plantation lands of Imalu / Piripiyama; Putjimirra; and Rangini North; (ii) the transmission line route; and (iii) the 40 ha area of land identified near Port Melville.

Provaris acknowledges that such Munupi Clan permission is not an approval for Provaris to proceed with development of the Tiwi H2 Project. Approval for Project development will be subject to a staged assessment, commencing with Provaris presenting and informing the Munupi Clan of the findings of this Referral, and the next stage of approvals and permissions required, ultimately progressing to approval of land tenure (by way of lease and sublease) and to develop and use specific sites. For this progression to occur, Provaris will need to address all key regulatory requirements including both Northern Territory and Commonwealth environmental assessments and approvals, sacred site clearances, national and international standards, work health and safety, water licences and approvals, dangerous substance regulations, electricity regulation and renewable energy legislation among other regulations and standards.

Provaris also acknowledges that in addition to these regulatory matters, further information will be required by the Munupi Clan to enable informed assessment of social, cultural, economic and infrastructure impacts, amongst others, including the economic benefits to the community and traditional owners, as well as environmental management and remediation.

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EXECUTIVE SUMMARY

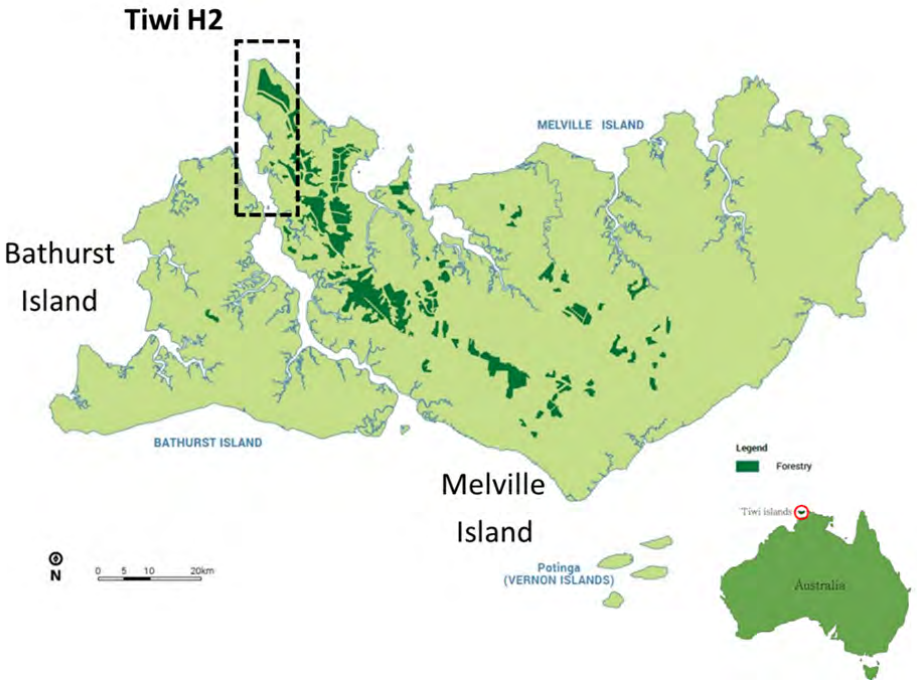
This Referral has been prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the proposal by Provaris Energy Ltd (Provaris) to develop green hydrogen production and export facilities on Melville Island, within the Tiwi Islands of the Northern Territory (NT). The hydrogen will be produced by electrolysis of purified sea water powered by solar energy, with production expected to reach 100,000 tonnes of hydrogen per annum (tpa). The proposal is known as the Tiwi H2 Project (also referred to in this document as 'the Project').

The Project consists of (as depicted overleaf):

- **Solar Precinct** (2,640 ha) located on the northern tip of Melville Island approximately 12 km north of the nearest town – Pirlangimpi – and 122 km north of Darwin. The land is currently under Acacia plantation which will be cleared by Tiwi Plantations Corporation (TPC) as part of its normal forestry operations prior to handover and commencement of construction by Provaris.
- **Transmission Line Corridor** (150 ha) for a high voltage 275 kV dual circuit 30 km transmission line that will carry the power generated at the Solar Precinct to the H2 Production Precinct.
- **H2 Production Precinct** (40 ha) located on remnant bushland immediately north of Port Melville (Port), and approximately 1.3 km south-east of Pirlangimpi. Within this precinct, seawater extracted from Apsley Strait will be purified and then converted by electrolysis into hydrogen.
- **H2 Export Precinct** (32 ha within Port Melville's development boundary), where the hydrogen will be compressed and loaded onto Provaris' proprietary compressed hydrogen ships (H2Neo) berthed at the Port. The hydrogen will be exported to markets in the Asia-Pacific region.

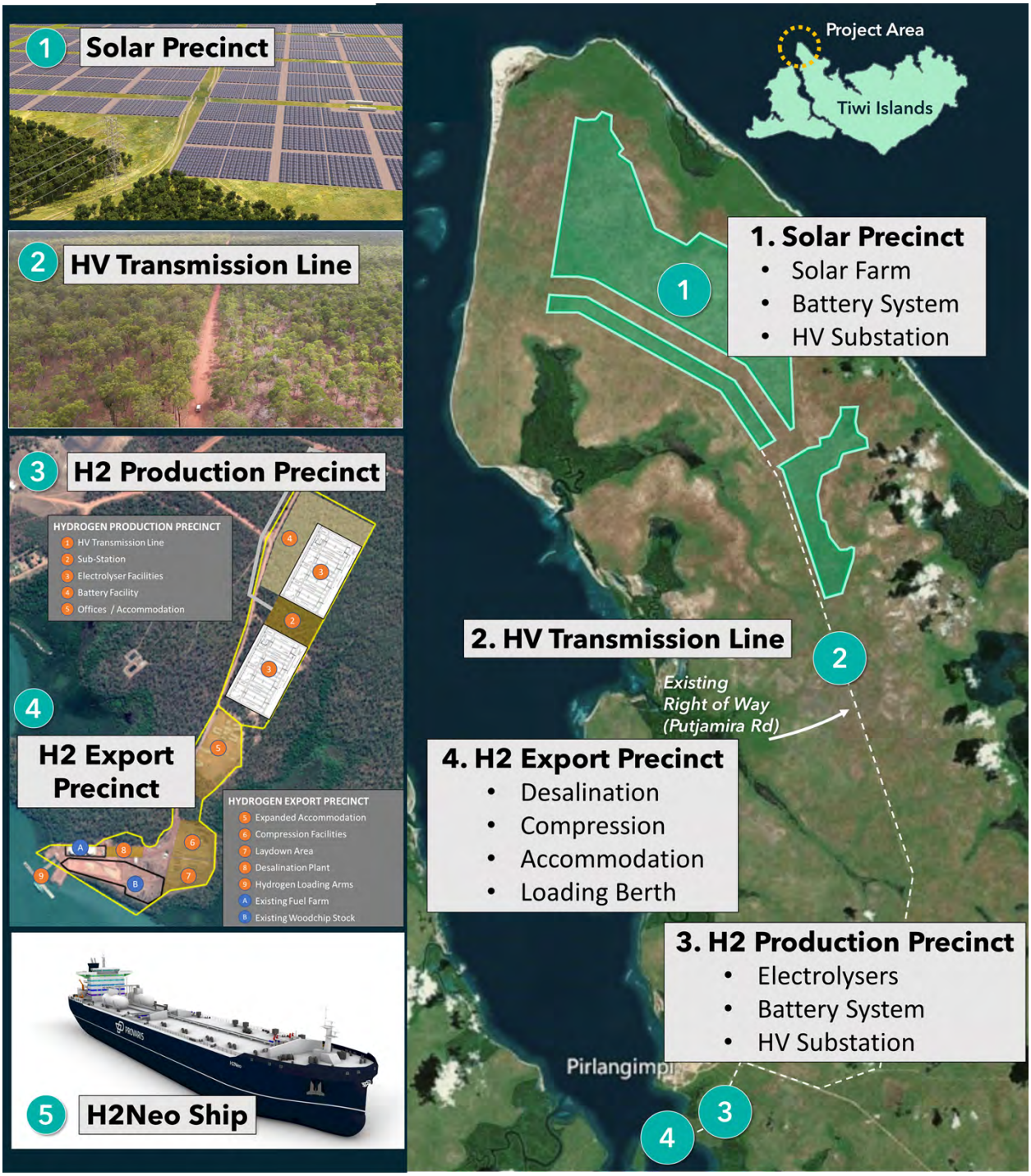
The entire Project footprint (2,862 ha) is on Munupi Clan land. Land tenure for the Project is as follows:

- Solar Precinct: TPC managed land within the Tiwi Aboriginal Land Trust (TALT).
- Transmission Line Corridor: majority of the land within the TALT, with a 2 km portion of the corridor on land managed by Office of Township Leasing within the TALT.
- H2 Production Precinct: Land managed by Office of Township Leasing within the TALT.
- H2 Export Precinct: Land managed by NT Port and Marine Pty Ltd within the TALT.



Project context

The construction of the Tiwi H2 Project will likely be undertaken in stages, so that hydrogen production and export volumes can increase over time in line with customer demand, as well as maintain an acceptable level of construction workforce in relation to the Pirlangimpi community. Each 36-month construction stage will likely add approximately 25,000 – 50,000 tpa of hydrogen production capacity. The Project life is expected to be at least 30 years.



Map of Tiwi H2 Project proposal footprint and site layout

Pre-referral screening of the Tiwi H2 Project determined that the proposal has potential to impact 7 of the 14 NT EPA environmental factors, namely:

Factor	Potential for significant impact
LAND	
Terrestrial ecosystems	Surveys have confirmed that threatened species and/or significant vegetation types are present within, and adjacent to, the Solar Precinct, Transmission Line Corridor and H2 Production and Export Precincts. Project activities – most notably clearing of remnant bushland within the Transmission Line Corridor (150 ha) and H2 Production Precinct (40 ha) footprints – will result in some loss of habitat that is utilised by threatened species. The occurrence of threatened species and significant vegetation types within the Project footprint, and potential impacts to these valued ecosystem components is discussed in Section 9.2 of the Referral.
WATER	
Hydrological processes	The key potential impact to Hydrological Processes relates to the potential for alteration of recharge to the groundwater aquifers underlying the Project footprint. The Project is not expected to alter flows in any surface watercourses, as there are none present within the direct disturbance footprint and runoff will continue to occur as overland flows discharged into vegetation surrounding the Project footprint. Potential impacts to groundwater recharge are discussed in Section 9.3 of the Referral. The Solar Precinct footprint will remain pervious to rainfall and therefore is not predicted to significantly reduce local groundwater recharge. .
SEA	
Marine environmental quality	The desalination process involves discharge of brine back into Apsley Strait. No other contaminants that are not already in the sea water will be discharged. The Desalination Plant Scoping Study shows that the impact of brine discharge on the marine environmental values in the Apsley Strait will be negligible. Nevertheless, the discharge will be regulated and monitored in accordance with the conditions of an environment protection licence. Potential impacts to marine environmental quality are discussed in Section 9.4 of the Referral.
Marine ecosystems	Project activities could impact upon marine ecosystems through: • Discharge of brine • Increased shipping traffic • Installation of a navigation lights. Discussion of marine ecosystem values and potential Project impacts are discussed in Section 9.5 of the Referral.
AIR	
Atmospheric processes	Greenhouse gases (GHG) will be emitted during construction and, to a much lesser extent, during operations. Estimates of Scope 1 and Scope 2 emissions are being prepared to inform Provaris of possible emissions avoidance and abatement opportunities. The hydrogen produced by the Project will provide GHG abatement opportunities in the Asia region. Further discussion of GHG is provided in Section 9.6 of the Referral.
PEOPLE & COMMUNITIES	
Community & economy	Project activities could negatively impact on the local community through construction workforce changing social dynamics and putting pressure on utilities. Additionally, inequitable distribution of benefits and lack of decision-making power could negatively impact Tiwi Islanders at a regional scale. The Project could have a positive impact on the local economy through employment, lease payments and upgrades to local infrastructure such as roads. Community and economy values, and potential impacts are discussed in Section 9.7 of the Referral.
Culture & heritage	The Tiwi Islands are a culturally significant landscape, and any development has potential to impact sites of cultural significance and/or heritage value. Early engagement with the AAPA, TLC and Munupi people has not identified any Aboriginal sacred sites within the

Factor	Potential for significant impact
	Project footprint, noting that Provaris will submit applications for Authority Certificate/s under the *Aboriginal Sacred Sites Act.* An archaeological heritage survey Earth Sea (2022) identified six cultural heritage features relevant to the project area – including three sites with isolated flaked stone silcrete artefacts, two culturally-modified trees (CMT), and a watercourse and swimming hole. Port Melville is adjacent to the Fort Dundas heritage site, which was nominated for listing under the *NT Heritage Act* in 2019 but has not been declared. The occurrence of cultural heritage features and potential impacts are discussed in Section 9.8 of the Referral.

This Referral details how the Project has accounted for key principles of environment protection and management (Part 2 of the EP Act), including:

- Early engagement with the community – particularly indigenous stakeholders – in a culturally-appropriate manner.
- Engaging suitably qualified professionals to undertake technical studies specifically for the Project to allow for evidence-based decision-making.
- Applying the precautionary principle whenever information is unknown or at insufficient detail to make an assessment.
- Committing to working with the local community and training providers to prioritise local employment and develop an industry that provides social and economic benefits to the Tiwi Islands.
- Using sustainable resources such as renewable solar energy and water from a desalination plant.
- Applying the environmental decision-making hierarchy through siting and design of project infrastructure to avoid impacts, and development of mitigation measures for potential impacts.

A summary of the likelihood of the Project having residual significant environmental impacts on environmental values is presented below.

- **Terrestrial Ecosystems.** The residual impact to terrestrial ecosystems will be minor mainly due to site selection making use of the existing plantation footprints. There will be no direct impact to sensitive vegetation types such as wetlands and rainforests, and no loss of any habitat critical to the survival of listed threatened species.
- **Hydrological Processes.** All potential impacts to surface water can be managed using Stormwater Management Plans and Erosion and Sediment Control Plans. Development of the H2 Production Precinct could reduce the area of recharge available for Pirlangimpi water supply bore-field. Provaris is discussing the implications of this situation with Power and Water Corporation (PWC). Accessing the Port bores for construction water use would only be for a limited time until a temporary, and then permanent, desalination plant is running. The Port bore is ~1.1 km from the bore-field and so any temporary drawdown is unlikely to impact the town's water supply.
- **Marine environmental quality.** The Desalination Plant Scoping Study shows that the impact of brine discharge on the marine environment in Apsley Strait will be negligible. Nevertheless, the discharge will be regulated and monitored in accordance with the conditions of an environment protection licence.
- **Marine ecosystems.** All potential impacts have been avoided through Project design - such as no significant night lighting at the Solar Precinct - or will be minimised through mitigation measures - such as ship operational procedures when navigating through Apsley Strait. Therefore, to minimise the impact of offshore lighting on marine turtle hatchlings, H2Neo ships will only be permitted to moor outside the biologically important areas identified for the Green and Olive Ridley turtles (refer to Figure 9-5).

- **Atmospheric processes.** Being a green hydrogen Project, the majority of GHG emissions occur during construction. Estimates of Scope 1 and Scope 2 emissions are being prepared to inform Provaris of possible emissions avoidance and abatement opportunities. The hydrogen produced by the Project will provide GHG abatement opportunities in the Asia region. Further work is required to confirm baseline conditions and assumptions on which to base emissions calculations. Provaris will prepare emissions estimates in accordance with accepted guidelines, and will work through this with relevant stakeholders, to further minimise emissions and determine avoidance and abatement opportunities.
- **Community and economy.** The Project will provide opportunities for the Tiwi community, and to the NT more broadly associated with establishing a safe, sustainable, and efficient supply chain for exporting green hydrogen. It is the Project's objective to provide a new, commercially resilient industry that will be a transformational business opportunity for the Tiwi Islands and align with the NT's hydrogen strategy to utilise its renewable energy to create a new export industry.

  Provaris has sought to minimise environmental impacts by repurposing currently under-utilised brownfield sites. The screening level assessment presented in this Referral indicates there is further work to be undertaken with the TLC and Tiwi people to address negative impacts and maximise benefits, and Provaris commits to undertaking this work as part of negotiating agreements for the Project.
- **Culture and heritage.** Although there are known values within, and surrounding, components of the Project footprint, these values can be protected – and impacts avoided – through implementation of measures such as no-go zones. Impacts to unidentified heritage can be minimised through implementation of standard unexpected finds procedures, and any other conditions determined in consultation with TLC and Munupi Clan.

At this stage, it is unclear whether offsets are required – particularly in relation to greenhouse gas emissions – and hence this Referral does not discuss them.

Provaris acknowledges the Referral identified the following items requiring further discussion:

1) The southern end of the Transmission Line Corridor and the H2 Production Precinct overlap, or are within, the 300 m wellhead protection zones for Pirlangimpi water supply bore-field (Section 9.3). PWC to decide whether the Project footprint can encroach upon the wellhead exclusions zones, and under what conditions. If such an encroachment is not permitted, Provaris proposes to either i) modify the Project footprint accordingly; ii) work with PWC to establish new wellheads to avoid any such impact with the Transmission Line Corridor (at its cost); or iii) supply water to the community from its proposed desalination plant.
2) An Acoustic Report (Operational Noise Impact Assessment) to be prepared once more detail is available regarding plant and equipment specifications of the H2 Production and Export Precincts.
3) Preliminary hazard assessment and analysis of the Project, including -solar farm; substations; battery energy storage system(s); transmission line; electrolysis and related facilities; compression and loading facilities; and H2Neo Ship at berth.
4) A GHG assessment is being undertaken to confirm estimates of Scope 1 and Scope 2 emissions. Further work is required to confirm baseline conditions and assumptions with which to base emissions calculations upon. Provaris will prepare emissions estimates in accordance with accepted guidelines, and will work through this with relevant stakeholders, to further minimise emissions and determine avoidance and abatement opportunities.

This Referral has been developed to demonstrate that this Project will develop a safe, sustainable and efficient supply chain for exporting green hydrogen in a way that minimises environmental and social impacts.

To this end, Provaris is committed to working closely with Tiwi Island stakeholders to develop a Project that delivers benefits to the local community during all Project phases.

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ACRONYMS & GLOSSARY

AAPA	Aboriginal Areas Protection Authority (NT)
bar	metric unit of pressure, with one bar being equivalent to 14.5083 pounds per square inch
BESS	Battery energy storage system
DAWE	Department of Agriculture, Water and the Environment (Commonwealth)
DWT	deadweight tonnage
EIANZ	Environment Institute of Australia and New Zealand
EMP	Environmental Management Plan
EP Act	*Environment Protection Act 2019* (Northern Territory)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPL	Environmental protection license
ERA	Emergency Response Area
ESCP	Erosion and Sediment Control Plan
ESD	emergency shutdown
GHG	greenhouse gas
GW	Gigawatts
GWp	Gigawatts in terms of direct current, related to solar panel capacity
ha	hectare
H2	hydrogen
H2Neo	Ship, based on Provaris' proprietary technology, for the marine transportation of compressed hydrogen (430 tonnes or 26,000 m^3 capacity)
HDPE	high density polyethylene (plastic)
HP	high pressure
kg	kilogram
kV	kilovolts
LNG	liquid natural gas
m^3	cubic metres
MNES	Matters of National Environmental Significance
Munupi Clan	One of the aboriginal clans that have traditionally occupied the Tiwi Islands and whose land covers the Project site
MW/MWh	megawatts / megawatt hours
MWp	megawatts in terms of direct current, related to solar panel capacity
nm	nautical mile, equivalent to 1.852 kilometres
NFP	not-for-profit
NGER	National Greenhouse and Energy Reporting
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTPM	NT Port and Marine Pty Ltd
OTL	Office of Township Leasing (Commonwealth)
Port	Port Melville
PLC	programmable logic controller
Provaris	Provaris Energy Ltd (ABN: 53 109 213 470), (ASX Code: PV1) being the proponent of the Tiwi H2 Project
PSU	practical salinity units
PWC	Power and Water Corporation

Referral	This Referral report, including Appendices
SOCS	Sites of Conservation Significance
TALT	Tiwi Aboriginal Land Trust, being the indigenous freehold owners of all the land comprising the Tiwi Islands (Melville Island and Bathurst Island), under the Aboriginal Land Rights (Northern Territory) Act 1976.
TITEB	Tiwi Islands Training and Employment Board
Tiwi H2 Project	The development by Provaris of up to 100,000 tpa green hydrogen production and export proposal on Melville Island (part of the Tiwi Islands), Northern Territory, as more fully described in this Referral
TLC	Tiwi Land Council, being a statutory body with the responsibility for, inter alia, representing and administering, or assisting with, the affairs of the Tiwi Island people and the Tiwi Aboriginal Land Trust.
tpa	tonnes per annum
TPC	Tiwi Plantations Corporation
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976* (Northern Territory)
WMPC Act	*Waste Management and Pollution Control Act 1998* (Northern Territory)

PUBLICATION STATEMENT

This Referral has been prepared by EcOz Environmental Consultants (EcOz) on behalf of Provaris Energy Ltd (Provaris). A listing of the key consultants, their qualifications and experience in the environmental field are provided below.

Key consultant	Qualifications	Experience
Kylie Welch *Managing Consultant - Impact Assessment & Approvals* *EcOz*	Bachelor of Science (Honours) Master Social Science (Environment & Planning) Certificate in Engagement – International Assoc, for Public Participation Certified Environmental Practitioner (EIANZ CEnvP 975)	20+ years
Glen Ewers *Managing Consultant – Ecology* *EcOz*	Bachelor of Science Bachelor of Law (Environment) Diploma of Arts (Environmental Studies) Graduate Certificate in Ornithology	15+ years
Sarah Ryan *Senior Environmental Consultant* *EcOz*	Bachelor of Environmental Science (Environmental Management)	10+ years
Emily Nagy *Environmental Consultant* *EcOz*	Bachelor of Environmental Science and Management	6+ years
Alice Nicholl *Environmental Consultant* *EcOz*	Bachelor of Science Master of Science (BioScience)	2+ years

Inputs from relevant technical consultants have been provided throughout the development of this Referral. A listing of the key technical consultants, their qualifications and experience in the environmental field are provided below.

Key technical specialist	Specialist area	Qualifications	Experience
Steve Hart	Greenhouse Gas	Bachelor of Science PIEMA	18+ years
Ben Keys – Earth Sea	People & Heritage	Bachelor of Archelogy (Honours)	16+ years

1 INTRODUCTION

This Referral has been prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the proposal by Provaris to develop green hydrogen production and export facilities on Melville Island, within the Tiwi Islands of the Northern Territory (NT). Hydrogen (H2) will be produced by electrolysis of purified sea water powered by solar energy. The proposal is known as the Tiwi H2 Project (and referred to in this document as 'the Project').

The proposal is being referred to the NT EPA to determine whether formal assessment is required pursuant to the NT *Environmental Protection Act 2019 (EP Act)*. This Referral also gives consideration as to whether the proposal should be referred for assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*).

1.1 About Provaris Energy

Provaris (formerly Global Energy Ventures Ltd) – a publicly-listed ASX company (ASX PV1) – is an early mover in the future of energy, developing integrated green hydrogen projects for export to regional markets through the simplicity and efficiency of compressed hydrogen. Provaris has offices in Perth (registered office), Sydney, Calgary (Canada) and Olso (Norway).

Provaris has developed the design of two proprietary compressed gaseous hydrogen carriers, being the H2Neo (26,000 m^3) and H2Max (120,000 m^3). Both ships have obtained Approval in Principle from the American Bureau of Shipping. The mature level of the ship design allows Provaris to effectively engage with shipbuilders, regulatory authorities (Class and Flag), and other industry stakeholders. The Tiwi H2 Project is based on using a fleet of the H2Neo ships.

Each H2Neo ship is powered by electric drive engines, a platform that enables the ship to be powered by a variety of low-carbon fuels and carbon-free propulsion technologies now being advanced – such hybrid solutions may include battery storage, internal combustion engines that run on hydrogen, and/or onboard hydrogen fuel cells in the future (when available). This will allow the H2Neo ship the potential to deliver a zero-emission marine transport solution for the export of hydrogen in the future.

Provaris has demonstrated that the simplicity and energy efficiency of its compressed hydrogen shipping solution is ideally suited for exporting hydrogen over medium distances (i.e., from Australia to Asia-Pacific), providing the opportunity for a low delivered cost of hydrogen to customers in the region.

1.2 About green hydrogen

Hydrogen production is assigned a colour code depending on the amount of greenhouse gases emitted per unit of production, presented below from highest to lowest emissions (Osman et al. 2022):

5) Brown hydrogen is produced from gasification of coal-based fuel
6) Grey hydrogen is produced using fossil fuels such as natural gas
7) Blue hydrogen is produced from fossil fuels like grey hydrogen but with a combination of carbon capture and storage to mitigate emissions
8) Green hydrogen is typically produced from 100% renewable sources such as hydro, wind or solar energies, with a lower carbon footprint, and use of the generated electricity to split water into oxygen and hydrogen molecules (electrolysis).

According to Koj et al. (2017), the majority of hydrogen is produced by reforming of natural gas and refinery gas, as a by-product of chemical production and through coal gasification. Less than 5% of global hydrogen production currently comes from electrolysis.

1.3 Project objectives and benefits

Provaris is proposing to develop green hydrogen production and export facilities on Melville Island, with production capacity expected to reach 100,000 tonnes of hydrogen per annum. The Project is a key part of Provaris' overall objective to develop a safe, sustainable and efficient supply chain for exporting green hydrogen. The Project will:

- Develop a new, sustainable, and commercially-resilient industry that will be a transformational business opportunity for the Tiwi Islands and align with the NT's hydrogen strategy to utilise its renewable energy to create a new export industry.
- Contribute to the NT's 2050 policy target of 'net-zero' greenhouse gas emission targets by providing a commercially viable production and export facility for green hydrogen.
- Minimise environmental impacts by repurposing currently under-utilised existing brownfield sites for development of new industry with a projected operation phase of 30+ years.
- Work closely with Tiwi Island stakeholders to develop a Project that delivers benefits to the local community during all Project phases.

Being primarily located on existing plantation land and within Port Melville, the Tiwi H2 Project aims to minimise environmental impacts (compared to selection of a greenfield site), development time and costs, as well as provide very close access to the future demand markets in the Asia-Pacific region. Provaris is committed to making the future of green hydrogen accessible through the simplicity and efficiency of compressed hydrogen.

The Tiwi H2 Project has in-principle support of key stakeholders to continue to progress the development of the required environmental and engineering assessments – including the Tiwi Land Council, the Munupi Clan, NT Port and Marine Pty Ltd and the Northern Territory Government.

Figure 1-1 depicts the entire compressed hydrogen supply chain. This Referral considers just the components that occur on Melville Island and within the NT (as depicted within the dashed lines below) namely:

- **Solar Precinct** – plantation land (installation of solar panels for electricity generation)
- **Transmission Line Corridor** – 30 km of undeveloped land, 50 m width (overhead electricity transmission to Port Melville)
- **H2 Production Precinct** – green hydrogen production
- **H2 Export Precinct** - desalination plant (demineralisation of sea water for electrolysers), compression and loading facilities – Port Melville (for loading of hydrogen onto Provaris' H2Neo ships).

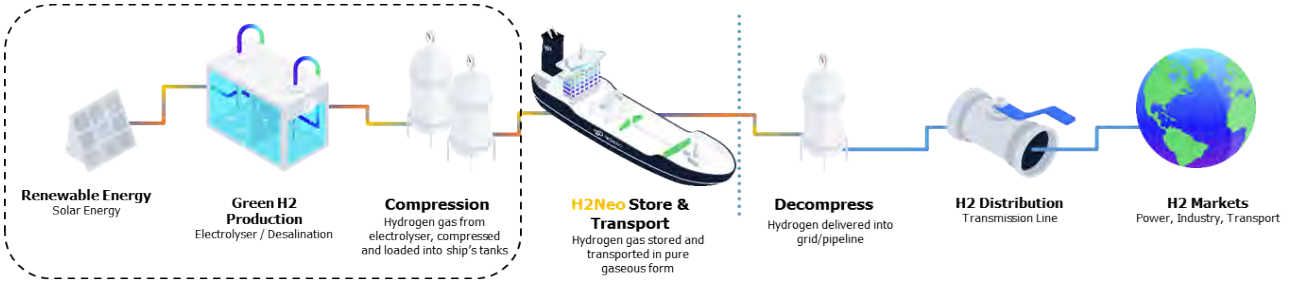

Figure 1-1. Illustration of the entire compressed hydrogen supply chain

1.4 Regulatory context

This section provides an overview of the key NT and Commonwealth environmental and heritage legislation applicable to the proposal, and key approvals, licences or permits received and/or required to proceed.

1.4.1 Northern Territory

The NT EPA will assess the information in this Referral to determine if the proposal requires assessment under the *EP Act*. Other key approvals, permits and licences that may be required under NT Government legislation are discussed in Table 1-1.

Table 1-1. Relevant NT legislation

Legislation	Relevance to proposal
Bushfires Management Act	Provides the framework for managing bushfire in areas outside the Emergency Response Area of cities and towns in the NT. The proposal area is located outside of the Bathurst Island Emergency Response Area (ERA) and will therefore be subject to the *Bushfires Management Act*. The Project is within the Arnhem Fire Management Zone as declared under section 58 of the Act. Relevant management and mitigation actions within the Arnhem Regional Bushfire Management Plan will be included in the Project's EMP.
Dangerous Goods Act	Provides for the safe storage, handling and transport of certain dangerous goods (including chemicals). Hydrogen gas is considered a dangerous good in accordance with section 3 of the Act, as it is defined as a 'fuel gas' in section 2 of the *Dangerous Goods Regulations 1985.* Dangerous goods will be handled and transported during construction and operation of the Project in compliance with the requirements of the Act.
Electricity Reform Act	The Act regulates the electricity supply industry, to make provision for safety and technical standards for electrical installations and for other purposes.
Heritage Act	Provides for the identification, declaration, conservation and protection of archaeological places and objects. All sites on the NT Heritage Register and archaeological sites are protected under this Act. No registered heritage or archaeological sites are located on the proposal area. A cultural heritage survey identified a few significant cultural heritage values proximate to the Project footprint which have been avoided and buffered through changes to Project design.
Northern Territory Aboriginal Sacred Sites Act	The Act protects sites that are 'sacred and otherwise of significance in the Aboriginal Tradition'. Authority Certificates are required for all components of the proposal in the NT prior to commencement of works. Provaris has applied for Authority Certificates and now the Aboriginal Areas Protection Authority (AAPA) will engage with site custodians to identify sacred sites protection requirements. Provaris is required to avoid directly impacting sacred sites and ensure all personnel are aware of Restricted Works Areas locations and comply with any conditions of the Authority Certificates. According to the AAPA Abstract of Records (Appendix E), there are no registered Aboriginal sacred sites located on the proposal area, as declared under the Act.
Planning Act	The purpose of this Act is to establish a system to facilitate planning for the orderly use and development of land. Of relevance to this Project is that a permit to clear native vegetation will be required for clearing of land to develop the Solar Precinct, Transmission Line Corridor and H2 Production Precinct.
Public and Environmental Health Act	The Act provides for the protection and promotion of the health of individuals and communities in the Territory. Under the Act it is an offence to cause a public health nuisance, which is anything that has or is likely to put at risk or damage public health e.g. dust, smoke, odour, waste, creation of biting insect breeding habitat. Wastewater works design approvals will be required for any upgrades to onsite wastewater management systems used to treat and dispose of sewage and greywater from the expanded accommodation facilities.

Legislation	Relevance to proposal
Territory Parks and Wildlife Conservation (TPWC) Act	Amongst other things, applies statutory obligations in relation to the protection of flora and fauna. Under the Act, the taking or interfering with wildlife that is listed as threatened requires approval at the Ministerial level. Threatened species are known or likely to occur within, or adjacent to, the Project footprint (refer Chapter 9.2). Seeking a permit to interfere with these would only be sought as a last resort if impacts could not be avoided.
Traffic Act	Under the Traffic Act, permit approval is required where construction activities are within a NT road reserve.
Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act	Provides for the transport of dangerous goods by road or rail, and for related purposes.
Soils Conservation and Land Utilisation Act	Provides for the prevention of soil erosion and for the conservation and reclamation of soil. As the proposed action include earthworks in proximity to watercourses, as well as stormwater drainage infrastructure, an Erosion and Sediment Control Plan (ESCP) will be required to facilitate compliance with the general provisions of this Act during construction.
Waste Management and Pollution Control (WMPC) Act	Provides for the protection of the environment by encouraging effective waste management, and pollution prevention and control practices. The *WMPC Act* establishes which activities require environmental protection approvals or licences, and also establishes environmental nuisances as an offence. The release of hypersaline water back into the Apsley Strait will require an environmental protection license under this Act.
Water Act	Provides for the investigation, allocation, use, control, protection, management and administration of water resources, and for related purpose. Provides the regulatory framework governing the installation and use of groundwater bores.
Weeds Management Act	Declares certain plants to be weeds, classifies weeds according to management requirements, and places obligations on landowners and occupiers to manage weeds. Provaris has an obligation to take reasonable measures to prevent the land from becoming infested with a declared weed; to prevent a declared weed spreading to other land and comply with statutory weed management plans.
Work Health and Safety (National Uniform Legislation) Act	The Act establishes a duty to identify and manage risks to health and safety of workers, including providing safe facilities, first aid, emergency plans, personal protective equipment, managing risks from airborne contaminants, hazardous atmospheres, storage of flammable or combustible substances, hazardous work. The Act contains specific requirements for remote or isolated work, which will apply. Notification to WorkSafe NT is required if hazardous chemical volumes stored on site exceed manifest quantities.

