Appendix L

Traffic Impact Assessment

Prepared for
Northern Territory Government
ABN: 84 085 734 992

AECOM

Transport Impact Assessment

Darwin Ship Lift Project

22-Oct-2021
Darwin Ship Lift EISDarwin Ship Lift EISDarwin Ship Lift EISDarwin Ship Lift EIS
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Transport Impact Assessment

Darwin Ship Lift Project

Client: Northern Territory Government

ABN: 84 085 734 992

Prepared by

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Table of Contents

Executive Summary

This document presents the Transport Impact Assessment (TIA) component for the Environmental Impact Statement (EIS) of the Darwin Ship Lift Project (the Project). The Terms of Reference (ToR) for the EIS set out considerations regarding the potential transport impacts associated with the construction and operation of the Project.

The initial Project risk assessment also identified risks associated with increased traffic during construction and operation. In response to these risks, potential impacts of the Project on road network capacity, intersection performance, safety and wider road network infrastructure for the critical construction and operation phases are considered in this report.

The construction phase of the Project is expected to generate a temporary increase of heavy vehicle traffic on specific parts of the surrounding road network. However, the projected quantity of vehicle movements and the anticipated period of construction is unlikely to have adverse effects on the road network operations.

The traffic forecast during the operational phase of the Project is expected to have a negligible operational impact on the road network during peak periods. Therefore, no material reduction in Level of Service (LoS) or intersection performance is anticipated.

Vehicle noise generated by the potential 24/7 haulage construction schedule may temporarily impact surrounding local residences. The risk of this impact to the Project can be managed through local consultation and communications.

In order to maintain a robust and reliable construction materials delivery schedule, it is recommended that operation of heavy vehicles during commuter peak periods is avoided where possible or require the Contractor (with Northern Territory Government assistance) to deploy a priority call system/s to minimise delay, congestion, vehicle emissions and pavement damage, which also avails improved efficiencies for deliveries and onsite dependent plant.

On-site vehicle access and manoeuvring requirements, driver scheduling impacts and risks can be addressed and appropriately mitigated through the implementation of a Construction Traffic Management Plan (TMP), Fatigue Management Plan and Incident Management Plan.

A separate detailed TMP should be prepared and approved for both the construction and operational phases. These detailed TMPs should be prepared and approved prior to construction works taking place or the subsequent operation of the facility.

1.0 Introduction

1.1 Background

AECOM has been commissioned by the Northern Territory Government (NTG) to prepare an EIS for the Darwin Ship Lift Project (the Project). Requirements for the assessment and mitigation of impacts on transport and traffic are identified in the EIS Terms of Reference (ToR) for the Project. The requirement for undertaking a Traffic Impact Assessment (TIA) was also identified as a mitigation measure to reduce risks associated with increased road traffic during construction and operations during the initial Project Risk assessment.

The Project is situated approximately 6.5 Kilometres (km) south-east of the Darwin Central Business District, on the East Arm Peninsula within Darwin Harbour. The site is approximately 700 m east north-east of the East Arm Wharf (EAW) and the Marine Supply Base (MSB) facility, and west of the Darwin Business Park (shown in). Road access is provided by Berrimah Road, linking the site into the Darwin road network including the Stuart Highway and Tiger Brennan Drive.

The mix of land uses surrounding the Project site include:

- West: the EAW and MSB. The EAW and MSB infrastructure supports export and import of dry bulk materials and liquids associated with the mining and petroleum industries, containerised/ break bulk and specialised heavy lift cargoes, general cargoes and live cattle exports.
- North: industrial land including the Darwin Port stockpile area and dredge spoil ponds, the Northern Cement plant, the Darwin Vopak Terminal (petroleum import and distribution terminal), the Common User Facility (CUF) and the passenger terminal of the Adelaide - Darwin rail line.
- East: the recently constructed Multi-user Barge Ramp Facility (MUBRF), and Catalina Island.
- South: the southern end of the Project site encompasses the intertidal zone and the East Arm water confluence with Elizabeth River which forms part of Darwin Harbour.

The location of the Project is shown in .

This report contains an assessment of the traffic and transport elements associated with the construction and operation of the Project. Potential impacts of the Project on road network capacity, intersection performance, safety and wider road network infrastructure for the critical construction and operation phases are considered.

1.2 Project overview

Once constructed, the Darwin Ship Lift Project will be Northern Australia's largest common user ship lift. The facility is planned to be operational in 2025 and is proposed to include:

- ship lift of approximately 26 metres (m) width and 103 m length, capable of lifting vessels weighing up to 5,500 tonnes including associated platform, blocking trestles and vessel transfer system
- self-propelled modular transporter (SPMT) vessel transfer system
- approximately 13 hectares (ha) of hardstand area for ship repair and maintenance
- vessel wash area with separate contained treatment and drainage system
- stormwater system to capture and treat runoff water before discharge
- enclosed blast and paint facility with separate contained drainage system
- site services and utilities
- security infrastructure
- ancillary facilities including:
    - administration building

  - ship lift control room
  - SPMT garage.
- access channel and dredged manoeuvring areas
- six wet berths
- heavy lift platforms suitable for a 100 t crane at each berth
- revetments and quay structures.

The proposed infrastructure layout is shown in Figure 2.

The completed facility will comprise:

- An NTG owned facility that will lease areas/berths on a common user basis under a principal Operator, and
- A privately owned berthing and maintenance facility.

Multiple marine service providers will operate concurrently at the common user facility and provide vessel operators with a variety of maintenance services within a secure area.

The construction and operation of the facility will fill an existing market gap and will facilitate further development of the region's marine services and logistics, therefore supporting jobs and economic growth of the Territory.

The ship lift and transfer system has been sized to accommodate the servicing of Australian Navy offshore patrol vessels (OPVs). This will provide long-term maintenance opportunities and is mutually beneficial to Darwin and the ADF, with six of northern Australia's OPVs anticipated to be based nearby at HMAS Coonawarra.

Other vessels that will be able to utilise the long-term maintenance opportunities provided by the facility include:

- the pearling industry
- the fishing industry
- the resources and energy sector.

The location of the Project maximises the use of existing and suitably zoned industry land and is in proximity to available and proposed industrial lots to support future growth.

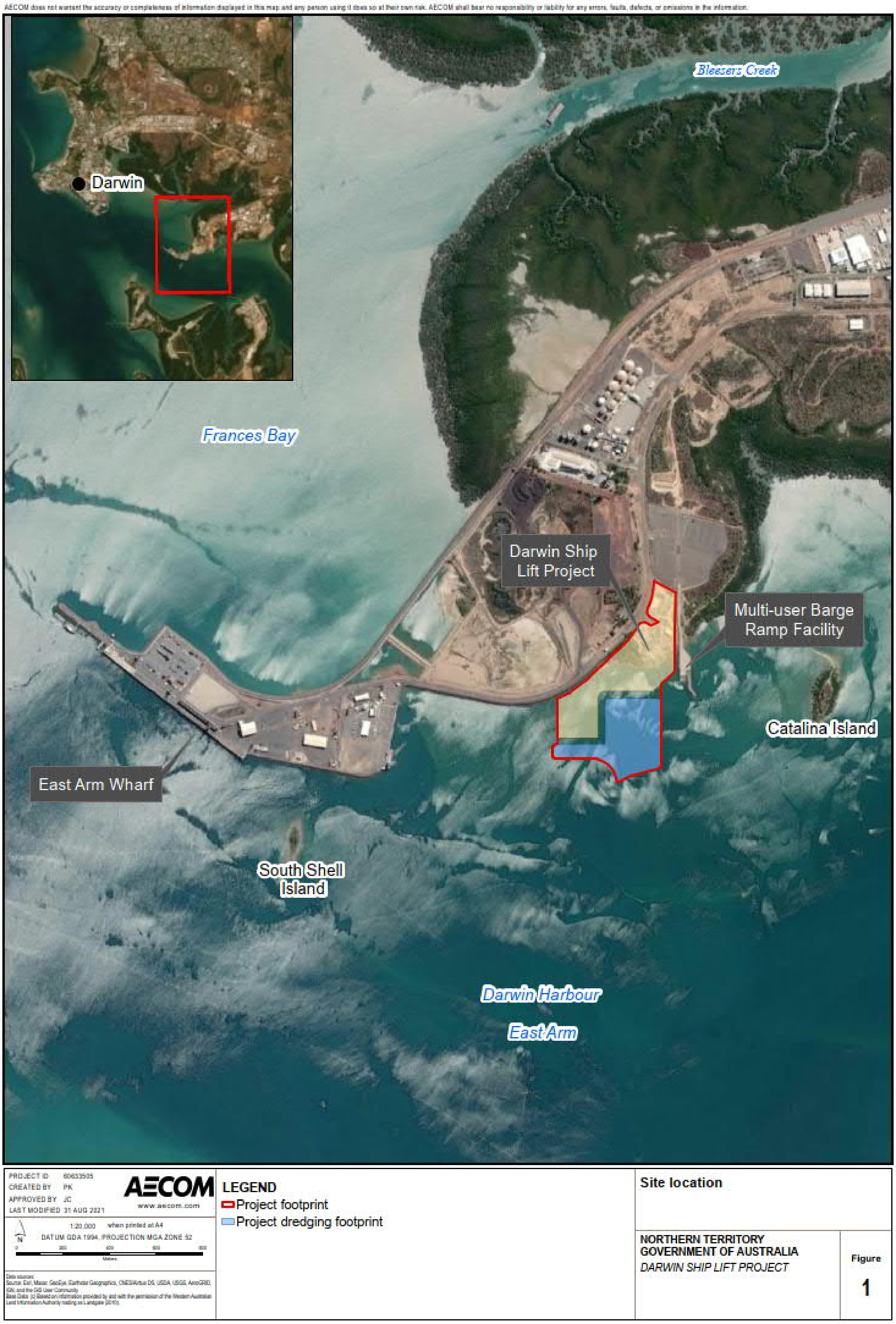

Figure 1 Site location

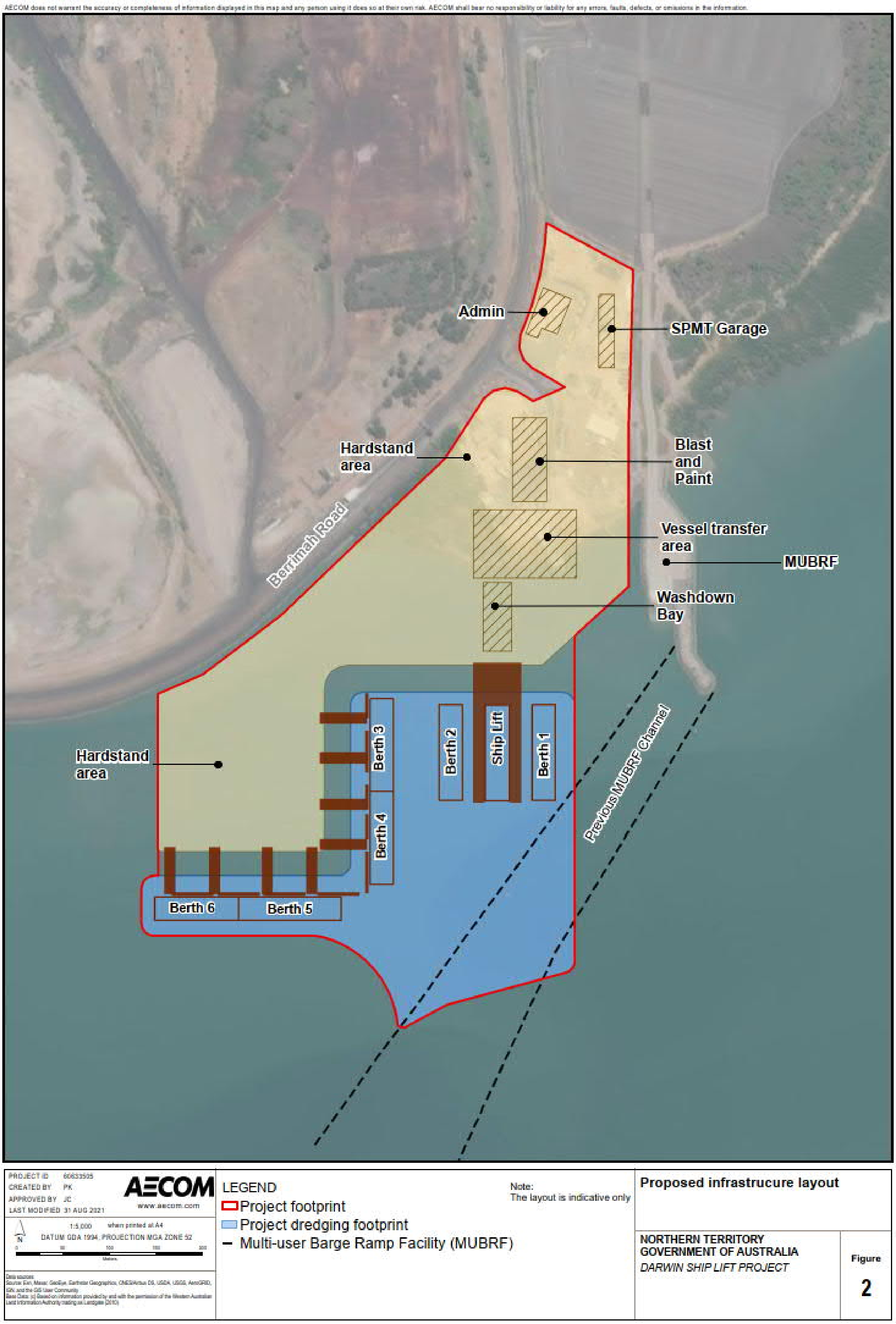

Figure 2 Proposed infrastructure layout

2.0 Terms of Reference

The ToR for the Project EIS identifies requirements for assessment and mitigation of impacts on transport and traffic in terms of social surroundings. This assessment addresses the requirements of the ToR.

Requirements of particular relevance to this report and where they have been addressed within this report are summarised as follows:

- Describe land traffic and transport activities during construction and operation including details on access, haulage routes, vehicle types, volumes of traffic (Section 5 and 6).
- Describe and quantify the potential impacts of Project infrastructure and activities, such as land transport and traffic impacts (Section 7, 8 and 9)
- Address all potential impacts and risks identified through the impact assessment, and identify measures to avoid, reduce or mitigate these impacts (Section 10 and 11).

3.0 Legislative and Strategic Planning Frameworks

3.1 Relevant Northern Territory legislation

3.1.1 Control of Roads Act 1953

The *Control of Roads Act* provides that, subject to the *Planning Act* and the *Local Government Act*, the control, care and management of all public roads in the Northern Territory vests with the Minister. This Act outlines the process which public roads can be opened and closed. Any public or gazetted roads that are required to be opened or closed as a result of construction or operation would be required to follow the provisions of the Act.

