



Department of Mines and Energy
Rum Jungle Intersection
Preliminary Design

June 2016

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1. Introduction

Northern Territory Department of Mines and Energy (DME) engaged GHD to undertake a preliminary design and construction cost estimate for a new intersection to provide access to the former Rum Jungle mine site for potential future rehabilitation works.

GHD's scope is limited to preliminary design of the new intersection, DME has engaged O'Kane Consultants Inc. to develop the detailed engineering design for the rehabilitation works, including haul roads through the site.

1.1 Purpose of this report

This report documents the preliminary design for the proposed intersection. The objective of this report is to:

- Document components of the preliminary design drawings
- Identify future works required in order to develop detailed design
- Detail utility services checks
- Identify issues that will need to be addressed as part of detailed design
- Provide an order of cost estimate of the intersection based on the preliminary design.

1.2 Scope and limitations

This report: has been prepared by GHD for Department of Mines and Energy and may only be used and relied on by Department of Mines and Energy for the purpose agreed between GHD and the Department of Mines and Energy as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Department of Mines and Energy arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.3 and throughout this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Department of Mines and Energy and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the preliminary cost estimate set out in section 4 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD. The Cost Estimate has been prepared for the purpose of an order of cost for construction and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent,

warrant or guarantee that the [works/project] can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

1.3 Assumptions / Existing Data

The following assumptions / existing data has been used in the course of producing this report and undertaking the preliminary design:

- High resolution aerial photography of the site (acquired 2010) supplied by DME
- High resolution LIDAR data (acquired 2016) supplied by DME
- Traffic volumes from Annual Traffic Report 2014, Department of Transport
- Anticipated traffic volumes and construction period associated with the rehabilitation project as supplied by DME
- Design centre line alignment for new access road prepared by O'Kane Consultants and provided in DXF format (supplied by DME)
- Dial-Before-You-Dig responses.

2. Existing conditions

2.1 Overall locality

Rum Jungle mine site (Section 2968 Hundred of Goyder) is an abandoned mine located 105 km south of Darwin, near the town of Batchelor (refer Figure 1).

The existing access to the mine site continues from the intersection of Rum Jungle Road and Litchfield Park Road. Access to the site is currently via an unsealed track that will be inadequate for future needs should rehabilitation proceed.

The proposed intersection is along Rum Jungle Road (refer Figure 2). Rum Jungle Road is an undivided road with a single traffic lane in each direction. The speed limit is 80 km/h and the width of the pavement is approximately 6.0 metres. The existing road reserve width is 100 m.

Available imagery from Google Earth Street View indicates the road pavement along Rum Jungle Road is in poor condition.