1.4.2 Commonwealth

The *EPBC Act* is the Australian Government's key environmental legislation. Approval under the *EPBC Act* may be required for any proposed action likely to have a significant impact on a matter protected by that *Act*. The environment assessment and approvals process of the *EPBC Act* aims to protect Matters of National Environmental Significance (MNES), as well as the environment in general where actions proposed are on, or will affect Commonwealth land, and/or where Commonwealth agencies are proposing to take an action.

The *EPBC Act* is administered by the Commonwealth Department of the Agriculture, Water and the Environment (DAWE).

An assessment of the potential impacts on matters protected by the *EPBC Act* has been undertaken for the proposal and has determined that an *EPBC Act* Referral is required (see Section 10).

1.5 Studies undertaken to inform this Referral

The following studies have been undertaken to inform this Referral:

- A Terrestrial Ecology Report, including data from a survey of vegetation types and threatened flora undertaken by EcOz (accompanied by Tiwi rangers) in early 2022 – see Appendix B.
- A Cultural Heritage Assessment Summary Report of an archaeological and heritage survey of the Project footprint by EarthSea (accompanied by Traditional Owners) in early 2022 – see Appendix C.
- A Desalination Plant Scoping Study undertaken by Jacobs in 2022 that includes desalination outfall modelling – see Appendix D.
- An Aboriginal Areas Protection Authority register check undertaken in 2022 – see Appendix E.

2 PROPOSAL DESCRIPTION

This section describes the proposal, outlining the key physical components and their purpose/function, including infrastructure and major equipment.

2.1 Key components

The key components of the Project are presented in Table 2-1.

The total proposal footprint is approximately 2,862 ha, of which 2,640 ha is plantation land, 190 ha is remnant bushland and 32 ha is Port land (of which 27 ha has already been cleared for industrial / Port use).

Table 2-1. Key Project components

Project element	Component	Location	Details
Infrastructure	Solar Precinct (Section 2.4)	On three adjacent TPC plots – Imalu/Piripiyama (1,800 ha), Putjimirra (370 ha) and Rangini North (470 ha), approximately 18 km north of Port Melville	• Across 2,640 ha of existing plantation area • Up to 2.8 GWp of solar panel capacity • Up to 400 MW / 800 - 1,600 MWh battery energy storage system • Step-up sub-station
	Transmission Line Corridor (Section 2.4.5)	Solar Precinct to Port Melville, adjacent to Putjimirra Road	• Across 150 ha of undeveloped land with native vegetation • 275 kV dual circuit overhead line • 30 km in length, from the Solar Precinct to the H2 Production Precinct • 50 m wide easement adjacent to Putjimirra Road
	H2 Production Precinct (Section 2.6)	Adjacent (north) of Port Melville	• Across 40 ha of undeveloped land with native vegetation • Up to 100,000 tonnes of hydrogen production per annum • Step-down substation • Up to 1,500 MW of electrolyser capacity • Up to 400 MW / 800 - 1,600 MWh battery energy storage system • Using electricity produced at the Solar Precinct and transmitted via the transmission line, the H2 Production Precinct will produce hydrogen using electrolysis of purified sea water

Project element	Component	Location	Details
	H2 Export Precinct (Section 2.6)	Port Melville	• Within 32 ha Port Melville lease area, including 5 ha of native vegetation • Compression, loading and export of hydrogen • Desalination plant (4.2 ML per day of demineralised water) • 500-person construction camp • Compression facilities (up to 250 bar)
	H2Neo ships (Section 2.7)	Loading and berth facilities at Port Melville, shipping route north through the Apsley Strait	• Loading and berth facilities at Port Melville • Cargo of 430 tonnes of gaseous, compressed hydrogen • Use existing shipping channel through the Apsley Strait
Indicative execution schedule (Section 2.3)	Development / detailed engineering	All	2022 and 2023
	Project financial close	All	Early 2024
	Early works	All	Early 2024
	Commercial operations (partial)	All	Early 2027
	Commercial operations (full capacity)	All	Early 2030's
	Design life of facilities	Whole of Project	30 years
Workforce (construction)	Construction workforce	Solar Precinct	500 people (peak)
	Construction workforce	Transmission Line Corridor	
	Construction workforce	H2 Production Precinct	
	Construction workforce	H2 Export Precinct	
Workforce (operation)	Operations workforce	Whole of Project	100 people (long term)

2.2 Location and regional context

The Project is proposed to be located on Munupi Clan land on the northern tip of Melville Island approximately 122 km north of Darwin – see Figure 2-1.

The H2 Export Precinct is proposed to be located at Port Melville situated on the Apsley Strait, which runs north-south between the Melville and Bathurst Islands. The community of Pirlangimpi (Garden Point) is approximately 1.5 km north of Port Melville.

The site of the Solar Precinct is a further 22 km north of Port Melville – see Figure 2-2. The Solar Precinct is comprised of three portions of Tiwi Plantations Corporation (TPC) plantation.

The Transmission Line Corridor runs between the Solar Precinct and the H2 Production Precinct along Putjamirra Road. The outstation of Pitjimirra / Putjamirra is located approximately 2 km to the west of the Solar Precinct and is accessed via Putjamirra Road.

Relevant tenure and cadastral information is presented in Table 2-2. Accessing the proposal area requires land permits, issued by Tiwi Land Council (TLC). There is an airport at Pirlangimpi (Garden Point Airport) that is serviced by Fly Tiwi, which flies out of Darwin International Airport. Generally, there is a morning and an afternoon flight on weekdays. Accessing the Solar Precinct requires a four-wheel drive vehicle.

Table 2-2. Summary of proposal component locations

Latitude	Full co-ordinates (indicative) compiled within Appendix A
Longitude	
Street address	Not relevant
Tenement details	Solar Precinct: Tiwi Plantation Corporation managed land within the Tiwi Aboriginal Land Trust (TALT)
	Transmission Line Corridor: ~28 km on land within the TALT, and ~2 km on land managed by Office of Township Leasing within the TALT
	H2 Production Precinct: Land managed by Office of Township Leasing within the TALT
	H2 Export Precinct: Land managed by NTPM within the TALT
Lot/Section number	Entire proposal lies within NT Portion 1644
Local Government Area	Tiwi Island Regional Council
Town/Hundred	Tiwi Islands (Melville Island)
Zoning	Unzoned
Tenure	Freehold
Ownership of land	Munupi Clan (within the TALT)

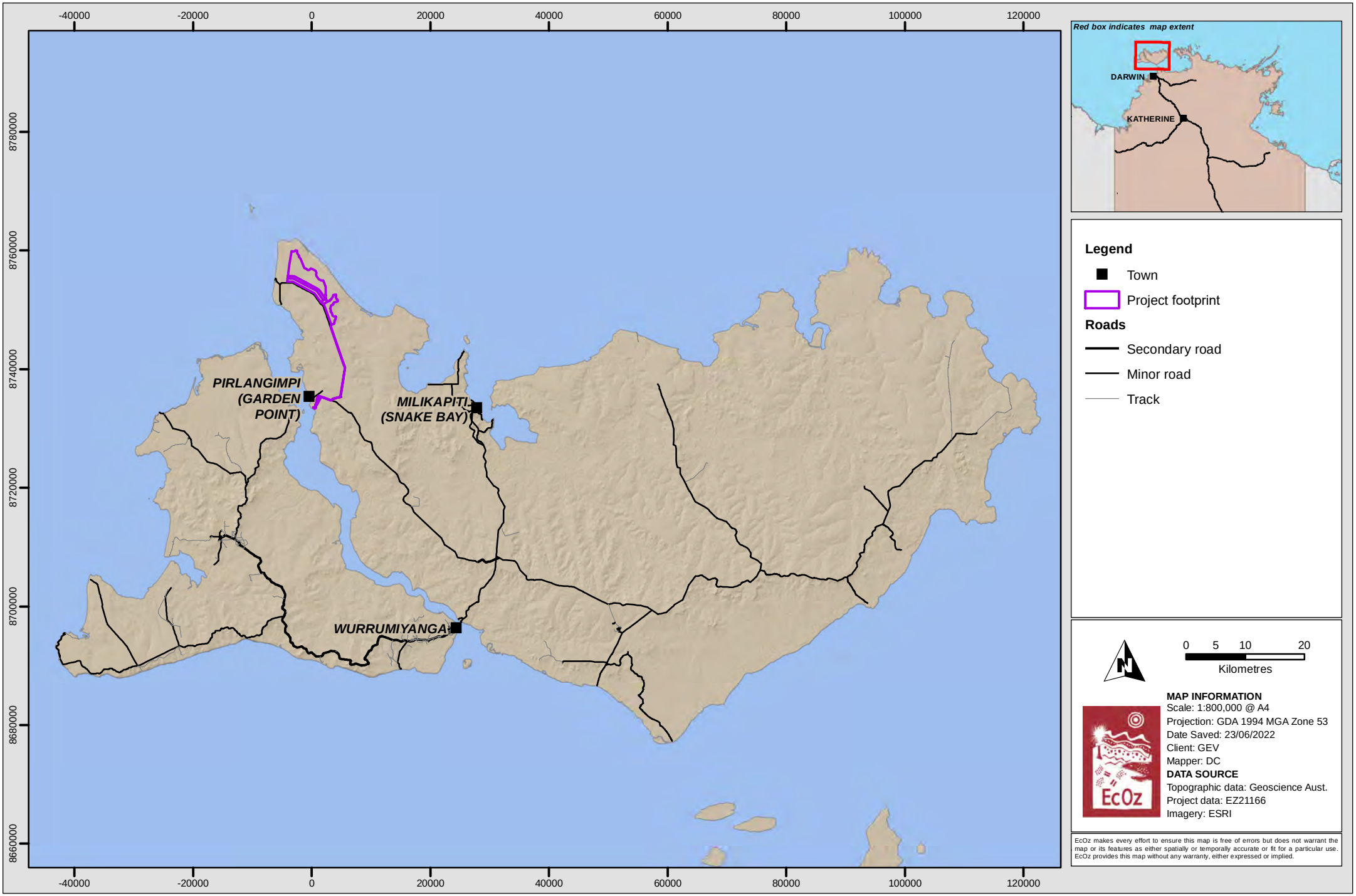

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Figure 2-1. Map showing the location of the Tiwi H2 Project

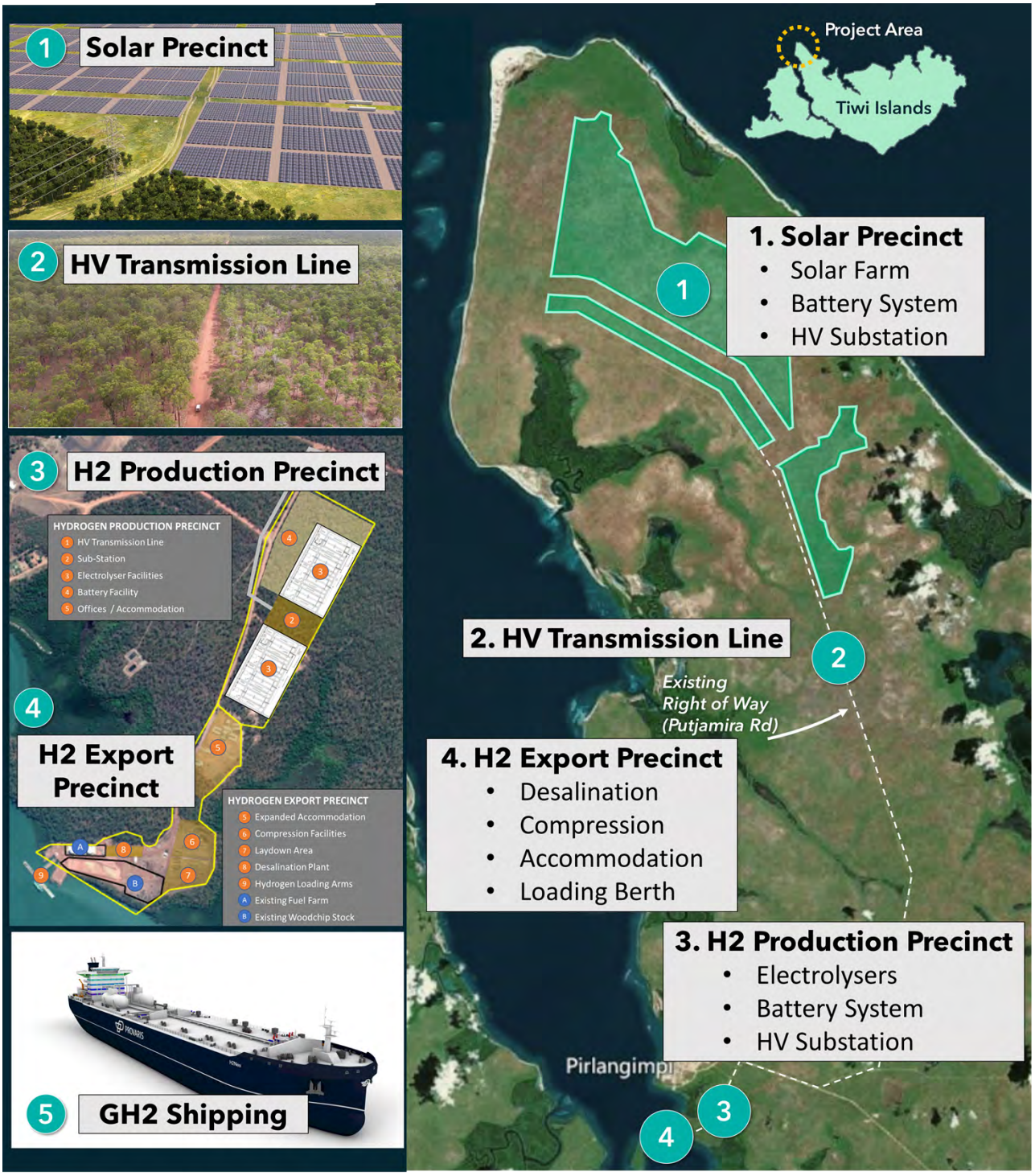


Figure 2-2. Map of proposal footprint and site layout

2.3 Project schedule

Provaris will continue to develop and progress the detailed engineering design of the Tiwi H2 Project throughout 2022 and 2023, in line with the permissions and approvals of the Munupi Traditional Landowners. This work will run in parallel to Provaris' ship engineering and class approval program.

The target project schedule can be summarised as follows:

- Development / detailed engineering: 2022 and 2023
- Financial close / commence construction: early 2024
- Initial construction phase: 2024 – 2026
- Commencement of hydrogen export: early 2027
- Project life: 30+ years

Hydrogen production and export is expected to commence in early 2027 at an initial rate likely to be 25,000 - 50,000 tpa. Further construction stage(s) will increase capacity up to the 100,000 tpa target level by the early 2030's.

The construction of the Tiwi H2 Project will likely be undertaken in stages, so that hydrogen production and export volumes can be increased over time in line with customer demand, as well as to maintain an acceptable level of construction workforce in relation to the Pirlangimpi community. Each 36-month construction stage will likely add approximately 25,000 – 50,000 tpa of production.

2.4 Solar Precinct

2.4.1 Footprint and site layout

The Solar Precinct will generate the renewable power requirement to produce and compress the hydrogen. The Solar Precinct footprint is 2,640 ha – see Figure 2-2. It will be located on three adjacent TPC plots – Imalu / Piripiyama (1,800 ha), Putjimirra (370 ha) and Rangini North (470 ha). TLC/TALT currently leases these plots to TPC. Subject to the approval of the Munupi Clan, it is proposed that TPC will clear the plots as part of its normal forestry operations, and then relinquish these plots back to TLC/TALT and, in turn, TLC/TALT (on behalf of the Munupi Clan) will then lease these areas to Provaris under a Section 19 Lease under the *Aboriginal Land Rights (Northern Territory) Act*, subject to terms and conditions being agreed between all three parties.

2.4.2 Existing environment

The following information is a summary taken from the Terrestrial Ecology Report in Appendix B.

Natural environment

The Solar Precinct is located entirely on an *Acacia mangium* plantation, within which there are two distinct communities:

1) Areas where the plantation has degraded or failed, reverting to an open transitional site with an understory of monsoon vine species and sub-shrubs. The introduced Wild Passionfruit was dense in these places, with numerous dead *Acacia* trees. The declared weed – Mission Grass – was also present in the plantation.
2) A closed canopy *Acacia* plantation, with sparse grass ground cover and isolated sub-shrubs – more typical of the intact, commercial *Acacia* plantations across Melville Island.

Both communities within the plantations retained red kandosol soils of the Piper land system and dense leaf litter. The plantation has not been burnt since it was planted in 2005. Surrounding the Solar Precinct is a woodland of Eucalypt mid-high woodland over *Acacia* shrubland with grass groundcovers.

There are no watercourses within the Solar Precinct.

Significant sites or features

The NT Government has identified Sites of Conservation Significance (SOCS) – the most important sites for biodiversity conservation for the NT. The Project area is within the Tiwi Islands SOCS which covers the entire Tiwi Islands and is of international significance (Harrison et al. 2009). Due to the isolation and climatic extremes (high rainfall), the Tiwi Islands support a high number of endemic and threatened terrestrial species. The isolation of the Tiwi Islands provides protection from threats the same species and habitats have encountered on the mainland.

Being, as it is, a plantation, any cultural or heritage sites within the Solar Precinct footprint are likely to have been significantly impacted or destroyed.

Sensitive receptors

Threatened species are known from the woodland surrounding the Solar Precinct, and it is likely that the plantation provides some degree of a habitat for some species. To the north-east of the Solar Precinct is the largest dry rainforest/vine thicket on the Tiwi Islands, covering more than 2,000 ha along the coast. These values are assessed in detail in Section 7.3.

2.4.3 Land use history

The TLC and TALT own the land. The land was cleared and planted with *Acacia mangium* in 2005. This plantation has not performed well due to poor soil conditions and disease.

The plantation land is not registered as a contaminated site under the *WMPC Act*.

2.4.4 Key physical components

The Solar Precinct will consist of the following components:

- Arrays of photo-voltaic panels of up to 2.8 GW_p capacity (see below).
- Up to 400 MW / 800 - 1,600 MWh battery energy storage system (8 ha).
- A step-up substation with a high volt transformer connection to the transmission line (5 ha).
- Drainage and erosion controls.
- A buffer zone of up to 50 m is being considered between the surrounding native trees and the edge of the solar farm, to account for sun shading from surrounding native trees; and to act as a fire buffer.

There will not be any accommodation at the Solar Precinct site.

There are several options being considered by Provaris regarding the design of the solar farm:

- **Fixed Tilt**, whereby the solar modules are mounted at a fixed inclination calculated to provide the optimum annual output profile – see Figure 2-3. The modules are normally oriented towards the Equator, at a tilt angle slightly less than the latitude of the site. The key benefits of this option are that they are simpler, provide the highest wattage per unit area, can require less site preparation, can be quickly deployed and are the most efficient.
- **Dual Axis Solar Trackers** can track the sun in its daily orbit across the sky, and as its elevation changes throughout the year, to maximise the intensity of incoming direct radiation. The advantage of tracking is an increase in performance; however, this needs to be weighed against the associated increase in land area, capital, and operating costs.
- **Single Axis Solar Trackers** track the sun in one dimension in its daily journey across the sky but do not adjust for the seasons – see Figure 2-4. In doing so, they achieve some of the output benefits of tracking, with a lesser penalty in terms of land area, capital, and operating cost.

The current view by Provaris is for a combination of fixed tilt and single axis tracking designs. The final decision will be made in the detailed design phase of the Project. Regardless of which design will be chosen, the panels and mountings will be designed and installed for the relevant cyclonic conditions.

The cleared areas beneath and between panels will be contoured to ensure that the direction of existing offsite surface water flows is maintained, but with necessary controls to minimise erosion and sedimentation. A detailed ESCP will be prepared. In addition, to minimise the chance of erosion of bare ground by wind in the dry season and run-off in the wet season – as well as to mitigate greenhouse gas emissions – there will be a groundcover across as much of ground not covered by solar panels as practicable from an operations perspective – see Section 5.1.2 for more detail. It may also be possible to plant a groundcover under the single axis tracking solar panels.

Figure 2-3. Photograph of fixed tilt solar panel arrays

Figure 2-4. Photograph of single axis solar tracker arrays

2.4.5 Indicative Site Layout (Solar Farm)

Indicative site layouts where prepared for the Tiwi H2 Project, as depicted in Figure 2-5 below.

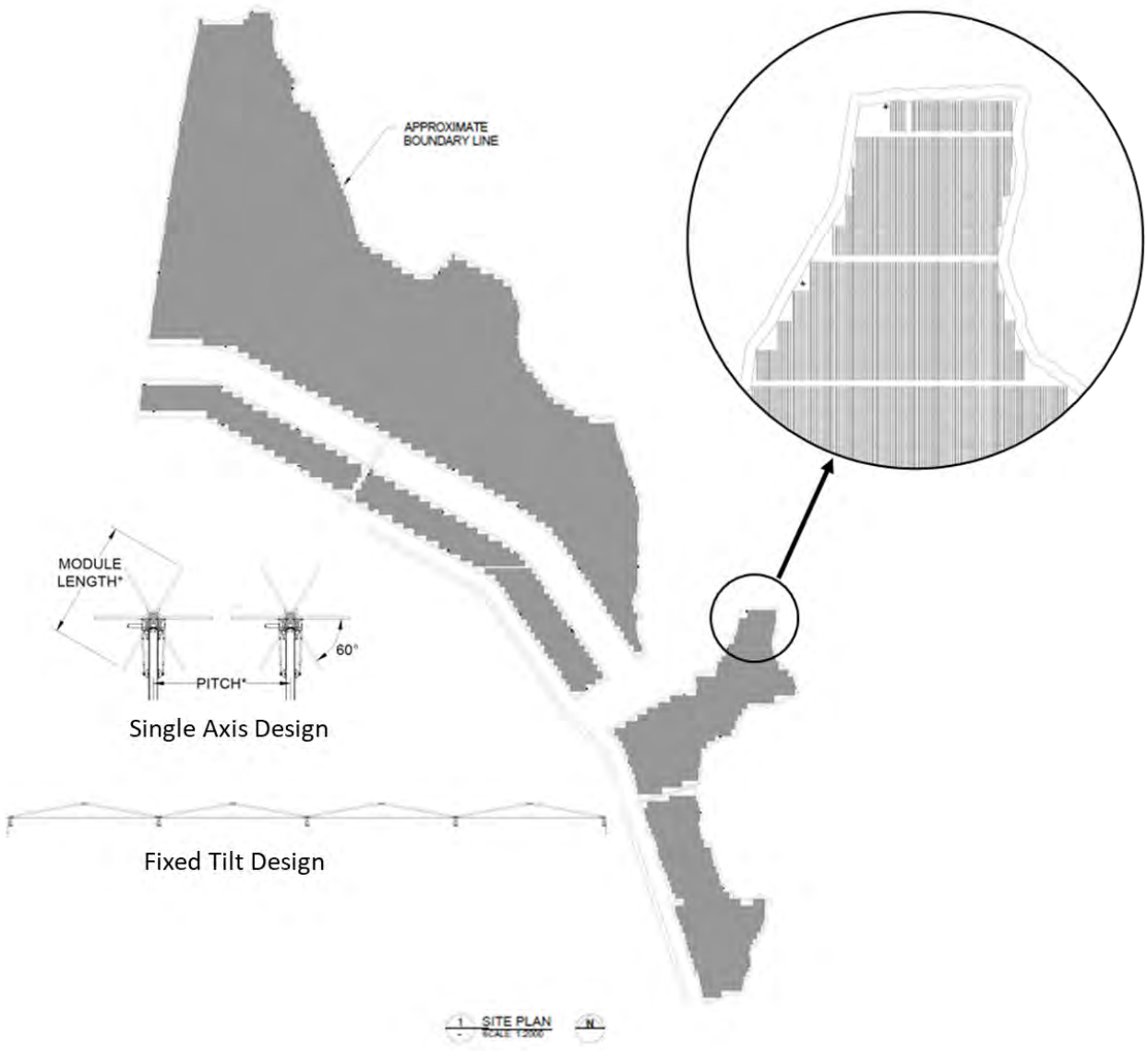


Figure 2-5. Solar Farm indicative site layout

2.4.6 Indicative Site Layout (Battery / Substation)

An indicative layout / location for the battery energy storage system and step-up substation is depicted in Figure 2-6 below, at the bottom of the Putjimirra plantation area.

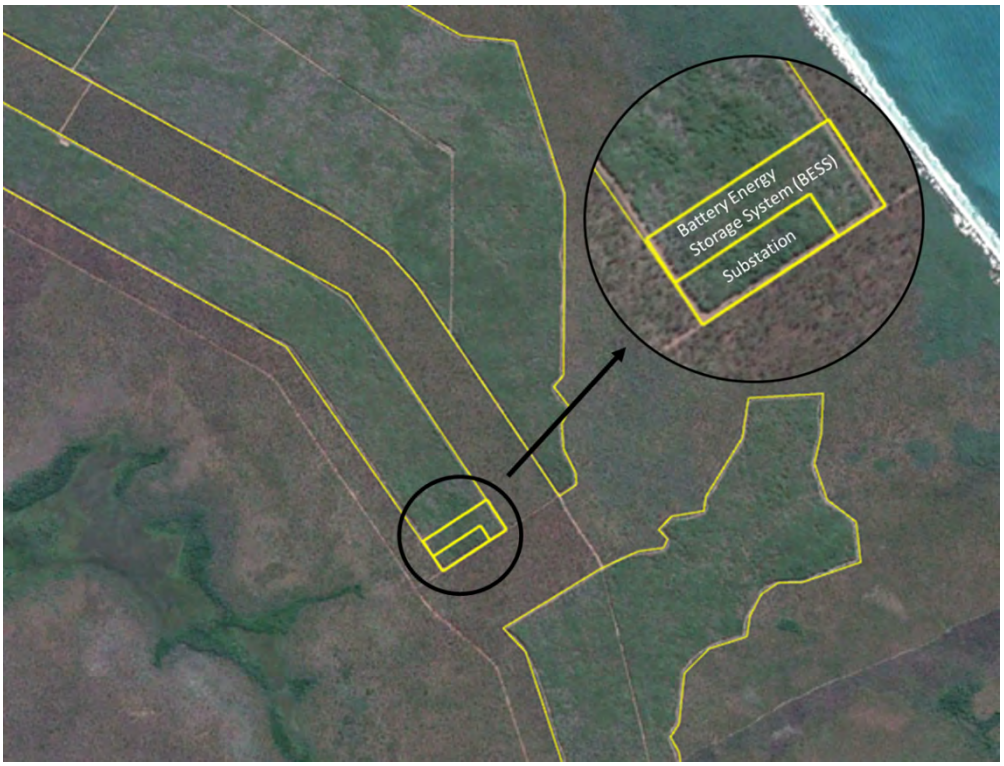


Figure 2-6. Battery / substation indicative site layout

2.5 Transmission line

2.5.1 Footprint and site layout

Provaris is proposing to build, own and operate a high voltage 275 kV dual circuit, above ground transmission line running 30 km from the Solar Precinct to the H2 Production Precinct. In accordance with NT Power and Water Corporation NP021 Easement Guidelines, the transmission line will be placed within a 50 m wide corridor adjacent to Putjamirra Road – see Figure 2-7.

2.5.2 Existing environment

The following information is a summary taken from the Terrestrial Ecology Report in Appendix B.

Natural environment

Land system mapping of the western half of Melville Island was undertaken by Wells et al. (1978) at a scale of 1:250,000. This was prior to the development of the plantations. The mapping identifies four land systems to be traversed by the Transmission Line Corridor – Table 2-3 and Figure 2-8. These land systems were ground-truthed during the 2022 field visit for the Project.

Table 2-3. Summary of the land systems relevant to the Transmission Line Corridor

Land system	Landform	Soil	Vegetation
Lateritic plains			
Dundas	Undulating terrain with common intermittent streams and drainage depressions, small areas of internally draining estuarine plains, dominantly Quaternary deposits of silt, fine sand and minor gravel alluvium overlying Van Diemen sandstone	Sandy or loamy red earths – rises, mottled sandy or clayey soils – depressions	Open Eucalypt forest – rises, Variable shrubland – depressions
Piper	Flat to very gently sloping sand plains, poorly consolidated Quaternary sand and silt overlying Tertiary Van Diemen sandstone	Predominantly red earthy sands	Open Eucalypt forest
Tiwi	Gently undulating terrain between central plateau surface areas and northern sand plains, poorly consolidated Quaternary sand and silt overlying Tertiary Van Diemen sandstone	Deep sandy red earths	Open Eucalypt forest
Sandstone plains and rises			
Callemondah	Colluvial slopes – includes weathered plateau remnants and plateau foot slopes – small areas occur adjacent to plateau surface, weathered lateritised Van Diemen sandstone	Frequently shallow sandy and gravelly red massive earths	Open Eucalypt forest

There are seven water crossings within the Transmission Line Corridor along Pitjimirra Road – namely Blue Water Creek, three first-order unnamed seasonal drainage lines and three wetlands – see Figure 2-8. The head waters of all the watercourses were on the eastern side of the road, with the water crossings and drainage towards the west. Drainage Line 2 drains from a wetland and Drainage Line 3 drains into a wetland before joining a second order stream. The remaining three are points at which the Transmission Line Corridor crosses wetlands.

The Transmission Line Corridor footprint and surrounding areas are part of the fire management program conducted by the Tiwi Land Rangers and TPC. These areas are part of the asset protection program and are burnt annually in the early dry season to manage fuel loads. Relevant to the Transmission Line Corridor, weed distribution corresponded to areas of environmental disturbances along roads and tracks. The most frequent weed observed during the field visit was *Sida acuta* and Mission Grass.