3.1.2 Traffic Act 1987

The objective of this Act is to regulate traffic, which includes provisions in relation to the erection and operation of traffic control devices. Traffic control devices refer to signals, signs or markings displayed for the purpose of regulating, warning, or guiding traffic. Under the Act, consent from the applicable competent authority is required prior to the erection and operation of traffic control devices.

3.2 Relevant strategic plans

3.2.1 Greater Darwin Plan 2012

The Plan outlines the long-term vision and plan for the Greater Darwin area as well as referencing the Port Masterplan for specific expansion plans for East Arm to support growth of tonnage capacity and related activity.

3.2.2 Darwin Port Expansion Plan: Australia's Gateway to Asia – Draft 2012

This document summarises the Greater Darwin Plan (2012) specifically relating to the Port of Darwin, and outlines opportunities and recommendations for Australian Federal Government involvement in the expansion of port capacity in Darwin, specifically the investment of $50 million toward the East Arm Wharf expansion project and greater involvement of the private sector in infrastructure development.

3.2.3 10 Year Infrastructure Plan 2019-2028

The 10 Year Infrastructure Plan aims to provide transparency in planning and prioritises projects that have been identified as supporting future growth and prosperity of the Northern Territory. The Plan outlines the Darwin Port Ship Lift facility and anticipated infrastructure upgrades, many of which have since been completed. These include the construction of:

- Two new lanes from Tiger Brennan Drive to Kirkland Road, which was completed in 2016
- Extension of the Tiger Brennan Off-Ramp, completed in July 2016
- Upgrade of the Kirkland Road and Woodlake Boulevard intersection to improve safety, completed in October 2016.

3.2.4 Darwin Regional Land Use Plan 2015

The purpose of the Darwin Regional Land Use Plan is to help identify the critical characteristics and requirements, which will shape future growth in the region and establish an overarching strategic framework for future development. Presented in the document are plans for industrial development on the East Arm and plans to improve utilisation and efficiency of the existing port infrastructure.

3.2.5 Northern Territory Road Safety Strategy 2004 – 2010: Reduced Road Trauma

The NT Road Safety Strategy is aimed at reducing the number, severity and cost of road crashes in the NT. The Strategy aims to achieve a 40% reduction on current road fatalities, consistent with targets set nationally. One of the key objectives designed to meet the challenge of reducing road trauma included:

- A safer road network, by ensuring planning, design, construction, development, maintenance and management of the road network enhances and supports good road safety principles and practices.

3.2.6 Development Guidelines for Northern Territory Government Controlled Roads, 2015,

The Development Guidelines for Northern Territory Government Controlled Roads, Department of Transport, April 2015, Version 1.0 apply to any development or infrastructure that impacts on the road network or that will ultimately be transferred to the NTG. These Guidelines also outline the Department’s involvement in the assessment of land use development applications under the Planning Act and provide details of the Department’s approval processes.

3.2.7 Northern Territory Towards Zero Action Plan 2018-2022

The Towards Zero Road Safety Action Plan presents a vision of zero deaths or accidents on roads within the Northern Territory. It outlines a strategy taking a holistic approach to reducing road deaths and accidents, using a ‘Safe Systems’ approach, which considers how the whole road system can be more forgiving to reduce the consequence of mistakes by road users.

4.0 Methodology

The following tasks have been undertaken to complete the traffic and transport assessment for the Project:

- An initial review of existing site and network conditions in the context of the Project.
- The collection and analysis of existing traffic data representative of current normal operations (2019 and 2020 to ensure the impact of COVID-19 is excluded from the analysis).
- A review of relevant strategic plans to: contextualise this Project within the East Arm precinct; identify proposed cumulative impact of development at East Arm; and identify relevant proposed network upgrades for land-based traffic that may impact this Project.
- A review of the proposed Darwin Ship Lift Facility and estimated traffic and transport usage based on an indicative construction program, construction transport fleet options, estimated hours of operation during construction, site-based truck unloading restrictions, employment generation during operation and associated peak hour traffic generation.
- Desktop analysis of the Project area to: establish existing traffic conditions; identify multi-modal networks and services; identify safety and accessibility issues particularly for heavy vehicles on proposed haulage routes.
- Review of recent crash history for the Project study area to assist definition and avoidance of existing problem areas.
- Estimated traffic generation, route selection, and site-fill haulage duration associated with the construction of the Project, based on sourcing of fill material from two sites , fleet operation assumptions, and on-site restrictions.
- Undertake traffic impact review and summarise the impact of Project site during post-construction operation.
- Undertake traffic impact assessment of the Project for the construction period. The assessment includes:
  - Haulage route option identification from two key locations, to determine the safest and shortest routes.
  - Assessment of the proposed haulage routes including:
    - Impacts on road network capacity, specifically at key intersections.
    - Potential constraints of existing road infrastructure to accommodate the proposed vehicle dimensions, such as current road and intersection geometry and safe turning movements.
    - Noting any additional considerations such as short-term community impact.
- Following the assessment of the potential Project traffic and transport impacts, recommendations for management and potential mitigation measures identified impacts have been made.

5.0 Existing Conditions

5.1 Study area

This chapter describes the status of the existing road network within the vicinity of the Project location and provides details of the existing traffic conditions.

The Project will be situated on NTG land on the East Arm precinct of Darwin Harbour at the end of the East Arm Peninsula between the existing MUBRF at the Marine Industry Park.

Berrimah Road acts as the sole access to the EAW and consequently the Project site. The critical roads that have been identified within the study area for this traffic and transport assessment, are:

- Berrimah Road (sole access to site)
- Stuart Highway
- Wishart Road
- Tiger Brennan Drive
- Kirkland Road.

The location of these roads in relation to the Project site are illustrated in .

Figure 3 Traffic study area

Source of Base Map: Google Maps © 2020

5.2 Existing road network

5.2.1 Overview

The existing roads and intersections along the major arterial roads in the NT are frequently used by heavy vehicles and have been purpose built to accommodate a higher proportion of large vehicles, including triple road trains.

5.2.2 Stuart Highway

The Stuart Highway is a national major highway extending approximately 2,700 kilometres (km) from Darwin, NT to Port Augusta, South Australia (SA) and is identified as National Highway Route 1. The Highway is dual carriageway with a minimum of two lanes in each direction running from Darwin CBD east and then south, bordering the northern edges of Palmerston and continuing to Katherine to the south.

The Highway has a 100 kilometre/hour (km/h) posted speed limit in the vicinity of the Project. The road reservation east of Yarrawonga Road is typically 50-55 m wide, expanding at signalised intersections, and is typically a four-lane, two-way dual carriageway within the vicinity of the study area.

A typical cross section of Stuart Highway in the vicinity of the study area is presented in . The section is typical of Stuart Highway with a dual carriageway in both directions with a wide, grassed median.

Stuart Highway intersects with multiple roads throughout the network, but the following intersections are relevant for this study:

- Signalised intersection with Howard Springs and Lambrick Avenue
- Signalised intersection with Temple Terrace and Glyde Point Road.

Figure 4 Stuart Highway typical cross section, view to the south

Source: Google Maps © 2020

5.2.3 Berrimah Road

Berrimah Road provides north-south connectivity and provides access to east-west intersections including those with Stuart Highway, Tiger Brennan Drive and Wishart Road. It provides a key link between the Darwin International Airport, Stuart Highway and East Arm Port (Project location). The road is typically a single carriageway with one lane in each direction and provides an asphalt median to accommodate right turning traffic at intersections. The speed limit varies, between 60 km/h near East Arm Port, to 80 km/h approaching Tiger Brennan Drive and on to the Stuart Highway. A 40 km/h school zone exists from 7 am until 5 pm on school days, to the south of Stuart Highway.

The surrounding land use of the northern section of Berrimah Road includes schools, commercial and industrial zones. This causes a mixture of commercial vehicle and school related traffic. Within the Project study area, signalised intersection treatments along Berrimah Road control traffic at the intersections with Tiger Brennan Drive (the alternate, parallel route to the Stuart Highway from Darwin CBD) and Wishart Road.

Berrimah Road will provide the sole access to the Project site, which is located on the East Arm Wharf, as the road approaches the wharf to the south, the road widens to a dual carriageway with two lanes in each direction, additionally a truck passing/turning/parking zone and weighbridge facilities within the median are available. This can be seen in .

Berrimah Road intersects with multiple roads throughout the network, but the following intersections are relevant for this study:

- Signalised intersection with Wishart Road
- Signalised intersection with Tiger Brennan Drive.

Figure 5 Berrimah Road South of Wishart Road intersection, view to the south

Source: Google Maps © 2020

5.2.4 Tiger Brennan Drive

Tiger Brennan Drive provides an east-west connection from Darwin to Palmerston parallel to and south of Stuart Highway. Speed limits vary from 100 km/h in undeveloped and heavy commercial zones, to 60 km/h as Tiger Brennan Drive approaches Darwin CBD. Tiger Brennan Drive provides the most direct route for vehicles coming to and from the East Arm Port, the majority of major intersections on Tiger Brennan Drive are signalised with some residential streets connected via limited access slip roads. Tiger Brennan Drive merges onto Stuart Highway at the intersection with Stuart Highway and Roystonea Avenue, which is a grade separated interchange.

A typical cross section in the vicinity of the study area is presented in and that shows a cross section of Tiger Brennan Drive between Berrimah Road and Wishart Road. Tiger Brennan Drive typically has two lanes in each direction.

Tiger Brennan Drive intersects with multiple roads throughout the network, but the following intersections are relevant for this study:

- Signalised intersection with Berrimah Road
- Signalised intersection with Wishart Road and Tivendale Road
- Merger of Roystonea Avenue and Stuart Highway into Tiger Brennan Drive.

Figure 6 Tiger Brennan Drive intersection with Berrimah Road, view to the west
Source: Google Maps © 2020

Figure 7 Tiger Brennan Drive typical cross section, view to the east
Source: Google Maps © 2020

5.2.5 Wishart Road

Wishart Road provides a direct east-west connection from Berrimah Road to Tiger Brennan Drive and Kirkland Road. Wishart Road typically has one lane in each direction and has a speed limit of 80 km/h.

A typical cross section in the vicinity of the study area is presented in and that show a cross section of Wishart Road between Berrimah Road and Kirkland Road. Wishart Road intersects with the following roads on the network:

- Signalised intersection with Berrimah Road
- Signalised intersection with Kirkland Road
- Signalised intersection with Tiger Brennan Drive and Tivendale Road / Wishart Road.

Figure 8 Typical cross-section of Wishart Road, view to the west
Source: Google Maps © 2020

Figure 9 Typical cross-section of Wishart Road, view to the east
Source: Google Maps © 2020

5.2.6 Kirkland Road

Kirkland Road provides east-west connectivity and has a single carriageway in both directions, although the carriageway widens for turn lanes for short periods to provide dedicated right and left turns onto Woodlake Boulevard, Bree Street, Toft Road, Fowlestone Road and Syrimi Road. At its western end the road begins at the intersection with Wishart Road and ends further south-east at the four-way roundabout with University Avenue and Elrundie Avenue. The carriageway is typically a single carriageway along the majority of the route, however at the eastern end at the approach to the roundabout with Elrundie Avenue the carriageway increases into two lanes. At the western end at the intersection with Wishart road the carriageway also increases to three lanes to queue at the traffic lights.

Kirkland Road has a speed limit of 100 km/h reducing to 80 km/h approaching the intersections with Elrundie Avenue and Wishart Road. It has two level crossings for trains on the carriageway that are not grade separated, consequently resulting in some delay to traffic when barriers are activated.

Presented in is a typical cross section of Kirkland Avenue illustrating the single carriageway capacity in both directions.

Figure 10 Typical cross section of Kirkland Rd, view to the west
Source: Google Maps © 2020

5.3 Critical Intersections

Highlighted in are the intersections that are expected to be impacted most by the additional trip generation proposed as part of the Project and have therefore been identified as critical intersections that require further study. This section outlines the location and existing capacity of these intersections.

The critical intersections identified for further assessment are:

A. Berrimah Road / Wishart Road

B. Tiger Brennan Drive / Berrimah Road

C. Wishart Road / Kirkland Road

D. Tiger Brennan Drive / Wishart Road.

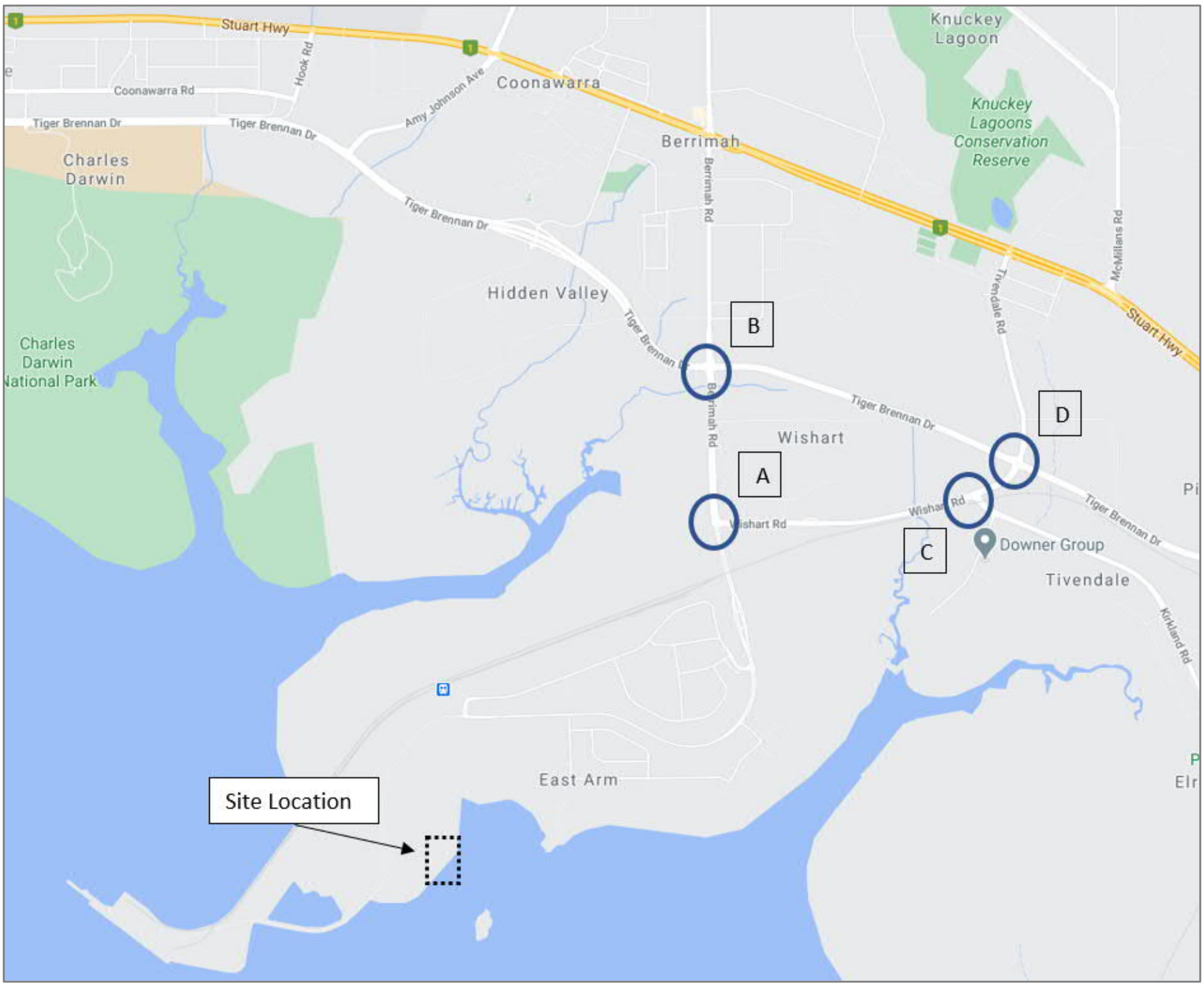

Figure 11 Intersection assessment locations
Source: Google Maps © 2020

5.3.1 Berrimah Road/Wishart Road

Presented in is the signalised “T” intersection that includes Berrimah Road and Wishart Road. This shows that on the approach to the intersection along Berrimah Road south, a total of three lanes are provided. These include two straight through lanes that continue north on Berrimah Road and one signalised dedicated right turn lane onto Wishart Road.