Figure 1 Locality Map*

*Image sourced from Google Earth

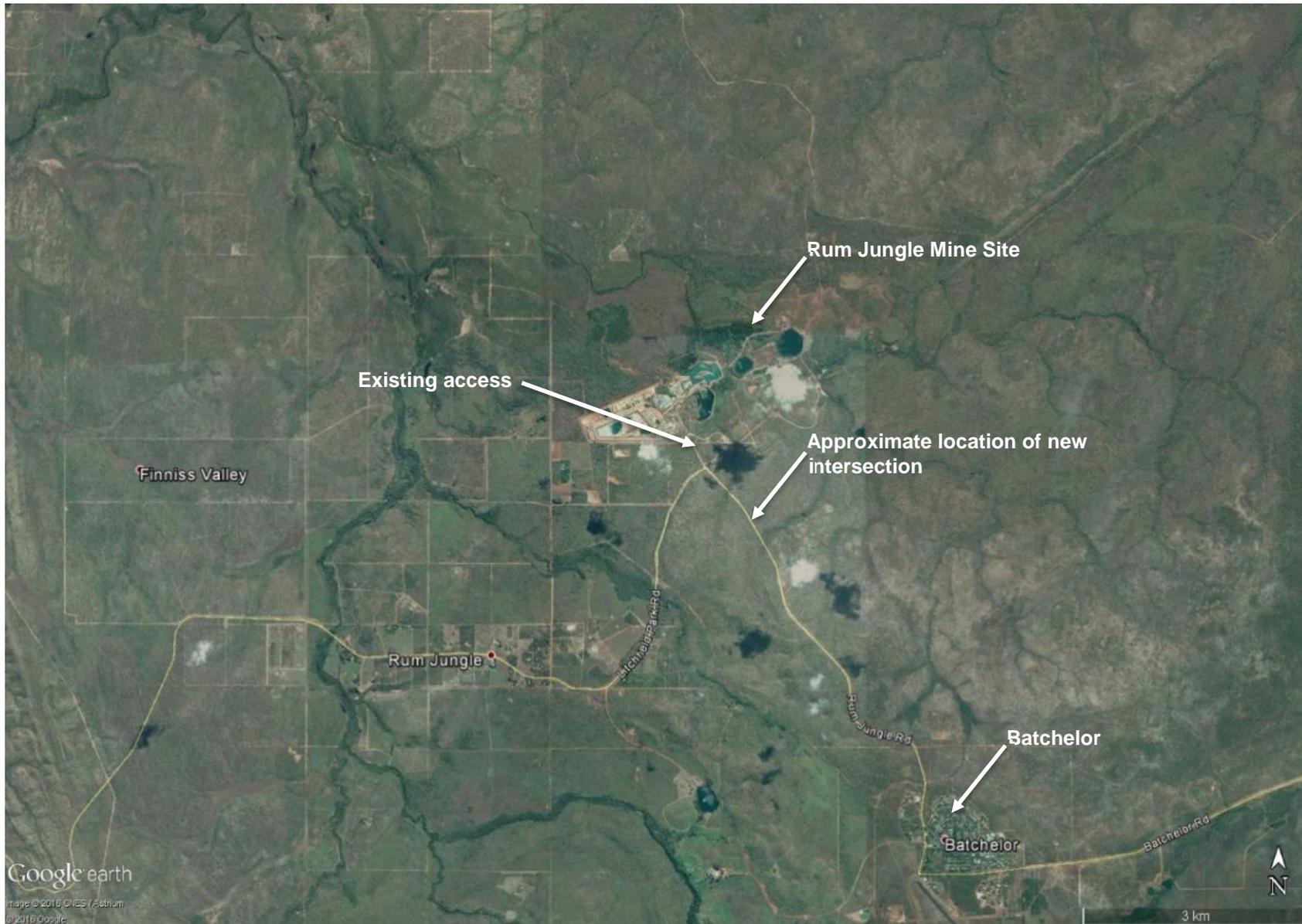


Figure 2 Site Map*

**Background image sourced from Google Earth*

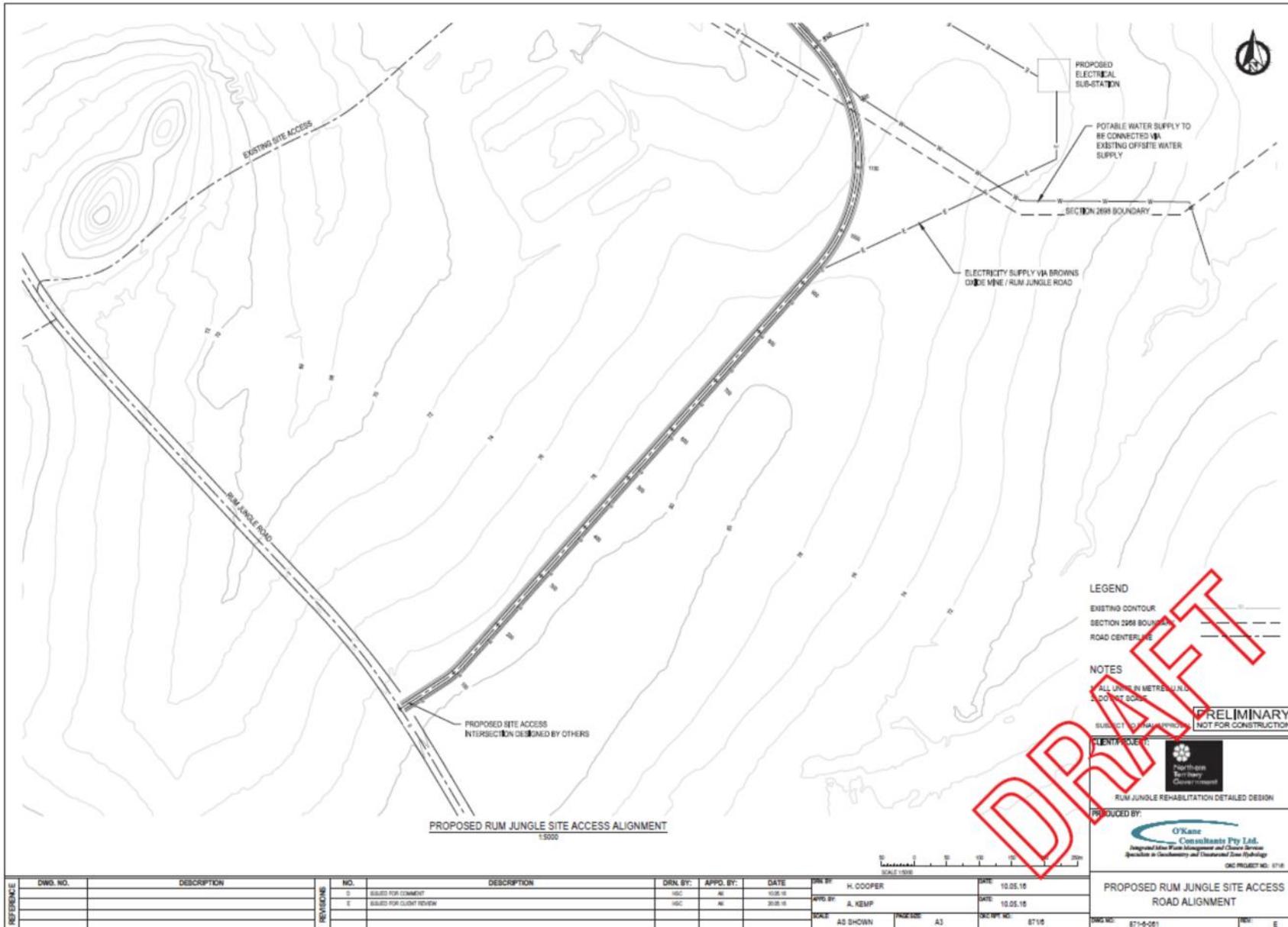


Figure 3 Proposed Rum Jungle Site Access Road Alignment *

*O'Kane Construction Pty Ltd

2.2 Existing Services

Dial Before You Dig has been carried out and indicates that presence of the following utilities owned by Telstra SANT and Power & Water Corporation respectively:

- Direct buried optical fibre cable and 100 mm PVC conduit located within the existing road reserve boundary, along the north-east side.
- Overhead HV conductors and line poles located within the existing road reserve boundary, along the north-east side. The approximate location of the overhead electrical line is visible in the aerial photography of the site provided by DME.

2.3 Existing traffic volumes