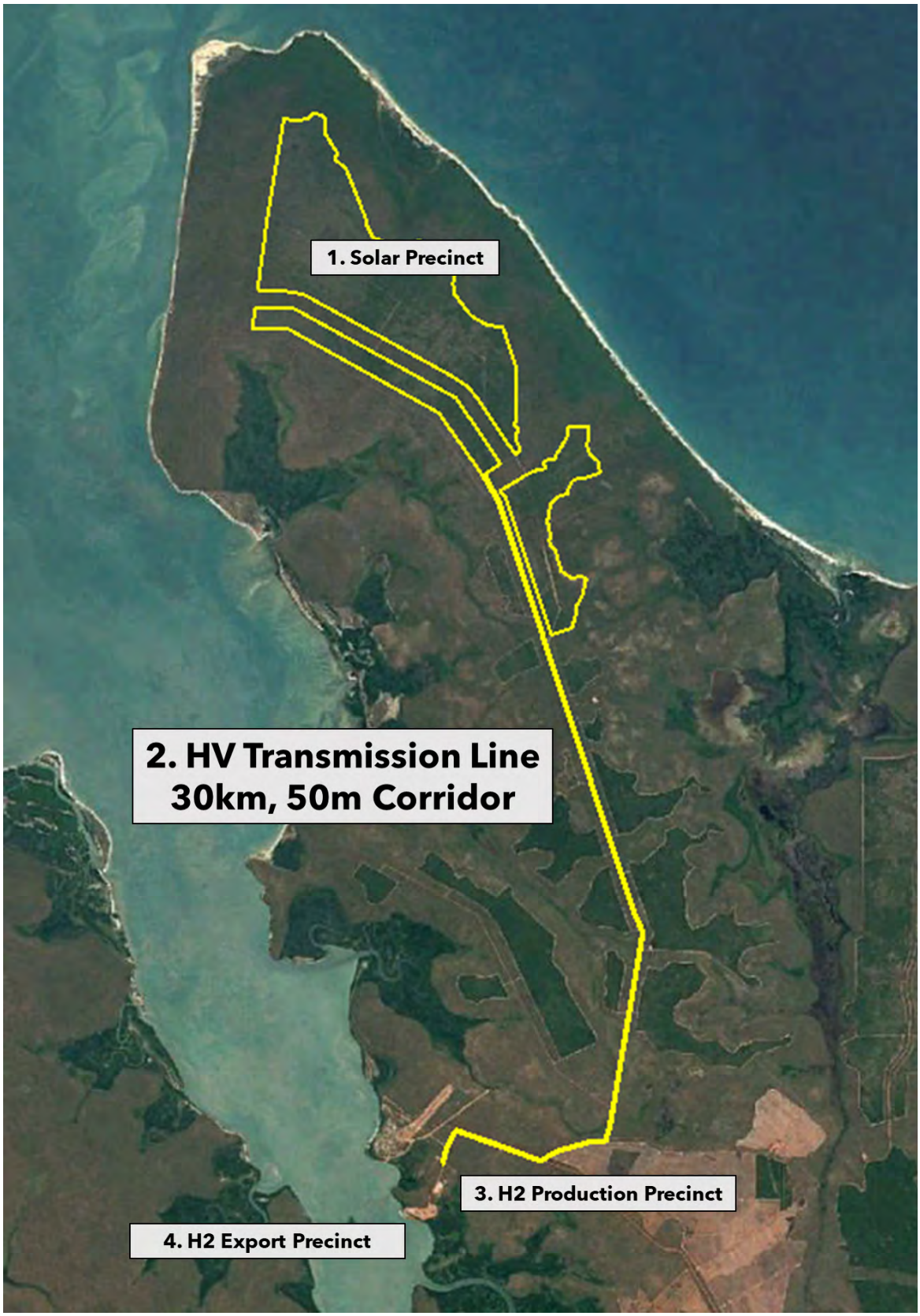
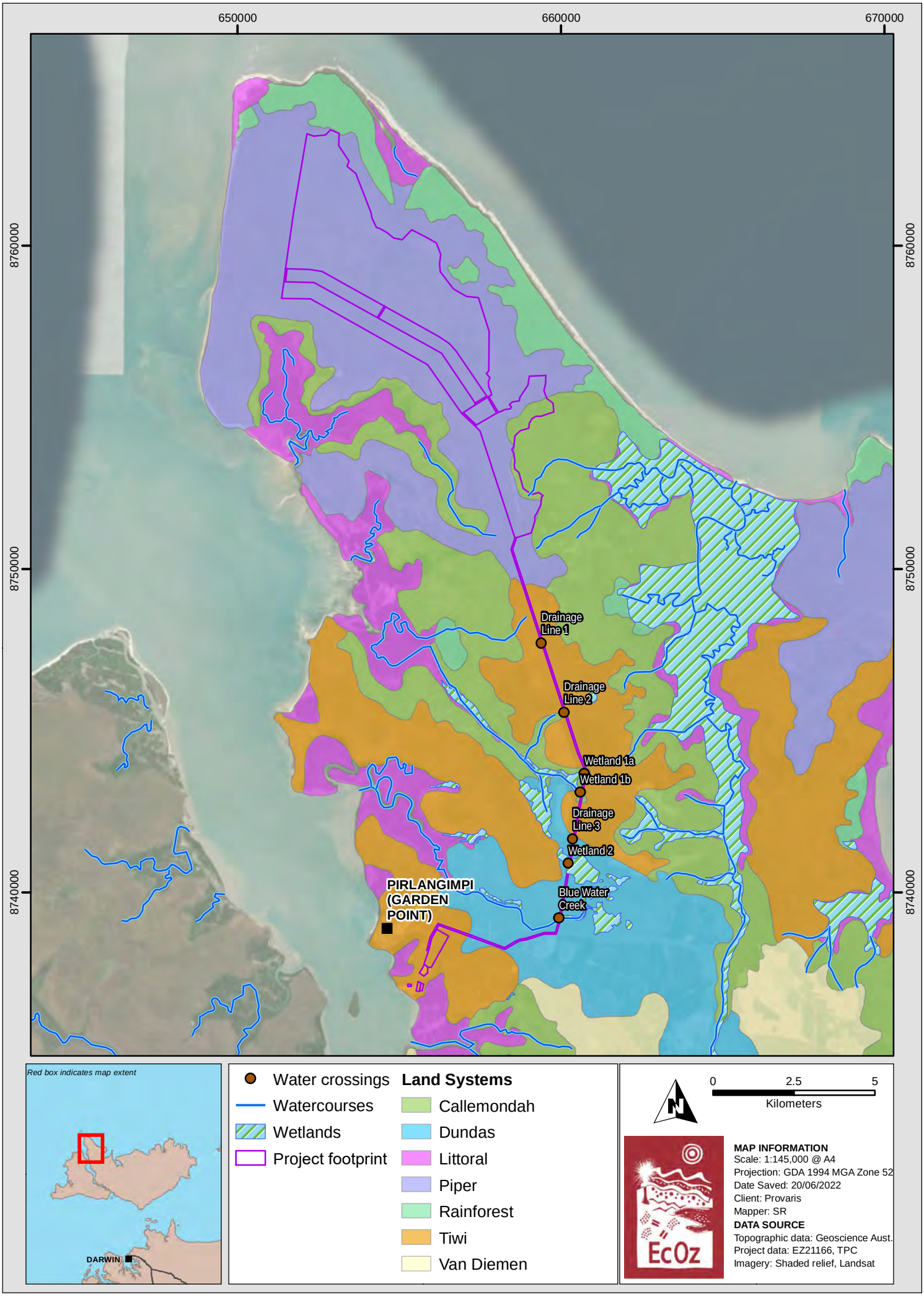


Figure 2-7. Map of the Transmission Line Corridor



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ21166 - Tiwi Islands Hydrogen Export Project\01 Project Files\Referral\Fig 2-5 Land systems and water.mxd

Figure 2-8. Map of land systems and watercourses relevant to the proposal

Significant sites

As noted in Section 2.4.2, the Tiwi Islands are a SOCS.

Detailed in Section 9.8.2, two significant cultural sites were detected within the Transmission Line Corridor during the Cultural Heritage survey:

1) One culturally-scarred tree (CST) – another CST was identified nearby the Transmission Line Corridor.
2) A watercourse and swimming hole towards the southern end of the transmission line.

Sensitive receptors

Threatened species have been recorded in the woodland habitats traversed by the Transmission Line Corridor.

Significant vegetation types (as defined by the NT Land Clearing Guidelines) occur in the corridor. Two of the drainage lines intersected support distinct riparian vegetation, including some rainforest. The corridor also intersects two wetlands and supports large hollow-bearing trees at some locations.

These values are assessed in detail in Section 7.3.

2.5.3 Land use history

The TALT owns the land through which the Transmission Line Corridor runs. It is a greenfield site (running adjacent to a road reserve). No part of the corridor is registered as a contaminated site under the *WMPC Act*.

As detailed in Section 9.3.2, the Transmission Line Corridor intersects three of the four wellhead exclusion zones for the Pirlangimpi bore-field.

2.5.4 Key physical components

An above-ground, alternating current (AC) transmission line will be installed between the Solar Precinct and the H2 Production Precinct. Transmission towers will stand ~450 m apart, supporting six 275 kV transmission cables (three cables per circuit, one circuit each side of the tower) and up to two earth wires. The size (diameter) of the cable will be determined during the detailed engineering phase of the project. Subject to the final design of the tower, the cables are approximately 5 to 7 m apart.

The basic dimensions of the transmission towers are up to 45 to 60 m in height and 10 to 25 m in width, depending on final design – see, e.g., Figure 2-10. The tower design is suitable for Wind Category C regions and would have suitable lightning protection for the Tiwi Islands location.

Water crossings will be spanned, and the tower foundations on each side will be located as far away from the water crossing as possible (i.e.,~ 225 m either side). The tower footings will consist of four footing legs. Each footing is usually circular and 1.5 m in diameter, and each footing leg is ~4.5 – 9 m deep, subject to geotechnical conditions. The centres of the footing legs are approximately 10 m apart as shown in - Figure 2-9.

In accordance with PWC Guidelines, the Transmission Line Corridor clearing should be confined to 50 m, with trees overhanging the 50 m Transmission Line Corridor selectively lopped or pruned, with trees to be cut at ground level and roots left, except in the access track to each tower. However, low shrub under 1 m are not required to be cleared within the Transmission Line Corridor in order to minimise erosion.

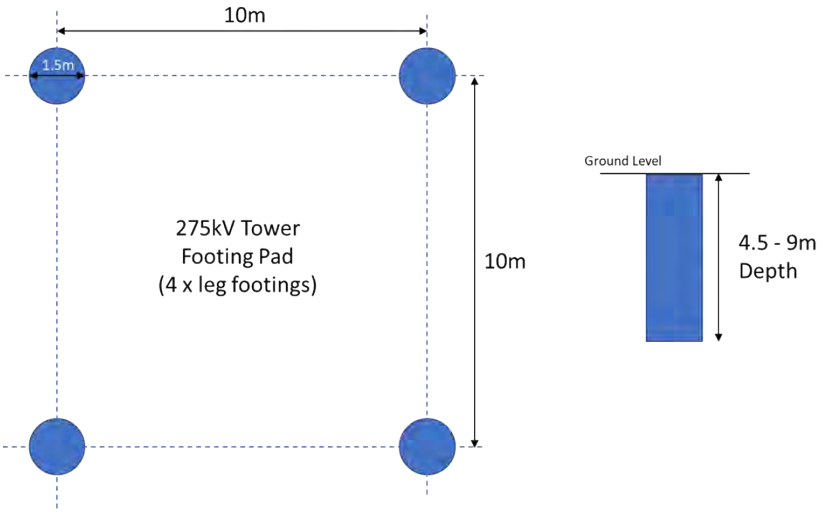


Figure 2-9. Indicative tower footing layout

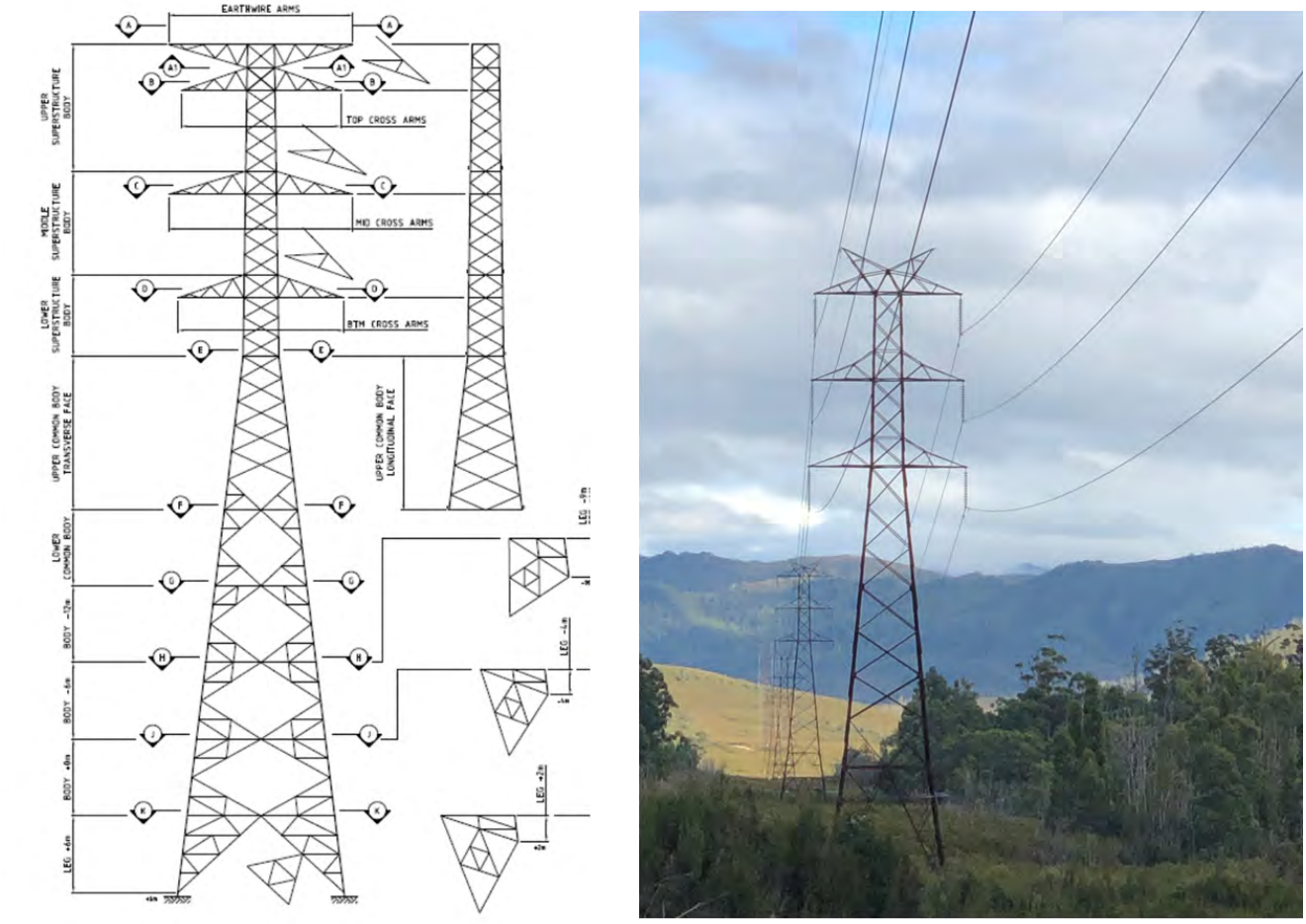


Figure 2-10. Schematic of an indicative transmission tower

2.6 H2 Production and Export Precincts

Producing hydrogen using electrolysis essentially involves extracting and purifying water (desalination of sea water for this Project), then supplying such de-mineralised water to the electrolyser facility which – using the renewable electricity generated and transmitted from the Solar Precinct – produces green hydrogen and

oxygen. The hydrogen is then dried and purified, then compressed and loaded directly into the cargo hold of the H2Neo ship berthed at Port Melville. The oxygen will be vented to the atmosphere.

2.6.1 Footprint and site layout

The H2 Production Precinct will be located within a sub-lease of 40 ha adjacent and to the north of Port Melville, with the H2 Export Precinct located within the existing 32 ha Port Melville Industrial Precinct – see Figure 2-11.

The current indicative layout assumes that the TPC woodchip laydown area remains in use over the life of the Tiwi H2 Project.

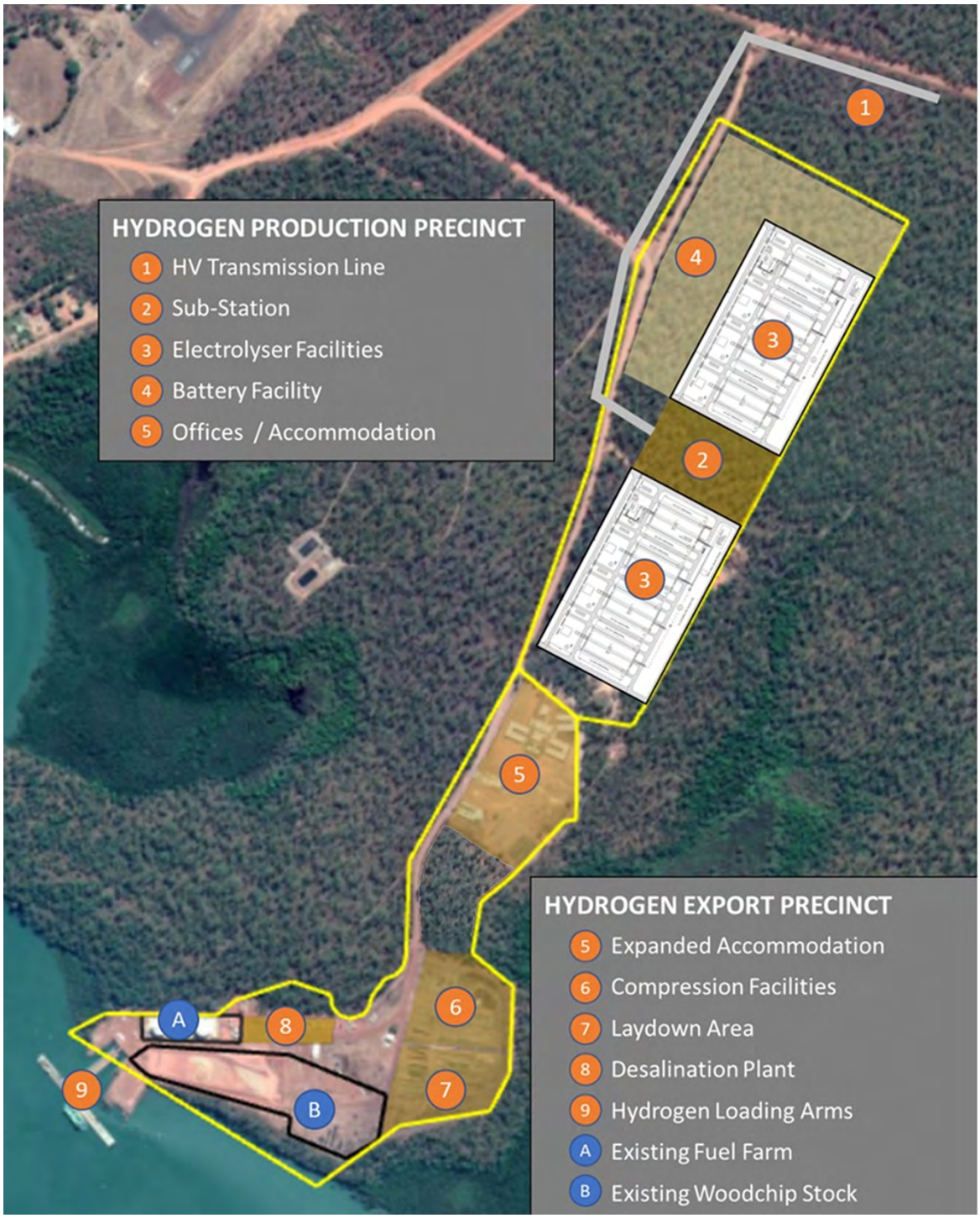


Figure 2-11. Indicative layout of the H2 Production and Export Precincts

2.6.2 Existing environment

Natural environment

The following information is a summary taken from the Terrestrial Ecology Report in Appendix B.

The H2 Export Precinct will be located on land that has already been cleared for use by Port Melville. The vegetation within the H2 Production Precinct is representative of the Tiwi land system (see Table 2-3) – a tall grassy Eucalypt woodland with minimal shrubs. There are no watercourses within these components.

The H2 Production Precinct and surrounding area are part of the fire management program conducted by the Tiwi Land Rangers and TPC. These areas are part of the asset protection program and are burnt annually in the early dry season to manage fuel loads.

Within the Project area, weed distribution corresponded to areas of environmental disturbances. *Sida acuta* and Mission Grass were the most frequent weeds observed at Port Melville, and along roads and tracks.

Significant sites or features

Fort Dundas was a military fort and the site of the first British settlement in northern Australia settlement from 1824 to 1827, primarily situated approximately 600 m north-west of Port Melville, but with features scattered throughout uncleared areas of the landscape adjacent to the Port. There are features north of the Project's desalination plant and solar monitoring area (south), with the closest approximately 20 m north. The feature lies in an area of undisturbed native vegetation. Fort Dundas is recorded on the NT archaeological database and the Register of the National Estate (non-statutory archive). It is not yet listed on the NT Heritage Register; however, a nomination for registration was accepted on 8 March 2019 – the Heritage Council is yet to make a final decision on the nomination.

The Project footprint avoids all previously recorded heritage features mapped by Crosby (1978). The Project will maintain appropriate buffer distances from Fort Dundas artefact sites that were recommended by the NT EPA for the Port Melville development.

Archaeological surveys were undertaken in relation to the construction of Port Melville (Fredrickson 2003). Sites were identified in the vicinity of the port, but not within the cleared footprint for the Port itself. Recommendations were made to avoid impacts to the features identified nearby, and to manage any unexpected finds. Any archaeology not identified during these surveys is likely to have been impacted through the development and/or ongoing operations of Port Melville.

Sensitive receptors

Threatened species have been recorded in the woodland within, and surrounding, the H2 Production Precinct.

Significant vegetation types (as defined by the *NT Land Clearing Guidelines*) occur adjacent to the precinct footprint. The H2 Production Precinct is adjacent to a 7 ha patch of spring-fed rainforest that connects with a larger 30 ha area of dry rainforest to the south. The H2 Export Precinct has a 2.3 ha patch of dry rainforest 340 m to the north-east, along the coast. Large hollow-bearing trees were recorded in the H2 Production Precinct.

These values are assessed in detail in Section 7.3.

2.6.3 Land use history

The H2 Production Precinct is located 1 km east of Pirlangimpi, on land within the Pirlangimpi township, managed by the Office of Township Leasing (OTL).

The H2 Export Precinct is within the Port Melville Industrial Estate which is located south of Barlow Point on Melville Island, 63 nautical miles north of Darwin. It was constructed in 2004 with the main purpose to facilitate the export of forestry products by TPC, such as woodchips and bulk logs and underwent significant

development in 2015 for oil and gas facilities. In addition to providing berthing facilities (detailed in Section 2.7), the site has:

- a fuel tank farm (3 x 30 ML tanks)
- a woodchip stockpile area
- accommodation and offices.

The Port Melville area is leased from the TALT by Port Melville Pty Ltd, and sub-leased to (and operated by) Ezion Offshore Logistics Hub (Tiwi) Pty Ltd via a 50-year sub-lease. Ezion changed its name to NT Port and Marine Pty Ltd (NTPM), in 2017, which is a wholly owned subsidiary of Singaporean listed company AusGroup Limited (AusGroup).

Prior to its construction in 2015, AusGroup and TPC executed a Facilities Agreement where AusGroup agreed to develop the Port as a marine supply base, including for the laydown and storage, with a barge load out facility for the export of woodchips; whilst TPC agreed to continue to use the Port to export its woodchips and other forest and horticultural products. Under such agreement, AusGroup provided TPC with a licence over sufficient land area, immediately adjacent to the berth, for the receiving and storage of woodchips, and the performance of wood chipping operations.

Discussions are ongoing between Provaris and NTPM on the preferred contractual structure – and associated terms and conditions – relating to use of this land. Such contractual discussions include leasing and use of Port Melville by Provaris from NTPM; or an outright 100% acquisition of NTPM, the current Port sub-lessee and operator, from AusGroup.

Neither precinct is registered as a contaminated site under the *WMPC Act*.

2.6.4 Key physical components

The H2 Production and Export Precincts will contain infrastructure and plant capable of producing 100,000 tonnes of hydrogen per annum. As shown in Figure 2-11, the precincts will contain the following (noting area sizes are indicative at this stage):

- Step-down substation (~5 ha)
- Desalination plant (~1 ha)
- Proposed re-purposing one of the existing fuel storage tanks (10 million litres) for the storage of potable water
- ~1.5 GW hydrogen electrolyser (~20 ha)
- Compression facilities sufficient to compress and load hydrogen to up to 250 bar pressure (~2 ha)
- High pressure pipework and loading facilities (arms) suitable for compressed hydrogen to be loaded onto Provaris' compressed hydrogen ships (H2Neo)
- Allowance for a secondary battery energy storage system (~8 ha)
- Laydown area (~3 ha)
- Offices and accommodation (~6 ha)
- Security fencing.

There is sufficient area for other infrastructure, such as roads, access, buffer distances and drainage. Further details are provided for specific components below.

Electrolyser

The splitting of water into hydrogen and oxygen using electrical energy occurs within the electrolyser unit. The oxygen will be vented directly into the atmosphere. The hydrogen gas is then dried and purified and, in the case of the Tiwi H2 Project, compressed from 10 – 20 bar, to the 250 bar required to be stored directly into the H2Neo ship's cargo hold, berthed at Port Melville ready for export when full.

This Referral is based on two 745 MW alkaline electrolyser plants; however, as the Project progresses closer to financial close, advances in technologies and plant configurations will be reviewed to select the

manufacturer, technology and plant configuration that delivers the lowest cost of hydrogen to the customer. The maximum height of the electrolyser plant is likely to be less than 30 m.

The alkaline electrolysis process in illustrated is Figure 2-12. Aspects of the process that are particularly relevant to assessing potential environmental impacts are discussed below.

The electrolyte (called 'lye') is an aqueous 25% potassium hydroxide solution. It is stored in a secure tank manufactured from carbon steel and is produced by dissolving potassium hydroxide pellets/flakes in demineralised water. Apart from occasional topping-up of electrolyte, its use is within a closed cycle. All the other electrolyser options being considered have a solid electrolyte.

The feed water supply to the electrolyser must be of a high purity since impurities will concentrate inside the electrolyser, causing corrosion and deposits on surfaces. Water impurities will be removed to create demineralised water, using a desalination plant, as described below.

Several components in the hydrogen production facility require cooling, including the electrolyser cell stack, gas scrubber, gas dryer and compressor. It is proposed that such cooling be provided via a fin-fan cooling system operation.

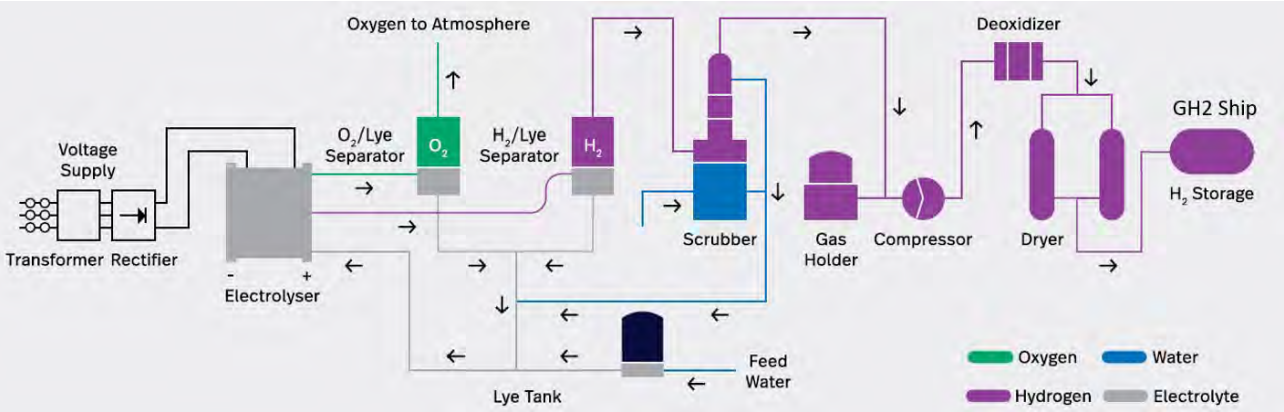


Figure 2-12. Schematic of electrolysis process

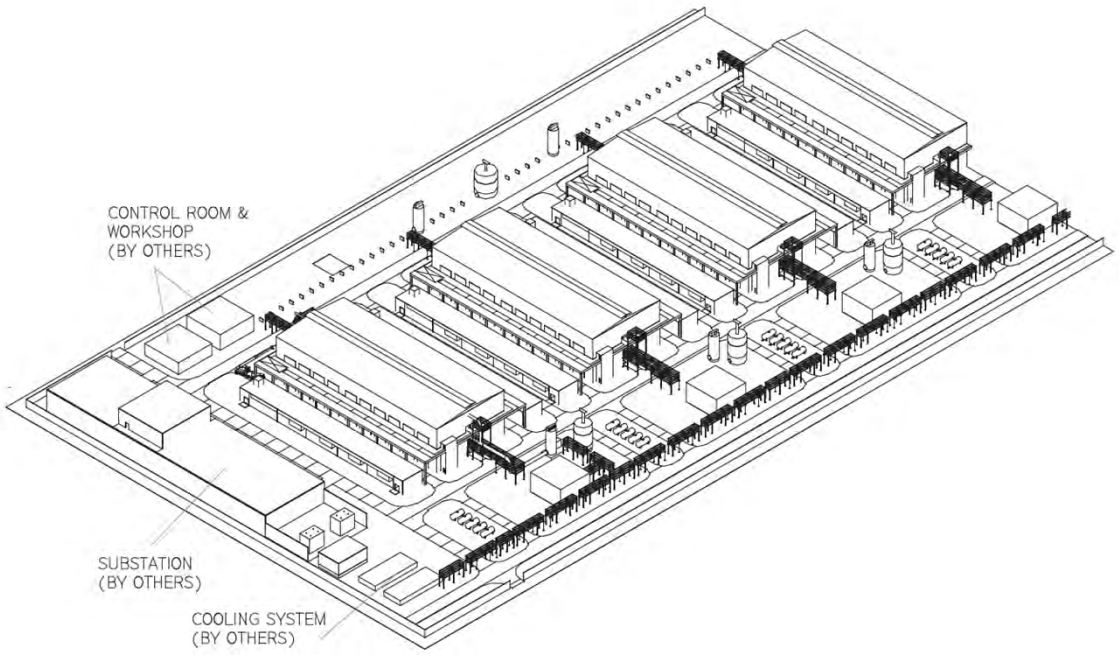
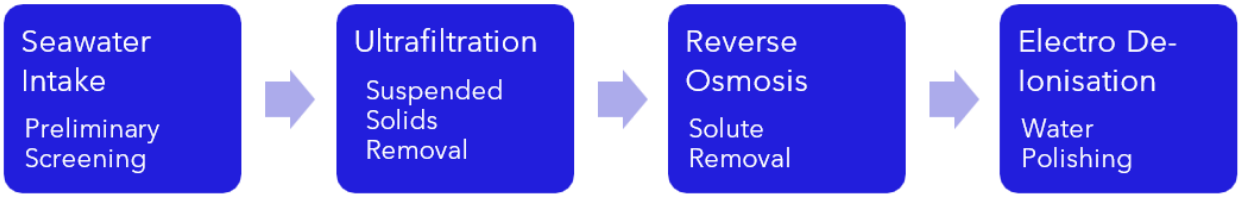


Figure 2-13. Electrolysis Facility (745MW)

Figure 2-14. Graphic of proposed layout (for illustrative purposes only)

Desalination

The feed water for the electrolysers will be sourced from desalinated and demineralised seawater. The process train consists of:



The process uses membranes and electrodes and does not involve any chemicals. Approximately 10 litres of de-mineralised water are required to produce 1 NH of hydrogen. Therefore, to accommodate a maximum production capacity of 100,000 tonnes of hydrogen per annum, the Tiwi H2 Project will require 1 gigalitre of de-mineralised water per annum.

It is assumed that the desalination plant will run continuously, with the provision of a water storage tank, currently identified as using one of the three existing 10 megalitre storage tanks on site. The plant will source seawater from Apsley Strait; brine produced by the plant will be discharged into Apsley Strait. Details regarding the water inlet and outlet for the desalination plant are presented in Section 2.7.4.

Accommodation

For the existing Port operations, there is a 150-person accommodation village and ancillary infrastructure on site – see Figure 2-15.

The accommodation facilities are to be expanded to the required 500-person level. Provaris has set aside an area of 6 ha in the location of the existing accommodation for this expansion. Some of this land will likely be used for disposal of additional treated wastewater (i.e., sewage and greywater) from an onsite treatment system designed and operated in accordance with the *NT Code of Practice for Wastewater Management.*

Figure 2-15. Photograph of existing accommodation

2.7 Berth and ships

2.7.1 Footprint and site layout

The H2Neo ships that will be used to store and export the hydrogen will utilise the existing Port Melville berth.

2.7.2 Existing environment

The Apsley Strait is approximately 62 km long and ranges from 0.55 to 5 km in width. At the Port, the strait is ~2.4 km wide. The strait separates Melville and Bathurst Islands (Tiwi Islands) and connects the Timor Sea in the north and Beagle Gulf in the south. The strait has a large tidal range. The seabed directly off Port Melville drops steeply to about 40 m depth; the depth alongside the berth is 14 m.

The channel between St Asaph Bay and Port Melville by which vessels navigate through the northern entrance of Apsley Strait is largely in deep water. This section provides marginal habitat for marine megafauna and

therefore it is unlikely that significant populations of marine megafauna would aggregate or remain in the channel.

2.7.3 Land use history

A wharf has existed at the Port Melville site since at least 2003. This initial structure was weakened during a cyclone in 2005 and eventually failed in September 2007.

The current berthing facilities at the Port were constructed in 2014 and consist of concrete pontoons forming a floating deck. The pontoons are held in place by dolphins and piles. The main berthing face (deck) is 220 m in length with 10 equally spaced fenders. Mooring systems are provided by six mooring buoys, wharf dolphins and bollards.

The supply barge for Pirlangimpi does not use this facility, docking, instead, at the town's landing.

2.7.4 Key physical components

The Port Melville berth has a 220 m long berth face with a 110 m concrete shore connection pontoon. It is approved for vessels up to 50,000 DWT and has a water depth of 14 m alongside (as per NTPM website).

Based on an initial engineering review, it is unlikely the structure will need to be modified to facilitate the H2Neo ships (47,000 DWT). However, infrastructure for loading hydrogen onto the ship will be installed. Moreover, the water intake and outlet for the desalination plant will be located on the berthing infrastructure.

Provaris does not envisage that there will be any need for dredging or installation of new marine infrastructure at the Port to accommodate the H2Neo ships. However, some navigational aids are likely to be installed within Apsley Strait for the crossing of Mermaid Shoal.