Wishart Road has a total of three turning lanes that includes two signalised dedicated right turn lanes onto Berrimah Road northbound, and one give way lane turn left onto Berrimah Road southbound.

Figure 12 Aerial image of the Berrimah Road and Wishart Road intersection
Source: Image - Nearmaps © 2020

5.3.2 Berrimah Road / Tiger Brennan Drive

Presented in is the signalised four-way intersection that includes Berrimah Road and Tiger Brennan Drive. Berrimah Road south has a total of five lanes at the intersection that includes one signalised right turn on Tiger Brennan Drive east, two lanes straight through to remain on Berrimah Road and two dedicated left turns onto Tiger Brennan Road west.

Tiger Brennan Drive east has a total four lanes that includes one give way left turn onto Berrimah Road, one signalised right turn onto Berrimah Road and two signalised straight through lanes to remain on Tiger Brennan Drive.

It is important to note that the construction of a grade-separated overpass that will connect Tiger Brennan Drive west to Tiger Brennan Drive east (as per the approached labelled in in Figure 13) is expected to be completed in 2022. The overpass will separate traffic from Tiger Brennan Drive and Berrimah Road, thereby enabling continuous flow of traffic along Tiger Brennan Drive. This will reduce traffic delays during peak hours, improve connectivity for freight transport to the EAW and improve safety. Additionally, an off-road cycle path along Tiger Brennan Drive from Berrimah Road to Roystonea Avenue will also be constructed as part of the overpass project.

Figure 13 Aerial image of the Berrimah Road and Tiger Brennan Road intersection

Source: Image - Nearmaps © 2020

5.3.3 Wishart Road / Kirkland Road

Presented in is the signalised four-way intersection that includes Wishart Road / Kirkland Road and Distribution Drive. Wishart Road west has four lanes that includes one dedicated left turn that allows for a give way movement onto Distribution Drive, two signalised dedicated right turns onto Kirkland Road and one straight through lane to continue onto Wishart Road.

Kirkland Road northbound has a total of three lanes that include a give way left turn onto Wishart Road, one signalised dedicated right onto Wishart Road and one combined straight through and right turn that operate in conjunction with the level crossing signals, alarm and boom gates.

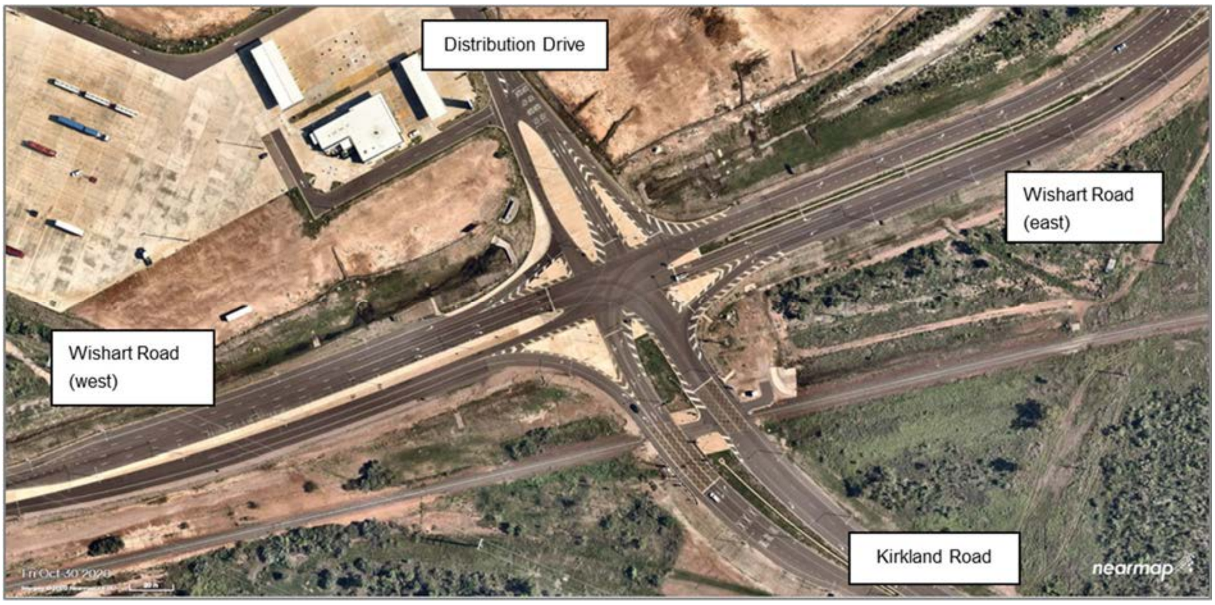

Figure 14 Aerial image of the Wishart Road and Kirkland Road intersection
Source: Image - Nearmaps © 2020

5.3.4 Tiger Brennan Drive / Wishart Road

Presented in is the four-way intersection that includes Wishart Road, Tiger Brennan Drive and Tivendale Road. Wishart Road has a total of three lanes that include a give way left turn onto Tiger Brennan Drive west, a signalised right turn onto Tiger Brennan Drive east and a signalised straight through onto Tivendale Road.

Tiger Brennan Drive west has a total of four lanes that includes two signalised straight through lanes, one give way lane left onto Tivendale Road and a signalised right lane onto Wishart Road.

Tiger Brennan Drive east has a total of four lanes that includes one give way left turn onto Wishart Road, one signalised right turn onto Tivendale Road and two straight through lanes to continue on Tiger Brennan Drive.

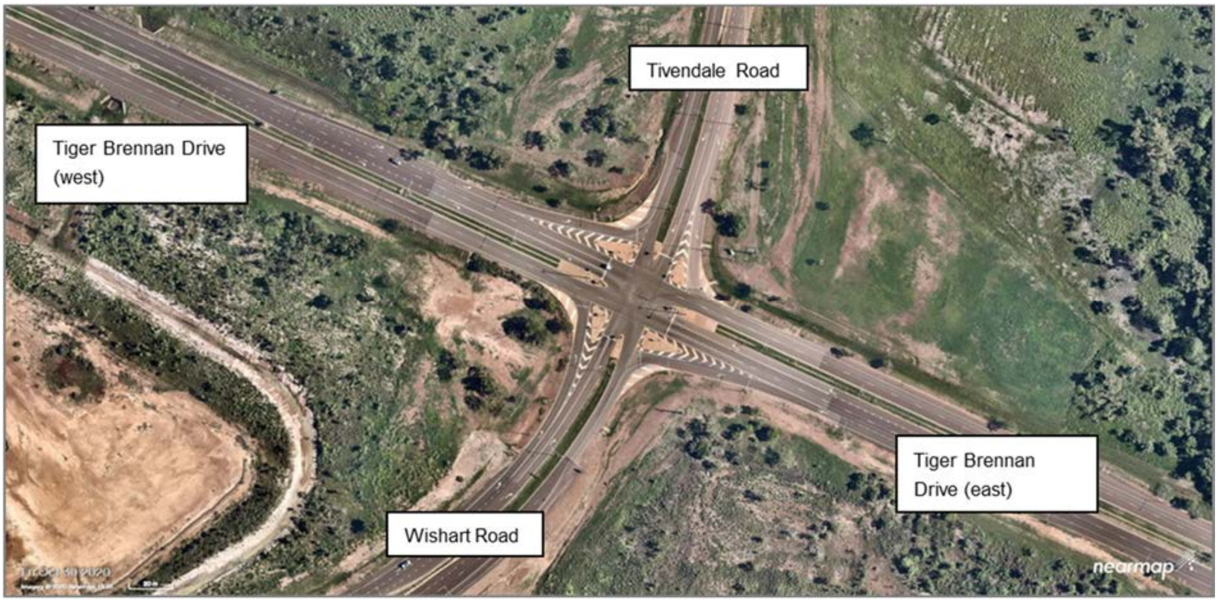

Figure 15 Aerial image of the Tiger Brennan Drive and Wishart Road intersection
Source: Image - Nearmaps © 2020

6.0 Existing Traffic Volumes

6.1 Recorded traffic volumes

Presented in and are the locations of the traffic counts that have been extracted from the traffic volume data provided by the Department of Infrastructure, Planning and Logistics (DIPL). It is important to note that traffic volume data was not available for all the roads included in this study. Traffic volume information which has been extracted includes data for the following roads:

- Berrimah Road (UDVDP029)
- Stuart Highway (UDVDP010)
- Kirkland Road (UDVDP085)
- Tiger Brennan Drive (UDVDP022).

Additionally, traffic volumes have been included for roads that are anticipated to be impacted by the proposed haulage routes, that are located outside of the primary study area. These include:

- Howard Springs Road (UDVP019)
- Arnhem Highway (UDVDP019)
- Elrundie Avenue (UDVDP061)
- Channel Island Road (UDVC072).

6.2 Traffic volume summary

Presented in Table 1 is a summary of the traffic volume data for each of the identified sites. The data presented shows the average annual daily traffic volumes for inbound (towards Darwin) and outbound flows for the period from 2014 to 2019.

The traffic volume data shows that these roads are typically operating below full capacity and many of the flows are considered as low to medium daily flow demands, in accordance with the Austroads Guide to Traffic Management Framework.

6.3 Percentage heavy vehicles

Presented in Table 2 is a summary of the vehicle classification collected at the fixed ADT station. The data indicates a relatively high proportion of heavy vehicles on Berrimah Road, Kirkland Road and Arnhem Highway, which is expected due to these roads providing a direct connection between quarry and pastoral industries to the port. It is important to note that Berrimah Road also has a high proportion of large vehicles (up to 19%) using the carriageway. No further breakdown of heavy vehicle classification is available.