Traffic data has been sourced from the latest available NT Government Department of Transport (DoT) Annual Traffic Report (2014) using count station:

- RDVP035 Litchfield Park Road, 5 km west of Finnis River Crossing.

The average annual daily traffic volume (AADT) at RDVP035 was 444 vehicles per day (vpd) with a 50 / 50 directional split. Since 2005, this AADT has grown at approximately 3% per annum.

3. Concept Design

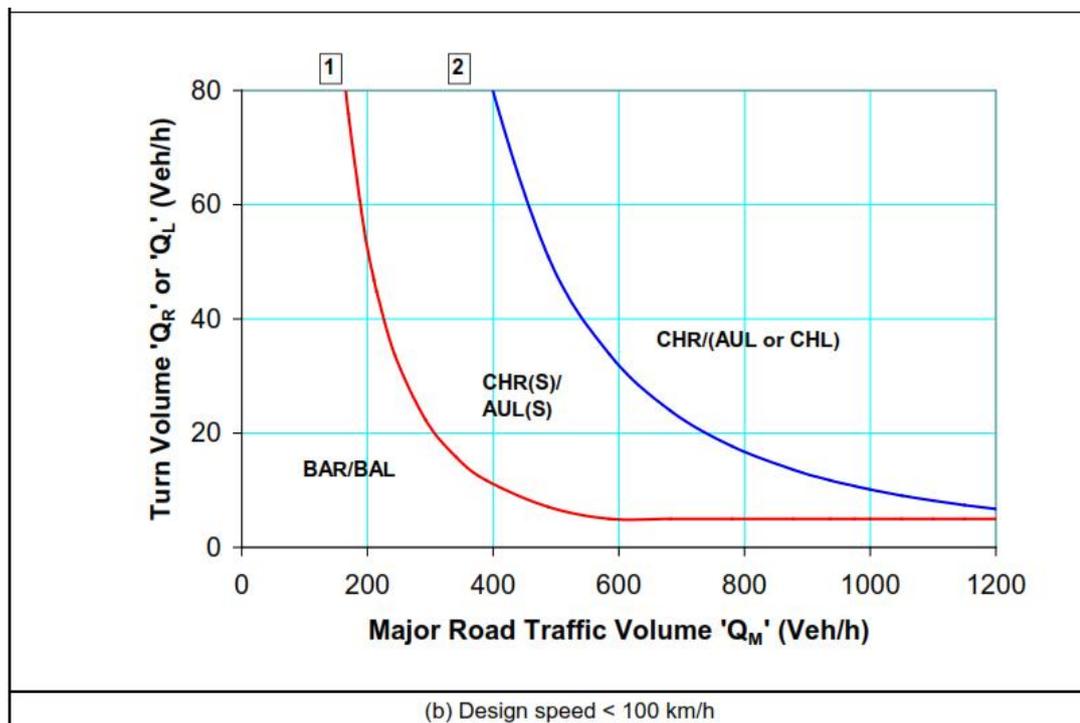
3.1 Traffic Generation

The Rum Jungle Rehabilitation Project is expected to take eight years to complete (commencing mid-2017), during which time road trains and light vehicles will enter and depart the site.

Based on a 3% per annum increase, the predicted AADT along Litchfield Park Road will reach 615 vpd by 2025. Assuming peak hour volumes typically account for 10% of the daily total volume, at this location the major road traffic volume would be 62 vehicles / hour.