Inlet and outlet

Primary design objectives for the water inlet and outlet for the desalination plant are:

- Locating the intake for consistent seawater quality, and to avoid intermittent stormwater discharge, propellor wash or wave-related turbidity.
- Locating the outfall in tidal current for dispersion to limit the environmental risk.

There are numerous intake configurations possible. A pier-mounted intake would need to cope with varying sea levels by utilising arrangements such as a fixed, full height coarse screen cage and submersible pumps. A pontoon mounted pumping system could be fabricated off-site and installed with minimal disturbance to the surroundings.

Likely requirements, assuming the intake pipeline and cables can be mounted on the existing floating jetty remote from mooring, are:

- Wire screens approximately 750 mm in diameter and 2 m long, located at least 1 m below water and possibly another raised in a standby position.
- A pontoon attached to the existing floating jetty with a duty and a standby pump and winching or lifting devices for periodic screen maintenance. The intake pontoon would likely be a self-contained unit, fabricated off-site and complete with any control or power cubicles, piping, manifold and valves (i.e., approximately house-boat in size). However, if the existing jetty has unused area, a pontoon may not be required.
- Short lengths of 300 mm flexible hose connecting to 375 mm diameter pipelines attached to the shore-facing side of the jetty and extending as a buried on-shore pipeline to the desalination plant site. Power and control cables in ducts on the jetty would be buried (or overhead) to the power supply and desalination plant respectively.

This configuration is presented in Figure 2-16.

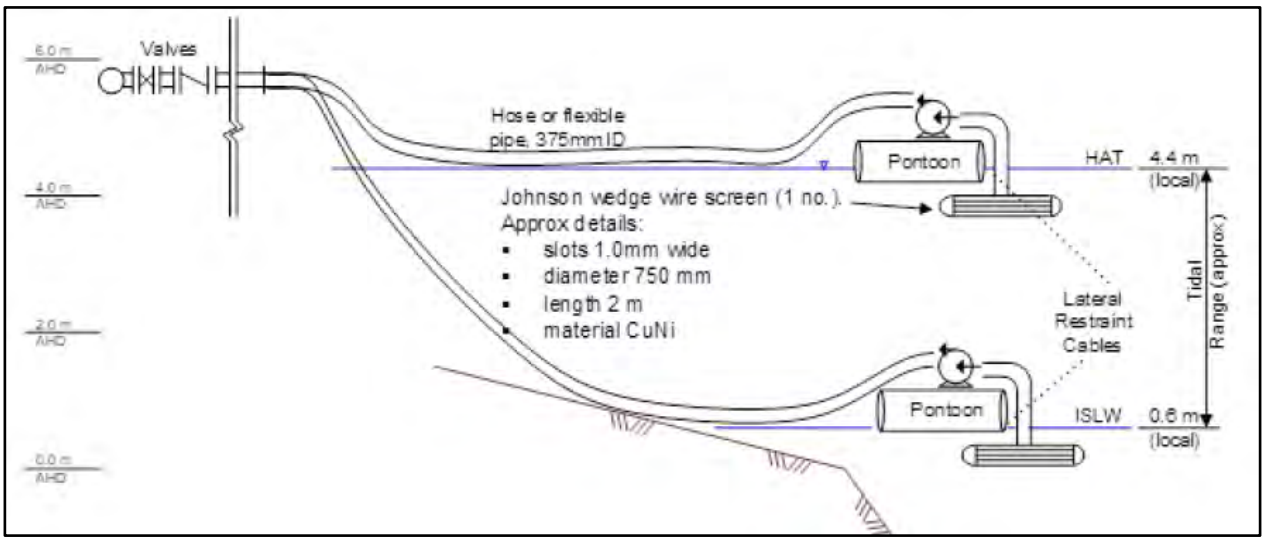


Figure 2-16. Schematic of seawater intake infrastructure

The outlet configuration is shown in Figure 2-17. Likely requirements include:

- A brine discharge header tank at the desalination plant to collect all discharge streams and allow for air release prior to the flow entering the outfall pipeline.
- A 300 mm diameter HDPE gravity pipeline extending from the desalination plant to the opposite end of the existing jetty from the intake.
- A vertical HDPE drop pipe extending approximately 4 m below sea level with a 200 mm discharge nozzle suitable for the marine environment.

This design conforms with accepted practice, is sufficiently distanced from the intake and, with the pipe/nozzle mounted on the existing jetty, will have little to no disturbance to the sea floor. The strong tidal currents will augment mixing.

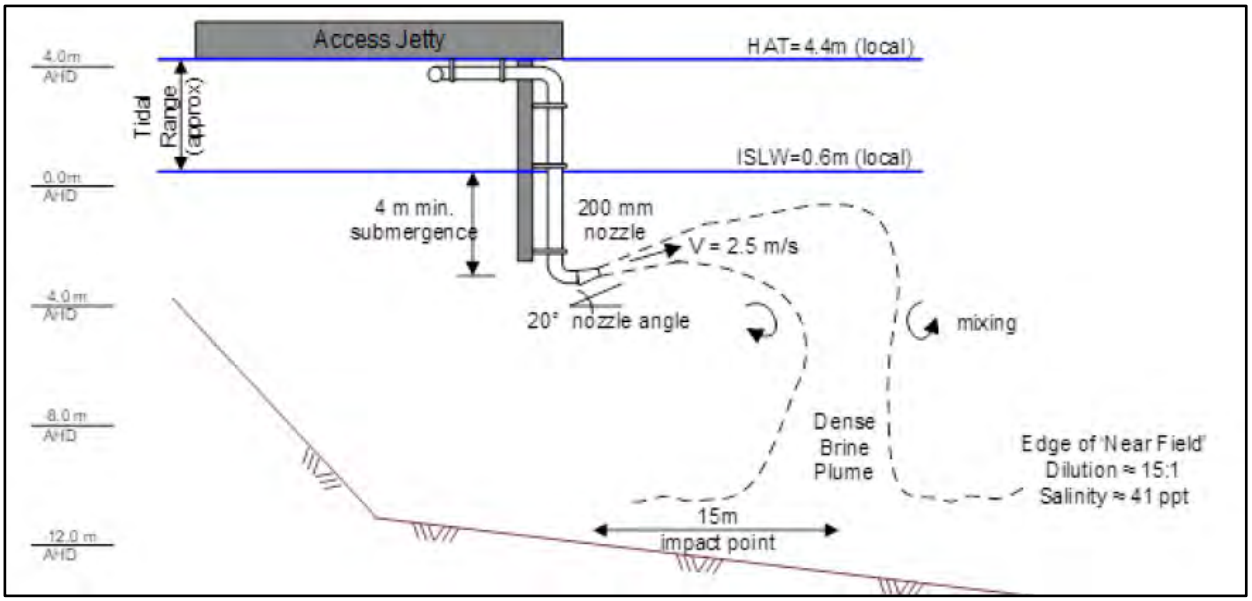


Figure 2-17. Schematic of saline water outlet infrastructure

Loading

Once compressed, high pressure pipework will transfer the hydrogen from the outlet of the compression facilities to the loading arms located on the berth, for H2Neo ship loading. Collectively, these comprise the loading facilities – see Figure 2-18.

The existing berth will be shared with TPC for as long as they require export facilities and/or a laydown area.

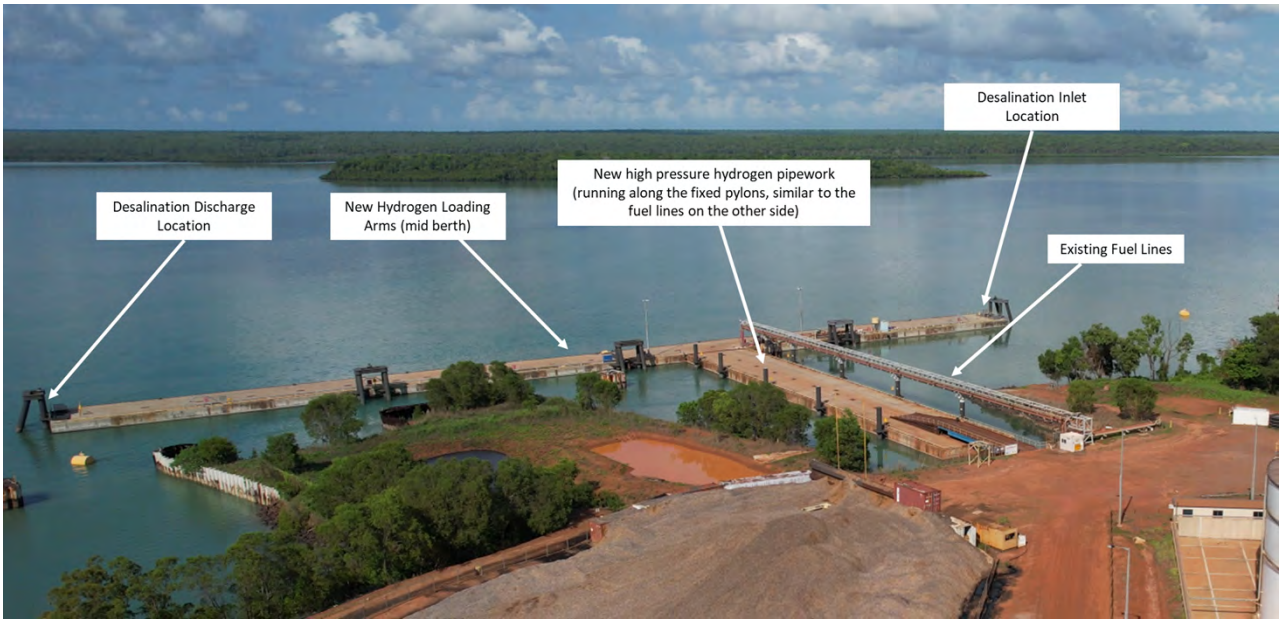


Figure 2-18. Photograph of existing and proposed berthing infrastructure

Ships

Upon production, the hydrogen will be compressed and then piped into the berthed ship for storage. Compression is a proven, safe, and reliable method of storing and transporting hydrogen and is already used in upstream and downstream hydrogen applications. As an export carrier, compression stores, transports, and delivers hydrogen in a high purity gaseous form. Compressed hydrogen is a modular solution that can accelerate the development of greenfield export projects due to the minimal technical barriers, small environmental footprint, ability to load follow the renewable energy profile, and by avoiding the energy and capital-intensive processes to convert hydrogen to a liquid or chemical state (such as ammonia).

In 2020, Provaris introduced the world's first large-scale compressed hydrogen ship. The company's patent-pending, intellectual property is the design of a pressure vessel to enable bulk compressed, non-liquefied, hydrogen storage in volumes that significantly exceed those offered by other compression technologies.

In 2021, Provaris received Approval in Principle from the American Bureau of Shipping for the 120,000 m^3 (2,000 t) and 26,000 m^3 (430 t) compressed hydrogen ships. This Referral Report is based on the use of 26,000m^3 430 tonne ships ship – called the H2Neo – depicted in Figure 2-19, and with the specifications presented in Table 2-4.

The largest vessels that presently utilise the Port are the 200 m woodchip carriers, with length and width like that of the 210 m H2Neo ship. The Port is approved for vessels up to 50,000 DWT and has a water depth of 14 m alongside (as per NTPM website).

No dredging is being proposed for the Tiwi H2 Project. The H2Neo ships will be able to work around any tidal restriction at such time. This is because there will likely be limited production and/or loading during the night, allowing the loaded ship to transit the channel and depart, and for the empty arriving ship to transit the channel and berth, ready for loading.

Use of ships to transport hydrogen is discussed in Section 5.4.1, storage safety in Section 5.8.2.

Figure 2-19. Image of a H2Neo ship

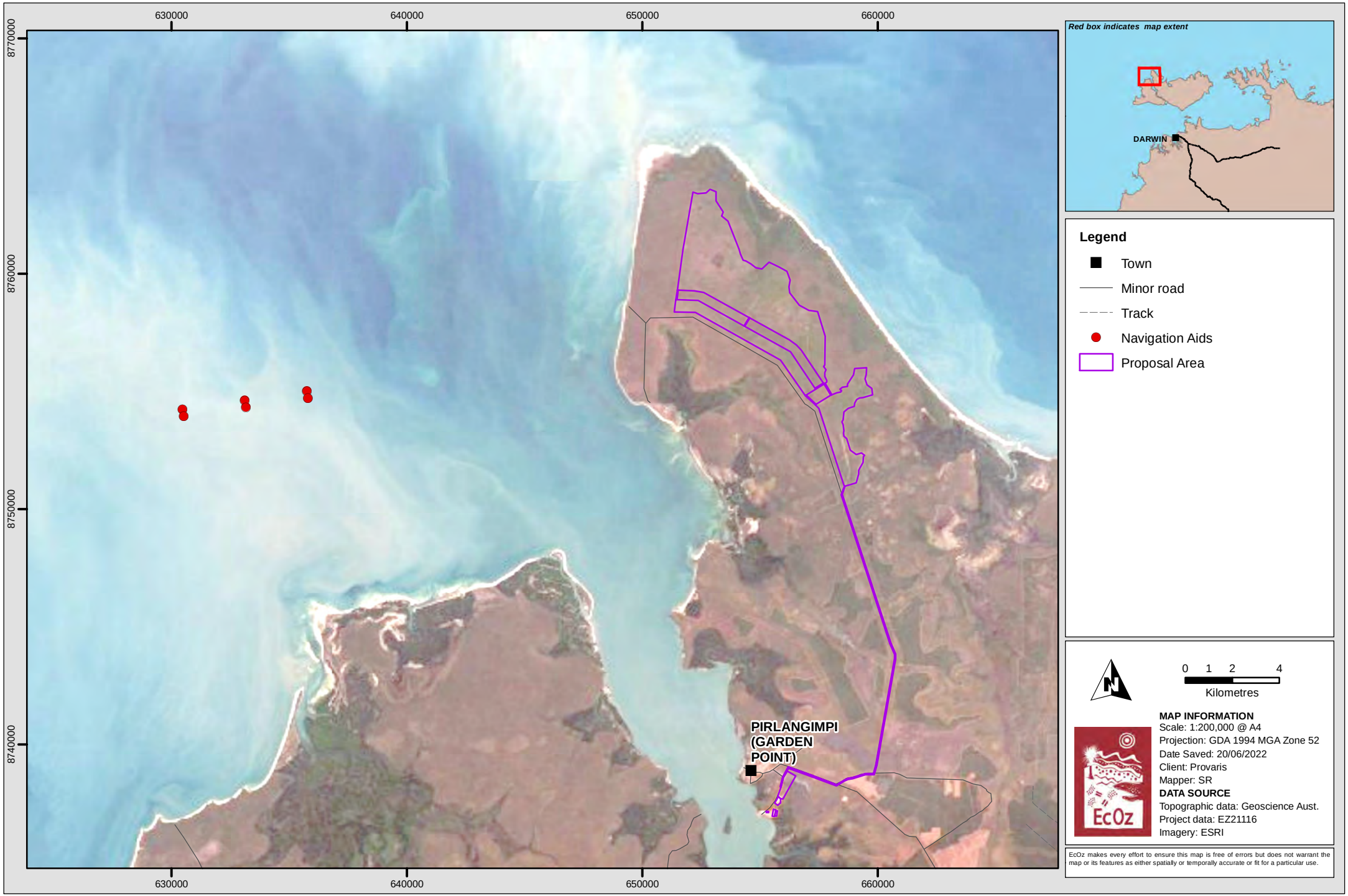
Table 2-4. H2Neo ship specifications

Specification	Value	Unit
Hydrogen cargo	430	tonnes of hydrogen
Length	210	m
Beam / Breadth	30	m
Depth (to main deck)	17	m
Draft	9.0	m (loaded)
	8.9	m (lightship)
Cargo parameters	25,500	m^3 (water vol)
	250	bar
Weight	16,570	tonnes (base ship)
	30,000	tonnes (with 2 cylinders)
	430	tonnes (H2 cargo)
	47,000	tonnes (total loaded displacement)

Aids to navigation

There are currently no aids to navigation in the northern approaches to the Port via Mermaid Shoal and Apsley Strait. Based on preliminary discussions with the Port Melville Harbour Master, it is envisaged that six buoys (navigational aids) will need to be installed to ensure safe and reliable passage of the H2Neo ships across the Mermaid Shoal section. Two of the buoys would be installed at the commencement of the Mermaid Shoal channel (east), two in the middle, and two at the end of the section (west). The width between the two buoys would be 300 m, with indicative locations shown in Figure 2-20.

Each buoy is likely to adopt a cyclone type mooring, consisting of three legs secured on the sea floor by either concrete blocks or anchors. Navigational aids are required to flash every 2 to 6 seconds.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ21166 - Tiwi Islands Hydrogen Export Project\01 Project Files\Referral\Fig 2-13 Navigational Aids.mxd

Figure 2-20. Map showing location of proposed navigation aids across Mermaid Shoal

3 SITE SELECTION AND ALTERNATIVES

The section examines the various alternative sites, layouts and approaches that were considered by Provaris prior to deciding upon the Project presented in this Referral.

3.1 Site

The Project footprint has been designed to capitalise on the following considerations:

- **Proximity to the global hydrogen market.** Tiwi Islands and Port Melville are located along the northernmost part of Australia, providing Provaris with a strategic location for regional shipping to the emerging hydrogen markets across the Asia-Pacific region.
- **Continuous access to Port facilities to allow for docking of a hydrogen transport ship**. Port Melville is currently under-utilised and has a lot of the required infrastructure to allow for the ingress, berthing, loading, and egress of H2Neo ships for the export of hydrogen.
- **Land area that can be utilised for a Solar Precinct of adequate size to power the hydrogen processing and compression facilities**. The Solar Precinct will be located on the site of plantation areas that TPC have advised are under-performing due to wood rot. In keeping the placement of the Solar Precincts within already disturbed areas this will reduce the requirement to disturb native/remnant bushland within the Tiwi Islands.
- **Areas of high solar intensity.** Solar intensity increases as one travels north on Melville Island.
- **Access to water**. Being located adjacent to Apsley Strait provides a proximate supply of seawater for desalination/demineralisation and supply to the electrolysers.

Other Project configurations that were considered involved nesting some/all the hydrogen production infrastructure within the Solar Precinct. This would have reduced the development footprint at the Port but was decided against because it required significant additional linear disturbances in the form of a compressed hydrogen pipeline and a demineralised water pipeline. A variation of this considered installing a compressed hydrogen pipeline from the Solar Precinct heading north-east off the coast and then using a buoy loading system to fill the H2Neo ships at sea. This was dismissed because of the potential for a significant environmental impact to the shoreline and turtle nesting in the region.

An alternative that is always available is to ‘do nothing’. This would therefore mean that none of the environmental and social benefits associated with Project would manifest. To do nothing would not:

- Develop a new, sustainable, and commercially resilient industry that will be a transformational business opportunity for the Tiwi Islands and broader NT.
- Contribute to ‘net-zero’ greenhouse gas emission targets by providing a commercially viable production and export facility for green hydrogen.
- Minimise environmental impacts by repurposing currently underutilised, existing brownfield sites for development of new industry with a projected operation phase of 30+ years.

It is likely that the existing plantation would be harvested and then either allowed to re-sprout Acacias, or replanted with the Queensland Eucalypt species that TPC have been trialling. It is unclear how long this would persist.

3.2 Design

As detailed in Section 2.4.4, there are three solar farm designs under consideration.

A battery energy storage system is currently proposed to be located at the Solar Precinct. This allows the capacity rating of the transmission line to be reduced, lowers the peak rating of the electrolyser facility, and allows for efficiency in storage prior to transmission via the substations and transmission line. It also minimises space at the H2 Production Precinct if sufficient space is not available. However, some or all the battery capacity could be re-located to the H2 Production Precinct, or additional battery capacity installed at the H2 Production Precinct.

Regarding the transmission line, after consultation with the key stakeholders, the design and location were selected based on:

- **Existing road access** which eliminates the need for Provaris to clear native vegetation to build, own and operate a new access road – reducing cost and environmental impacts.
- **Semi-disturbed footprint** due to the transmission line route following the side of the existing road reserve. Provaris will locate the towers on the side of the road that is less environmentally sensitive, based on the ecology survey.
- **Reduced land disturbance** using towers compared with buried cables. A below ground option would require the entire 50 m corridor to be excavated down to 3 m to lay all the required cables. With the above ground option, the 50 m corridor only needs to be pruned during operations (so trees do not hit or fall onto the cables); ground cover and low shrubs within the corridor will remain.

The desalination plant was selected over other water source options to minimise environmental impacts. Due diligence and consultation with stakeholders identified issues and environmental impacts associated with relying on existing water sources, and rainwater collection methods/tanks, to provide water.

4 PRINCIPLES OF ENVIRONMENT PROTECTION AND MANAGEMENT

The Project has applied the principles of environment protection and management (Part 2 of the EP Act), and Section 43 general duty on proponents. Details of this are provided in Table 4-1.

Table 4-1. Checklist of the EP Act section 42 and 43 requirements

Section 43 General duty	Comment
Have the following principles of ecologically sustainable development been taken into consideration in the design of the proposed action?	
Decision-making principle	**Yes** – the Project has considered both short- and long-term impacts and benefits – including impacts during construction, operation, and decommissioning of Project infrastructure. • Provaris has undertaken early engagement with the community, particularly Indigenous stakeholders (Section 7).
Precautionary principle	**Yes** – this assessment is based on both existing information and studies undertaken specifically for the Project and undertaken by suitably-qualified professionals. If information is unknown or sufficient detail to make an assessment is not yet available, the precautionary principle has been adopted. For example, mitigations for some potential social impacts are not yet developed, therefore impacts have been assigned a higher level of significance, even though Provaris is committed to working with relevant stakeholders to ensure impacts are within an acceptable level.
Principle of evidence-based decision-making	**Yes** – this assessment is based on both existing information and studies undertaken specifically for the Project and undertaken by suitably-qualified professionals.
Principle of intergenerational and intergenerational equity	**Yes** – the Project aims to benefit and improve the community and environment, by contributing renewable sources of energy to the global market, developing a green hydrogen industry in the NT, and providing benefits to the local Tiwi community. The Project is committed to working with the local community and training providers to prioritise local employment and develop an industry that provides social and economic benefits to the Tiwi Islands, and NT more broadly.
Principle of sustainable use	**Yes** – the Project will use renewable solar energy and water from a desalination plant to produce green hydrogen and service other operational facilities such as staff accommodation.
Principle of conservation of biological diversity and ecological integrity	**Yes** – ecological assessments have been undertaken for the Project to inform design and development. The Project has already amended design to avoid impacts to Typhonium plants near Port Melville. Additionally, sites have been selected based on areas previously cleared and developed - roads and port infrastructure - and areas of low biodiversity – the plantation has reduced fauna diversity compared with surrounding native woodland. Further impacts are described in Section 9.2 and Section 9.5.
Principle of improved valuation, pricing and incentive mechanisms	**Yes** – this referral documents the lifecycle of the Project, including management of waste through all stages. The Project will develop a more competitive market for green hydrogen.
Have the following management hierarchies been taken into consideration in the design of the proposed action?	
Environmental decision-making hierarchy	**Yes** – the Project has applied the environmental decision-making hierarchy through siting of project infrastructure to avoid impacts, and

	development of mitigation measures. The site was selected based on the existing infrastructure and disturbed nature of the site. Additionally, Project design has been, and will continue to be, informed by results of due diligence assessments. Provaris is committed to offsetting any unavoidable impacts.
Waste management hierarchy	**Yes** – this referral documents how the Project will manage waste generated. By using existing infrastructure, waste produced during construction is avoided and minimized. There is limited waste and by-products from the electrolysis process (only oxygen and hydrogen). Provaris is committed to implementing recycling processes and disposing of any unavoidable waste in a sustainable manner.
Other section 43 considerations	
Have communities that may be affected by the proposed action been provided with information and opportunities for consultation?	**Yes** – Provaris has engaged in early consultation with TLC and Munupi Clan, introducing them to the Project and asking for input on Project design, where relevant. Provaris will continue to engage with TLC and Munupi Clan, to inform them of impacts identified in this referral, and consultation with Pirlangimpi community residents will be guided by recommendations of TLC. Details of consultation can be found in Section 7.
Has consultation with affected communities, including Aboriginal communities' been undertaken in a culturally appropriate manner?	**Yes** – engagement with Aboriginal stakeholders has been culturally appropriate. Provaris has undertaken consultation guided by TLC and will continue to engage based on their recommendations – including engagement with Pirlangimpi community. Details of consultation can be found in Section 7.
Has community knowledge and understanding (including scientific and traditional knowledge and understanding) of the natural and cultural values of areas that may be impacted by the proposed action been sought and documented?	**Yes** – early consultation with TLC and Munupi Clan identified potential impacts to groundwater and unnecessary disturbance regarding transmission line design. This informed the design of the Transmission Line. Additionally, consultation with and involvement of cultural monitors during a field heritage assessment identified heritage values to be avoided. Mitigation recommendations of the cultural monitors has informed Project design and will be documented in management plans.
Have Aboriginal values and the rights and interests of Aboriginal communities' been addressed in relation to areas that may be impacted by the proposed action?	**Yes** – Provaris will work with TLC to ensure the local community maintain access long-term to areas of value. Early consultation has informed Project design, and ongoing consultation will ensure the Project does not impact the values, rights, and interests of Pirlangimpi community and the Tiwi Islands more broadly.

5 CONSTRUCTION & OPERATIONAL DETAILS

This section complements Section 2 by describing the construction and operational activities associated with actioning this proposal.

5.1 Solar Precinct

5.1.1 Construction

Construction of the Solar Precinct site will be undertaken as per the phased approach mentioned above. Development will likely start with the southern section to allow for efficiency in construction and cabling runs. Clearing of the land, which will be undertaken in a stage-by-stage approach by TPC as part of their normal plantation harvesting processes – namely harvesting the trees. Then stump removal, and some soil levelling and compaction will be required for solar panel installation.

Construction activities across the precinct will commence with site preparation and construction facilities installation – including environmental management requirements such as pre-clearance fauna surveys, installation of erosion and sediment control measures, construction of access roads and hardstand areas and erection of fencing.

In parallel to the solar array being installed, the battery energy storage system and step-up substation will also be constructed. This will include the construction of security fencing, earth grids and concrete footings and installation of electrical equipment including large transformers requiring specialised transport to site.

To accommodate the transport of these transformers, some upgrades of the existing roads may be required. Provaris will continue to work with TPC and TLC to understand the options to upgrade the road to meet the construction requirements of the solar farm and transmission line. Any large plant and machinery that is required will be brought in by barge. Concrete production will be at the existing Port Melville Industrial Estate, using a batching plant with the raw materials, where not available locally, to be barged to the plant. The concrete will then be transported to site via standard cement trucks.

The solar array will be built through staged construction. Bulk earthworks will be completed to establish the design terrain to meet the mounting structure requirements. Specialised earthworks equipment will be brought to site as required. Spoil and excess materials will be managed throughout the construction phase and waste will be considered with a waste management plan to be developed. Once the earthworks are clear of the work area, the underground cable installation will be completed, followed by the mounting structures and the panel installation. Materials and equipment will be transported by barge to Port Melville and then trucked up to the Solar Precinct site. All materials will be shipped to site and moved around using loaders and trucks.

Construction will likely occur mainly in daylight hours. It is estimated that approximately 30,000 litres of water will be required each day for dust suppression. Water to be sourced from the proposed desalination plant.

5.1.2 Operation

Operational activity associated with the Solar Precinct will comprise of routine inspections, maintenance and cleaning. No significant night lighting is envisaged for the Solar Precinct; however, the battery and substation areas will require lighting for emergency operations and security.

A groundcover of perennial native grasses such as *Eriachne sp.* will be sown between solar panels across as much of the Solar Precinct as practicable without compromising operations. Seed will be collected locally. It is expected that Acacia will continue to sprout from the seedbank in the soil for quite a few years after clearing. These plants will be sprayed or manually removed, as will any weed infestations. Sprays will be applied topically to minimise drift outside of the precinct. Further detail on these measures will be provided in a Weed and Groundcover Management Plan. Depending on the mounting structure selected, weed maintenance will be completed through slashing and/or spraying to maintain growth.

Provaris will undertake several risk assessment workshops with consultants from across the Project scope in order to prepare an appropriate Emergency Management Plan. The plan will provide a safe and reliable procedure for plant stand-by during cyclones, including stowing the solar panels and placing the facilities into a safe, standby mode.

5.2 Transmission Lines

5.2.1 Construction

The transmission lines and towers will be constructed according to appropriate Australian standards. Micro-siting of towers will allow for avoidance of sensitive receptors – such as creeks, wetlands and culturally-significant sites.

The construction of the transmission lines will involve the following activities:

- **Site preparation** – prior to the construction of the towers, the tower locations will be cleared of vegetation, together with an area to accommodate laydown and machinery. Provaris will work with the construction contractor to minimise the area cleared, however, the area is likely to be 30 m x 30 m per tower location. As per PWC guideline, as the corridor is adjacent to the existing road, an access track to each tower location will be built.

  In accordance with PWC Guidelines:

  - The Transmission Line Corridor clearing should be confined to 50 m, with trees overhanging the 50 m Transmission Line Corridor selectively lopped or pruned.
  - Trees to be cut at ground level and roots left, except in the track to each tower location.
  - However, low shrub under 1 m need not be cleared within the Transmission Line Corridor in order to minimise erosion.

- **Foundation construction** – begins with the drilling of four footing holes per tower. Each footing is usually circular and 1.5 m in diameter, and 4.5 to 9 m deep, subject to geotechnical conditions. The centres of the footing holes are approximately 10 m apart. Once the concrete has cured, construction of the structure itself can begin. Concrete will be made with the existing Port Melville Industrial Estate, using a batching plant, and then transported to site via standard cement trucks.

- **Structure construction** – generally, the tower structure will be built from the ground up. The tower structure will be assembled in sections, adjacent to the tower location using a crane to lift the sections into place. Sections are then bolted together. Tower erection is usually performed by a crane or other methods. This is shown in the image to the right.

- **Wire-stringing operations** – these activities include the installation of conductor, ground wire, insulators, stringing sheaves, vibration dampeners, weights, suspension, and dead-end hardware assemblies for the entire length of the route. Wire stringing involves firstly, the stringing the pilot line to install the conductor; then winching/pulling the conductors across the span; then a tensioner is used to sag the conductors to the proper tension; then finally spliced, after which each conductor is affixed to the towers.

5.2.2 Operations

The only operational activity associated with the transmission will be routine inspections, maintenance, and localised clearing of any problematic vegetation, including weeds.

5.3 H2 Production and Export Precincts

5.3.1 Construction

Construction priorities within these precincts will be:

1) The expansion of the Port Melville accommodation facilities to allow for the required workforce to be on the island for construction of the remaining Project components
2) The temporary containerised desalination plant for water supply for construction purposes until the permanent desalination plant commences operations.

Construction activities across the precinct will commence with site preparation, including environmental management requirements such as pre-clearance surveys in bushland areas, installation of erosion and sediment control measures, and erection of fencing. Laydowns will be within previously disturbed areas.

The electrolyser facilities and associated plant will also be built in stages, each over 36 months.

5.3.2 Operations

Hydrogen production and preparation for export will occur continuously except during maintenance or emergency shut-downs (e.g. due to a nearby cyclone). The battery facility(s) will store the peaks for solar renewable generation, provide power during 'off-peak' times to the electrolysers, and provide sufficient generation during the night to maintain the electrolyser facility in a stand-by state (rather than shutting down).

5.4 Transport

5.4.1 Construction

Almost all the equipment, plant and materials required to construct this proposal will be shipped or barged in from Darwin or elsewhere. Existing roads will be used to access the Solar Precinct and Transmission Line Corridor from Port Melville.

5.4.2 Operations

Provaris is proposing to utilise its H2Neo ships to export hydrogen to the Asia Pacific region. The size of the H2Neo is similar to the woodchip vessels currently utilising the Port and the Apsley Strait. A ship will nearly always be berthed for hydrogen loading - other than leaving/arriving, and subject TPC's woodchip loading requirements. Shipping movements in the Apsley Channel will peak at 240 per year (one ship movement every 36 hours). Each fully loaded H2Neo ship would likely depart around 6 to 10 pm (end of the loading window for that day), and once departed out of the shipping channel, an empty H2Neo ship will enter Apsley Channel, and berth ready to commence loading by 6 am the following day (the start of the loading window for that day). Actual hourly, daily, and/or seasonal hydrogen production and loading rates from the Project may affect and alter this indicative shipping schedule.

Operation of the H2Neo ships will be in accordance with the *Port Melville Port Procedures and Information for Shipping* (NTPM 2018) which contains cyclone, quarantine, ballast water and biosecurity measures. In particular, in the event of a cyclone watch being announced, loading a H2Neo ship will cease and it will head out to sea until the cyclone threat has passed. There will likely be no moorings at sea. All H2Neo ships will be overseen by a pilot for passage between Mermaid Shoal and Port Melville. Provaris will manage its own pilotage and towage requirements. Pilots and tug crew will be accommodated at Port Melville; vessels – at least three tugs and two pilot boats – will be berthed at Port Melville (on the landward side of the Port) as is the current practice, and as depicted below in Figure 5-1.