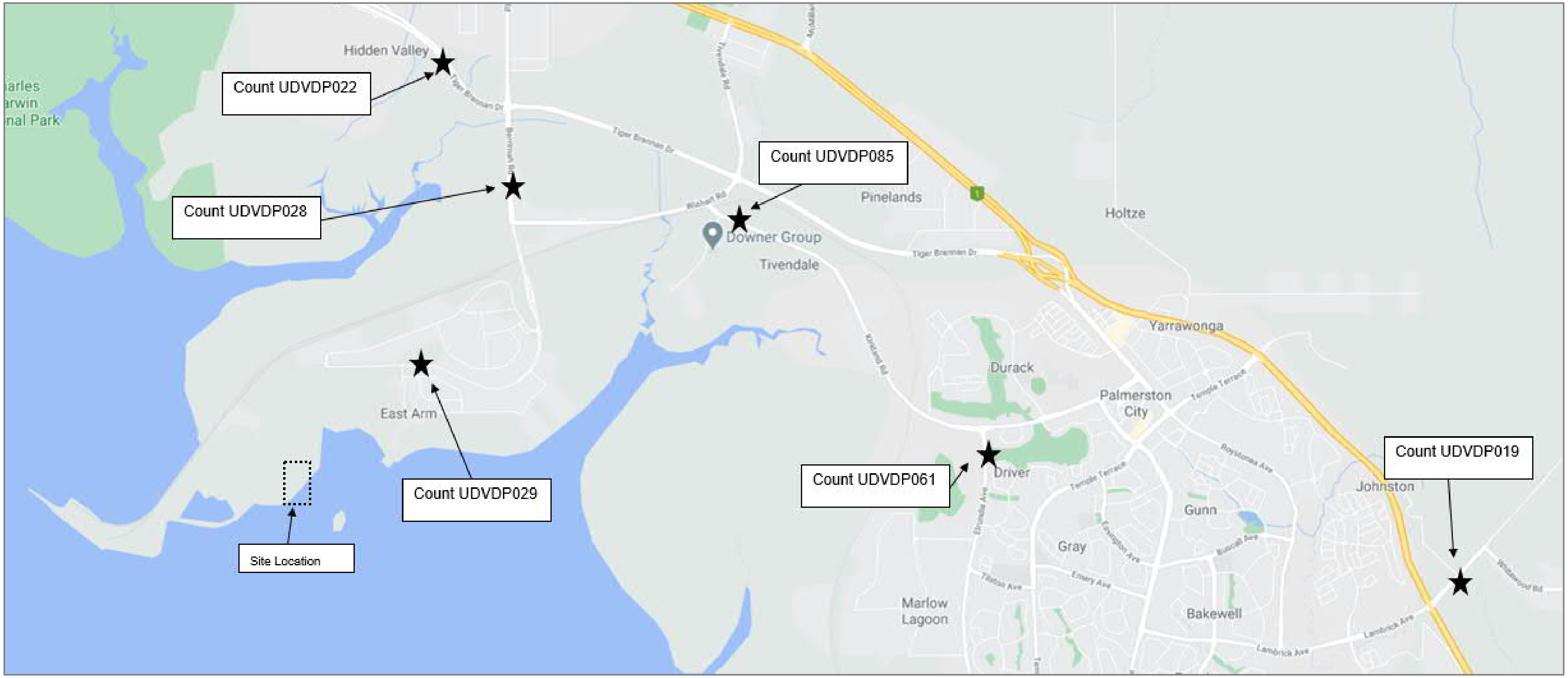

Figure 16 Traffic count locations within study area
Source: Google Maps © 2020

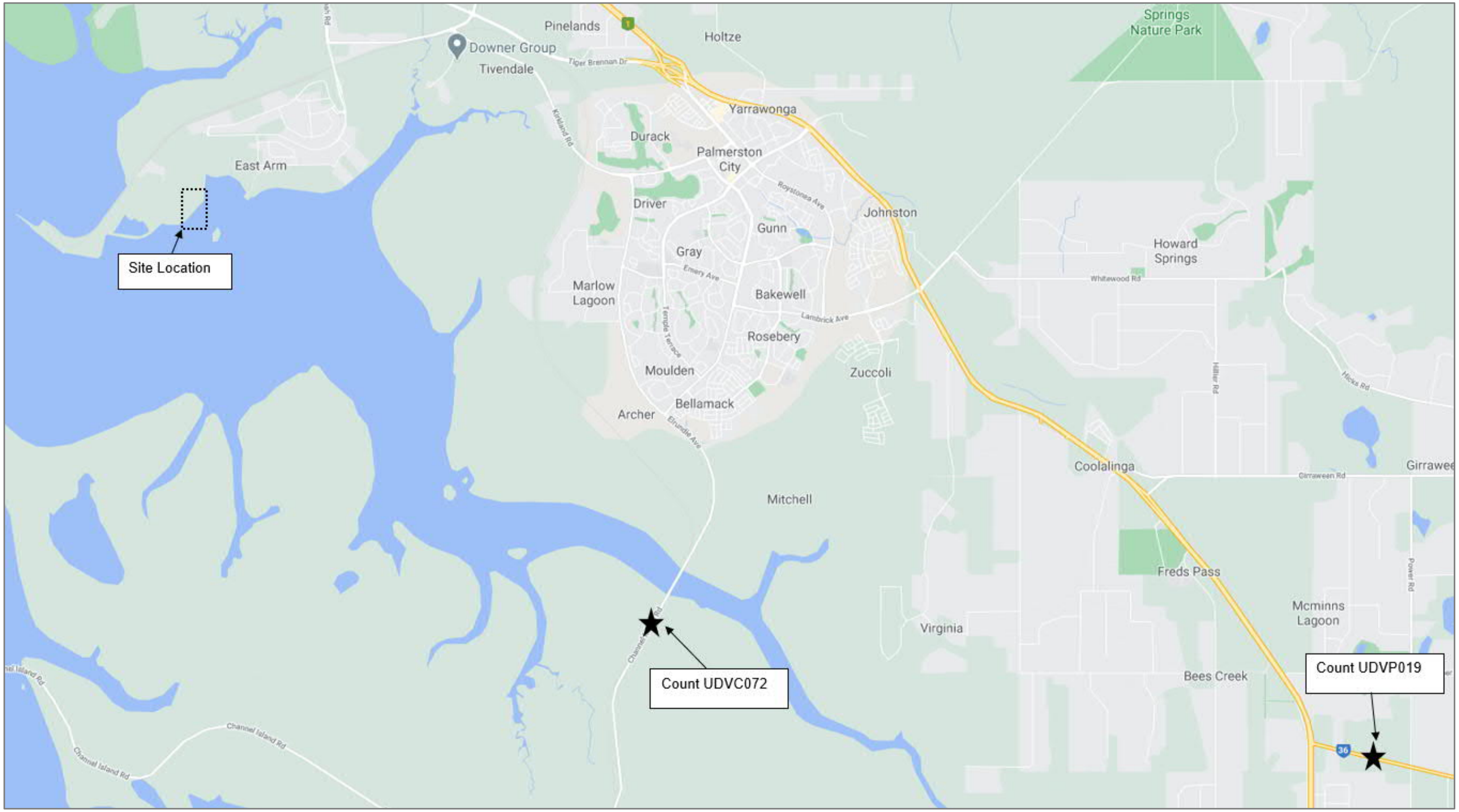

Figure 17 Traffic count locations – Channel Island and Arnhem Highway
Source: Google Maps © 2020

Table 1 Traffic volumes from 2014-19 – Annual daily average

Road	Count ID	Description	Year (Vehicles)						
			Direction	2014	2015	2016	2017	2018	2019
Berrimah Road	UDVDP029	350m West of Casey Street	Inbound	772	497	489	609	677	606
			Outbound	890	509	494	630	696	623
			Both	1662	1006	983	1239	1373	1229
	UDVDP028	400m South of Tiger Brennan Drive	Inbound	5227	5033	4919	4784	4663	4291
			Outbound	4509	4140	3840	3670	3729	3460
			Both	9786	9173	8759	5454	8392	7721
Stuart Highway	UDVDC079	Midway Yarrawonga and Tulagi Roads	Inbound	12618	11647	13035	13274	13089	13615
			Outbound	10772	10500	12845	11615	11372	10763
			Both	23390	22147	25880	24889	24461	24378
Kirkland Road	UDVDP085	500M West of Wishart Road	Inbound	5212	5675	6094	6134	5898	5757
			Outbound	4861	4969	5838	5806	5543	5449
			Both	10073	10643	11932	11940	11441	11206
Tiger Brennan Drive	UDVDP022	800M West Berrimah Road	Inbound	9989	9961	8672	10618	10919	10696
			Outbound	8676	9616	8241	9949	10245	10006
			Both	18665	19577	16913	20567	21164	20702
Channel Island Road	UDVDC072	South of Elizabeth River Bridge	Inbound	2199	1548	1385	1520	1821	950
			Outbound	2388	1812	1566	1535	1810	944
			Both	4589	3360	2924	3055	3631	1894
Howards Springs Road	UDVDP018	500m East of Stuart Highway	Inbound	4960	5037	5077	5251	4813	3894
			Outbound	5064	5061	5309	5184	4889	3885
			Both	10024	10098	10386	10435	9702	7779
Arnhem Highway	UDVDP019	500m East of Stuart Highway	Inbound	3789	3864	3782	3773	3703	3487
			Outbound	3808	3857	3789	3732	3641	3442
			Both	7597	7721	7571	7505	7344	6929
Elrundie Avenue	UDVDP061	200m South of University Avenue	Inbound	6084	6100	6112	6077	5860	5564
			Outbound	5654	5701	5776	5782	5582	5287
			Both	11738	11801	11888	11859	11442	10851

Table 2 Heavy vehicle classification

Road	Count ID	Description	Direction	Light Vehicles 3 or less axles	Heavy Vehicles (3 – 6 axles)	Large Vehicles (>6 axles)
				Classification %		
Berrimah Road	UDVDP029	350m West of Casey Street	Inbound	49	32	19
			Outbound	55	26	19
	UDVDP028	400m South of Tiger Brennan Drive	Inbound	75	19	6
			Outbound	79	17	5
Stuart Highway	UDVDC079	Midway Yarrawonga and Tulagi Roads	Inbound	Heavy Vehicle Data not available for Coverage Sites ("C")		
			Outbound			
Kirkland Road	UDVDP085	500M West of Wishart Road	Inbound	88	12	0
			Outbound	91	9	0
Tiger Brennan Drive	UDVDP022	800M West Berrimah Road	Inbound	98	2	0
			Outbound	98	2	0
Channel Island Road	UDVDC072	South of Elizabeth River Bridge	Inbound	Heavy Vehicle Data not available for Coverage Sites ("C")		
			Outbound			
Howards Springs Road	UDVDP018	500m East of Stuart Highway	Inbound	100	0	0
			Outbound	100	0	0
Arnhem Highway	UDVDP019	500m East of Stuart Highway	Inbound	90	9	2
			Outbound	90	9	2
Elrundie Avenue	UDVDP061	200m South of University Avenue	Inbound	Heavy Vehicle Data not available		
			Outbound			

6.4 Crash history

Presented in Table 3 is a summary of the crash history data recorded on roads within the study area of the Project over the past five years (2015-2019). It is important to note that data includes crash history incidents for the entire length of the carriageway, therefore some of the incidents will not be relevant to this study, particularly some of the incidents on Stuart Highway. For the purpose of analysis, crashes which occurred at the key intersections within the study area have been presented to help understand the intersection safety implications.

Tiger Brennan Drive recorded a total of 91 crashes over the five-year period and most notably two of the incidents resulted in two and three person fatalities, respectively. This is a significant number considering the length of the road, particularly when compared to the increased length of Stuart Highway. It is important to note that the construction of the planned grade-separated overpass that will separate traffic at the Tiger Brennan Driver and Berrimah Road intersection is expected to be completed in 2022. The overpass will enable continuous flow of traffic along Tiger Brennan Drive and remove a major conflict point and therefore mitigate the potential for further incidents at the intersection. Additionally, speed/red light cameras and 80 km/h zones have been implemented in the five-year period.

Berrimah Road recorded a total of 19 incidents of which one was fatal, five at the Wishart intersection and seven happened at the Tiger Brennan Drive intersection. Much of the network has undergone upgrades since these incidents occurred, particularly at key, high profile intersections such as Stuart Highway / Howard Springs Road and intersections on Wishart Road.

Table 3 Crash history from 2015-2019

Location	Total Accidents (includes entire route)	Incident Intersection (only intersections within study area are included)	Total Persons	
			Fatal	Admitted to Hospital
Berrimah Road	19	Wishart Road – 5 Tiger Brennan Drive – 7	1	2
Stuart Highway	135	Howard Springs -19 Roystonea Avenue – 4 Lambrick Avenue – 13 Tiger Brennan Drive – 1	1	33
Kirkland Road	36	Elrundie Avenue - 2 Wishart Road – 6 University Avenue – 2	0	9
Tiger Brennan Drive	91	Tivendale Drive –17 Wishart Road – 6	5	23
Wishart Road	18	Berrimah Road – 2 Kirkland Road – 5 Tiger Brennan Drive – 4	0	4

6.5 Existing public transport infrastructure

The NT Integrated Regional Transport Strategy stated that "at around 5%, Darwin has the lowest public transport mode share of any Australian capital city". At the time of writing, there are no publicised plans made available that propose improvements to public transport services or active transport infrastructure to East Arm that would promote public and active transport mode share for employees located in this area.

6.5.1 Railway

The interstate passenger rail and freight rail line are located 2.5 km from the proposed Project site and is grade separated from Berrimah Road north of East Arm and poses no constraint to vehicle access to the development.

There is no existing or proposed metropolitan passenger rail line services planned within an 800-metre walk distance of the development site, a distance that best represents the walkable catchment for passenger rail stations.

6.5.2 Bus routes

There are no existing or proposed bus services within 400 m of the development site, a distance that best represents the walkable catchment for access to bus stops.

6.5.3 Pedestrian and cycling network

The existing cycle route that is included on the regional cycle network is presented in this provides a proposed route for pedestrians and cyclists from Darwin to surrounding areas.

There is a shared path available on the southern side of Tiger Brennan Drive that continues into the Darwin CBD. Along Berrimah Road (south of the Tiger Brennan Drive intersection) on-road cycling is available in the form of a sealed shoulder. While pavement markings within the shoulder of Berrimah Road indicate that on-road cycling is supported between Tiger Brennan Drive and Wishart Road, it is unclear whether the shoulders south of the Wishart Road intersection continue to support on-road cycling. This may represent a barrier to cycle access to and from the Project site. Formalisation of the cycling route along Berrimah Road may encourage an increased cycle mode share to the East Arm precinct.

6.5.4 Footpaths

No footpath infrastructure has been identified within 1 km of the Project site.

6.5.5 Ferry services

There are two passenger ferry services operating from Darwin, which include

- Cullen Bay to Mandorah
- Cullen Bay to Tiwi Islands.

The ferry terminal, however, is not within a reasonable walking distance to the Project site so is not considered to impact travel to the Project site.

6.5.6 Existing conditions summary

This section of the assessment has set out the existing conditions of the transport network within the Project area. Key findings of the existing conditions assessment include:

- The Berrimah Road / Wishart Road intersection provides dedicated turning lanes for both inbound and outbound traffic from the site.
- The Wishart Road / Tiger Brennan Drive intersection provides dedicated turning lanes for both inbound and outbound traffic from the site.
- The Tiger Brennan Drive / Wishart intersection provides a dedicated right turn for traffic turning from Wishart Road onto Tiger Brennan Drive, the lane has significant capacity (estimated 150 m).
- Typically, Stuart Highway is a two-lane carriageway in both directions within the study area providing additional capacity and increased overtaking opportunities.
- The existing network already provides access of a high proportion of commercial vehicles.
- Public transport available to reach the Project site is very limited. Meaning it is unlikely to be significant factor for trip generation.
- Concerns with turning movements for large vehicles at the Elrundie Avenue and Kirkland Road roundabout .
- In the five-year crash analysis period, there has been a total of 299 crashes on the roads included in this review, which have resulted in seven fatalities, full details have been presented in Section 6.4.

7.0 Project Details

7.1 Overview

The proposed Project seeks to provide a facility that will enable the maintenance and servicing of Australian Defence Force and Australian Border Force vessels along with commercial and private vessels including vessels from the oil and gas marine industries. This section provides further details of the Project relating to construction and operation.

7.1.1 Construction

It is understood that approximately 500,000 cubic metres (m^3) of fill materials will be sourced from local borrow pit site(s) or clean fill sources within 20 km of the site, all material will be transported to the project site by road. The fill (400,000 m^3) will be sourced from a local quarry at either Howard Springs or Channel Island. Other material, including the pavement gravel (90,000 m^3), reclamation revetment armour rock (or quarry products for precast units) will be sourced from Mount Bundey along the Arnhem Highway. The proposed site location and haulage routes are presented in Section 8.2.2.

The Project will include both waterside and landside infrastructure, the key components of the construction phase have been presented below:

Waterside infrastructure includes:

- common user ship lift (26 m wide, 103 m long and capable of lifting vessels with up to 6 m draft and a maximum load of 5,500 t, including associated platforms, ship lift components, blocking trestles and vessel transfer system)
- six (6) berths
- heavy/lift platforms suitable for a 100 t crane at each berth
- dredged manoeuvring basin and berth pockets
- access channel with navigation aids.

Landside infrastructure includes:

- vessel transfer area and equipment including a SPMT system and SPMT garage
- ship lift control centre
- wash down area and water treatment plants
- heavy and light duty hardstand, dry berths and laydown areas
- blast and paint facility
- stormwater management system
- internal roads and car parks
- ancillary buildings including workshops and administrative offices.

shows the conceptual design of the facility including the extent of the existing MUBRF access channel which will be utilised by vessels to access the facility. No further dredging of this channel is intended.

The layout of the landside components of the facility will consider the:

- safe operational movements of all vehicles, service vehicles, operating plant and vessels
- requirements for vehicles movement and transporting vessels within the site, and connectivity between facilities.

The Project site will include the use of both existing and reclaimed land. Once constructed, the waterside and landside infrastructure combined will cover 27 ha, this includes:

- 4.5 ha of existing land
- 8.5 ha of reclaimed land

- 11.5 ha of water.

To build the landside components of the Project, approximately 715,000 m^3 of fill, 16,500 m^3 of revetment filter rock and 46,000 m^3 of armour materials are required. This is expected to comprise approximately:

- 400,000 m^3 of fill, sourced from local borrow pit site(s) or clean fill sources within 20 km of the site and transported to site by road
- 90,000 m^3 of pavement and subgrade material
- 1.2 ha of interlocking concrete block pavers for the SMPT vessel transfer areas
- 315,000 m^3 consolidated material, comprising stiff clays and rock, dredged (likely by BHD and barge) from below the ship lift system, manoeuvring basin and wet berth footprint areas which will be transported ashore.

Alternatively, a bund may be constructed within the reclamation area within which dredged material may be placed. This material would be dewatered and moved around the site for use as reclamation fill.

Filter rock (16,500m^3) will be sourced from a commercial quarry.

Armour material (46,000m^3) will either be sourced from a commercial quarry or comprise pre-cast concrete units.

Dredging is expected to be undertaken during both day and night-time hours, seven days per week. The dredging would not be continuous, and there would be periodic down time of the dredge (e.g. due to relocation of the dredge, shift changes, maintenance, and weather interruptions). Other activities associated with the dredging (e.g. pipeline relocations, anchor relocations, movement of attendant work boats and barges) will also need to occur intermittently during both daytime and night-time hours.

For other construction activities working hours will be refined by the construction contractor. Works may occur on a 24-hour basis or restricted to standard daytime hours, depending on the various factors, which may include the tasks to be undertaken, available timeframes, seasonal conditions, subcontractor agreements and environmental approval conditions.

It is anticipated there will be approximately 150 direct equivalent jobs during construction, with a large portion of the work completed within the NT.

7.1.2 Operation

The Project is anticipated to be operational by the year 2025. Companies conducting vessel maintenance services at the facility will provide their own project management team, workforce and operating methods and are accountable for their project execution, using the facility as an extension of their workplace.

Contracts will be executed between the facility operator and the users for use of defined facility infrastructure for an agreed period. Prior to access being granted, the users must demonstrate commitment to, and capability of meeting, basic and legislated health, safety, environment, security, and employee management standards, contained within a site Operational Environmental Management Plan (OEMP).

Operations are expected generally to follow standard Monday to Saturday daytime shifts, however work outside these hours may be dictated by tidal conditions and individual vessel maintenance turnaround requirements. Standard daytime hours in the NT are currently Monday to Saturday 7 am to 7 pm, and Sundays and public holidays 9 am to 6 pm.

It is anticipated that the workforce will include 15 directly employed full time staff, in addition, contract maintenance service providers will be utilised according to workloads. Contractors are predominantly expected to be located on existing industrial lots within the East Arm, therefore their impacts on the transport network may be negligible. Alternatively, external workforces may need to be bused to site to avoid generation of multiple light vehicle movements and accommodation of parking on-site.

8.0 Analysis of Transport Networks

8.1 Background and approach

To assess the anticipated impact of the construction and operation phases of the Project, analysis of the potential traffic generation associated with these activities has been undertaken. The traffic generation for the construction of the Project will depend heavily on the proposed program of the construction, which will be provided by the construction contractor. Therefore, the final elements of the construction phase are not expected to be confirmed until a construction contractor is appointed.

8.1.1 Operations phase

The operation impact of ongoing traffic generation by the Project activity is expected to be relatively minor in context of the existing road network. Contractors accessing the Project are predominantly expected to be located on existing industrial lots within the East Arm, containing the majority of traffic generation to the local road network. As the local road network has been built to accommodate the anticipated demand of the proposed developments in the East Arm area, including the Project, road access issues associated with contractors were not considered to be an issue from a volume perspective. Given the relatively low number of employees anticipated on the site (in the order of approximately 15 individuals), the estimated number of employee trips generated is expected to be negligible. Furthermore, servicing trips required to maintain site operation are likely to be minimal and can be conducted outside of peak hours. These will be detailed within a future site operational Traffic Management Plan (TMP) (refer Section 11.0). Given the anticipated low impact of traffic associated with the operations phase, this aspect has not been assessed further as part of this analysis.

There are limited personal travel alternatives to site other than by private car, and therefore the site will need to accommodate the required quantity of staff and visitor parking within the site boundary.

8.1.2 Construction phase

The most significant traffic impact is expected to be associated with the construction phase of the Project. The impact of the busiest period on the network will be used as the main focus of the review, therefore the remaining traffic impact review in this section focuses primarily on the analysis of the construction phase. The most significant concern will be the impact of additional large commercial vehicles on the road network and the associated social and safety impacts. Access into and egress from the construction site by large vehicles (up to triple road trains 53.4 m length) will also need to be accommodated.

8.1.3 Assumptions

To prepare and undertake this traffic impact assessment the following assumptions have been agreed with the NT government representative:

- Construction duration of approximately 24 months
- Triple road train vehicles will operate to site on a seven (7) days-per-week schedule
- Construction traffic hours of operation will avoid peak hour traffic periods (am and pm peak hours)
  - It is assumed that a “standard” 10-hour operational day is exclusive of the 1-hour am and 1-hour pm peak periods.
  - It is assumed that an “extended” 24-hour operational day constitutes a total of 22 hours of vehicle operation, avoiding the am and pm peak commuter periods.
- Delivery schedule at the Project site is restricted by the 12-minute unloading time required per vehicle, and only one triple road train can be accommodated on-site at any time
- Sources for construction reclamation fill material are Howard Springs or Channel Island
- Source for construction reclamation revetment (Quarry) material is Mount Bundey
- Proposed haulage routes from quarries to development site to take the shortest practicable route on roads suited to heavy haulage and triple road train geometrical requirements

- Intersection analysis to target major signalised intersections only
- Intersection analysis at Wishart Road to be cognisant of two (2) level crossings (note typically per week six (6) return services from the Adelaide Freight Terminal to Darwin, plus two (2) return Ghan passenger services on Kirkland Road and associated impact to intersection operation
- Operational base workforce of 15 personnel.

8.2 Construction trip generation and major haulage routes

8.2.1 Trip generation

This section provides details of the estimated traffic generation anticipated during peak haulage of the construction phase; the proposed haulage routes are presented in Section 8.2.2.

Presented in Table 4 are some estimated haulage calculation scenarios that demonstrate the variables that could impact the trip generation assumptions. The table provides a summary of the potential truck trip generation depending on the following factors:

- the fill site locations of Howard Springs and Channel Island (that impacts route transportation time)
- vehicle type (triple road trains)
- material weight – triple road trains can accommodate 60 t per trip, which is assumed as 30m^3 of site fill
- proposed fleet size (various)
- hours of operation (various).

It is assumed that the fill volume required will be evenly divided between the two fill source locations. If this balance should change then the quantity of trips would be somewhat impacted, with more trips required if the balance of fill increased from the Howard Springs site.

The travel time from Howard Springs is slightly longer than from Channel Island, and therefore the total time to complete the haulage program from Howard Springs will be longer than from Channel Island, assuming the same volumes, fleet size, and daily schedule.

The haulage scenario assumed for this TIA is based on a duration of truck unloading operations at site of 12 minutes, as indicated by the DIPL, limiting truck arrival rates to no more than five per hour. To avoid exceeding this limit and to ensure trucks do not queue at the site access point, a fleet size no greater than <u>three triple road trains per haulage route</u> can be accommodated. The overall haulage duration determined by this unloading restriction will be 278 days (approximately 9 months) based on a 10-hour/day schedule or 116 days (approximately 4 months) based on a 22-hour/day schedule (refer to Tables 4 and 5 for details).

Should the site unloading restriction be resolved and an increased truck fleet size could be accommodated (if for example the fill could be stockpiled on site), then site fill delivery may potentially be completed any time within approximately 3 weeks to 4 months based on increased fleet sizes and daily operational schedules (refer to Table 4).

However, with the site unloading limitations in place, the total number of round trips generated by fleets greater than three vehicles cannot be accommodated on the site (as shown in Table 5); the total duration of the site fill haulage activity is the number of operating hours scheduled per day, rather than the number of trucks within the fleet.

Presented in Table 6 is the anticipated construction program, assuming a 10-hour per day operation. The program details the timeframe that material required for construction will be delivered to site and the anticipated trip generation associated with these requirements. The total trips required to deliver each of the activities listed in Table 6 may take place any time in the period highlighted as best suits the construction schedule.

The peak period of trip generation for the purpose of this TIA is assumed to be month 11. The movements that contribute to the trip generation in month 11 of the schedule include delivery of reclamation site fill and structures material. Materials for structures will be delivered from multiple origin points (potential locations are detailed in Appendix A) and will likely only impact vehicle management at the site, which will need to be identified and resolved by the contractor's construction TMP (refer Section 11.0). These routes are therefore not included in the traffic impact assessment.

Therefore, only routes from the two (2) fill borrow pit areas have been reviewed to determine whether:

- The peak traffic generation during the Project construction period will impact current operation of the road network
- The proposed reclamation fill delivery schedule can be fulfilled given the status of the existing road network operations, or whether the schedule may need to adapt to accommodate peak commuter periods.

If the impact on the network during the peak period is deemed acceptable it will be assumed that the remainder of the program can be accommodated.

Table 4 Forecast Haulage Duration by Scenario

Activity	Material required	Source	Truck Size	Volume (m3)	Total No return trips (@ 30m3 per trip)	Total Days of Operation Required (assuming 10hr day)			Total Days of Operation Required (assuming 22hr day)		
						Fleet Size: 3 vehicles	Fleet Size: 10 vehicles	Fleet Size: 20 vehicles	Fleet Size: 3 vehicles	Fleet Size: 10 vehicles	Fleet Size: 20 vehicles
Site Fill	**Fill material**	**Howard Springs**	Triple Road Trains	200,000	6,666.7	277.8	83.3	41.7	115.7	34.7	17.4
		Channel Island		200,000	6,666.7	246.9	74.1	37.0	102.9	30.9	15.4

Table 5 Forecast Daily Haulage Scenario based on Site Unloading Restrictions

Fill Site	Cumulative Trips Per Hour for Differing Fleet Sizes (operations excluding peak commuter hours)			
	Fleet Size: 3 vehicles	Fleet Size: 6 vehicles	Fleet Size: 10 vehicles	Fleet Size: 20 vehicles
Howard Springs	2	5	8	16
Channel Island	3	5	9	18
Total Hourly Round Trips	**5**	**10**	**17**	**34**

Table 6 Indicative Construction Program and Selected Peak Period

Construction Activity	Month and Total Trip Generation																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Revetment	275 trips																							
Drainage layer																								
Site filling				13,333 trips																				
Pavements													2,630 trips											
Other concrete																								
Piling			112 trips																					
Drainage														60 trips (triple) 180 trips (single trailer)										
Water retic																								
Sewerage																								
Structures									660 trips (triple) 1,980 (single trailer)															

All trip generation forecasts shown in Table 5 are based on advice received from DIPL and/or calculations based on haulage rates from DIPL.

8.2.2 Proposed haulage routes and travel times

As presented in Section 8.2 based on the peak delivery period for construction materials, vehicles will be travelling to and from one of two local quarries. Routes to both quarries have been reviewed for this TIA. The site details are as follows:

- **Howard Springs** – approximately 24 km from Project site, estimated one-way trip – 21 minutes.
- **Channel Island** – approximately 21 km from Project site, estimated one-way trip – 18 minutes: alternative source fill.

Other assumptions built into the return trip travel time calculation include:

- Materials loading and unloading – 24 minutes per trip
- Refuelling – average 1 minute per hour
- Driver rest breaks – average of 6 minutes per hour.

Additional sites will also be used to source structural material during the same period of the construction program, however these sites have not been included in the assessment as the trips are not expected to be undertaken during the daily am and pm peak periods on the road network. These include:

- **Downer Group** – approximately seven (7) km, estimated one-way trip – seven (7) minutes.
- **NT Bitumen** – approximately 18 km, estimated one-way trip – 12 minutes.
- **Hanson Constructions** – approximately 12 km, estimated one-way trip – 12 minutes.
- **Humes depot, Winnellie** – approximately 13 km, estimated one-way trip – 14 minutes.

8.2.2.1 Howard Springs

The Howard Springs site is situated approximately 24 km from the Project site and for the purpose of this analysis is the assumed alternative source of fill material and the preferred location for gravel. The site location and assumed route is presented in .

The haulage route from the Howard Springs quarry to the Project site will begin on Howard Springs Road where the quarry is located. The haulage trucks will use this road to reach the signalised intersection with Stuart Highway via the dedicated right turn, then continue onto Stuart Highway before merging on Tiger Brennan Drive (grade separated) left onto Wishart Road via a signalised interchange passing through the signals at the Kirkland Road intersection. It will continue on Wishart Road until the signalised intersection with Berrimah Road before turning left onto Berrimah Road where it will continue until it reaches the Project site. It is expected that the same route will be taken in reverse for outbound trips.

The Howard Springs haulage route provides a direct and efficient route to the Project site. Additionally, the route will use roads and intersections that already provide access for heavy vehicles meaning no additional provision will be required and no concerns on the route regarding turning movements.

The critical Intersections the haulage route will use:

- Stuart Highway and Howard Springs / Lambrick Avenue
- Stuart Highway / Temple Terrace / Glyde Point Road
- Tiger Brennan Drive and Wishart Road / Tivendale Road
- Wishart Road and Kirkland Road
- Wishart Road and Berrimah Road.