Figure 5-1. Current berth locations of tugboats

Shipping will be undertaken in compliance with the recommendations designed to minimise impacts to marine megafauna that were made by the NT EPA in their Statement of Reasons for the Port Melville development in 2015, namely that:

> *The NT EPA recommends that the Proponent apply for a permit to take or interfere with protected wildlife under section 55 of the TPWC Act. At the discretion of the Director of Parks and Wildlife, the permit should condition the movement of large vessels (>50 m in length) to and from Port Melville in a manner that requires:*
>
> - *vessels to enter and exit the Apsley Strait only from the northern entrance*
> - *vessels to be overseen by a pilot while travelling between Port Melville and the pilot boarding station*
> - *vessels to not exceed a maximum of 12 knots when traversing between Port Melville and the pilot boarding station and 6 knots when navigating over Mermaid Shoal under normal operating conditions*
> - *the Proponent to maintain a register of dugong, cetacean and marine turtle sightings and vessel strikes*
> - *the Proponent to report any vessel strike to a dugong, cetacean or marine turtle to Marine Wildwatch within 24 hours of becoming aware of a vessel strike*
> - *for any dugong, cetacean or marine turtle vessel strike, the Proponent to review procedures and, where appropriate, implement measures to minimise the risk of future vessel strikes*
> - *the Proponent to submit an annual report to the Director of Parks and Wildlife that summarises data on all dugong, cetacean and marine turtle sightings and strikes and reviews the effectiveness of procedures to minimise vessel strikes and, where appropriate, describes additional measures to reduce the risk of future vessel strikes.*

5.5 Workforce

Provaris acknowledges that

> *Twenty years ago, Tiwi leaders decided that they would use up to 10% of their land to create an economy, with real jobs for their children and grandchildren… Tiwi leaders determined to establish*

a number of commercial businesses and enterprises in order to create jobs and income for their people. (TPC 2022)

Provaris hopes that the Tiwi H2 Project will help meet this vision, creating jobs and income for the Tiwi people. Provaris will work with Tiwi Islands Training & Employment Board (TITEB), an indigenous not-for-profit and Registered Training Organisation (RTO) that runs programs that prepare people for the workforce. With two or more construction stages, each of 36 months, construction jobs will be important. The operational phase will be the focus of training programs as it will create long-term, sustainable jobs that will evolve as the Project is scaled up to its full hydrogen production and export capacity.

5.5.1 Construction

Based on a staged construction approach, a peak construction workforce of ~500 people is estimated. It is expected this will be a combination of interested and able local residents, and workers from outside of the Tiwi Islands. Skilled and unskilled employment and training opportunities during construction and during operation will increase the diversity of the types of work that make up the Tiwi labour market. This level of the workforce is expected to be relatively level for the entire construction period.

5.5.2 Operations

As with most energy projects, the size of the construction workforce is much greater than that of the operational and maintenance personnel. Therefore, it is assumed that the accommodation built for the construction workforce will easily satisfy the requirements of the operational team (estimated to be in the order of 100 to 200 people). Operations staff would include roles such as Port and ship staff, and maintenance staff, and would include a mix of skilled and unskilled roles.

5.6 Water and energy source

5.6.1 Construction

Construction water requirements – primarily for dust suppression – are estimated to be 30,000 litres per day during the wet season, and 60,000 litres per day during the dry season. It is proposed that a temporary containerised desalination facility be installed as a priority to produce such water requirement during construction, thereby not impacting on the water requirements of the community during construction and operation. One container unit is able to produce well in excess of the above water requirements – see Figure 5-2 – and will use the inlet and outlet structures proposed for the permanent desalination plant proposed in this Referral.

Figure 5-2. Photograph of a temporary containerised desalination facility

Power during construction will be provided via a hybrid system, with temporary generator sets (diesel), with the potential to be supported by solar generation on site, or from the Solar Precinct via the proposed transmission line.

5.6.2 Operations

Operational water requirements can be met using water produced by the desalination plant. Power will be generated by the Solar Precinct and onsite batteries.

5.7 Emissions and discharges

5.7.1 Construction

Greenhouse gases

Construction-related greenhouse gas emissions are discussed in Section 9.5.6.

Noise

A variety of construction activities will result in noise – including bulk earthworks, site preparation activities, solar array construction, installation of overhead transmission lines, and multiple elements at the H2 Production and Export Precincts.

The nearest sensitive receptors are Pirlangimpi (1.5 km from the Port Melville construction area) and Putjamirra outstation (2 km from the Solar Precinct). Whenever possible, high noise works will be scheduled during the NT EPA prescribed acceptable construction times (Monday to Saturday 7am to 7pm and between 9am and 6pm Sundays or public holidays). Work outside the NT EPA construction times may be needed if it is not possible to work within these times; however, all noise will be managed in accordance with the NT EPA Noise Management Framework Guideline.

Dust

Impacts to air quality will be the greatest during the construction phase, when large areas of land and soils will be exposed and disturbed by construction works. Various mitigation and management measures are available and will be implemented. The Solar Precinct will be cleared in stages to minimise the area of bare earth exposed at any one time. Water carts may be used across the Project footprint to minimise dust emissions in areas of high risk at regular intervals. Regarding vehicle-related dust generation, on-site vehicle restrictions can be implemented (e.g. limit the speed of vehicles travelling on unsealed access roads) and where practical, stockpiles will be covered or dampened. Regular inspections of construction areas and roads will be carried out to identify potential sources of dust emissions.

5.7.2 Operations

Greenhouse gases

Operation-related greenhouse gas emissions are discussed in Section 9.5.6.

Noise

The electrolysers are essentially silent; the fans and compression pumps will generate noise during operations. An Acoustic Report (Operational Noise Impact Assessment) will be prepared once more detail is available regarding plant specifications of the H2 Production and Export Precincts.

Dust

Dust generated during operations will be minimal. The risk of dust from wind actions at the Solar Precinct will be minimised by the use of a groundcover, as explained in Section 5.1.2.

Desalination plant discharge

The desalination plant draws approximately 490 m^3 per hour of raw seawater (salinity of ~ 39 PSU - Table 9-5) to produce the necessary demineralised water requirements. The volume of discharged concentrated sea

water is expected to be approximately 312 m^3 per hour. More detail on the properties and composition of the discharge, and its potential impact on marine environmental quality, as presented in Section 9.3.6.

5.8 Handling (storage and transport) of hazardous substances

Storage and handling of all hazardous chemicals will be undertaken in accordance with Australian standards and guidelines, codes of practice, and manufacturer's directions. Material safety data sheets will be kept on site for each hazardous chemical at all storage locations. An Environmental Emergency and Spill Response Plan will be in place and equipment provided at all storage and handling locations. Spill kits, Personal Protective Equipment (PPE) and firefighting equipment will be kept with machinery and equipment as required by legislation, and personnel will be trained in spill response requirements procedures per the Environmental Emergencies and Spill Response Plan.

Additionally, transport of any substances considered to be dangerous goods by the criteria of Australian Code for the Transport of Dangerous Goods by Road and Rail, International Maritime Dangerous Goods Code (IMDG Code) for transport by sea and/or the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air during the construction period would be undertaken in accordance with the relevant codes, including segregation of certain classes of dangerous goods.

5.8.1 Construction

This Project does not require large volumes of chemicals to be stored for construction of the Solar Precinct or Transmission Line Corridor. During construction, temporary self-bunded fuel storages will be established for diesel, unleaded petrol (ULP), and oils & lubricants.

5.8.2 Operations

General

There is no need to transport or store large quantities of hazardous substances as part of operations of the Solar Precinct or the Transmission Line Corridor. Hazardous chemicals storage areas will be established for storage of minor quantities of fuels, oils/lubricants, cleaning chemicals, herbicides and pesticides where required.

The ultrafiltration and reverse osmosis processes of the desalination facility will require chemicals to maintain consistent operation – primarily to clean the membrane systems. Estimates of the quantities that will be needed are presented in Table 5-1.

Within the H2 Production Precinct, the electrolyser facility will require storage of potassium hydroxide pellets/flakes for use in the electrolyte (lye) solution. This will be in two 1,000 m^3 tanks as per standard management plans/controls. Potassium hydroxide is a hazardous chemical but is used here within a closed system such that it would only need to be emptied and disposed occasionally, at which time a specialist waste removalist would be engaged.

Approximately 20,000 m^3 of low-pressure nitrogen gas will be stored in a tank for use in the electrolysis process.

Other dangerous goods for the purposes of transport include, but are not limited to, those in Table 5-1.

Table 5-1. Hazardous chemicals required for hydrogen processing

Chemical	Annual consumption (L)	Concentration (%)[15]	Delivery frequency (d)	Storage volume (L)	Storage means
Sodium hypochlorite	13,000	12.5	28	1,300	Totes[1]
Sodium bisulphite	8,700	50	28	900	Totes
Hydrochloric acid	500	30	90	200	Drums
Citric acid	2,000	50	90	2,000	Totes
Sodium hydroxide	62,500	50	28	6,000	Tank
Sulphuric acid	78,500	98%	28	7,600	Tank
Anti-scalent	4,400	100%	90	1,400	Totes

[1] Totes or 'intermediate bulk containers' are industrial-grade containers engineered for the mass handling, transport, and storage of liquids, semi-solids, pastes, or solids.

Hydrogen

The following overview of safety issues surrounding hydrogen production and storage is derived from Fadwa and Monzure-Khoda (2021), who note that:

> *…the perceived high risk associated with hydrogen by society is an important challenge that must be addressed before any widespread use can be achieved. There are also preset notions regarding the safety of hydrogen when it comes to storage and transportation that are very similar to the concerns raised in the early days of the development of LNG supply chain.*

The feature of hydrogen that makes it distinct from other flammable and fuel gases is its low minimum ignition energy when mixed with air. However, in the event of a leak, hydrogen fuels are safer than hydrocarbon-based fuels, because they rise rapidly and dissipate quickly into the atmosphere, limiting their possibility of igniting. Moreover, hydrogen is much lighter than air and so disappears quickly, allowing the fuel to disperse relatively rapidly if the fuel leaks. This makes hydrogen safer than other spilled combustibles in open environments. Because hydrogen is colourless and odourless, without safety controls in place an unidentified leak could occur within a confined area, leading to an explosion.

Over the past decade the principal international shipping classification societies have established rules and guidelines for the design and construction of gaseous ships. The underlying premise is that a H2Neo ship built to these standards.

Emergency shutdown (ESD) systems are a key safeguarding system to protect personnel and equipment from potential hazards created by unexpected operating conditions or loss of containment events. The purpose of the ESD system is to safely shutdown the loading or unloading process when conditions exceed the normal working range.

An ESD system will be essential component of the loading, shipping, and unloading operations. The systems will be fail-safe and stand-alone and will utilise a programmable logic controller (PLC) with a dedicated, uninterruptable power supply. Initiations of shutdown systems will also be available via push buttons and/or switches located in the control room. The process safety instrumented system will receive its inputs from sensors that monitor the process. These signals will be continuously monitored by the PLC and will be programmed, designed, and installed to provide automated shutdown of equipment in such a manner as to result in a 'fail safe' shutdown state. The alarm, annunciation, and ESD system will also incorporate both gas detection and infrared fire sensors. Periodic function checks will be conducted to verify the system's ability to detect an unsafe condition.

5.9 Waste requirements

5.9.1 Construction

Wastes will be managed in accordance with the following hierarchy of approaches: Avoidance, Minimisation, Re-use, Recycling, Recovery (of energy and other resources), Treatment and Disposal. The waste products generated during construction of the Project are typical for such activities, and include such items as:

- Wood from equipment transport packaging (crates, boxes etc.)
- Metal (copper / aluminium /steel) from material offcuts / transport packaging
- Plastics from transport packaging, material offcuts etc.

The limitations of local landfill facilities on the Tiwi Islands are noted and it is not expected that this proposal will send any significant volumes of waste to these facilities. Most waste will therefore be shipped to Darwin for appropriate disposal. While on site, standard waste management will apply and be documented in a Hazardous Materials and Waste Management Plan. No waste will be stored within 200 m of a watercourse. Waste management will be in accordance with best practice guidelines (e.g. separation of waste, covering, bunded storage areas), and the requirements of the *Waste Management and Pollution Control Act*. Wastes will be stored at designated locations at each works area, with appropriate segregation and storage in line with the waste characteristics (i.e., putrescible, hazardous, listed, solid, liquid). Listed wastes will be stored in covered bunded areas, or in suitable containers, at designated locations prior to off-site removal and disposal by a licenced waste contractor.

5.9.2 Operations

There will be limited waste associated with operations of the Solar Precinct and Transmission Line Corridor. Any waste generated will be included in the waste streams for the H2 Production and Export Precincts that will be produced as part of day-to-day operations, such as:

- Inert solid wastes
- Municipal solid waste
- Putrescible waste
- Listed waste
- Grey and black water
- Sewage sludge
- Waste oils/lubricants
- Industrial waste.

The Project will require an environment protection licence (EPL) in accordance with Schedule 2 under the *WMPC Act* for discharge of brine water from the desalination plant. All activities will comply with the *WMPC Act,* including the general environmental duty in section 12 and the duty to notify of incidents causing or threatening to cause pollution under section 14 of the *WMPC Act*. The Project will adhere to the licence conditions of the EPL as determined by the NT EPA.

Apart from occasional topping-up of electrolyte (aqueous 25% potassium hydroxide solution), its use is within a closed cycle. Should disposal of the electrolyte solution be required (for cleaning/maintenance purposes), disposal will occur in accordance with the *Waste Management and Pollution Control Act*, either by engaging a licensed waste transporter to remove the waste to a licensed waste processing facility, or the Project would require an EPL for this action.

The limitations of local landfill facilities on the Tiwi Islands are noted and it is not expected that this proposal will send any significant volumes of waste to these facilities. Most waste will therefore be shipped to Darwin for appropriate disposal. In addition, the solar panels may need to be replaced or repowered after 40 years and the batteries every 15 years. Large volumes of solid waste will be produced during these events, and Provaris will use the nearest component recycling station to manage these wastes (noting that Sun Cable intend to develop one for their Australia-Asia PowerLink Project).

6 DECOMMISSIONING AND REHABILITATION

The expected lifespans of key Project components are estimated below, at which time the facilities will need to be replaced, re-powered or fully decommissioned:

- 30 years for the solar farm / panel
- 20 to 30 years for the battery facility
- 50 years for the transmission line
- 20 to 30 years for the hydrogen production and export facilities.

As the decommissioning phase of the Project approaches, Provaris will work with appropriate parties / consultants to adopt an appropriate waste management and decommissioning plan. Options for component recycling to reduce waste arising from decommissioning will be part of such a plan.

Although recycling facilities for solar panels already exist in Australia, recycling technologies are expected to advance significantly by the 2070 timeframe estimated for decommissioning. Provaris would, however, endeavour for the solar panels to be re-purposed, rather than for recycling.

The proposed waste management plan would be developed in consultation with the Munupi Clan and relevant government agencies based on the following objectives:

- Solar Precinct: to be fully decommissioned and rehabilitated with the intention of returning the sites back for plantation use or, if required, rehabilitated and return back to the original surrounding native vegetation.
- Transmission Line Corridor: to be fully decommissioned and disturbed areas rehabilitated back to their original state (similar to that of the surrounding native vegetation). Alternatively, the infrastructure may be transferred to the NT Government for ongoing use for the purpose of supporting electricity transmission across the Tiwi Islands.
- H2 Production Precinct: to be fully decommissioned and rehabilitated back to its original state (similar to that of the surrounding native vegetation).
- H2 Export Precinct: all facilities that were installed for the Tiwi H2 Project to be fully decommissioned, unless re-purposed for continued use as part of the Port Melville on-going operations.

7 CONSULTATION

The *EP Act 2019* requires proponents to engage with stakeholders who may be affected by their proposal and to support these communities and the public to understand the potential impacts and benefits of a proposed action. The *NT EPA's Stakeholder Engagement and Consultation Guidance for Proponents (2021*) recognises that stakeholder consultation is an important component of social, cultural and health impact assessments, over and above formal opportunities for feedback on documents placed on public exhibition. Provaris' objectives and approach to stakeholder engagement, guided by the NT EPA's Stakeholder Engagement and Consultation Guidance for Proponents (2021), were:

- To identify the specific communication needs of potentially affected communities and identifying culturally appropriate methods of communication.
- To communicate and introduce the proposal to stakeholders and find out their perceptions, concerns, interests, aspirations and issues with the proposal which in turn may inform aspects of proposal design, operation and closure and the stakeholder engagement process itself.
- To build relationships with key stakeholders, gain local support and maximise positive benefits.
- To gather information – stakeholders can inject knowledge, contribute to baseline information, new ideas and help identify risks resulting in better environmental impact assessment. Aboriginal stakeholders often have traditional knowledge of biodiversity and the local environment and can provide valuable input into the environmental impact assessment of a proposal.
- To meet legislative requirements to engage with stakeholders for land access, agreements and approvals.
- To increase efficiency of assessment and approval – the ability to demonstrate good engagement history can assist in understanding regulatory requirements and pathways and the assessment and approvals process, which can result in fewer adverse environmental impacts and fewer conflicts during and following assessment.

These objectives were captured in Provaris' pre-feasibility study, which formed the basis for ongoing engagement and consultation activities. Consultation has, and will continue to, be undertaken in accordance with section 43 *EP Act* general duty of proponents.

7.1 Stakeholders

Provaris commenced consultation with relevant stakeholders in April 2021. Consultation has been undertaken through a variety of methods, including email, phone calls, and formal meetings (both virtual and in-person). Stakeholders and relevant corporations consulted to date include:

- Government stakeholders:
    - Department of Environment, Parks and Water Security (DEPWS)
    - Territory Investment Commissioner
    - Department of the Chief Minister and Cabinet
    - Office of Township Leasing (OTL)
    - Tiwi Regional Council
- Aboriginal traditional owner groups, land council and authorities:
    - AAPA
    - Tiwi Land Council (TLC)
    - Munupi Aboriginal Corporation
    - Munupi Clan

- Private corporations:
    - Land Development Corporation
    - Midway Ltd
    - Tiwi Plantations Corporation (TPC)
    - NT Port and Marine / AusGroup (NTPM)

7.2 Stakeholder engagement

Provaris has undertaken early engagement with relevant stakeholders, ensuring any key issued raised could be addressed before key decisions are made, allowing for stakeholder feedback to influence proposal design. Consultation has been undertaken using a variety of materials to assist with explaining the proposal to Aboriginal and non-Aboriginal audiences. Materials used to date include tailored PowerPoint presentation, maps and images, using multiple platforms (including phone, email and formal meetings). This has ensured information is presented to stakeholders in multiple formats, allowing for clarifications or follow-up questions to be addressed by Provaris promptly. Consultation with the residents of Pirlangimpi will be undertaken based on recommendations from TLC.

Provaris is committed to maintaining open, ongoing and culturally appropriate communication with Aboriginal stakeholders throughout the proposal in its entirety. Consultation with Aboriginal people has been directly with the TLC and Munupi Aboriginal Corporation, in addition to discussions with cultural managers working with ecological and cultural heritage survey teams, and engagement with AAPA. Provaris has been engaged in discussions with TLC and Munupi Landowners to:

- Introduce Provaris and the proposal
- Communicate proposal components (both infrastructure and location)
- Explain proposal rationale and benefits
- Discuss ongoing land agreements
- Gain an understanding of local knowledge to inform proposal design
- Gain support and approval for Provaris to undertake due diligence assessments on Tiwi land.

To ensure field surveys were carried out in a culturally appropriate manner, Provaris employed cultural managers to be involved in field surveys, also allowing Provaris to engage directly with local people regarding local values. Cultural managers will be employed to assist with ongoing components of the Project where relevant.

7.3 Addressing stakeholder concerns

Provaris has maintained ongoing, clear communication with stakeholders, addressing any concerns promptly and offering additional information or meetings to ensure any concerns or issues are managed. The proposal has been given in-principle support by the Munupi Landowners, TLC, AusGroup, the Northern Territory Government and TPC, based on information presented to date. Provaris has kept records of issues raised or advice provided, including actions taken in response. Generally, stakeholders have been supportive of the proposal, and issues raised have been resolved through clarifications and follow-up communication.

Overall, stakeholders have shown general support for the Project and facilitated/taken part in the planning process where appropriate. However, some concerns have been raised during consultation by various stakeholders which are documented in Table 7-1. Provaris has responded to each issue raised and will continue undertaking consultation through the rest of the Project lifecycle.

Table 7-1. Stakeholder engagement summary

Relevant stakeholder(s)	Key issues	Action/mitigation
Tiwi Land Council Munupi Corporation	**Communication with Indigenous landowners** TLC and the Munupi Clan requested Provaris to provide clear and honest presentations of what the Project visually looks like, what permissions are required during the study period, and what is required during construction and operations.	Provaris has made several presentations to TLC and the Munupi Clan ensuring that it was visually clear what the Project was, and what was required. Permissions were requested and subsequently granted for the current study phase.
	Respect of Tiwi culture, approvals and permissions The Project is proposed to be built of Tiwi Land, particularly the land of the Munupi Clan. No work, development or construction can occur without the approval and permission of the Munupi Clan.	Provaris has made several presentations to the full Munupi Clan, clearly listing out its planned environmental and engineering study requirements and seeking specific permissions to be granted to Provaris to undertake such work. Permissions have been requested on a phase approach, updating the Munupi Clan on progress and outcomes before proposing to move to the next stage of development.
	Miscommunication/clarification request TLC requested clarification on multiple items after Provaris presentation to TLC Board.	Provaris responded promptly to TLC to confirm and clarify with TLC that Provaris: • Is not seeking any financial assistance from the Tiwi People • Will use no additional locally-sourced fresh water supplies (other than currently use by the Port). • Will meet all safety regulations and requirements • Requested TLC's consideration to enter into an agreement of support
	Water catchment In meetings with the TLC and Munupi Clan, Provaris raised the possibility of building several rainwater catchment tanks (the size of football fields) to capture and store rainwater, therefore reducing the reliance on desalination. The concern raised by the Munupi Clan was that this option would take water away from the land, that would naturally fall on it.	Provaris discontinued studying the option for building such rainwater catchment tanks, and concentrated on ensuring the desalination option did, in fact, have a very low impact on the environment.
	Ground disturbance In meetings with the TLC and Munupi Clan, concerns were raised with the disturbance to waterways if the transmission line was buried/underground rather than	Provaris ceased studying the underground option, as the above ground installation option was more environmentally friendly and acceptable to the Munupi Clan.

Relevant stakeholder(s)	Key issues	Action/mitigation
	installed above ground. Any "digging" of the land should be kept to a minimum.	
	Community Involvement Provaris advised by key stakeholders to involve the Munupi people as much as possible during the current study phase of the Project.	In accordance with the permissions granted by the Munupi Clan, Provaris will always involve at least two cultural monitors and/or rangers when on country. This assists with communications and Project progress.
	Protection of local waters and fishing The Port Melville area is a naturally beautiful region, and therefore the local community is rightfully protective of the region. Additionally, Provaris was made aware that there could be community fondness to continue fishing off the Port Melville berth (which could not continue if the Project is realised).	Provaris has made all efforts to ensure that it does not disturb the ocean floor (at Port Melville), with both the intake and outlet of the proposed desalination plant being either connected to the berth itself or floating. Also, no dredging is planned of the Apsley Channel. Modelling suggests brine discharge will have negligible effect on the surrounding marine environment, and discharge will be monitored in accordance with conditions of an environment protection license. Provaris sought advice from TLC and Port Melville, both clarifying that fishing is prohibited on the berth, therefore, no action or mitigation required from Provaris.
	Protection of local flora and fauna The local community is rightfully protective of the flora and fauna in the region.	Provaris has been making – and will continue to make – all efforts to ensure the design of the Solar Precinct, transmission line and hydrogen production and export facilities are designed and built to minimise the environmental impact to region. The Project is a green environmental project, which must extend to the protection of the Tiwi Islands.
Midway TPC	**Solar Precinct location** Midway (4 May 2021) suggested the Northern Beaches plantation area for the proposed Solar Precinct due to such area as having poor soil leading to poor growing conditions being experienced and the presence of rot being a problem. This was later supported by TPC.	Provaris selected the current Solar Precinct as its preferred location to build, own and operate the Solar Precinct and did not consider any other plantation areas further.

7.4 Future engagement

7.4.1 Acknowledgement

Provaris acknowledges that:

> *Twenty years ago, Tiwi leaders decided that they would use up to 10% of their land to create an economy, with real jobs for their children and grandchildren… Tiwi leaders determined to establish a number of commercial businesses and enterprises in order to create jobs and income for their people. (TPC 2022)*

Provaris hopes that the Tiwi H2 Project will help meet this vision, creating jobs and income for the Tiwi people.

Provaris acknowledges that Munupi Clan permissions to date relating to the Referral submission are not an approval for Provaris to proceed with development of the Tiwi H2 Project. Approval for Project development will be subject to a staged assessment, commencing with Provaris presenting and informing the Munupi Clan of the findings of this Referral, and the next stage of approvals and permissions required, ultimately progressing to approval of land tenure (by way of lease and sublease) and to develop and use specific sites. For this progression to occur, Provaris will need to address all key regulatory requirements including both Northern Territory and Commonwealth environmental assessments and approvals, sacred site clearances, national and international standards, work health and safety, water licences and approvals, dangerous substance regulations, electricity regulation and renewable energy legislation among other regulations and standards.

Provaris also acknowledges that in addition to these regulatory matters, further information will be required by the Munupi Clan to enable informed assessment of social, cultural, economic and infrastructure impacts, amongst others, including the economic benefits to the community and traditional owners, as well as environmental management and remediation.

Therefore, ongoing consultation will be undertaken, and Provaris will continue to work closely with relevant stakeholders in future. Provaris recognise the ongoing developmental nature of successful consultation, and will continue to modify and adapt consultation throughout time as necessary. Additionally, Provaris will develop formal processes during Project operation, to review and evaluate stakeholder engagement practices, and improve where necessary.

Based on experience to date, Provaris commit to the following actions during future Project stages.

7.4.2 Referral consultation

- Present a summary of this Referral, its key findings and level of environmental impact to the Munupi Clan and TLC in a culturally appropriate manner. Concerns, improvement and/or suggestions discussed will be recorded, and used to inform other stakeholder meetings and Project development.
- Schedule a meeting with Andrew Cowan (Territory Investment Commissioner Department of the Chief Minister and Cabinet) and his team to present a summary of the Referral submission, its key findings and level of environmental impact. Provaris will again take note of any concerns, improvements and/or suggestions discussed at the meeting.
- Introduce and present a summary of the Referral submission, its key findings and level of environmental impact, at a Federal Government level. Any concerns, improvements and/or suggestions will be noted and addressed. Any other interested party, if appropriate will also be given a presentation on the key findings and level of environmental impact of the Referral submission. Any concerns, improvements and/or suggestions will be noted and addressed.

7.4.3 Project development

- Present findings and achievements from assessments that require Munupi Clan and TLC permissions to the relevant stakeholders, allowing Munupi Clan and TLC opportunity to make decisions and judgements informed by the information Provaris is using to develop the Project.

Concerns, improvement and/or suggestions discussed will be recorded, and used to inform other stakeholder meetings and Project development.

- Seek new permissions and approvals from the Munupi Clan and TLC for each Project activity planned on Country during the next phase of development, as has been done to date. Such process to repeat itself, ending with the execution of Section 19 Lease(s) for the Project.
- In all presentations to the Munupi Clan, ensure that it continues to follow the established process, with TLC, OTL and TPC to keep all fully informed. TLC to organise and schedule the Munupi Clan meetings, for all parties (TLC, OTL and TPC) to be present at such meeting; and for Minutes of Meeting to be kept and issued to all relevant parties as a record of the permissions and approvals granted by the Munupi Clan, and any concerns or issues raised.
- Continue to work together with the NT Government, especially with the case manager - Kirsten McComiskie (Senior Director, Major Projects, Department of the Chief Minister and Cabinet) and Sandra Schmidt (Executive Director – Top End Region, Department of the Chief Minister and Cabinet) using multiple methods of consultation and communication.
- Seek Major Project Status for the Project, further ensuring a co-ordinated development plan with the NT Government.
- Continue to work with TLC and OTL regarding section 19 lease agreements.
- Work closely with TLC and Munupi Clan regarding how the Project can best benefit the local Tiwi community.

7.4.4 Construction and rehabilitation

- Establish a procedure for any issues or complaints during construction to ensure issues are dealt with appropriately. Such a procedure will be developed in consultation with Munupi Clan and TLC to be culturally appropriate and accessible.
- Establish a procedure for notification of the local community to advise them of planned works and any potential impacts to them. Such a procedure will be developed in consultation with Munupi Clan and TLC to be culturally appropriate and accessible.
- Work closely with TLC and TITEB, an indigenous NFP and Registered Training Organisation that runs programs that prepare people for the workforce, to maximise community uptake of employment and training opportunities during construction and operation.

7.4.5 Operation

- Establish a procedure for the local community and other stakeholders to provide feedback or raise any concerns during the Project operation. Such a procedure will be developed in consultation with relevant key stakeholders.
- Work closely with TLC and TITEB, an indigenous NFP and Registered Training Organisation that runs programs that prepare people for the workforce, to maximise community uptake of employment and training opportunities during construction and operation.

8 OTHER RELEVANT PROJECTS

Cumulative impacts are impacts that can accumulate as a result of additive or interactive processes and actions, interactions among multiple management measures (past, present and future), a combination of multiple minor impacts over time, and activities conducted over a wider area than the proposed action, such as the activities of multiple projects operating in a region.

Existing or planned projects on Melville Island that Provaris is aware of, and that could contribute to cumulative impacts, are discussed below.

8.1 Port Melville and TPC operations

The Project has been designed to work alongside existing Port activities. There has been a very low level of activity at the Port for a few years now compared to the planned operations of eight large vessel movements per month (NTPM 2017), which is forecast to remain the case. The woodchip industry has not proven lucrative, such that current shipping movements are lower than the anticipated ten per year and this is likely to remain the case for the life of the *Acacia* plantations. In many ways, the Tiwi H2 Project subsumes the activities that were planned and approved for the Port, minimising the likelihood of any significant cumulative impact.

8.2 NT Department of Infrastructure, Planning and Logistics

The NT Department of Infrastructure, Planning and Logistics recently submitted a proposal to the NT EPA for two road upgrade Projects on Melville Island.

8.2.1 Paru Road Upgrade

The Paru Road Upgrade Project consists of upgrading and formalising Paru Road on Melville Island. The Referral for the Paru Road Upgrade Project identified construction being undertaken in the 2021 and 2022 dry seasons (AECOM 2021); however, a supplementary environment report was prepared, with consultation closing in March 2022. This Project is approximately 40 km from the Tiwi H2 Project and it is therefore considered unlikely there will be significant cumulative impacts resulting from this Project.

8.2.2 Melville Island Road Upgrades

The Melville Island Road Upgrades Project consists of the upgrade of Pirlangimpi Road (47 km) and Pickertaramoor Road (26 km) on Melville Island. Parts of Pirlangimpi Road near Pirlangimpi community identified for upgrade works overlap with the Project area for the current Project. The Referral for the Melville Island Road Upgrades Project identified construction near Pirlangimpi commencing in 2024, which coincides with the projected construction commencement for the current Project.

This could result in a small degree of cumulative impact near Pirlangimpi town in terms of water availability, road traffic and construction noise. The footprint for this Project is confined such that it would contribute to any cumulative impact on terrestrial ecosystem values.

8.3 Santos Barossa project

Santos is proposing to develop the Barossa gas field, 300 km north of Darwin. The project would require a pipeline to run north of Tiwi Islands, and around the western side of Bathurst Island. At the nearest point, the pipeline would be approximately 35 km west of Port Melville and the entrance to the Apsley Strait.

9 ENVIRONMENTAL FACTORS

9.1 Overview

The NT EPA has developed a framework for the assessment of environmental impact. The framework uses 14 environmental factors to provide a systematic approach to organising environmental information and to establish environmental objectives against which proposals will be assessed. Pre-referral screening of the Tiwi H2 Project undertaken by EcOz Environmental Consultants determined that the proposal has potential to impact 7 of the 14 environmental factors. A summary of the pre-referral screening outcomes is presented in Table 9-1.

The seven environmental factors that may be impacted are discussed in further detail in subsequent sections of this Referral Report. For each factor, the following items are addressed:

- **Environmental factor objective and context** – the NT EPA's objective for the environmental factor.
- **Presence of environmental values** – description of the valued environmental components that are present within our surrounding the proposal footprint that could be impacted by the proposal.
- **Impact assessment** – assessment potential impacts and consistency with relevant policy and guidance.
- **Environmental protection and management** – description of measures proposed to avoid, mitigate or offset the potential adverse impacts.
- **Cumulative impact** – description of any potential cumulative impacts (successive, incremental and combined impacts of past, present and reasonably foreseeable proposals within the area of influence of the proposal).
- **Residual impact** – assessment of whether by implementing the measure the NT EPA's objective for the environmental factor is likely to be met.