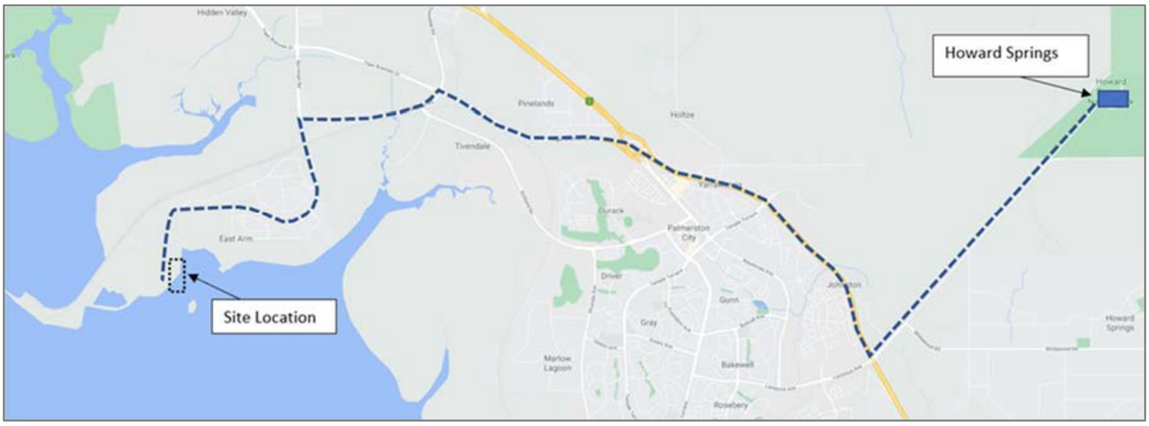

Figure 18 Howard Springs site location and proposed haulage route
Source: Google Maps © 2020

8.2.2.2 Channel Island

The Channel Island site is situated approximately 21 km from the Project site and for the purpose of this analysis is the assumed source of fill material. The site location and proposed vehicle route is presented in .

The haulage route from the Channel Island site to the Project site will begin on Channel Island Road, haulage trucks will take a left turn from the site onto Channel Island Road which merges into Elrundle Avenue further to the north, the route will follow Elrundle Avenue until it reaches a roundabout which allows a left turn onto Kirkland Road. From Kirkland Road it will turn left onto Wishart Road via the signalised intersection before turning onto Berrimah Road where it will continue onto the Project site. It is expected that the same route will be taken in reverse for outbound trips.

This route provides the most direct and efficient route for vehicles to access the site, however there are concerns with some sections of the route being located in close proximity to residential properties, specifically on Elrundie Avenue, which also has a number of small turning movements into residential areas raising both potential noise and safety concerns. However, it is important to note that Elrundie Avenue is one of the three (3) main routes currently used to haul products to the main arterial (Stuart Highway).

The geometry of the intersection with Kirkland Road and Elrundie Avenue can accommodate the turning requirements of a 53.4 m triple road train; the roundabout is approximately 47 m in diameter and offers a 10.5 m wide circulating carriageway meaning that a triple road train is expected to be able to perform the required turn (illustrated in). However, these vehicles will not be lane correct throughout the turning movement and will use all of the circulation way when making this turn. If this route is adopted, then a review of the safety considerations at this intersection will need to be addressed in the contractor's construction TMP.

There are two (2) level crossings on Kirkland Road that provide for approximately two (2) rail movements per day, these are slow moving trains meaning that boom gates can be down for several minutes at a time. It is important to note however that the rail traffic is scheduled to use these crossings outside of peak hour traffic and is not expected to impact peak hour operations at the Kirkland and Wishart Road intersection. Therefore, due to the combination of the low frequency services and the operation times of these boom gates, the likely delay is expected to minimal. However, based on this information, it is likely that the TMP and haulage schedule will need to take account of this potential impact.

The critical Intersections the haulage route will use:

- Elrundie Avenue and Kirkland Road / University Avenue Roundabout
- Wishart Road and Kirkland Road – Signalised
- Wishart Road and Berrimah Road – Signalised
- Two (2) Level Crossings.

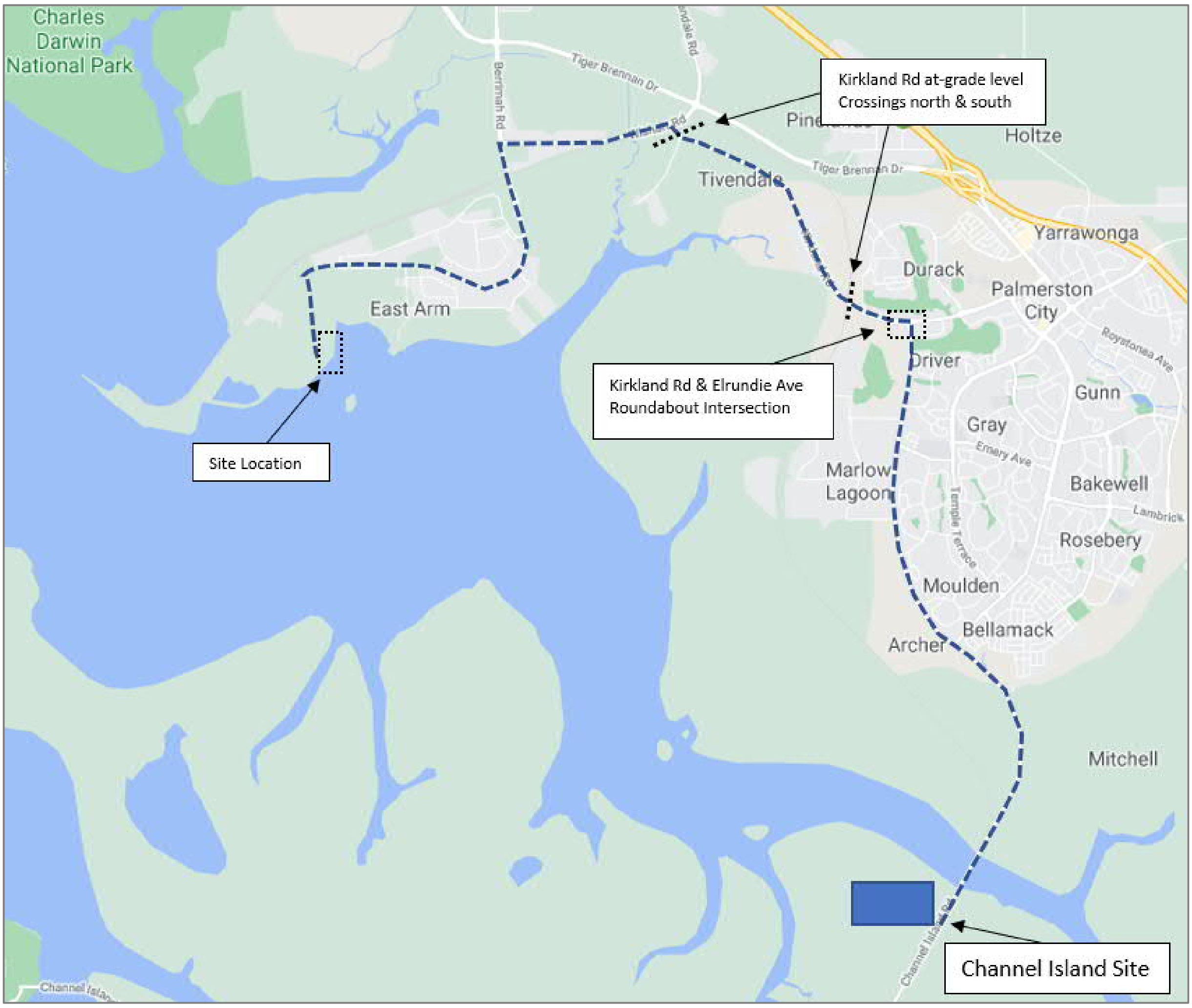

Figure 19 Channel Island site location and proposed haulage route
Source: Google Maps © 2020

Figure 20 Sketch of the Kirkland Road / Elrundie Roundabout turning movement for a Triple Road Train
Source: Google Maps © 2020

8.2.2.3 Proposed haulage summary map

A summary map has been presented in to illustrate on the network the proposed haulage routes for all of the key material sites associated with the land reclamation. The map shows that all of the proposed routes will use Wishart Road to access Berrimah Road. The haulage route from Channel Island is expected to travel through the residential area using Elrundie Avenue and Kirkland Road until the intersection with Wishart Road where all three routes merge.

Figure 21 Proposed critical haulage routes – Summary map
Source: Google Maps © 2020

9.0 Road Network Assessment

9.1 Background and approach

SIDRA intersection analysis has been conducted on each of the identified critical intersections featured in the study area. The goal of this assessment is to investigate the existing peak hour traffic impact on the relevant intersections on the identified haulage routes to indicate whether a small increase in traffic associated with the construction phase of the Project is likely to impact the operation of the existing network or whether the network will impact delivery of the Project haulage schedule.

The anticipated rate of one triple road train every 12 minutes does not merit modelling, however modelling of the background traffic will highlight any prospective issues for the construction phase.

Any change to site restrictions that allows for significantly faster processing of trucks (less than half the time, e.g. less than 6 minutes per truck) or the ability to unload more trucks simultaneously (greater than two at a time) would impact the operation of intersections reviewed by this TIA, as shown by the total round trip forecasts in Table 5.

9.1.1 Cumulative traffic volumes

The cumulative traffic volumes have been calculated using data from the DIPL 2019 traffic counts and data from the NT Government regarding the anticipated trip generation on the network during the construction and phase.

9.1.2 Performance metrics and level of service targets

The network results of the analysis summarised in this report are presented in terms of:

- Delay – The average delay experienced per passenger car unit (measured in seconds).
- Level of Service (LoS) – The LoS (ranging from A to F) provides an indicator of the performance of the network or individual movement based on the average delay per passenger car unit (PCU). The LoS for intersections during peak periods (as defined in Transportation Research Board’s Highway Capacity Manual - Special Report 209) shall be Level D or higher, with no individual major movement having a LoS lower than Level D and no individual minor movement having a LoS lower than Level E.
- Degree of Saturation (DoS) – The DoS is a ratio of the demand to capacity, with DoS over 90 percent indicating a congested intersection, and DoS of 100 percent indicating an intersection at capacity and DoS over 100 percent indicating oversaturated conditions. The DoS provided represents the maximum DoS at the intersection. The DoS for signalised intersections should generally not exceed 0.90 in accordance with the Austroads Guide to Traffic Management Part 12.
- Queue – The length of the average maximum back of queue (measured in metres).

9.2 Intersection assessments

The performance and safety of intersection operations is a critical consideration for the Project. The performance of an intersection has the potential to affect where on the network additional traffic volumes and where there is significant change to the traffic composition of turning vehicles. It is the aim of this analysis to determine the existing performance of the critical intersections on the primary proposed construction haulage routes.

Three (3) critical intersections have been modelled using SIDRA Intersection (Version 9.0) for the 2020 morning and afternoon peak periods. As the scope of works for the Project includes only the elements immediately associated with the construction of the Project it is assumed that all other transport outside of this scope are not covered by this transport assessment.

It is important to note that the SIDRA analysis was completed with the following constraints and assumptions applied:

- Accurate data for cycle times, phase frequencies and average phase times within the peak hours was not available. Therefore, for the purpose of the analysis, a sensible phasing arrangement from the available SCATS information was adopted and both the cycle and phase times were optimised in SIDRA.

- The heavy vehicle proportions referenced from the available data are based on daily mid-block counts and only at selected locations. Therefore, the heavy vehicle assumptions are high-level and likely to be conservative, because typically fewer heavy vehicles travel during the network peak hours.
- The conservative heavy vehicle assumptions adopted is the likely reason why Tiger Brennan Drive / Wishart Road operates close to (though slightly below) maximum capacity (DoS 1.0).

9.2.1 Tiger Brennan Drive / Wishart Road Intersection

The Tiger Brennan Drive / Wishart Road intersection is a four-way signalised intersection. The existing intersection layout is presented in and the SIDRA results for the peak periods are presented in Figure 22 and Table 7.

The results show that in both the am and pm peak periods, the intersection is operating above the acceptable DoS threshold for a signalised intersection (DoS<0.90). In the am peak period, the critical 95th percentile queue extends 614m for the eastern through movement. In the pm peak period, the critical 95th percentile queue extends 579 m on the western through movement.

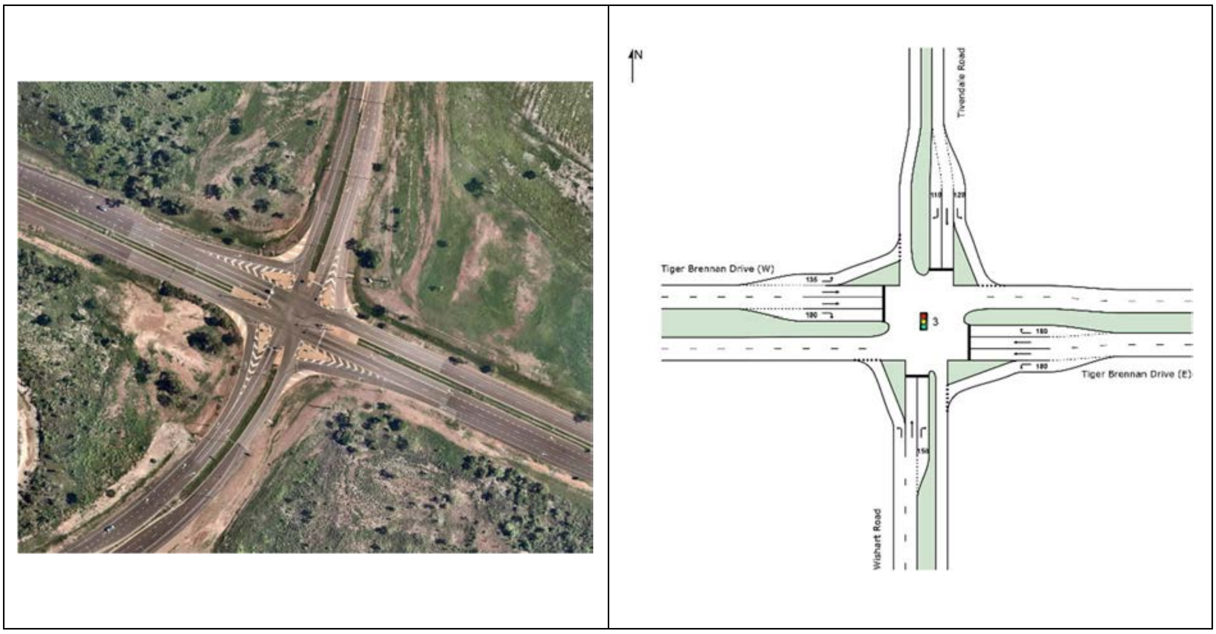

Figure 22 Tiger Brennan Drive / Wishart Road intersection – Aerial view and SIDRA layout

Table 7 Tiger Brennan Drive / Wishart Road intersection – SIDRA results

Analysis scenario	DoS	Intersection LoS (delay based)	Critical average delay (seconds)	95% back of queue distance (m)
2020 AM Peak	0.999	LoS F	118	614 (Eastern Thru)
2020 PM Peak	0.968	LoS F	119	579 (Western Thru)

It is important to note that although the SIDRA analysis presented shows that the intersection may not be operating at a desired level of service during the morning and afternoon peak periods, the traffic volumes throughout the remainder of the day are found to decrease significantly. Therefore, the intersection is expected to operate at an acceptable level of service throughout the majority of the day.

The 15-minute SCATS traffic volumes for the Tiger Brennan Drive/Wishart Road intersection have been presented in . This graphic indicates the significant peak in traffic volumes for the assessed peak periods (7:15-8:15 am and 4:15-5:15 pm). In the morning, the traffic volumes decrease from approximately 700 vehicles per 15-minute period to approximately 350 vehicles per 15 minutes by approximately 9:00 am.

Similarly, in the afternoon, the data indicates that traffic volumes increased from approximately 500 vehicles to 700 vehicles per 15 minutes over the course of 30-minute period (from 4:00 pm to 4:30 pm). Following the afternoon peak period, the traffic volumes again decrease significantly after 5:15 pm and continue to decrease in the later hours as expected.

As a sensitivity test, a SIDRA analysis has been undertaken during an off-peak period between 9:00 to 10:00 am (results presented in Table 8) to give an indication of the typical operation of the intersection during the day between the peak periods indicated in .

The results show that the intersection is operating below the acceptable DoS threshold for a signalised intersection (DoS<0.90) at 0.506. In this period, the average delay is 35 seconds compared to 118 and 119 seconds in the am and pm peak periods. Therefore, outside of the peak periods where the traffic demand is seen to become particularly concentrated, the intersection is expected to operate at a satisfactory level of service.

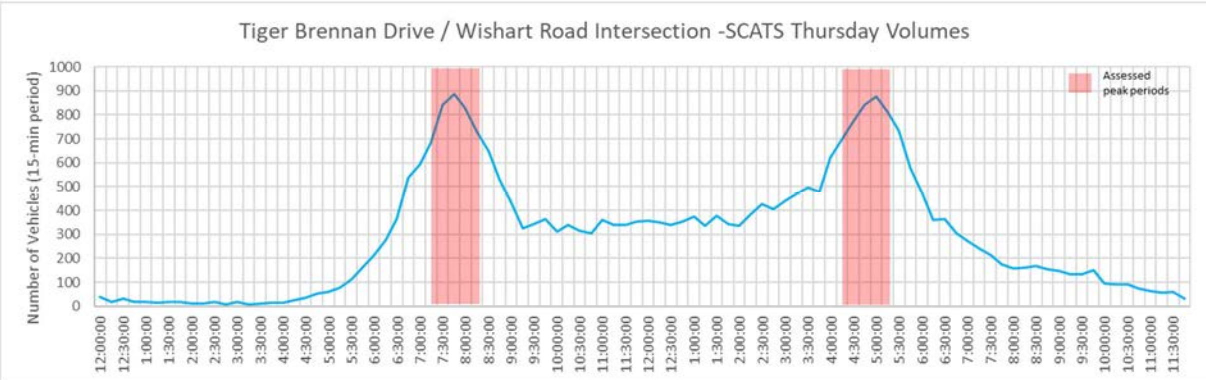

Figure 23 Traffic volumes at the Tiger Brennan Drive / Wishart Road intersection

Table 8 Tiger Brennan Drive / Wishart Road intersection – Off-peak SIDRA results

Analysis scenario	DoS	Intersection LoS (delay based)	Critical average delay (seconds)	95% back of queue distance (m)
2020 Off-peak period	0.506	LoS C	35	41

9.2.2 Berrimah Road / Wishart Road intersection

The Berrimah Road / Wishart Road intersection is a signalised T-intersection. The existing intersection layout and SIDRA assessed layout is presented in . The results of the SIDRA analysis are presented in Table 9.

The results show that in both the am and pm peak periods, the intersection is operating within the acceptable DoS threshold for a signalised intersection (DoS<0.90).

In the am peak period, the critical 95th percentile queue extends 157 m for the eastern right turn movement; however, as this is a dual right lane, it is expected that vehicles will begin to occupy the full-length lane when the short lane (150 m) has reached its storage capacity.

In the pm peak period, the critical 95th percentile queue extends 167 m on the southern right turn movement. This is a short lane with a queue storage of 115 m, meaning that the short lane will likely queue into the adjacent, full-length through lane in this peak. However, the southern through lanes only each experience a queue of 35 m, therefore the overflow of the right turn lane is not anticipated to significantly impact the through traffic.

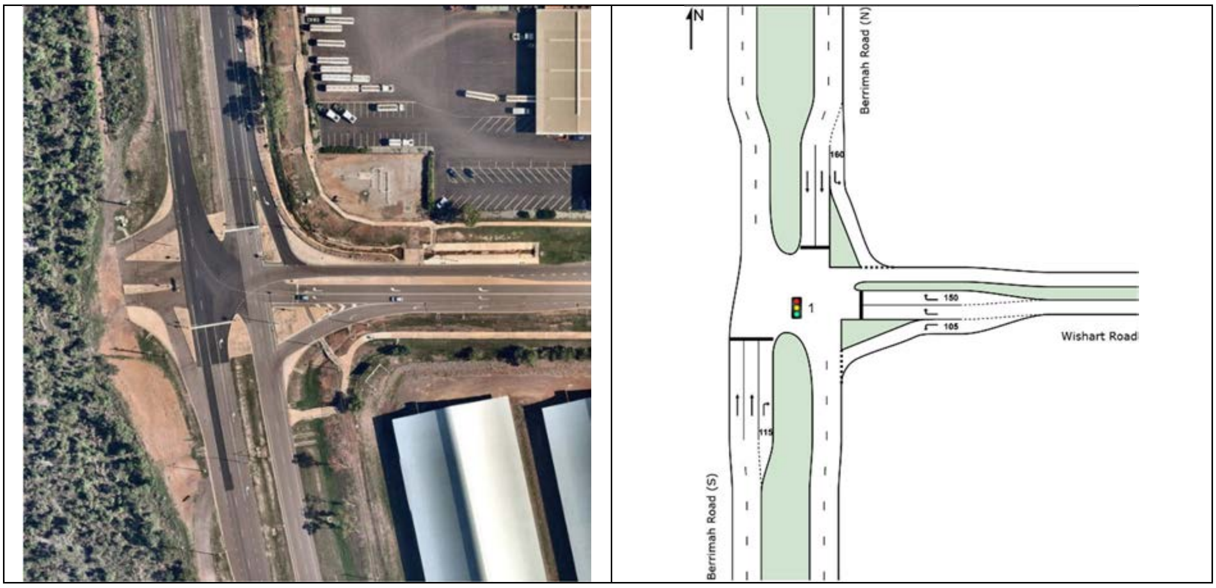

Figure 24 Berrimah Road / Wishart Road intersection – Aerial view and SIDRA layout

Table 9 Berrimah Road / Wishart Road intersection – SIDRA results

Analysis scenario	DoS	Intersection LoS (delay based)	Critical average delay (seconds)	95% back of queue distance (m)
2020 AM Peak	0.464	LoS D	36	157 (Eastern RT)
2020 PM Peak	0.424	LoS C	24	167 (Southern RT)

9.2.3 Wishart Road / Kirkland Road intersection

The Wishart Road / Kirkland Road intersection is a four-way signalised intersection presented in .The existing intersection layout and SIDRA assessed layout are shown in and the SIDRA results are presented in Figure 25 and Table 10.

The results show that in both the am and pm peak periods, the intersection is operating within the acceptable DoS threshold for a signalised intersection (DoS<0.90). In the am peak period, the critical 95th percentile queue extends 113 m for the eastern through movement. This is a full-length lane, and both short lanes on either side of the through lane extend further than the back of queue distance so is not expected to block vehicles from entering these turning lanes.

In the pm peak period, the critical 95th percentile queue extends 377 m on the eastern left turn movement. This is a short lane with a queue storage of 305 m, meaning that the short lane will likely queue into the adjacent, full-length through lane in this peak. It is noted that the western through lane also experiences a 95th percentile queue of 360 m.

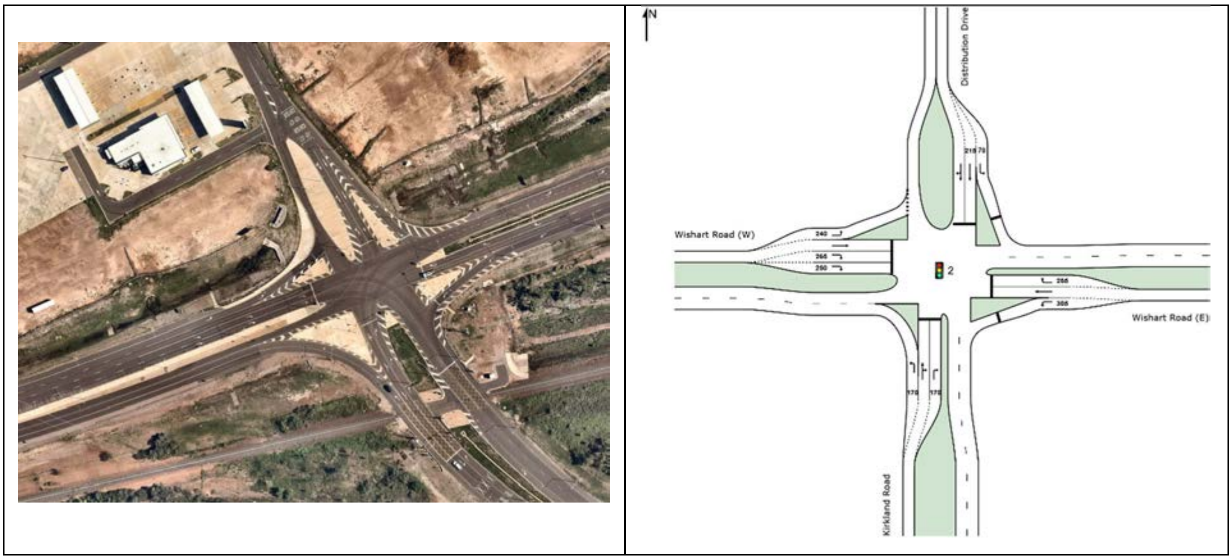

Figure 25 Wishart Road / Kirkland Road intersection – Aerial view and SIDRA layout

Table 10 Wishart Road / Kirkland Road intersection – SIDRA results

Analysis scenario	DoS	Intersection LoS (delay based)	Critical average delay (seconds)	95% back of queue distance (m)
2020 AM Peak	0.390	LoS C	28	113 (Eastern Thru)
2020 PM Peak	0.843	LoS D	43	377 (Eastern LT)

9.2.4 Summary of existing intersection performance and impact to the Project

Three (3) main intersections were modelled to determine the current performance during the am and pm peak hour periods at the following locations:

- Tiger Brennan Drive / Wishart Road
- Berrimah Road / Wishart Road
- Wishart Road / Kirkland Road.

Berrimah Road / Wishart Road intersection and Wishart Road / Kirkland Road intersection both operate satisfactorily during both peak periods, despite the conservative heavy vehicle percentages applied. Therefore, it is unlikely that the construction traffic associated with the Project will impact existing network operations at these locations, nor will the existing network impact the proposed delivery schedule.

However, the modelling of the Tiger Brennan Drive / Wishart Road intersection suggests it is operating at a LoS F during both peaks, which suggests flow breakdown is likely due to higher levels of congestion. In this case, it is believed that the SIDRA model is likely over-estimating the level of impact associated with the conservative heavy vehicle percentages applied in the model. Nevertheless, the output indicates that utilising this intersection for the Project construction traffic during peak hour would be inadvisable and the delivery schedule would be recommended to take into account potential delays at this intersection during busier periods of network operation.

The addition of up to five (5) additional truck movements per hour associated with the construction phase of the Project at each of the above intersections is unlikely to significantly alter the existing network analysis results outlined above.

10.0 Site Arrangements

10.1 Access and egress

Site access and egress at East Arm will need to accommodate entry, exit and internal manoeuvres of triple road train vehicles. The construction and operational TMPs will need to ensure that vehicle entry and exit is not compromising road vehicle safety and mobility on Berrimah Road.

10.2 Construction parking

The site will need to accommodate parking for all construction related employees undertaking work on-site. Specific and suitable parking locations for light vehicles will need to be demonstrated in the contractor's TMP.

There may be a requirement for larger vehicles to park on site during the day or overnight. Specific and suitable parking locations for heavy vehicles will need to be demonstrated in the contractor's construction TMP.

10.3 Operational parking

The Project is planned to be operational in 2024. Vehicles will continue to access the site via Berrimah Road. Vehicle traffic generated by the site is expected to be consistent with the type of traffic currently generated by the EAW and other nearby industries and is likely to include light vehicles and 4WD utilities, rigid body trucks, gross mass vehicles without trailers, articulated vehicles, B-Doubles, fuel transport vehicles, heavy lift and franna cranes and elevated work platforms.

Operations are expected generally to follow standard Monday to Saturday daytime shifts, however work outside these hours may be dictated by tidal conditions and individual vessel maintenance turnaround requirements. Standard daytime hours in the NT are currently Monday to Saturday 7 am to 7 pm, and Sundays and public holidays 9 am to 6 am.

Fifteen (15) full time equivalent (FTE) roles are expected on site once the facility is fully completed. In addition, contract maintenance service providers will be utilised according to workloads. Contractors are predominantly expected to be located on industrial lots within East Arm. The site road layout and car parking will be designed to facilitate staff, servicing requirements and emergency vehicle access.

11.0 Management Measures

Following an assessment of the potential Project traffic and transport impacts in Section 9.0 of this report, the following section outlines recommendations for management and mitigation measures for identified impacts.

11.1 Intersection upgrades

It is considered that upgrades to existing intersections will not be required due to a combination of the existing network being suitable for existing and proposed trip generation and the location of the scheme.

11.2 Traffic management

A separate detailed TMP should be prepared and approved for both the construction and operational phases. These detailed TMPs should be prepared and approved prior to construction works taking place or to the operation of the facility.

11.2.1 Construction and Traffic Management

The Construction TMP should take into consideration the following components for the construction phase:

- Haulage routes and circulation within site
- Requirement for over dimensional Permits
- Requirement for traffic controllers
- Community consultation
- Dates and duration of construction
- Access and egress on construction site for triple road train manoeuvring
- Compliance with driver facility legislation.

11.2.2 Operations traffic management

The Operational TMP should take into consideration the following components for the operation phase:

- Onsite parking provided
- Safe access and egress from site
- Safe passage from access road to parking area
- Convenient and obvious ways to approach the entrance to the car park
- Convenient and safe ways of circulating within the car park and advice about the location of pedestrian access to entrance doors
- Safe routes to walk amongst or past parked cars to reach entrance doors.

11.3 Haulage compliance measures

11.3.1 Road axle limits

This Project is expected to increase the number of axle repetitions the road pavement is exposed to, particularly during the 24-month construction period. It is assumed that the road pavements in the study area have been designed to withstand a certain number of axle repetitions which are forecast during the design life of the road due to the existing demand of heavy vehicles on the network.