Consistent with section 26 of the *EP Act*, the identification of opportunities focusses on applying the environmental decision-making hierarchy as follows:

1. **Avoid** – Ensure that actions are designed to avoid adverse impacts on the environment.
2. **Mitigate** – Identify management options to mitigate adverse impacts on the environment to the greatest extent practicable.
3. **Offset** – If appropriate, provide for environmental offsets for residual adverse impacts on the environment that cannot be avoided or mitigated.

Table 9-1. Assessment of environmental factors relevant to the Tiwi H2 Project

Factor	Potential for significant impact	Relevant section
LAND		
Landforms	**NO.** There are no distinctive landscape features present within the Project footprint.	N/A. Significant impacts are unlikely. Factor not further assessed.
Terrestrial environmental quality	**NO.** Wind and/or water erosion of exposed surfaces after land clearing could lead to reduced quality and integrity of land and soils. Impacts can be managed during construction using standard ESCP measures. During operations, this will be managed at the Solar Precinct through a combination of design, ESCP and use of a groundcover – see Section 5.1.2.	N/A. Significant impacts are unlikely. Factor not further assessed.
Terrestrial ecosystems	**YES.** Surveys have confirmed that threatened species and/or significant vegetation types are present within, and adjacent to, the Solar Precinct, Transmission Line Corridor and H2 Production Precinct footprints. Project activities – most notably changes in land use of currently vegetated areas – could have an impact on those values, especially in areas of remnant bushland within the Transmission Line Corridor and H2 Production Precinct footprints.	9.2
WATER		
Hydrological processes	**YES.** The location and/or small disturbance footprints of the H2 Production Precinct and Transmission Line Corridor mean they will have minimal impact of surface hydrology. The current rainfall run-off regime at the Solar Precinct site contributes to the water supply of an adjacent patch of rainforest. The Solar Precinct will remain pervious to rainfall and so there should not be a significant impact on local groundwater recharge. Moreover, there do not appear to be any beneficial users of groundwater associated with the Solar Precinct. The southern end of the Transmission Line Corridor and the H2 Production Precinct overlap, or are within, the 300 m wellhead protection zones for Pirlangimpi water supply bores. Development of the H2 Production Precinct could reduce the area of recharge available for some of those bores. Accessing Port bores for construction water use (prior to the desalination plant being commissioned) could lead to drawdown of that groundwater resource, with potential implications for the beneficial users of nearby bores.	9.2.6
Inland water environmental quality	**NO.** The only surface watercourses relevant to the Project are the few creeks within the transmission lines corridor. However, these can be spanned by the transmission lines such that they are not impacted. Standard controls will be implemented during construction and operations (e.g. erosion and sediment controls) to mitigate potential impacts to surface water quality in runoff from the Project footprint.	N/A. Significant impacts are unlikely.

Factor	Potential for significant impact	Relevant section
	There are no sources of groundwater contamination from Project activities. All onsite chemical storage and use will be in accordance with Australian standards.	Factor not further assessed.
Aquatic ecosystems	**NO**. There are no aquatic ecosystems that will be impacted by the Project. The only surface water features (and therefore, aquatic ecosystems) relevant to the Project are the few creeks within the transmission line corridor. These can be spanned by the transmission lines such that they are not impacted.	N/A. Significant impacts are unlikely. Factor not further assessed.
SEA		
Coastal processes	**NO.** The Project uses existing Port infrastructure and requires no works that could impact the coastline.	N/A. Significant impacts are unlikely. Factor not further assessed.
Marine environmental quality	**YES.** The desalination process involves discharge of brine back into Apsley Strait. No other contaminants that are not already in the sea water will be discharged. Modelling (Appendix D) shows that the impacts of the brine discharges will be small and contained to an area in the immediately vicinity of the proposed outfall.	9.3.6
Marine ecosystems	**YES.** Project activities could impact upon marine ecosystems through: • Discharge of brine • Increased shipping traffic • Installation of a navigation lights	7.5
AIR		
Air quality	**NO.** During construction, dust could be generated by machinery and from exposed areas because of land clearing. During operations, dust could be created from wind erosion at the Solar Precinct. Standard dust control methods and progressive clearing will minimise this potential impact during construction. Wind erosion at the Solar Precinct will be managed through a combination of design, ESCP and use of a groundcover – see Section 5.1.2.	N/A. Significant impacts are unlikely. Factor not further assessed.
Atmospheric processes	**YES.** Greenhouse gases (GHG) will be emitted during construction and, to a much lesser extent, during operations. Estimates of Scope 1 and Scope 2 emissions are being prepared to inform Provaris' consideration of emissions avoidance and abatement opportunities. The hydrogen produced by the Project will provide GHG abatement opportunities in the Asia region. Further discussion of GHG is provided in Section 9.6 of the Referral.	9.3.6
PEOPLE & COMMUNITIES		

Factor	Potential for significant impact	Relevant section
Community & economy	**YES.** Project activities could negatively impact on the local community through construction workforce changing social dynamics and putting pressure on utilities. Additionally, inequitable distribution of benefits and lack of decision-making power could negatively impact Tiwi islanders at a regional scale. The Project could have a positive impact on the local economy through employment, lease payments and upgrades to local infrastructure such as roads.	9.7
Culture & heritage	**YES.** The majority of the Project footprint has already been cleared and disturbed, which reduces the likelihood of archaeological sites or objects occurring within the footprint. A cultural heritage survey identified some existing values within, or adjacent to, the Transmission Line Corridor – see Section 9.8.2. Port Melville is adjacent to the Fort Dundas heritage site. An Abstract of Records from the Aboriginal Areas Protection Authority (AAPA) showed there are no registered sacred sites relevant the Project footprint – see Appendix E. An Authority Certificate will be sought from AAPA to ensure any sacred sites relevant to the Project footprint are identified and avoidance/mitigation measures are implemented in accordance with the conditions of the certificate.	9.8
Human health	**NO.** There are no impacts to human health associated with this Project.	N/A. Significant impacts are unlikely. Factor not further assessed.

9.2 Terrestrial ecosystems

9.2.1 Factor objective and context

Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The information for this section is primarily derived from the Terrestrial Ecology Report in Appendix B. That report was compiled using desktop spatial databases maintained by the NT Government, data from previous surveys in the region (undertaken by other entities) and the results of a site visit and field survey undertaken for this Project by EcOz in early 2022.

The latter survey focussed on ground-truthing land system mapping, determining habitat quality and targeting particular threatened species – namely Red Goshawk, Masked Owl and Typhonium species. That survey was undertaken in accordance with the following guidelines:

- *Draft Typhonium Survey Guidelines*
- *Weed Data Collection – A Field Guide for Collecting Weed Data for the NT*
- *Survey guidelines for Australia's threatened birds*
- *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping (Brocklehurst et al. 2007)*.

9.2.2 Presence of environmental values

Receiving environment

The Project footprint occurs on lateritic and sandstone plains that are dominated by open Eucalypt forest.

The Solar Precinct is located almost entirely on an *Acacia mangium* plantation, within which there are two distinct communities (see Figure 9-1):

3) Areas where the plantation has degraded or failed, reverting to an open transitional site with an understory of monsoon vine species and sub-shrubs covering approximately 60% of the plantation. The introduced Wild Passionfruit was dense in these places, with numerous dead *Acacia* trees. The declared weed – Mission Grass – was also present in the plantation.

4) A closed canopy *Acacia* plantation, with sparse grass ground cover and isolated sub-shrubs covering approximately 40% of the plantation.

Degraded plantation

Intact plantation

Figure 9-1. Photographs of the two types of vegetation within the Solar Precinct

Surrounding the Solar Precinct is a woodland of Eucalypt mid-high woodland over *Acacia* shrubland with grass groundcovers. This vegetation type is also dominant within, and surrounding, the Transmission Line Corridor – which traverses four similar land systems (see Section 2.5.2). The H2 Export Precinct will be located on land that has mostly been cleared for use by the Port. The vegetation within the H2 Production Precinct is representative of the Tiwi land system (see Table 2-3) – a tall grassy Eucalypt woodland with minimal shrubs.

The H2 Production Precinct, Transmission Line Corridor and surrounding areas are part of the fire management program conducted by the Tiwi Land Rangers and TPC. These areas are part of the asset protection program and are burnt annually in the early dry season to manage fuel loads. The Solar Precinct (plantation area) has not been burnt since it was planted in 2005.

Weed occurrence within the footprint generally corresponded to areas of environmental disturbances along roads and tracks. The most frequent weed observed during the field visit was *Sida acuta* and Mission Grass. The introduced Wild Passionfruit was dense in the degraded areas of plantation.

Sensitive receptors

In the NT, some vegetation types are considered significant under the *Land Clearing Guidelines* (DEPWS 2021) due to their unique and/or inherently high biodiversity values. As detailed in the Terrestrial Ecology Report (Appendix B), significant vegetation was found in, or adjacent to, all Project areas – see Figure 9-2. These are large old growth trees, hollow-bearing trees, riparian vegetation and wetlands. Rainforest communities and GDE's are present in close proximity to Project components.

Species at risk of extinction may be listed as threatened species under the *TPWC Act* and/or *EPBC Act*. Eleven threatened flora and fauna species are known to occur, or have a reasonable likelihood of occurring, within the Project area:

- **Red Goshawk** are surveyed annually by TPC along all tracks, roads and fire breaks surrounding the plantations. While the Project area contains vegetation that may be suitable for Red Goshawk nesting, there are no recent records of nesting by Red Goshawks within it, likely due to the presence of higher quality habitat available in other parts of Melville Island and the increase in forestry activities since 2015. However, the Solar Precinct, Transmission Line Corridor and H2 Production Precinct are within the home range of known Red Goshawk pairs and they are highly likely to use vegetation within such area as foraging habitat.
- **Partridge Pigeons** were commonly observed during field surveys in March 2022 in all of the Project components, including within the plantations.
- There are numerous records of **Masked Owls** on Melville Island, with the highest density being recorded along the road corridor from the Solar Precinct and along the Transmission Line Corridor. The presence of Masked Owls suggests there is suitable habitat within such areas which is likely to be within recorded owls home ranges. Masked Owls have also been observed within the plantations, foraging in open areas and roosting within plantation trees.
- **Brush-tailed Rabbit-rats, Black-footed Tree-rats** and **Northern Brushtail Possum** were recently the focus of a study adjacent to the Solar Precinct in Imalu, which found den sharing and range cross-over between the species (Penton et al. 2020). This study also suggested individuals use the plantations for transport or foraging before returning to den in hollow trees adjacent in native vegetation or wildlife corridors. There is also native bushland containing suitable foraging and roosting habitat for these species within the Transmission Line Corridor and H2 Production Precinct. All three species were detected adjacent to the H2 Production Precinct in 2021 surveys completed by Connect Environmental (2022).
- **Northern Brush-tailed Phascogale** are likely to be present in the Transmission Line Corridor and H2 Production Precinct because they include areas of significant vegetation with large Eucalyptus trees likely to contain hollows, that may be used by this species for nesting and shelter. The smaller, narrower trees in the plantation mean the likelihood of this species being present is lower than in the surrounding native vegetation.

- The **Pale Field-rat** was recently detected in Eucalypt forest adjacent to the H2 Production Precinct. The presence of suitable habitat within and surrounding the H2 Production Precinct, recent detections adjacent and along the Transmission Line Corridor, and the intersection of watercourses within such area, indicate the Pale Field-rat is highly likely to be present in remnant bushland in the Transmission Line Corridor and H2 Production Precinct, but unlikely in the Solar Precinct.
- **Butler's Dunnarts** preferred habitat is found within the Transmission Line Corridor and the H2 Production Precinct. Dunnarts were recently detected by camera adjacent to the H2 Production Precinct; however, the individuals were unable to be identified at the species level. Targeted surveys have not been undertaken within plantations, so they may occur within the Solar Precinct as well.
- The Transmission Line Corridor intersects multiple watercourses; consequently, **Mertens' Water Monitor** is likely to occur wherever riparian habitat is intersected.
- **Darwin Cycads** were observed throughout the H2 Production Precinct and Transmission Line Corridor during field surveys, including occasionally within the Solar Precinct. The Transmission Line Corridor, H2 Production and Export Precincts all contained a large number of plants. No areas of high density – i.e. >1,000 individuals per hectare – were identified.

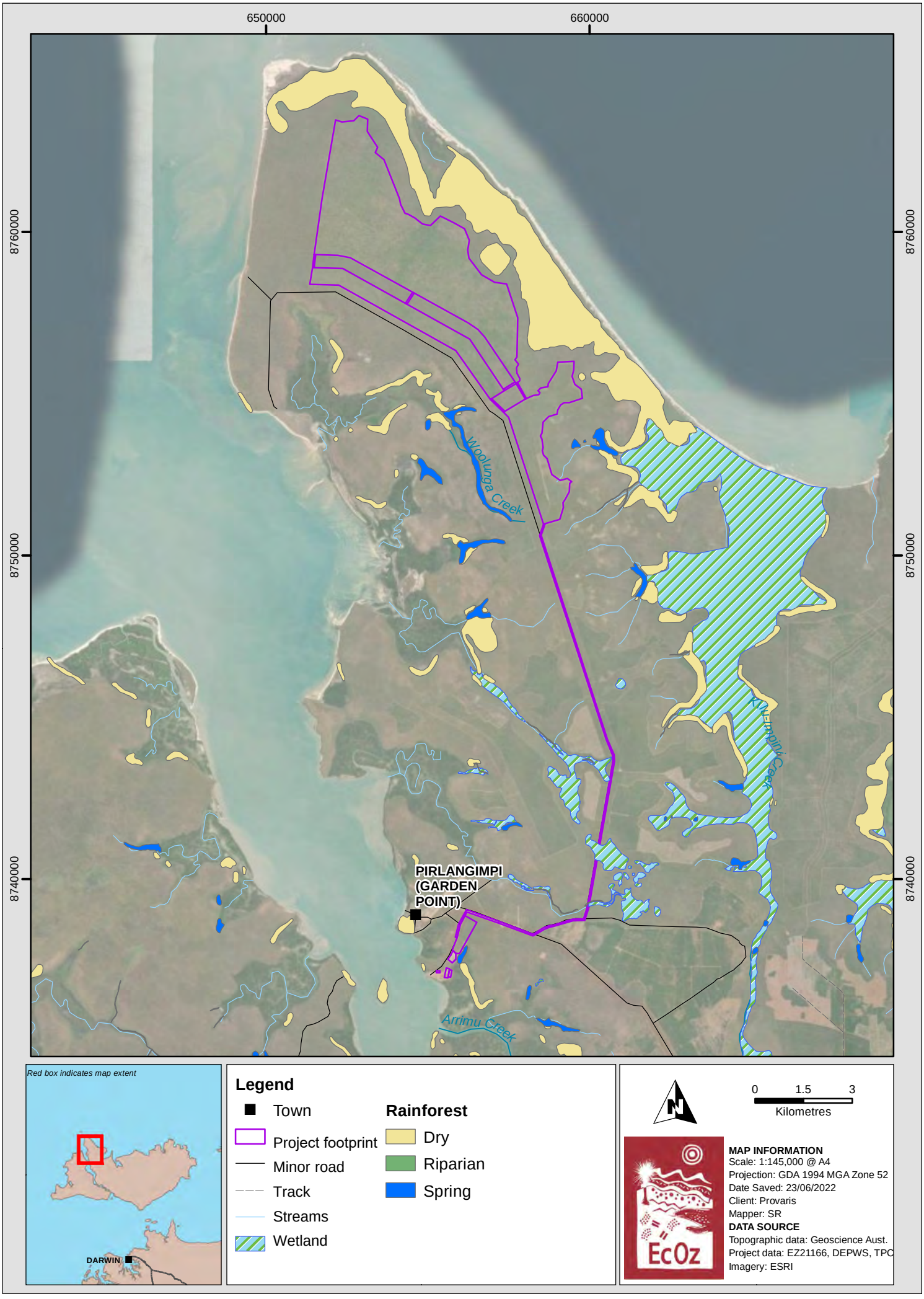
The listing status of these species is presented in Table 9-2.

Table 9-2. Listing status of threatened species known or likely to occur within the Project footprint

Species	Status	
	EPBC	TPWC
Red Goshawk *(Erythrotriorchis radiatus)*	VU	VU
Partridge Pigeon *(Geophaps smithii smithii)*	VU	VU
Masked Owl (Tiwi Islands' sub-species)*(Tyto novaehollandiae melvillensis)*	EN	EN
Brush-tailed Rabbit-rat *(Conilurus penicillatus)*	VU	EN
Black-footed Tree-rat (Melville Island sub-species) *(Mesembriomys gouldii melvillensis)*	VU	VU
Pale Field-rat *(Rattus tunneyi)*	-	VU
Northern Brushtail Possum *(Trichosurus vulpecula arnhemensis)*	VU	-
Darwin Cycad *(Cycas armstrongii)*	-	VU
Northern Brush-tailed Phascogale *(Phascogale pirata)*	VU	EN
Butler's Dunnart *(Sminthopsis butleri)*	VU	VU
Mertens' Water Monitor *(Varanus mertensi)*	-	VU

EN = Endangered, VU = Vulnerable

Despite extensive targeted surveys in all areas modelled as high likelihood habitat, threatened Typhonium plants were only detected within the Port Melville lease area, south of the H2 Production Precinct. The plants are either *Typhonium jonesii* or *Typhonium mirabile* – both threatened species. Genetic samples were taken; results are expected in July 2022. The Project footprint has been adjusted (within the proposed H2 Export Precinct) to ensure that this occurrence of plants is not disturbed. Consequently, they are not assessed any further.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ21166 - Tiwi Islands Hydrogen Export Project\01 Project Files\Referral\Fig XX Rainforest and wetlands.mxd

Figure 9-2. Map of significant vegetation types

9.2.3 Potential impacts

General biodiversity and sensitive vegetation

The Project has the potential to have the following impacts on terrestrial ecosystems:

- Loss of habitat for fauna species due to change in land use. The total footprint for the Project is 2,862 ha (2,640 ha Solar Precinct; 150 ha Transmission Line Corridor; 40 ha H2 Production Precinct; and 32 ha H2 Export Precinct). Total area for which land use will change from either native vegetation or plantation monoculture, is approximately 2,773 ha, of which 2,640 ha (95 %) is plantation. The plantation land will be cleared by TPC as part of its normal forestry operations prior to hand-over and commencement of construction by Provaris.

  A key assumption associated with this potential impact is that whilst the plantation provides habitat for some species, it represents lower value habitat for fauna compared with surrounding native woodland. This is because – for approximately 40 % of the plantation – the vegetation is predominantly a monoculture of a non-endemic species. The remaining 60 % is 'failed' plantation, with many dead Acacias, vine ticket undergrowth and weeds. Across the entire Solar Precinct footprint, there is a paucity of hollow-bearing trees that provide roosts for many fauna species. Therefore, of the total areas for which land use will change from native vegetation or plantation, 95% of that represents lower quality habitat of either non-endemic monoculture, or failed plantation.

- Direct loss of significant wetland and riparian vegetation due to land clearing for the Transmission Line Corridor. This impact will be avoided because the ~450 m gap between towers makes it possible to span these vegetation types. Impacts associated with stringing the cables can also be minimised by using a helicopter in such areas.

- Indirect loss of nearby significant vegetation due to changes in the hydrological regime within the Solar Precinct. Surface water run-off – and possibly groundwater recharge – from rainfall on the plantation contribute to the water supply of an adjacent patch of rainforest. The impact to these from the Project should be minimal because they can be maintained through a Stormwater Management Plan informed by hydrological modelling. While this may require localised alteration of overland surface water flows, there will be no change to flows in any watercourses. Run-off will be diverted to the site boundaries and discharged into surrounding vegetation.

  Most of the Solar Precinct will not be hardstand and so will remain pervious to rainfall. Rainfall onto the solar panels will infiltrate the soils beneath the panels and will run-off during significant rainfall events when the soils are saturated during the wet season.

- Reduced habitat quality or biodiversity due to the introduction and/or spread of weeds. The Tiwi Islands have managed to avoid infestation by some of the most harmful weeds in the Top End – including Gamba Grass. The introduction of these species – which could be irreversible – would likely be catastrophic for biodiversity values

- Reduced fauna diversity due to the introduction of the Cane Toad via construction or operations freight. Because this species – which has led to severe declines in many native fauna species – is not present on the Tiwi Islands, its introduction could be catastrophic for biodiversity values.

- Habitat fragmentation and edge effects[1] due to the change in land use; from vegetation to infrastructure. Even though the Solar Precinct will be cleared by TPC as part of its normal forestry operations prior to hand-over and commencement of construction by Provaris – the change in land use of the Solar Precinct – from monoculture plantation to the Solar Precinct – may cause habitat fragmentation, especially on the wildlife corridors currently in place between plantation patches.

[1] An 'edge effect' occurs when intact vegetation is disturbed, resulting in the newly-created edges between the intact and disturbed areas becoming lower quality habitat. Apart from the increased likelihood of weed infestation, edge effects are more pronounced in densely vegetated areas where exposure to wind and sunlight (which change micro-climates, reduce soil moisture and encourage lower canopy plant species), and increased vulnerability to fire (because of more understorey).

The open woodland and forest surrounding the Project footprint are not very susceptible to edge effects. In accordance with PWC Guidelines, the Transmission Line Corridor clearing will be confined to 50 m, with any trees overhanging the 50 m corridor selectively lopped or pruned. Trees will be cut at ground level and roots left, except within the access tracks to each tower. However, clearing of low shrubs under 1 m is not required within the Transmission Line Corridor to minimise erosion. The Transmission Line Corridor may not need to be entirely cleared (subject to final design), and so it is considered unlikely there will be any potential habitat fragmentation or edge effect impacts commonly associated with linear developments.

Threatened species

The *EPBC Significant Impact Guidelines 1.1* produced by the Commonwealth Government (DEWHA 2013) describe the process for determining the significance of impacts to threatened species. The NT does not have an independent process, and so it is standard practice that species listed as threatened in the NT – but not federally – are also assessed using the Commonwealth's process. Some species are listed under both NT and Commonwealth legislation, but not always under the same status. Throughout this section, the high – more threatened status – is the one presented, because it is also the status according to which the species will be assessed using the process described in this section.

When assessing whether a Project will have a significant impact on a threatened species known, or likely, to occur in the Project footprint the first step is to determine whether the occurrence constitutes an <u>important population</u> – as defined in *EPBC Significant Impact Guidelines 1.1*. This is because, in most circumstances, by definition, a Project's activities can only have a significant impact on an 'important population' of a threatened species.

The potential impacts of the Project upon threatened species are:

- <u>Loss of threatened fauna species habitat due to the change in land use at the Solar Precinct, Transmission Line Corridor and H2 Production Precinct; from vegetated area to infrastructure</u>.

  As mentioned above, a key assumption associated with this potential impact is that the area proposed to be developed for the Solar Precinct will be cleared by TPC as part of its normal forestry operations prior to hand-over and commencement of construction by Provaris. Also, whilst the plantation currently provides habitat for some threatened species, it represents lower value habitat compared with the core habitat present in the surrounding, native woodland. The plantations provide some value for foraging (perhaps limited by the lack of mid-storey food plants) and moving between native bushland areas, but they are not core habitat for roosting or breeding due to a paucity of hollow-bearing trees that provide roosts for many fauna species.

  The remnant bushland within the other components of the Project footprint (i.e. the Transmission Line Corridor and the H2 Production Precinct) constitutes core habitat, similar to that in adjacent and surrounding bushland.

  There are seven threatened fauna species of relevance – see Table 9-3. The occurrences of all these species on the Tiwi Islands are considered important populations (as per the *EPBC Guidelines* discussed earlier in this sub-section) because they remain as key source populations for these species which have drastically declined on the mainland. However, as shown in Table 9-3, the proportion of these species habitats on Melville Island that will be lost from land-clearing for this Project is very small – no more than 0.03% of core habitat and 0.66% of total habitat (including plantations).

Table 9-3. Threatened species with the potential to be significantly impacted by land clearing

Species	Habitat within the Project footprint	Proportion of total core habitat on Melville Island	Proportion of total habitat on Melville Island (including all plantations)
Partridge Pigeon	132.5 ha (core) 2,862 ha (total, including plantation)	0.029%	0.57%
Red Goshawk		0.034%	0.65%
Masked Owl		0.025%	0.50%
Brush-tailed Rabbit-rat		0.029%	0.57%
Black-footed Tree-rat		0.029%	0.57%
Northern Brush-tailed Phascogale		0.034%	0.66%
Pale Field-rat		0.029%	0.57%
Butler's Dunnart		0.030%	0.58%
Northern Brushtail Possum		0.025%	0.50%

- Mortality of non-mobile threatened species – *Typhonium* and Darwin Cycad – during land clearing within the Transmission Line Corridor and H2 Production Precinct.

  Impacts to Typhonium are unlikely. This is because all high likelihood habitat for this species within the Project footprint has been surveyed according to DEPWS guidelines, and the only plants that were recorded are in an area that has since been buffered from disturbance (see Appendix B).

  The Transmission Line Corridor, H2 Production and Export Precincts all contained large numbers of Darwin Cycads. The situation is similar within savannah woodland across the Tiwi Islands. Areas with high-density stands of cycads – more than 1,000 plants per hectare – are important for maintaining the species' diversity and function (Hill 2020). No such areas were identified within the Project footprint. Removal of individual Darwin Cycad plants that occur within the Project area is unlikely to be a significant impact on the Tiwi Island population because the 132.5 ha that will be cleared represents a small portion – 0.027% – of the suitable habitat present on Melville Island.

- Mortality of threatened fauna due to land clearing activities. The likelihood of this impact occurring is low because most individuals should be able to vacate the area of their own accord. Pre-clearance surveys and use of a fauna spotter-catcher during land clearing will also minimise this impact – see Section 9.2.4.

- Disturbance to breeding cycles of threatened bird species – Red Goshawk and Masked Owl – due to land clearing activities within the Transmission Line Corridor and H2 Production Precinct (there being no nesting habitat for these species within the Solar Precinct). It is possible that these species currently nest, or will establish a nest prior to land clearing, within the Project footprint. If these nests are disturbed or destroyed whilst containing young, the species could be impacted. Pre-clearance surveys will mitigate this impact – see Section 9.2.4.

- Mortality of Red Goshawks due to collisions with transmission line infrastructure. Overhead wires associated with powerlines present a mortality/injury hazard to birds through collision with powerlines or by electrocution from powerlines. Along the Transmission Line Corridor, the very high voltage conductors are spread well apart (the distance between the closest is 5 to 7 m) and so the air gap between live components is too large to be bridged by any bird species. Despite the presence of powerlines across Melville Island, there are no records of negative interactions between them and Red Goshawks. The likelihood of this impact occurring is therefore low. If monitoring indicates otherwise, Provaris will use line markers / bird diverters on the wires in key hotspot areas – e.g. near active nests, watercourse crossings and wetlands.

9.2.4 Environmental protection and management

The mitigations proposed in this section are commonly applied and effective measures for minimise impacts to fauna.

Pre-clearance surveys and use of a fauna spotter-catcher

A pre-clearance survey will be conducted prior to the clearing and development by a qualified ecologist to identify any potential habitat for wildlife. This will include surveying for nests or breeding activity by the Red Goshawk and Masked Owl. Red Goshawk nests are easily identifiable and visible, due to their distinctive shape and size. Masked Owls nest in tree hollows which can be difficult to detect, as such targeted nest surveys may be required within areas identified for land clearing. In the event a tree with an active nest is identified, appropriate actions will be taken subject to advice from ecologists and/or the Department of Environment, Parks and Water Security.

Prior to any land clearing being undertaken, management procedures will be developed which will stipulate controls to be implemented to minimise impacts to threatened species, and fauna in general, as a result of clearing. Measures may include:

- Pre-clearance surveys by an ecologist (fauna spotter-catcher), prior to clearing and each morning before clearing commences.
- Checking any trenches/pits/excavations prior to works each morning, and removing and relocating any trapped wildlife.
- Ensuring an ecologist is present during clearing to relocate wildlife found, or provide aid as required.
- Steps to be followed in the event a threatened species is identified during clearing activities.

Biosecurity

The introduction and/or spread of weeds will be managed through a Weed and Groundcover Management Plan. This plan will include hygiene and quarantine measures to prevent the introduction of new species to the island and all Project components, prevent the spread of weeds within the site, and will detail control measures for existing weed infestations.

Port Melville has an existing Biosecurity Plan which covers pests from marine operations. All measures within this plan will be maintained.

In accordance with existing Port biosecurity, quarantine measures including pre-shipment inspection, arrival inspection, fenced and trapped lay down areas and ongoing monitoring for Cane Toads will be implemented across the Project, for all goods and persons travelling to Melville Island. All shipping/freight entities will be partnered with, and training provided for, the quarantine requirements for goods and persons travelling to the Tiwi Islands.

9.2.5 Residual impact

The objective of this environmental factor is to maintain three environmental values associated with terrestrial habitats – biodiversity, ecological integrity and ecological functioning. This section assesses whether this development is likely to have a significant impact on those values, as well as on threatened species protected under NT and/or Commonwealth legislation.

Biodiversity

Biodiversity is derived from ‘biological diversity’, and refers to the variety of animal and plant life within a region. Areas with a range of habitats support higher biodiversity.

The Project footprint is almost entirely (~95 %) on degraded Acacia plantation with low flora diversity (which will be cleared by TPC as part of its normal forestry operations prior to hand-over and commencement of construction by Provaris), and therefore is also likely to have reduced fauna diversity compared with surrounding native woodland. Only a small proportion of the Project footprint contains bushland; almost all of

which is savanna woodland and forest – the dominant vegetation types on the Tiwi Islands. The loss of approximately 0.03 % of this habitat type for this Project will not lead to a loss in biodiversity.

Ecological integrity

Ecological integrity is about the quality of ecosystems (including extent, condition and connectivity of habitats) and their capacity to adapt to change.

The remnant vegetation within the Project footprint has the highest value with regards to ecological integrity because it is intact, contiguous with similar vegetation and relatively weed-free. The frequent burning regime, however, does reduce the condition of this remnant bushland. Clearing the remnant vegetation within the Project footprint will have a minor impact on ecological integrity – the Transmission Line Corridor requires clearing only during construction and will not create a barrier to wildlife passage during operations; the H2 Production Precinct is adjacent to existing disturbances due to the Port development and the road, and is small compared with the extent of contiguous and intact habitat present in the surrounding area.

The ecological integrity of the Solar Precinct is compromised due to the low diversity and degraded condition of the plantation. Clearing of the plantation land by TPC prior to handover to Provaris may reduce habitat connectivity, but to a far less degree than if the land supported native bushland.

Ecological functioning

Ecological functioning is taken to mean the functions that ecology has in maintaining other environmental values in the region. For instance, the presence of intact vegetation stabilises the soil and thereby reduces erosion which could cause reduced soil and surface water quality. Some ecological functions can be replaced with technological ones.

The remnant bushland within the Project footprint provides ecological functions such as soil stability and groundwater recharge. The former will be replaced with hardstand and/or erosion and sediment controls (ESC); the potential impact on the latter is discussed in Section 9.2.6.

The ecological functions of the plantation – soil stability, groundwater recharge and supply of surface water to surrounding habitats (especially the large rainforest patch) – will not be significantly altered. Use of a groundcover and ESC within the Solar Precinct will minimise loss of soil; drainage design and management will ensure that impacts to rainfall run-off and recharge regimes are minimal.

Vegetation also provides an ecological function as a carbon sink. The potential impacts of the Project on this are discussed in Section 9.5.6.

Threatened species

For threatened species likely to occur as an important population within a Project footprint, determination as to whether Project activities are likely to have a significant impact on that population is undertaken using the criteria within *EPBC Significant Impact Guidelines 1.1*. The criteria consider whether Project activities are likely to:

- Lead to a long-term decrease in the size of an important population
- Reduce the area of occupancy of an important population
- Fragment an existing important population into two or more populations
- Disrupt the breeding cycle of a population
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent the species is likely to decline
- Adversely affect critical habitat
- Result in invasive species, that are harmful to the species, becoming established in the species' habitat

- Introduce disease that may cause the species to decline
- Interfere with the recovery of a species.

None of these criteria are likely to be met by this Project's activities because:

1) The proportion of threatened fauna species habitats on Melville Island that will be lost from land-clearing for this Project is very small – no more than 0.03% of core habitat and 0.66% of total habitat (including plantations). No critical habitat will be lost.
2) Biosecurity and weed management measures will be put in place to ensure that invasive species do not become established.
3) Other mitigation measures will minimise the likelihood and severity of other potential impacts, such as disturbance to breeding Masked Owls.

Conclusion

The assessments undertaken for this environmental factor conclude that the residual impact to terrestrial ecosystem values will be minor, will not impact wetlands and rainforests, and will not lead to any significant impacts to threatened species.