However, the additional number of heavy vehicles forecast to be generated by the Project is expected to increase the wear on the pavement and increase the likelihood that minor maintenance might be required. With no assessment of the roads in the study areas outlining the current condition or age of the pavement, it is not possible at this time to quantify the impact the Project might have on the road surfaces.

It is recommended that a pavement condition program be implemented to monitor the impact and identify any deterioration to the road pavement over the duration of construction. In order to do this a baseline study must be completed to identify the existing conditions of the exiting public routes, which are to become part of the haulage routes.

11.3.2 Securing loads

It is assumed that all loads being transported to and from the site will be secured in accordance with the relevant legislation. All vehicles must be correctly licenced and compliant with relevant up to date legislation. Legislation: NT Traffic Regulations 1999.

11.4 Management of driver fatigue

During the construction there is the potential risk of driver fatigue due to the volume of materials required for completion of the works. This risk will be managed through the appropriate implementation of a Fatigue Management System (FMS) in accordance with the Northern Territory Road Transport Fatigue Management Code of Practice.

This code of practice, this has been developed “to assist transport operators to implement management systems which meet occupational health and safety obligations under the Work Health Act in relation to driver fatigue”.

11.5 Incident management

Due to the nature of the Project, it is expected that relevant guidelines will be adhered to. It is expected that an Incident Management Plan will be utilised in order to set out processes and response measures that are to be implemented in case of a non-compliance to relevant guidelines or should an emergency situation arise.

12.0 Summary and Conclusions

This report has assessed the potential impacts of the Project in response to the EIS ToR and the initial Project risk assessment.

12.1 Construction

In summary, in relation to construction this report concludes that:

- The Project is estimated to generate in excess of 10,000 additional trips in total over the duration of 24-month construction phase. Month 11 of the program is currently forecast to deliver the greatest single daily movement with over 100 heavy vehicle return trips per day during that period.
- The additional trip generation created by the proposed construction schedule is not predicted to have a significant impact on the LoS or intersection performance.
- Road safety is not expected to increase disproportionally because of the construction or operation phases of the development.
- A review of the proposed haulage routes identified the most direct and efficient routes for trucks and established preferable site usage.
- The SIDRA analysis identifies that the identified critical intersections currently operate within the DoS threshold for a signalised junction (excluding the Tiger Brennan Drive and Wishart intersection).

  Three (3) intersections were modelled during the am and pm peak hour periods:

  - Tiger Brennan Drive / Wishart Road.
  - Berrimah Road / Wishart Road.
  - Wishart Road / Kirkland Road.

  Tiger Brennan Drive / Wishart Road intersection modelling outputs suggest it is operating at a LoS F during both peaks, which suggests that flow breakdown is likely to occur. However, it is believed that the SIDRA model is likely over-estimating the level of impact associated with the conservative heavy vehicle percentages applied. Nevertheless, the output indicates that utilising this intersection for the Project construction traffic during peak hour would be inadvisable and the delivery schedule would be recommended to take into account potential delays at this intersection during busier periods of network operation.
- The addition of up to five (5) additional truck movements per hour associated with the construction phase of the Project at each of the above intersections is unlikely to significantly impact the existing network analysis results outlined above. Safety management plans are proposed in order to manage issues and incidents during construction.
- To avoid exceeding the on-site limitation of five vehicles per hour and trucks queuing at the site access point, it was concluded that a fleet size of no greater than three triple road trains per haulage route would be able to be accommodated.
- The overall haulage duration determined by this unloading restriction could be 278 days (approximately 9 months) based on a 10-hour/day schedule or 116 days (approximately 4 months) based on a 22-hour/day schedule.
- Site access and egress at East Arm will need to accommodate entry, exit and internal manoeuvres of triple road train vehicles. The construction TMP will need to ensure that vehicle entry and exit is not compromising road vehicle safety and mobility on Berrimah Road.

12.2 Operation

In summary, in relation to construction this report concludes that:

- Vehicle traffic generated by the site is expected to be consistent with the type of traffic currently generated by the EAW and other nearby industries and is likely to include light vehicles and 4WD utilities, rigid body trucks, gross mass vehicles without trailers, articulated vehicles, B-Doubles, fuel transport vehicles, heavy lift and franna cranes and elevated work platforms.

- Operation is expected to include approximately 15 full time staff.
- Operations are expected generally to follow standard Monday to Saturday daytime shifts, however work outside these hours may be dictated by tidal conditions and individual vessel maintenance turnaround requirements. Standard daytime hours in the NT are currently Monday to Saturday 7 am to 7 pm, and Sundays and public holidays 9 am to 6 pm.
- To ensure safe movement in and out of the Project site an Operational TMP should be prepared that outlines the safe manoeuvring space for large vehicles on-site, dedicated access and egress point for all vehicles and pedestrians, and allocation of adequate parking to account for the needs of all employees and visitors to the site.

12.3 Recommendations

To mitigate potential impacts caused by this development, the following recommendations have been proposed.

- A separate detailed TMP should be prepared and approved for both the construction and operational phases. These detailed TMPs should be prepared and approved prior to construction works taking place or to the operation of the facility.
- Construction traffic should avoid the identified peak hour traffic periods where possible in order to mitigate impacts and potential delays
- The construction program should avoid scheduling delivery of multiple construction parts and materials wherever possible to reduce the risk of excessive deliveries and trips on the network
- Safe access and egress from site should be a key focus for the appointed construction contractor due to slow moving large vehicles during the construction phase.

13.0 References

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Appendix A

Additional Haulage Routes

Appendix A Additional Haulage Routes

Downer Group

Figure 26 Downer Group Site and proposed haulage route

Source: Google Maps © 2020

NT Bitumen

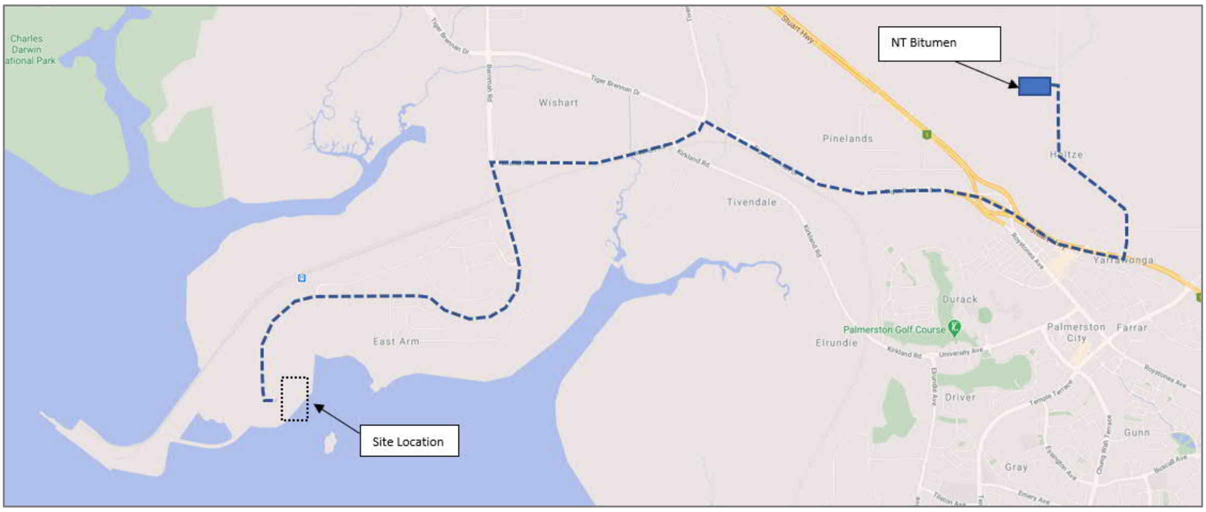

Figure 27 NT Bitumen site location and proposed haulage route

Source: Google Maps © 2020

Hanson Constructions

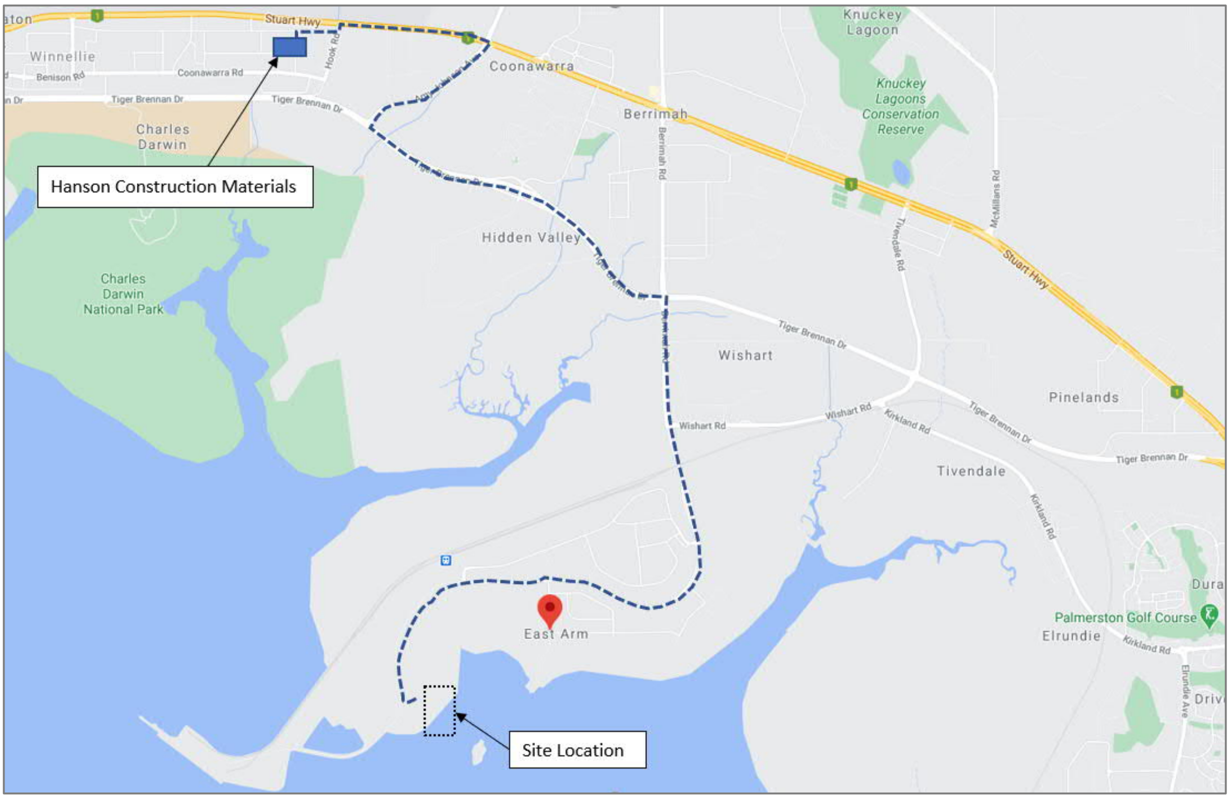

Figure 28 Hanson Construction Materials site location and proposed haulage route

Source: Google Maps © 2020

Humes Depot, Winnellie

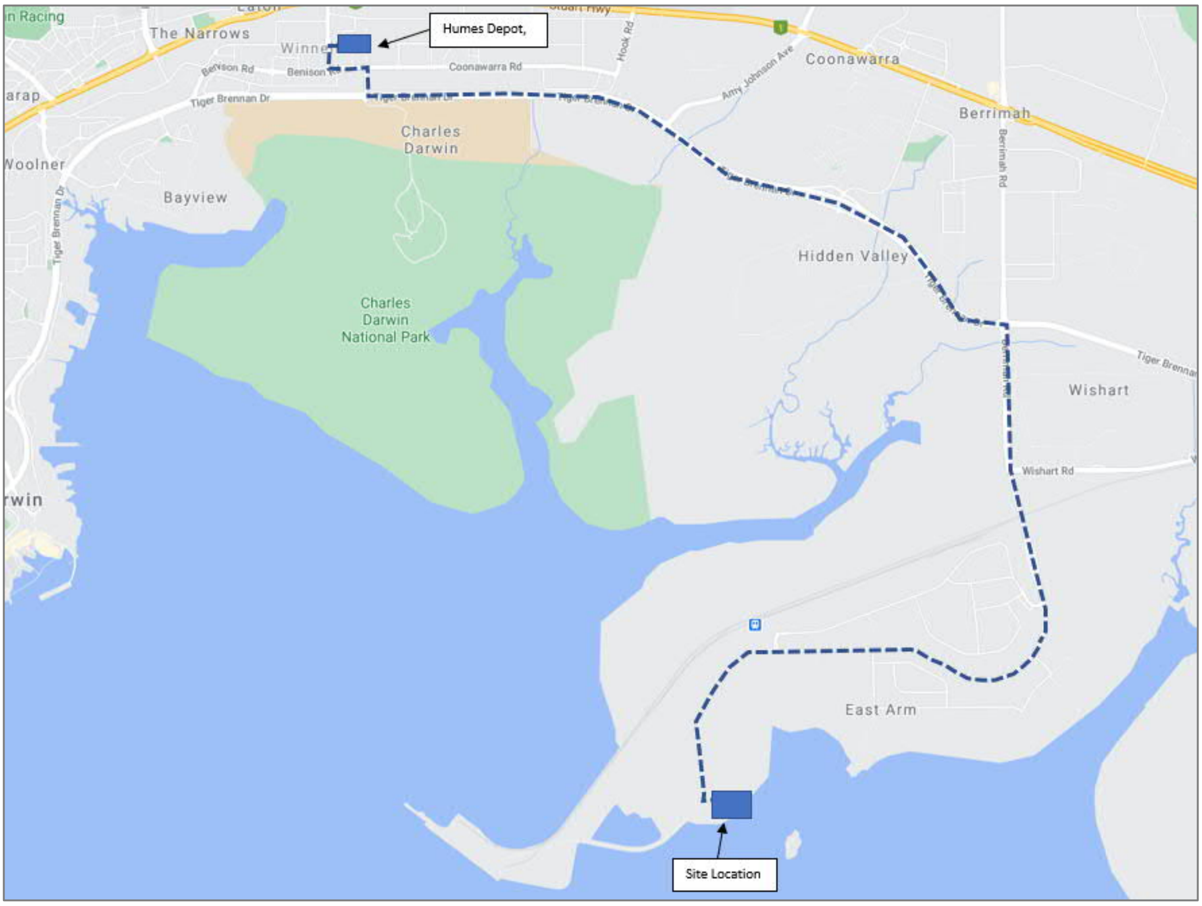

Figure 29 Humes Depot site location and proposed haulage route

Source: Google Maps © 2020