9.2.6 Cumulative impact

The biggest impacts to biodiversity and threatened species on Melville Island occurred when large areas of land were changed to plantation. The conversion of 2,640 ha of plantation – which does still have some habitat and biodiversity value – to an intensive solar farm will have some additional impact for the life of the Project, which will be mitigated afterwards through rehabilitation of the site back to native bushland.

Where this Project and the road upgrades proposed by the NT Government coincide, the collective footprint of these projects are small and will have a negligible cumulative impact. There remain in the vicinity large areas of suitable habitat for all of the woodland threatened species.

9.3 Hydrological processes

This section only assesses potential impacts to groundwater hydrological processes. This is because the likelihood of impacts to surface water processes is inherently low. The location and small disturbance footprints of the H2 Production Precinct and Transmission Lines Corridor mean they will have minimal impact of surface hydrology. Current rainfall run-off at the Solar Precinct site contributes to the water supply of an adjacent patch of rainforest. That drainage regime will be maintained through a Stormwater Management Plan informed by hydrological modelling – as discussed in Section 9.2.

9.3.1 Factor objective and context

Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.

The information for this section comes from desktop resources such as NT Government datasets, bore reports and information supplied by Port Melville. Preliminary hydrological modelling of the Solar Precinct has been completed; digital elevation modelling is in the process of being undertaken.

9.3.2 Presence of environmental values

Receiving environment

Haig et al. (2003) identified two regional aquifer systems on the Tiwi Islands; a shallow, unconfined aquifer, and a deep confined aquifer. The shallow aquifer occurs within the Van Diemen Sandstone and overlying laterite and alluvium. It covers the majority of both Tiwi Islands and is the most readily used for bore water supplies. Recharge of this shallow aquifer system occurs each wet season through direct infiltration of rainfall.

During the dry season, water drains from the system such that shallow bores fluctuate up to 5 m between seasons.

Groundwater production potential is dependent on the thickness of the aquifer. In areas where the sandstone is greater than 60 m thick, yields of up to 10 L/sec are likely. Areas of less than 20 m thick are likely to only produce up to 0.5 L/sec, while shallow groundwater supplies are unlikely where there is no underlying Van Diemen Sandstone.

The deep, confined aquifer occurs within the Moonkinu Member and is separated from the shallow aquifer by a relatively impermeable layer of claystone and siltstone. It is approximately 30 to 60 m thick and bore yields range between 0.5 and 4 L/sec. Recharge to this aquifer no longer occurs. Water in this aquifer derives from rainfall that occurred over 7,000 years ago when the sea level was approximately 130 m lower than present.

Groundwater extracted for use at the Imalu outstation is taken from bore RN035207, 800 m from the Solar Precinct. Groundwater from the Port's water supply bores (RN035208, RN038613, RN038614 and RN038616) is drawn from a depth of 10 to 19 m and, as such, is from the shallow aquifer system. Water quality from this bore is good but yields are low (approximately 0.5 L/s). Active bores within 1.5 km of the H2 Production and Export Precincts are depicted in Figure 9-3 and listed in Table 9-4.

Table 9-4. Active bores within 1.5 km of the Transmission Line Corridor, Hydrogen Production and Export Precincts

Bore no.	Bore name	Yield (L/s)	Completion date	Water level (m)	Purpose
RN004972	Investigation Bore No. 1	0	1964-08-17	0	Unknown
RN004973	Investigation Bore No. 2	0	1965-07-18	0	Unknown
RN005619	Job 324 No. 1	0	1966-10-08	0	Unknown
RN032889	O.B. No 6 Melville Island	3.5	2000-11-17	10.2	Monitoring
RN035207	Matilda Minerals (Melville Island)	1.2	2005-11-05	3.6	Production
RN035208	Matilda Minerals (Melville Island)	0.5	2005-11-06	10.2	Production
RN038613	Tiwi Aboriginal Land Trust (Teras Australia)	0.6	2014-07-15	10.5	Production
RN038614	Tiwi Aboriginal Land Trust (Teras Australia)	2.5	2014-07-17	9	Production
RN038615	Tiwi Aboriginal Land Trust (Teras Australia)	1.5	2014-07-19	8.8	Production
RN038616	Tiwi Aboriginal Land Trust (Teras Australia)	0.75	2014-07-19	10.8	Production
RN040182	Power & Water (Garden Point)	4	2017-06-09	9	Production
RN040183	Power & Water (Garden Point)	1	2017-06-10	17.4	Monitoring
RN040185	Power & Water (Garden Point)	1.2	2017-06-12	16.0	Monitoring
RN040186	Power & Water (Garden Point)	4	2017-06-13	9.2	Monitoring
RN040220	Power & Water (Garden Point)	3.3	2017-06-18	2.3	Production
RN040221	Power & Water (Garden Point)	9	2017-06-19	0	Monitoring
RN040223	Power & Water (Garden Point)	4	2017-06-23	0	Production
RN040224	Power & Water (Garden Point)	5	2017-06-24	0	Production
RN040226	Power & Water (Garden Point)	0	2017-06-28	0	Monitoring
RN040227	Power & Water (Garden Point)	2.5	2017-06-29	0	Monitoring

Sensitive receptors

Groundwater-dependent ecosystems (GDE's) refer to 'natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services' (Richardson et al. 2011). These areas provide essential habitat for a diverse range of flora and fauna, and can be easily impacted by poor land management and planning.

Based on definitions from Eamus et al. (2006), the Atlas of Groundwater Dependent Ecosystems maps three types of GDE – subterranean, aquatic (i.e. ecosystems dependant on surface expression of groundwater) and terrestrial (i.e. ecosystems dependent on the sub-surface presence of groundwater, often accessed when roots penetrate via the capillary fringe which lies above the saturated zone of the water table). The Atlas classes each mapped GDE according to the degree of certainty that it is, indeed, a GDE. Several aquatic GDE's are mapped proximate to the Project footprint, but none are within the footprint. On Melville Island, rainforest and wetlands are considered terrestrial GDE's. There are a number of rainforests and wetlands proximate to the Project area (as shown on Figure 9-2), which are therefore considered GDEs, however most are outside of the footprint. The Project area only intersects with three low-potential terrestrial GDE's at the Blue Water Creek crossing.

Beneficial uses

Until recently, Blue Water Creek was the drinking water source for Pirlangimpi (PWC 2021). Drinking water is now extracted from four bores in the bore-field near Pirlangimpi (RN040182, RN040220, RN040223 and RN040224; as shown on Figure 9-3). These bores are surrounded by a 300 m wellhead protection zone, the intent of which is to provide a buffer from the bore to protect groundwater quality and quantity (i.e. activities with potential to impact groundwater quality or extract groundwater should not be undertaken within the exclusion zone). There are two additional production bores, which are not currently equipped, which could be used in future to supplement future demand for the community's drinking water supply (RN040221 and RN040186, also shown on Figure 9-3). The Transmission Line Corridor intersects three of the four wellhead exclusion zones. The H2 Production Precinct overlaps the wellhead exclusion zone of one of the bores which is proposed for future use (RN040186).

Port users currently extract from bores RN035208, RN038613, RN038614 and RN038616. Bore RN038614 supplies the potable water treatment plant for NTPM accommodation and offices, bore RN035208 supplies potable water to the TPC offices and the berth (for staff consumption, fire-fighting and sales to vessels), and bores RN038613 and RN038616 supply the NTPM wash down yard and workshops.

Potable water for the Imalu outstation residents is extracted from bore RN035207, 800 m from the Solar Precinct.

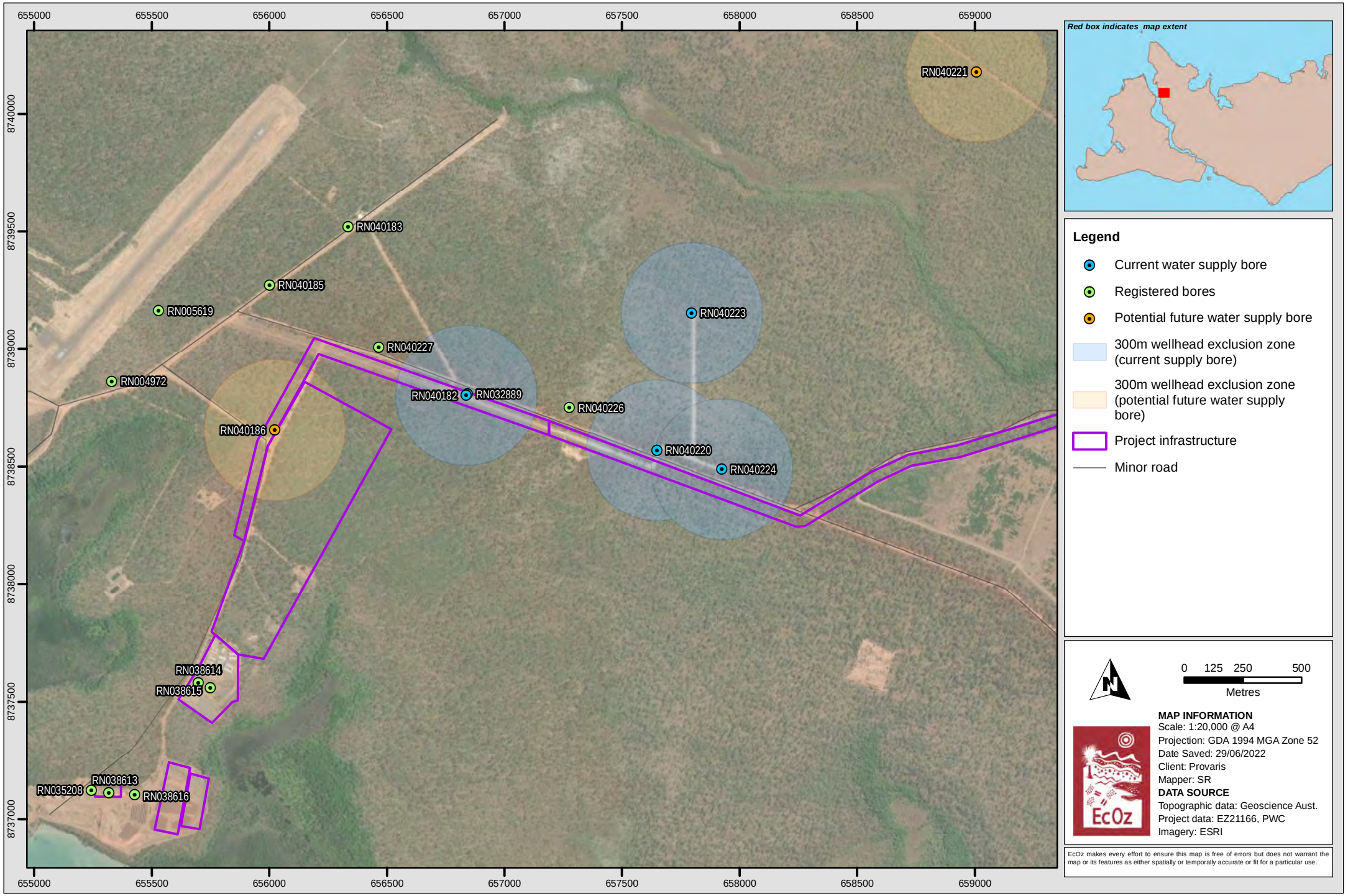


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Figure 9-3. Map showing Pirlangimpi drinking water bore exclusion zones in relation to the proposal

9.3.3 Potential impacts

The Solar Precinct will remain pervious to rainfall and so there should not be a significant impact on local groundwater recharge. Similarly, the Transmission Line Corridor will remain pervious to rainfall and therefore will not impact on local groundwater recharge. The H2 Production and Export Precincts will result in an increase in impervious land surface, however their footprints are relatively small and therefore unlikely to impact on groundwater recharge to the shallow aquifer more broadly. Some localised reduction in recharge may occur, which is discussed below.

The construction priority will be to build and commission a temporary modularised desalination unit in order to provide all of the Project's construction water needs. This will be installed as a priority at the beginning of construction, therefore avoiding the use of groundwater as a Project water source. Construction water needs associated with installing the temporary modularised desalination unit are not high and can be met by the existing water supply of the Port.

There are two potential impacts to groundwater hydrology associated with the Project:

1) The southern end of the transmission line and the H2 Production Precinct overlap, or are within, the 300 m wellhead protection zones for Pirlangimpi water supply bore-field (currently used or potential future use bores). It is unlikely that construction and operation of the transmission line will impact on groundwater recharge or groundwater quality. The construction of the H2 Production Precinct will result in an increase in impervious land surface, which could impact local recharge around the proposed future water supply bore. Provaris is in consultation with PWC in regards to this, and would be willing to establish new wellheads, at its cost, to avoid any impacts on the Pirlangimpi water supply.
2) Accessing the Port bore for construction water use (prior to the temporary desalination unit being commissioned) could lead to drawdown of that groundwater resource, with potential implications for the users of nearby bores.

Because the bore-field aquifer is shallow and unconfined, it will also be necessary to evaluate the potential for contamination of the water source from Project activities – noting that there are no high-risk sources of contamination associated with this Project (see Section 5.8).

9.3.4 Environmental protection and management

By prioritising development of the desalination plant, Provaris is mitigating potential impacts associated with use of groundwater during construction.

Power and Water Corporation (PWC) will decide whether the Project footprint can encroach upon the wellhead exclusions zones, and under what conditions. If such an encroachment is not permitted, Provaris will either i) modify the Project footprint accordingly; or ii) work with PWC to establish new wellheads to avoid any such impact with the Transmission Line Corridor (at its cost); or iii) supply water to the community from its proposed desalination plant.

9.3.5 Residual impact

The objective of this environmental factor is to protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.

All potential impacts to surface water can be managed using Stormwater Management Plans and ESCP's.

The Project is not predicted to alter groundwater availability for any GDE's. The footprint of the transmission line is so small as to not impact upon the recharge of the Pirlangimpi water supply bore-field. However, development of the H2 Production Precinct could reduce the area of recharge available for one bore which is proposed to be used in future. Provaris is discussing the implications of this situation with Power and Water Corporation.

Accessing the Port bores for construction water use would only be for a very limited time until the temporary, and then permanent, desalination plants are operational. The closest user of the bore is the Port. By this stage, it is likely that Provaris will be the major user of the Port, and so will not be impacted. The Port bore is ~1.1 km from the bore-field and so any temporary drawdown is unlikely to impact the town's water supply.

9.3.6 Cumulative impact

No substantive cumulative impacts have been identified. The proposed Melville Road Upgrades also encroach upon the Pirlangimpi bore-field – something PWC will no doubt consider when determining whether this Project can do so.

9.4 Marine environmental quality

Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.

The information for this section comes from desktop resources such as NT Government datasets, and the Desalination Plant Scoping Study in Appendix D.

9.4.1 Presence of environmental values

Receiving environment

The Apsley Strait is approximately 62 km long and ranges from 550 to 5,000 m in width. At the Port, the strait is ~2.4 km wide. The strait separates Melville and Bathurst Islands (Tiwi Islands), and connects the Timor Sea in the north and Beagle Gulf in the south. The strait has a large tidal range which generates strong tidal currents reaching up to 5 knots on the ebb. During flood tide, the currents flow from north to south, and during the ebbing tide from south to north. The Desalination Plant Scoping Study in Appendix D presents predicted tidal currents at the site. The seabed directly off Port Melville drops steeply to about 40 m depth; the depth alongside the berth is 14 m.

Water quality monitoring data from Port Melville's monthly water quality program were analysed to characterise the ambient water quality around the site – see Appendix D. Key findings were that salinity levels range from ~12 to ~37 PSU[2]. There are both seasonal and interannual variations in salinity, but the highest variations are likely caused by freshwater inflows from nearby creek systems. There is little difference in salinity evident throughout the water column. Turbidity is generally the largest (maximal value of 438 NTU) on the wharf side and the smallest (<10 NTU) on the other side of the strait. Project site turbidity is likely determined by weather conditions, vessel movements, tidal phases and discharge of highly turbid freshwater from the creek systems that feed into the strait.

Sensitive receptors

The channel between St Asaph Bay and Port Melville by which vessels navigate through the northern entrance of Apsley Strait is largely in deep water. This section has little benthic habitat to attract marine megafauna and therefore it is unlikely that significant populations of marine megafauna would aggregate or remain in the channel.

9.4.2 Potential impacts

The primary potential impact to marine environmental quality is from the discharge of brine generated during the desalination process into the Apsley Strait.

Using data from Port Melville monitoring and from the desalination plant provider, a comparison of inlet/feed and outfall water quality is presented in Table 9-5. Whilst there are a range of chemicals needed to ensure the ultrafiltration and reverse osmosis processes maintain consistent operation, these will be neutralised prior

[2] Practical salinity units – which are the same as parts per thousand

to blending with the brine concentrate for disposal. This is the approach adopted at the Perth and Sydney desalination plants.

Table 9-5. Predicted water quality of desalination intake and outfall

Parameter		Unit	Feed	Outfall
Physical properties	TDS	PSU	39	63.5
	Conductivity	µs/cm	56,342	91,770
	Temp	°C	26.5	26.5
	pH	-	8.3	7.0
Chemical composition	TSS	mg/L	Up to 100	159
	Ammonia	mg/L NH_4 as N	0	0
	Phosphorus	mg/L as PO_4	0	0.002
	Barium	mg/L	0	0.1
	Bicarbonate	mg/L	158	256
	Borate	mg/L	5	8.5
	Bromide	mg/L	74	129
	Calcium	mg/L	452	787
	Chloride	mg/L	25,466	37,372
	Fluoride	mg/L	1.13	1.97
	Iodide	mg/L	0.06	0
	Iron	mg/L	0.02	0.035
	Magnesium	mg/L	1,427	2,484
	Potassium	mg/L	430	749
	Silica	mg/L as SIO_2	0	0.03
	Sodium	mg/L	11,939	20,858
	Strontium	mg/L	15	26
	Sulphate	mg/L	2,996	5,277

Modelling of the outfall was undertaken by Jacobs as part of the Desalination Plant Scoping Study – see Appendix D The conclusion was that the proposed outfall site (the south-east end of the Port's existing jetty) is subject to strong tidal currents which promote good mixing of the discharge. Consequently, the impacts of discharges will be small and contained to an area in the immediate vicinity of the proposed outfall, with no salinity impacts of greater than 0.5 PSU predicted outside a zone of 100 m radius from the outfall. This is shown in Figure 9-4.

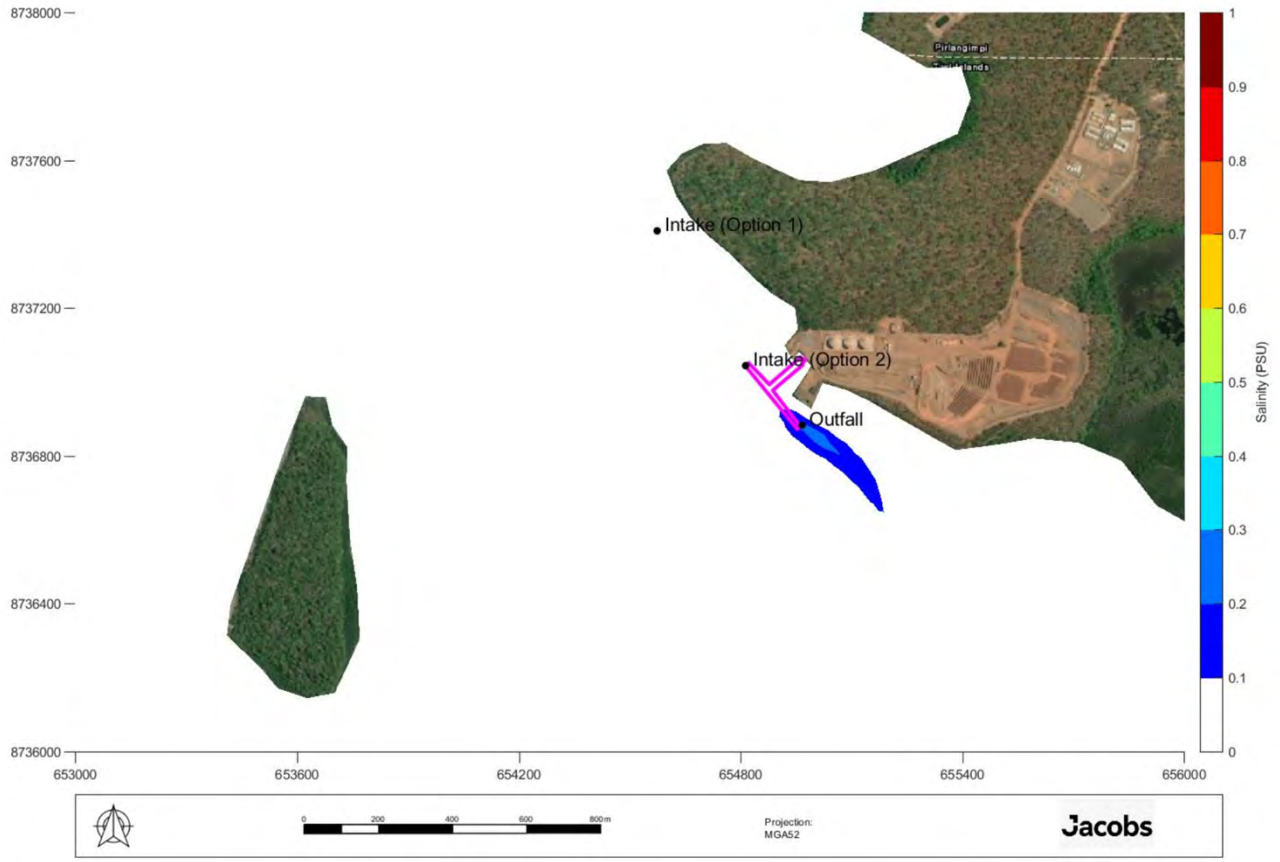

Figure 9-4. Map of modelled salinity increase (90th percentile)

9.4.3 Residual impact

The objective of this environmental factor is to protect the quality and productivity of water, sediment and biota so that environmental values are maintained. The Desalination Plant Scoping Study shows that the impact of brine discharge on the marine environmental values in Apsley Strait will be negligible. Nevertheless, the discharge will be regulated and monitored in accordance with the conditions of an environmental protection license.

9.4.4 Cumulative impact

No substantive cumulative impacts have been identified. Current Port operations do not result in any brine discharge.

9.5 Marine ecosystems

9.5.1 Factor objective and context

Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The information in this section comes from desktop resources – in particular, a detailed light model assessment of the impacts on marine turtle nesting sites of the light generated by Port Melville (Guinea 2015). Marine turtle nesting sites in the northern part of the Tiwi Islands were surveyed 21 times by Parks and Wildlife Service of the Northern Territory from 1993 to 2004 (Chatto and Baker 2008).

Marine turtles are protected under the *EPBC Act* as listed threatened species. The key policy document for this potential impact is the *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds* (Commonwealth of Australia 2020).

9.5.2 Presence of environmental values

The Tiwi Islands are very important for marine turtle nesting, with breeding records for all four species of marine turtle known to regularly breed in the NT. Nesting on the Tiwi Islands is dominated by Flatback Turtle *(Natator depressus)* and Olive Ridley *(Lepidochelys olivacea)*; the two less common nesting species are Green Turtle *(Chelonia mydas)* and Hawksbill Turtle *(Eretmochelys imbricata)*. Under the *EPBC Act*, three of these marine turtle species are listed as 'Vulnerable'; the Olive Ridley is listed as 'Endangered'.

Marine turtles nest along the beach around Cape van Diemen and the coastline to the east, and inhabit the adjacent marine waters (see Figure 9-5). The nesting areas have been determined by the presence of a significant quantity of turtle tracks recorded in surveys (Chatto & Baker 2008). The coastal and marine waters of the region as also identified the Commonwealth Government as a 'biologically important area' for the Green Turtle and Olive Ridley Turtle. These areas are used by turtles during the inter-nesting period between laying each successive clutch of eggs over a nesting season. Inter-nesting habitat critical to the survival of marine turtles is located immediately seaward of designated nesting habitat within a buffer area of 20 km for Green Turtles and Olive Ridley Turtles, and 60 km for Flatback Turtles (DoEE 2017). H2Neo ships will traverse these biologically-important areas – see Figure 9-5.

All four species of turtle are highly likely to occur in the waters around the Tiwi Islands. However, the channel between St Asaph Bay and Port Melville by which vessels navigate through the northern entrance of Apsley Strait is largely in deep water – providing marginal habitat for marine megafauna – therefore it is unlikely that significant populations of marine megafauna would aggregate or remain in the channel.

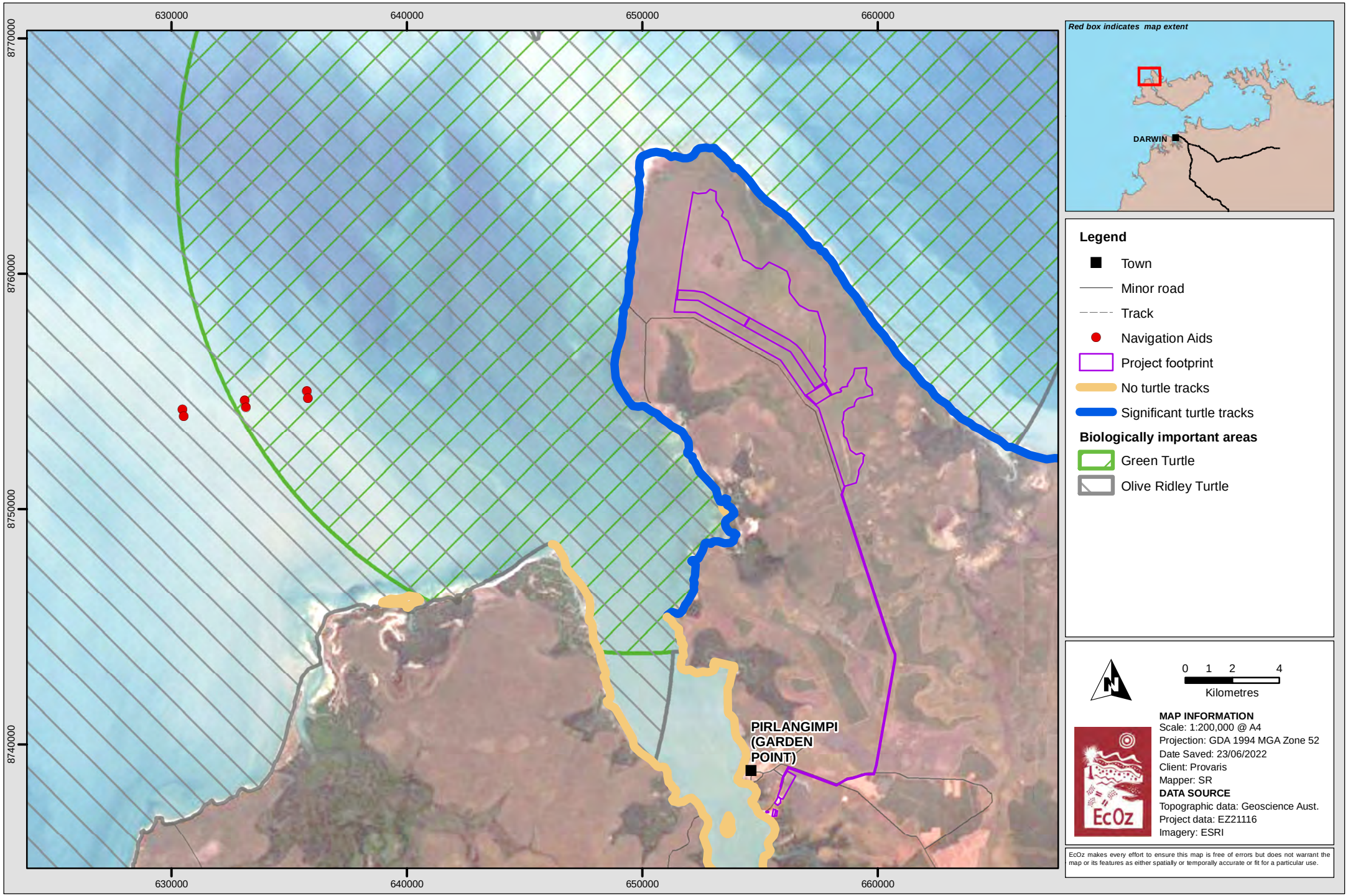

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Figure 9-5. Map of marine turtle habitat relevant to the Project

9.5.3 Impact assessment

The Project has potential to have the following impacts on marine ecosystems:

- Solar Precinct lighting disrupting the orientation of hatchlings. It is well documented that artificial light at night that is located close to marine turtle nesting beaches disrupts the orientation of hatchlings, either resulting in movement in the wrong direction away from the sea (misorientation) or preventing the hatchings from taking a direct path to the sea (disorientation) – both of which increase the likelihood of their premature death (Witherington and Martin 2000). However, no significant night lighting is envisaged during construction or operations of the Solar Precinct.
- Port operational lighting disrupting the orientation of hatchlings. Guinea (2015) undertook a detailed light model assessment of the impacts on marine turtle nesting sites of the light generated by Port Melville, and found that there was none. This Project will have similar night lighting during Port operations.
- Ship navigation lights disrupting the orientation of hatchlings. As explained in Section 2.7.4, three pairs of navigation lights are required approximately 9 km north of Bathurst Island (see Figure 9 5). Because installation of navigation lights was not proposed for the Port Melville development, their impact was not assessed by Guinea (2015). Navigation lights are used in current Port Melville operations onboard ships; however, these lights transit briefly through the area. However, navigation lights – both on ships and on buoys or markers – are commonly used in shipping routes worldwide. Most countries have adopted the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) system of navigational marks, and this is also in use throughout Northern Territory waters. Navigational markers in line with IALA guidelines have flashing lights at night. DAWE National Light Pollution Guidelines for Wildlife (2020) recommends restricting marine lights to navigation lights at night only, suggesting the impact of navigation lighting is less than that of having vessels lit.
- Onboard ship lighting disrupting the orientation of hatchlings. According to Guinea (2015), in tropical Australia, ships enter and leave ports regularly at night with no reported negative impact on nesting sea turtles close to the port. These include ports such as Gladstone where ships pass Curtis Island Flatback rookery; Cape Lambert and the Flatback nesting beach at Bells Beach; Port Hedland and the nesting area at Cemetery Beach; and even Darwin where vessels pass within sight of the nesting beaches of Cox Peninsula and Casuarina Beach.

  Whilst lighting on moving ships is unlikely to impact nesting sea turtles, Guinea (2015) made the incidental observation that a ship which was at anchor (near the proposed location of this Project's navigation lights) with all its external lights on was clearly visible from the important turtle nesting beaches north of Apsley Strait mouth.
- Mortality of megafauna from boat strikes. This impact has a low inherent risk of occurring because Apsley Strait provides only marginal habitat for marine megafauna and ships using Port Melville adopt a suite of controls designed to minimise interactions with megafauna (as described in Section 5.4.2).
- Reduction in habitat value due to brine discharge. As detailed in Section 9.3.6, the impacts of brine discharges will be small and contained to an area in the immediately vicinity of the proposed outfall, such that the likelihood of a significant impact to marine ecosystems is negligible. The proposed outfall location is not located adjacent to known turtle nesting beaches (as show on Figure 9-5).

9.5.4 Environmental protection and management

Use of navigation lights will in accordance with best practice regarding marine turtle safety, which could include restricting vessel lights to navigational lights only whilst ships are navigating that stretch of water.

To minimise the impacts of lighting from vessels moored offshore, Provaris will investigate the option of the H2Neo ships being fitted with a level of block out blinds, limiting the amount of light spill around the vessel. If deemed necessary, a 'lights-off' policy around turtle nesting beaches and a restriction on outdoor vessel lights to navigational lights only will be implemented.

The NT EPA assessment process associated with the development of Port Melville included an in-depth assessment of the potential impacts to marine ecosystems from the operation of the Port and increased vessel traffic in Apsley Strait. The Port agreed for shipping to be undertaken in compliance with the recommendations designed to minimise impacts to marine megafauna that were made by the NT EPA in their Statement of Reasons for the Port Melville development in 2015 – see Section 5.4.2 of this Referral for detail. With controls in place, the NT EPA concluded that those activities were not considered likely to have a significant impact. This Project will have similar vessel traffic requirements and will adopt the abovementioned controls.

9.5.5 Residual impact

All of the potential impacts to marine ecosystem values have been avoided through project design (such as no night lighting at the Solar Precinct) or will be minimised through mitigation measures (such as ship operational procedures when navigating through Apsley Strait). Critical to minimising impacts of offshore lighting on marine turtle hatchlings will be strict implementation of lighting restrictions on H2Neo ships moored offshore awaiting transit to the Port.

9.5.6 Cumulative impact

The light sources discussed in this section are the only known or proposed light sources in the vicinity, and so it is not necessary to assess cumulative impacts. It is unknown whether project activities from the proposed Barossa gas pipeline will coincide with this Project, but is seems unlikely given the distances between the two projects.

9.6 Atmospheric processes

9.6.1 Factor objective and context

Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.

Estimates of Scope 1, Scope 2 and relevant material Scope 3 emissions are required to assess the Project against the NT EPA Atmospheric Processes factor and are also specified under the National Greenhouse and Energy Reporting (NGER) legislation. To this end, a Greenhouse Gas Assessment Report is being prepared by EcOz to support the assessment of the Project against the NT EPA atmospheric processes factor. The report will provide a preliminary estimate of Scope 1 and Scope 2 Greenhouse Gas (GHG) emissions associated with the construction and operation of the Project.

The model calculation methodology to be used in the GHG Assessment Report will align with the following legislation, regulations, standards and guidelines:

- ISO 14064 Greenhouse gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas GHG emissions and removals.
- GHG Protocol Corporate Accounting and Reporting Standard.
- National and Territory GHG Legislation, regulations & policy:
  - *National Greenhouse and Energy Reporting Act 2007.*
  - *National Greenhouse and Energy Reporting Regulations 2008*.
  - National Greenhouse and Energy Reporting (Measurement) Determination 2008.
  - *Greenhouse Gas Emissions Management for New and Expanding Large Emitters Policy*.
- Full Carbon Accounting Model (FullCAM).

The report will also be aligned with NT *Draft GHG Offsets Policy and Technical Guidelines 2021*.

9.6.2 Presence of environmental values

In 2019, total emissions for the NT were 20.7 million tonnes CO_2e[3] – a 46.5% increase on 2005 levels (DISER 2021). This was largely due to strong growth in mining and exports driving increases in fugitive emissions, as well as stationary energy emissions. In 2018, energy, agriculture, land use change and forestry sectors were the largest emitters, accounting for a combined 98% of the Territory's emissions (DISER 2021).

The NT Government has an objective to transition to a low carbon economy, reflected in the target of net zero emissions by 2050, established by the Climate Change Response (DENR 2020). The NT has a unique opportunity to benefit from low carbon opportunities with its abundance of natural assets, including renewable and green energy production for use both domestically and internationally. The NT Government recognises the economic potential in growing low-carbon industries, such as electrified transport, green hydrogen production and export, and electrified manufacturing plants. The NT Renewable Hydrogen Master Plan (DITT 2021) provides a framework for a renewable hydrogen industry in the NT, identifying the Territory's vision to be recognised as a leader in the transition to renewable hydrogen.

9.6.3 Potential impacts

Modelling is being undertaken to estimate the GHG emissions associated with the construction, operation and decommissioning of the Project. The scope and boundary of the GHG emissions estimate being prepared for the Project will meet the requirements of the *GHG Emissions Management for New and Expanding Large Emitters Policy* (NT Government 2021), as is illustrated in Figure 9-6 and summarised below.

Likely scope 1 emissions for the construction, operation and decommissioning of the Project are detailed below. Embodied carbon emissions from the raw materials of the Project will be excluded from the estimate. The upstream lifecycle emissions of the materials utilised in the construction and operation of the Project lies outside the scope of the environmental impact assessment under the *EP Act* and, as such, will be excluded from this GHG estimate.

The downstream product of the Project is hydrogen supplied to overseas commercial, industrial and consumer users, with an end product of water from the use of this hydrogen. There are no tangible significant scope 3 emissions associated with the supply and use of hydrogen to these users, therefore scope 3 emissions will not be considered further.

[3] Greenhouse gas emissions are measured as kilo-tonnes of carbon dioxide equivalence (CO_2e). This means that the amount of a greenhouse gas that a business emits is measured as an equivalent amount of carbon dioxide which has a global warming potential of one (Clean Energy Regulator 2022).

Example: Boundary of Assessment – Solar Project Environmental Approval

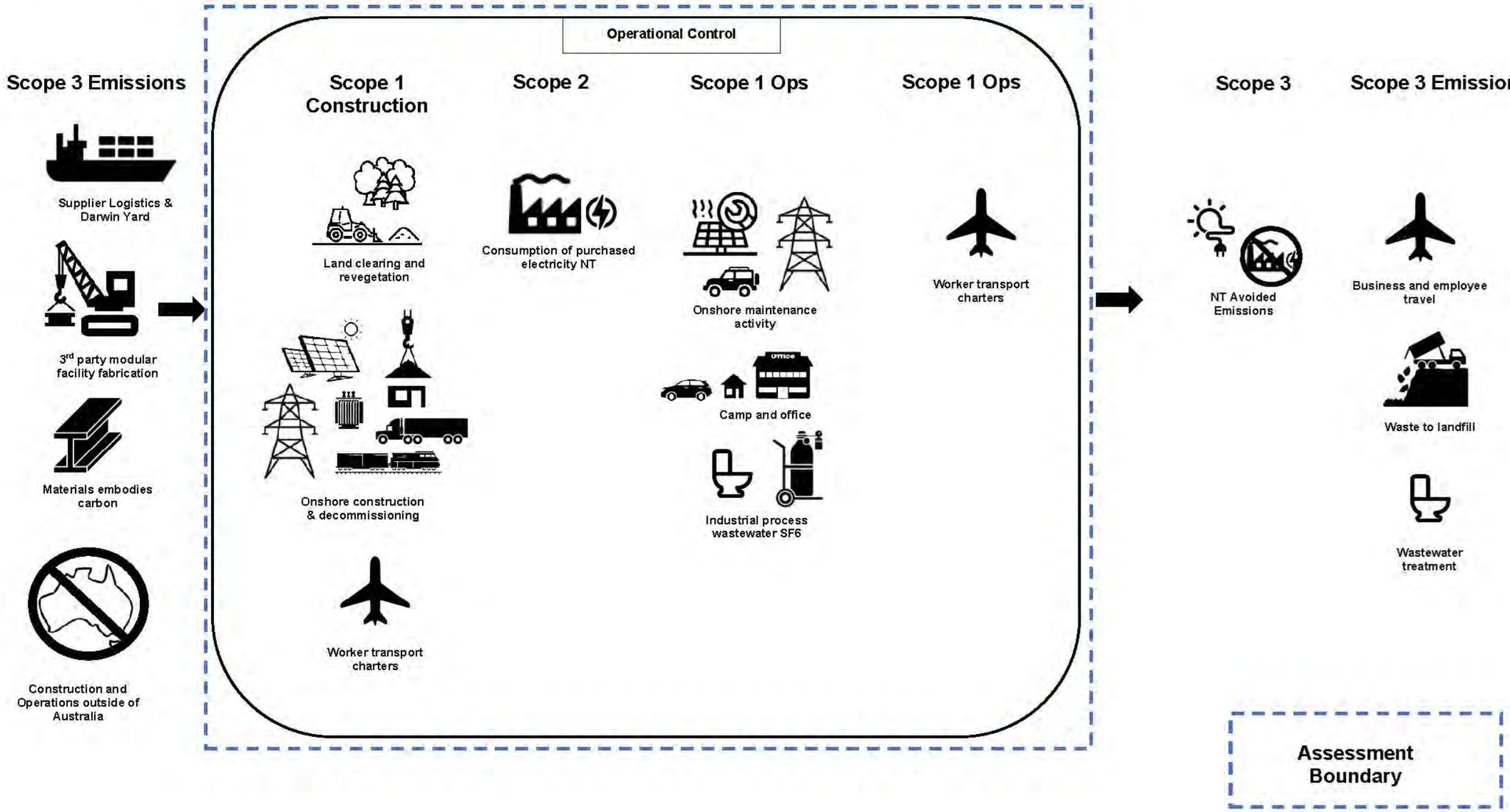

Figure 9-6. Diagram of GHG emissions estimate scope and boundary

Being a green hydrogen Project, the majority of emissions will result from the construction phase, including those resulting from the change in land use. Further work is required to confirm baseline conditions and assumptions with which to base emissions calculations upon. For emissions estimates related to change in land use at the Solar Precinct, there are two possible baseline scenarios with which to base modelling on. Should the Project not exist, land use will either be:

- Ongoing plantation operations
- Restoration of the site to native vegetation.

Therefore, construction of the Solar Precinct will result in a change in future land use from either plantation or native vegetation. Acacia plantations sequester more carbon than native vegetation, and therefore result in larger emissions when cleared. This is due to the increased productivity and biomass of the Acacia plantation when compared to native vegetation, the large amount of organic material which enters the soil during the plantation life, and the large amount of organic material which enters the soil following harvest of the plantation.

Provaris will work through these two scenarios – and their associated assumptions - with relevant stakeholders, and in accordance with relevant guidelines, to ensure estimates are accurate, and determine any avoidance and abatement opportunities.

9.6.4 Environmental protection and management

The Project has avoided emissions, through careful decision-making and design development – including:

- The use of renewable energy sources for energy supply to the H2 Production Precinct and H2 Export Precinct, including accommodation services for workers.
- Use of existing port infrastructure, reducing the use of building materials and construction time.
- Use of previously cleared roads and industrial land at the port minimises clearing of vegetation.
- Exploring temporary solar installations to power construction facilities.
- Staging of construction allows the Project to operate off renewable energy sources and water sourced from the desalination plant as soon as possible, by prioritising the development of this essential infrastructure, scaling up the remainder of the Project over time. This approach also retains plantation vegetation for as long as possible, increasing time available for plantation sequestration.
- Provision of hydrogen to global markets will contribute to emissions reductions globally, contributing to avoidance of international emissions.

Provaris will continue to review opportunities to reduce emissions of the Project and integrate an emissions reduction scope of work into the design process of the Project. GHG emissions estimates will continue to be reviewed throughout the design process, minimising and refining emissions where possible. Additionally, Provaris will engage with relevant stakeholders to explore the opportunity to provide renewable electricity supply and potable water supply to the Pirlangimpi town. If possible, this would reduce the town's dependence on expensive liquid fuel, and reduce GHG emissions associated with power generation at the town.

Once the GHG Assessment is completed, any requirements for further mitigations and/or offsets will be identified and incorporated into a management plan.

9.6.5 Residual impact

The NT EPA's objective for this environmental factor is to minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.

Being a green hydrogen production and export Project, operation of the Project will contribute to reduced global emissions. Additionally, emissions will be avoided as described above, through use of existing infrastructure and existing areas of developed and cleared land. The Project will also engage with relevant stakeholders to

explore the opportunity to provide a local renewable electricity supply to Pirlangimpi community, reducing local emissions.

Further work, including consultation with relevant stakeholders, is required to confirm appropriate assumptions and baseline scenarios for use in modelling, to ensure emissions calculations are accurate. Once modelling is complete, the potential for residual impacts will be quantified, and further mitigations and/or offsets will be identified and implemented as required under relevant national legislation and policies.

9.6.6 Cumulative impact

Significant cumulative impacts are unlikely because the main source of emissions is expected to be due to the change in land use at the Solar Precinct (i.e. land clearing and future change in use from a plantation to a Solar Precinct). Apart from that associated with the plantations across Melville Island, no other large areas of land are known to be cleared in the foreseeable future. Any other plantations that are cleared on Melville Island are likely to be regrown, limiting the contribution to cumulative GHG emissions.

The other potential for cumulative impacts arises in the construction phase of the Project and its potential to coincide with the construction phases of known and possibly unknown Projects on the Tiwi Islands – for instance, with the construction phase of the Melville Island Road Upgrade Project for a period. The resultant increase in traffic volume, industrial machinery use, and construction activity simultaneous to the Project could yield higher GHG emissions for the NT in a particular time period. However, such emissions are not substantial, meaning that in the context of total NT emissions, the significance of this potential cumulative impact is very low.

9.7 Community and economy

9.7.1 Factor objective and context

Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.

The assessment of this factor has been based on a combination of desktop research, consultation, technical assessments and local knowledge. Guidelines used to inform the assessment include:

- Environment Protection Act 2019
- IAP2 Quality Assurance Standard for Community and Stakeholder Engagement
- NT EPA Guidance for Proponents – Stakeholder Engagement (2019)
- New South Wales Social Impact Assessment Guideline for Statement Significant Projects (2021)

An Acoustic Report (Operational Noise Impact Assessment) will be prepared once more detail is available regarding plant specifications of the Hydrogen Production and Export Precincts.

9.7.2 Presence of environmental values

Receiving environment

Tiwi Islands are owned and managed by TLC and TALT. Tiwi Islands has a population of approximately 2,743 (ABS 2020) with over 90% of the population identifying as Aboriginal or Torres Strait Islander. The region has a high unemployment rate comparative to the rest of Australia (unemployment rate was 23.7% in 2016 compared to 6.9% across Australia). Major economic activities for the Tiwi Islands are commercial fishing generated by non-Tiwi interests. Other economic activities on the Islands include forestry, aquaculture and tourism.

The proposal is in the north-eastern extent of Melville Island on the land of the Munupi Clan. Port Melville (the location of the hydrogen processing facility) is a working port, containing both operational infrastructure, laydown areas and accommodation facilities. Port Melville is located on Apsley Strait, which runs north-south

between Melville Island and Bathurst Island. Apsley Strait is used by commercial barges that bring supplies to the Tiwi Islands, as well as ships that collect timber from the wharf near Pirlangimpi on Melville Island. Apsley Strait is also used for commercial and recreational fishing.

Current exports from Port Melville include woodchip and logs from plantation forestry, supported by fuel sales to local vessels. The residential community nearest to Port Melville is Pirlangimpi (formerly Garden Point), 1.5 km north. Pirlangimpi has a population of approximately 370 - 440 (ABS 2016; Bushtel 2022), of which more than 90% identify as Aboriginal or Torres Strat Islander. Pirlangimpi is one of the two largest communities on Melville Island (the other being Milikapiti, approximately 27 km east of Port Melville). Facilities in Pirlangimpi include a bank, post office, supermarket, health clinic, library, police station and recreation club. There is also a tourist fishing resort that offers accommodation and guided tours (fishing and cultural).

The site of the Solar Precinct is a further 22 km north of Port Melville, on an existing plantation managed by TPC. The plantation was cleared of native vegetation and established in 2005, and prior to this it was undeveloped. The outstation of Putjamirra is located approximately 2 km to the west of the proposed Solar Precinct (existing plantation land) and is accessed via Putjamirra Road. Putjamirra has a population of less than five (Bushtel 2021) with three permanent dwellings and no community services.

The Transmission Line Corridor connecting the Solar Precinct and the H2 Production Precinct will run approximately 30 km alongside Putjamirra Road. Putjamirra Road is currently used by Tiwi people accessing homelands, the Putjamirra outstation and school camps, TPC staff for plantation access and research groups accessing the CSIRO carbon plots.

Sensitive receptors

The closest sensitive receptors are Pirlangimpi, approximately 1.5 km north of Port Melville, and Putjamirra outstation, approximately 2 km west of the proposed Solar Precinct location.

9.7.3 Potential impacts

A screening level assessment of potential social impacts (positive and negative) was undertaken using the screening tool and guidance provided in the *New South Wales Social Impact Assessment Guideline for Statement Significant Projects (2021).* The purpose of the screening assessment is to identify those impacts that are potentially significant, and therefore will require further assessment to be undertaken to ensure they are avoided and mitigated to an acceptable level, or in the case of positive impacts, work is undertaken to ensure the benefits are realised by the local community.

The following assumptions apply to this assessment:

- The Project has in-principle support from the TLC, but has not yet been approved. Tiwi people will have the ultimate say as to whether the Project will proceed and under what conditions (refer to Provaris' acknowledgement at the beginning of this Referral).
- The Project will be constructed and operated in accordance with all relevant regulatory guidelines which will provide for adequate protection of community health and safety.
- Ongoing engagement and consultation will be undertaken through the process of negotiating agreements. Other negative impacts may be identified and would need to be addressed to the satisfaction of the Tiwi People in order for agreements to be reached for the Project to proceed.

Identified impacts are described in Table 9-6. The potential impacts were identified considering the issues raised by the TLC and other stakeholders, and professional judgement of the assessors informed by knowledge and experience of the social impacts that have occurred in association with other similar projects on Aboriginal land in the NT. Three positive impacts were identified, all of which are considered to be potentially significant in terms of providing economic and employment opportunities to the Tiwi community and the NT. These are:

- Ongoing economic benefits through annual lease payments for duration of project life.

- Employment opportunities for local residents during construction as well as local rangers during planning and construction - skilled and unskilled employment and training opportunities during construction.
- Employment opportunities for local residents during operations (30 years), as well as local rangers during operation phase - skilled and unskilled employment and training opportunities during operation.

Twelve negative impacts were identified, three of which are considered potentially significant in terms of their impact on the well-being of the local community. These are discussed in more detail below.

Construction workforce

Provaris forecast a peak of 500 workers required over the construction period – effectively doubling the local population during peak construction periods. The accommodation facilities at the Port are to be expanded from the current level for 150 people to accommodate the required workforce. This influx of people to the area may have impacts on the local community if workers access and utilise services in the community and/or access land for recreational activities such as sightseeing or fishing. This could introduce conflict into the community when there are some people who are supportive of the Project and some people who are not, and also could put pressure on existing capacity of services and infrastructure that support the community (e.g. rubbish generation, septic system, water supply, power, access to food and services). Provaris will work with the TLC to determine the additional services required to support the construction workforce with the objective that there will be no impact to service provision to the local community, and to establish the boundaries in relation to the construction workforces' access to and use of land outside of the Port precinct

Disempowerment of local community

It is possible some parts of the local community could feel disempowered if they are not afforded a voice in decision-making and/or do not benefit from Project in the long-term. This could include local community members of Pirlangimpi, or Tiwi people across the broader Tiwi Islands region, that do not have direct connection to the land on which the Project is located. To date, the community does not have any experience with large-scale industrial type development, so the Project will introduce new operations and changes to the local area that some residents may feel they have no influence over.

The Tiwi Islands are Aboriginal Land and so the people do have a choice over what Projects are allowed to proceed and operate on the islands and the Project cannot proceed without their endorsement. However, the community is diverse, and it is likely there may be some difference in opinion regarding the Project. Minimisation of impacts to the local community and maximisation of benefits are key to both the wellbeing of the community and success of the Project, and the measures needed to achieve this will be developed in consultation with the TLC and Tiwi people as part of negotiating Project agreements.

Operations workforce and benefits

Project benefits such as lease payments, royalties, employment opportunities may not be distributed equitably. Lease payments and royalties from use of land and Section 19 Agreements will inevitably benefit certain groups over others. Although there will be employment opportunities available for the broader community through both construction and operation, there may be barriers to uptake of opportunities from communities across the Tiwi Islands. Opportunities may be better suited to certain demographics of residents due to physical requirements of the role, or travel to/from work due to geographic location limiting the uptake of opportunities and therefore benefit to residents across the Tiwi Islands. Experience on other Projects indicates it will take consistent effort to achieve the most local benefit from the Project, and Provaris propose to work with TITEB – an indigenous NFP and Registered Training Organisation that runs programs that prepare people for the workforce – and to work directly with TLC and local community to break down barriers to uptake of opportunities.

Table 9-6. Potential community and economy impacts (positive and negative)

Project activity	Description of potential impact	Category	Positive or negative	Potentially significant	Mitigation/enhancement measures under development in consultation with TLC and other stakeholders
Construction					
Construction workforce	Provaris forecast a peak of 500 workers required during the construction phase. The accommodation facilities are to be expanded from the current level for 150 people to accommodate the required workforce. This influx of people to the area may have impacts on the local community, even though the workers will be accommodated at the existing Port facilities.	Community	Negative	Yes	• Work with relevant stakeholders, including TLC, to refine workforce numbers and develop management plans, to minimise impacts to the community from the construction workforce. • Management measures could include: o Engaging with TLC and PowerWater in relation to capacity of existing power, water and waste facilities to service worker accommodation. o Engaging with NT Government services providers in relation to health and emergency services. o Augmenting existing or establishing additional supplies and services if required to ensure security of service provision to the community. o Establishing a Code of Conduct, and providing workers with training about conduct in a remote area.
	Employment opportunities for local residents during construction period as well as local rangers during planning and construction - skilled and unskilled employment and training opportunities during construction.	Livelihoods	Positive	Yes	• Work with TITEB, an indigenous NFP and Registered Training Organisation that runs programs that prepare people for the workforce. • Work with TLC and local community to break down barriers to uptake of opportunities.
Construction of proposal components, including land clearing, site preparation and installation of infrastructure	TLC and Munupi Landowners have expressed concern over impacts to the local environment (both land and sea) which is culturally significant.	Culture	Negative	No	• Continue to engage with and involve Indigenous stakeholders and rangers in field assessment and design development. • Incorporate Indigenous knowledge and views into project decisions (i.e. overhead transmission line and desalination plant design selected to avoid and minimise potential impacts identified through consultation. • Inform and consult TLC and Tiwi People in relation to the EIA presented in the Referral, and work

Project activity	Description of potential impact	Category	Positive or negative	Potentially significant	Mitigation/enhancement measures under development in consultation with TLC and other stakeholders
					directly with people to ensure concerns and aspirations are addressed.
	Disturbance or destruction of Aboriginal sacred sites, and other culturally significant areas.	Culture	Negative	No	• Unexpected finds 'stop work' procedure. • Continue consultation with Indigenous stakeholders. • Application for AAPA Authority Certificate. • Cultural heritage field assessment has been undertaken with archaeologist and cultural monitors (refer Section 9.8).
	Loss of amenity due to noise and dust emissions from construction activities.	Surroundings	Negative	No	• Dust suppression methods. • Construction noise level monitoring, construction activities occurring in accordance with *NT EPA Noise Management Framework Guideline 2018.*
Traffic on local roads	Access and traffic flows to adjacent areas are restricted and/or delayed during construction. Disruption to daily activities of local residents, landowners and users by construction along the ROW while transmission line is being constructed and the road infrastructure is being upgraded.	Way of life	Negative	No	• Traffic management plans. • Informing community when and where works are planned.
Water and power supply for construction	Community and service provider concern about water and power availability, drawdown of groundwater bores, surface water sources, impact on existing power supplies.	Surroundings	Negative	No	• Engage with TLC and PWC in relation to capacity of existing supplies to service construction phase requirements. • Augment existing or establish additional supplies if required to ensure security of supply to community.
Operation					
Operations payments and employment	Inequitable distribution of benefits from the project. Lease payments, royalties, employment opportunities.	Livelihoods	Negative	Yes	• Work with relevant stakeholders, including TLC, to minimise impacts to the community from the inequitable distribution of benefits.
	Employment opportunities for local residents during operations (30+ years), as well as local rangers during operation phase - skilled and unskilled employment and	Livelihoods	Positive	Yes	• Work with TITEB, an indigenous NFP and Registered Training Organisation that runs programs that prepare people for the workforce. • Work with TLC and local community to break down barriers to uptake of opportunities.

Project activity	Description of potential impact	Category	Positive or negative	Potentially significant	Mitigation/enhancement measures under development in consultation with TLC and other stakeholders
	training opportunities during operation.				
Project operation, including maintenance and general day-to-day operation of project components	Disempowerment of local community who feel they are not afforded an influential voice in decision-making and/or do not benefit from project in the long-term.	Decision-making systems	Negative	Yes	• Work with relevant stakeholders, including TLC, to develop an ongoing engagement strategy that supports the community in decision-making, where relevant.
	Operational noise impacts from hydrogen processing facility.	Surroundings	Negative	No	• Undertake a noise assessment to inform whether mitigation required to meet residential noise criteria at nearest sensitive receptors. • Commit to meeting noise criteria.
	Consultation with Indigenous stakeholders has raised concerns regarding safety standards of the proposal, the project operations are relatively novel and new technology may cause stress to local residents.	Health and wellbeing	Negative	No	• Undertake hazard and risk assessments for project components to ensure community safety is upheld. • Communicate hazard and risk assessment results to community in a culturally appropriate way. • Undertake the project, during all phases, to relevant safety standards, with procedures in place such as emergency shutdown procedures.
Above ground transmission line	Visual impact of overhead transmission lines.	Surroundings	Negative	No	• Ensure local community are aware of what the structures look like and the size before construction.
H2Neo ship movements during project operation cause noise and/or restrictions on community access to waterways	Ship movements may cause noise and/or restrictions on community access to waterways.	Community	Negative	No	• Ships to adhere to existing Port operating restrictions and procedures, including speed when passing the community and approaching the Port.
Annual long term lease payments ($/ha pa) under each of the proposed Section 19 Lease Agreements	Ongoing economic benefits through annual lease payments for duration of project life.	Livelihoods	Positive	Yes	• Consult with TLC and OTL regarding Section 19 Lease Agreements. • Adjust for annual escalation rate.

9.7.4 Environmental protection and management

Mitigation/enhancement measures being developed in consultation with the Tiwi Land Council for each identified impact are described in Table 9-6.

Provaris is committed to having a positive social impact on the Tiwi Islands and in the Northern Territory more broadly, and will work with relevant stakeholders to determine how the Project can best support and benefit the Tiwi region and Pirlangimpi community. Specific measures needed to address negative impacts and maximise benefits will be further developed in consultation with Tiwi stakeholders, and Provaris expect that achieving social and economic outcomes will be a part of negotiated agreement/s.

9.7.5 Residual impact

The NT EPA's objective for the Community and Economy factor is to: *Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.* The Project will provide opportunities for the Tiwi community, and to the Territory more broadly associated with establishing a safe, sustainable, and efficient supply chain for exporting green hydrogen. It is the Project's objective to provide a new, commercially-resilient industry that will be a transformational business opportunity for the Tiwi Islands and align with the NT's hydrogen strategy to utilise its renewable energy to create a new export industry. Provaris has sought to minimise environmental impacts by repurposing currently under-utilised brownfield sites. The screening level assessment presented in this Referral indicates there is further work to be undertaken with the TLC and Tiwi people to address negative impacts and maximise benefits, and Provaris commits to undertaking this work as part of negotiating agreements for the Project.

9.7.6 Cumulative impact

The main potential for cumulative impacts to the community relate to overlapping project construction phases, with impacts associated with traffic on local roads and accommodation of construction workforces. There are two road upgrade Projects planned – Paru Road and Melville Island Road – that could overlap with the Tiwi H2 Project. While some cumulative residual impacts as a result of overlapping construction phases are possible, the significance of identified impacts for this Project are not expected to change.

Furthermore, this Project will be developed in such a way as to not impact upon Port functions and activities required by existing users.

9.8 Cultural and heritage

9.8.1 Factor objective and context

Protect sacred sites, culture and heritage.

This assessment was informed by a Cultural Heritage Assessment was undertaken for the Project by Earth Sea Heritage (2022) – see Appendix C - including both desktop components and a field survey with local rangers. Additionally, a report by Crosby (1978) on Fort Dundas was reviewed to provide context to the existing environment.

9.8.2 Presence of environmental values

Receiving environment

Melville Island, and the Tiwi Islands more broadly, are home to the Tiwi people. Culture is still strong on the islands, with people many maintaining a strong connection to the environment. The Tiwi people are thought to have occupied the islands since the last ice age, when the islands were separated from the mainland approximately 11,000 years ago (Tiwi Land Council 2022).

Large areas of the Tiwi Islands comprise remnant bushland; however, the current Project area is mostly land that has been disturbed by previous activity associated with construction of Port Melville, roads, and forestry plantations. Although the area has been subject to disturbance, some heritage and cultural values remain throughout. Additionally, the plantation has been subject to previous surveys during the assessment of the Tiwi Islands Forestry Project and no values are known to have been identified.

Sensitive receptors

Earth Sea (2022) identified six cultural heritage features relevant to the project area – including three sites with isolated flaked stone artefacts, two culturally-modified trees (CMT), and one culturally significant watercourse (which includes a swimming hole). The majority of the cultural heritage features are outside of the direct disturbance footprint, although two of the isolated flaked stone artefacts are located within the proposed accommodation area and existing Port Melville accommodation area. The CMT within the Transmission Line Corridor is protected under the *Heritage Act*. This CMT will not be impacted by the Project and will be flagged off and buffered during construction. Similarly, the watercourse will be spanned by the overhead transmission lines and will not be impacted by Project activities.

Two cultural heritage risk areas were identified through surveys. These areas were determined to have a higher likelihood of containing cultural heritage than the surrounding landscape, due to their high potential to contain CMTs, and also poor ground surface visibility during the survey (i.e. artefacts are difficult to see).

Earth Sea (2022) also identified historic heritage features of the Fort Dundas site, both within and adjacent to the proposed H2 Export Precinct. One earth depression with associated soil/rock pile was identified adjacent to the expanded accommodation area. The remaining features are outside the current project area, with two lines of rock features adjacent to the existing port access road, and other features up to 155 m from the site. The earth depression within the expanded accommodation area is considered to be associated with Fort Dundas, but the assessment was constrained by poor ground visibility. Features include possible graves, convict barracks, potential sawpit and rubbish dumps, and remaining free standing walls. Fort Dundas was a British military fort and settlement from 1824 to 1827, consisting of various structures such as housing, fences, a church, and a hospital. The site has been well studied by Crosby (1978).

Consultation with AAPA did not identify any sacred sites within the project area. Additionally, six AAPA Authority Certificates have previously been authorised covering Port Melville and a section of Pirlangimpi Road near the Port.

9.8.3 Potential impacts

This assessment assumes that Indigenous stakeholders consulted with to date have communicated concerns they have regarding impacts to culture, and identified known heritage sites within the project area.

There is potential for Project activities – primarily during construction – to impact both known and unknown heritage, through unintended damage or destruction of archaeological sites or objects, heritage places or cultural features. This includes both tangible heritage – such as the known features identified above – and intangible heritage, through changes in land use and potential impacts to connections held between the Tiwi people and Country.

9.8.4 Environmental protection and management

Based on the Cultural Heritage Assessment, Provaris has already implemented measures to avoid impacts to known heritage and cultural values. These include:

- Early consultation with AAPA to ensure any sacred sites could be avoided. Provaris will obtain an Authority Certificate from AAPA to ensure any sacred sites relevant to the Project are identified and management measures implemented in accordance with the conditions of the certificate.
- Relocation of the desalination plant, to be contained within previously-disturbed areas, avoiding impacts to features of Fort Dundas.

- Undertake a survey with improved visibility of the earth depression adjacent to the area for the expanded accommodation facility prior to construction to confirm if the feature is associated with Fort Dundas and determine if implementation of a no-go zone/buffer of the site is required.
- Establishing no-go zones around features of Fort Dundas adjacent to the desalination plant.
- Commitment to avoid works near Fort Dundas features.
- Early and ongoing consultation with TLC and Munupi Clan to avoid impacts to environmental values and Tiwi culture – this consultation has already resulted in design decisions that minimise use of environmental resources and ground disturbance.
- Design of the transmission line infrastructure to span the culturally-significant watercourse, and implementing buffer zones around the identified CMT's as requested by Traditional Owners.
- A Cultural Heritage Management Plan (CHMP) will be prepared in consultation with TLC and Munupi Clan, including 'stop works' procedures, staff education and inductions, protocols for maintaining access for local people to areas of value, and any other relevant conditions determined in consultation with a heritage specialist, TLC and Munupi Clan.
- Undertaking clearance surveys – with improved ground visibility – of the two identified cultural heritage risk sites, for which there is still a chance unidentified heritage exists, and the eastern extent of Fort Dundas where ground visibility was previously low.
- Inclusion in Construction and Operations Environmental Management Plans the locations and protective measures of known heritage values, to avoid impacts during Project activities.

These measures will all contribute to mitigating and minimising any potential impacts to unknown heritage. Unexpected finds procedures will be developed and adhered to, managing risks to heritage not identified to date. Reporting on any incidents will be undertaken.

9.8.5 Residual impact

The NT EPA's objective for the Culture and Heritage factor is to: *protect sacred sites, culture and heritage*. Although there are known heritage and cultural values within, and surrounding, components of the Project footprint, these values can be protected – and impacts avoided – through implementation of the abovementioned measures. Impacts to unidentified heritage can be minimised through implementation of standard unexpected finds procedures, and any other conditions determined in consultation with TLC and Munupi Clan.

9.8.6 Cumulative impact

The Melville Roads Upgrade Project identified a medium risk of unintended impacts to unknown heritage, and provided multiple mitigation and management measures to be implemented. It is unlikely there will be cumulative impacts to unknown heritage, based on the due diligence both that project and the current Project have undertaken, and widely accepted management measures available to be implemented.

10 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

There are nine Matters of National Environmental Significance (MNES) protected under the *EPBC Act*:

- World Heritage properties
- National Heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth Marine Areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines)
- A water resource, in relation to coal seam gas development and large coal mining development.

The only MNES relevant to the Twi H2 Project is listed threatened species.[4] The potential for impacts to threatened species has been considered in Section 9.2 of this report. The conclusion was that no listed threatened species are likely to be significantly impacted upon by this development.

Nevertheless, for due diligence, Provaris intend to submit a Referral to the Department of Agriculture, Water and the Environment as per the *Environment Protection and Biodiversity Conservation Act 1999*.

[4] H2Neo ships will be moored in the Commonwealth Marine Area; however, they will not have any impact on the environment therein.

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