Rehabilitation works will be undertaken during the Dry Season to minimise impacts on the surrounding environment. The construction period is 214 days per year with annual road train movements estimated at 1,000 to Batchelor and 1,500 to Mt Burton. This is assumed to equate to an AADT of approximately 12 vpd.

The Austroads Guide to Road Design Part 4A (Unsignalised and Signalised Intersections) contains warrants for auxiliary turning lanes based on major and minor road traffic volumes. The traffic volumes indicate that a Basic Right-Turn and Basic Left-Turn treatment would be suitable for the proposed intersection (refer Figure 4).



Source: Arndt and Troutbeck (2006).

Figure 4.9: Warrants for turn treatments on the major road at unsignalised intersections

Figure 4 Warrants for un-signalised intersection turn treatments*

*Source: Figure 4.9, Austroads Guide to Road Design – Part 4A: Usingalised and Signalised Intersections

There are no simple numerical warrants for acceleration lanes. Austroads Part 4A (5.2.2) recommends that they are considered in circumstances such as when there are insufficient gaps in the major road flow, turning volumes are high (300-500 vph), sight distance is restricted or heavy vehicles joining the traffic stream would cause excessive slowing of major road traffic.

With consideration of the high percentage of heavy vehicle manoeuvres at the intersection and the requirements nominated in the project brief, the following intersection layout has been adopted within the concept design:

- Channelised right turn (CHR) suitable for a two-lane rural road
- Deceleration lane for left turns from the major road (Litchfield Park Road)
- Acceleration lane for left turns onto the major road (Litchfield Park Road).

3.2 Sight Distance

Based on aerial imagery and high resolution LIDAR data, the estimated sight distance from the proposed intersection along Rum Jungle Road is estimated to be 350 m to the north and 235 m to the south. The sight distance is limited to the south by the existing vertical geometry with a high point south of the proposed intersection.

Safe Intersection Sight Distance (SISD) is approximately 233 m, based on:

- D_t – decision time = observation time (3 s) + reaction time (2.5 s)
- V – operating speed = 80 km/h
- d – coefficient of deceleration = 0.24 (truck)
- a – longitudinal grade = -1.3%

Minimum Gap Sight Distance for a critical gap acceptance time of 10 seconds and approaching vehicle speed of 80 km/h is 222 m. The critical movement is the right hand turn from the minor road which requires a 14-40 sec for not interfering with the approach vehicle and 5 seconds for two lane / two way requiring the approaching vehicle to slow (111 m).

3.3 Intersection Concept Design

3.3.1 Design Standards

Listed below are the design guidelines used as input to the concept design:

- Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections
- Clear zones – In accordance with Northern Territory Government Clear Zone Guidelines for Rural Roads
- Department of Infrastructure (DoI) Standard Drawings.

3.3.2 Channelised Right Turn (CHR)

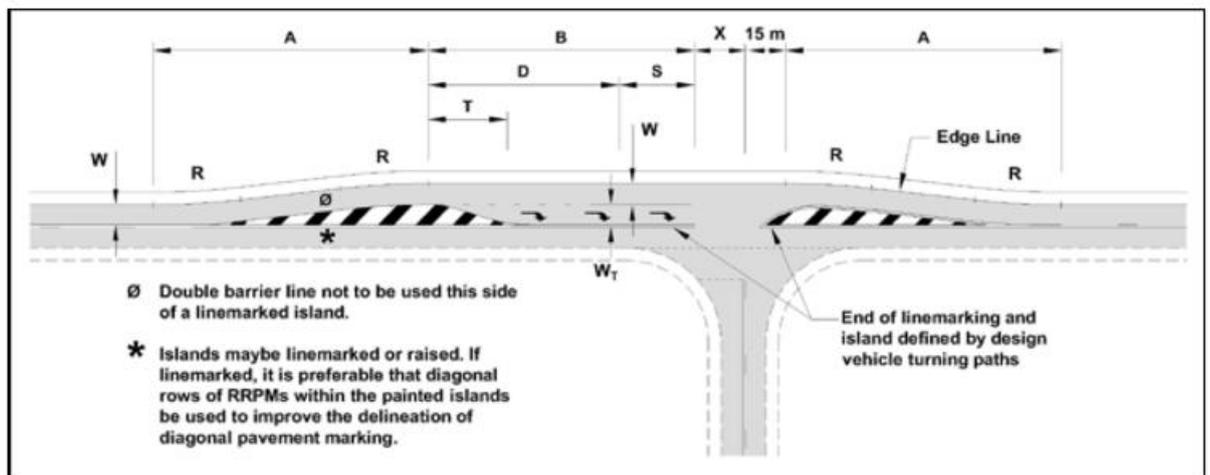


Figure 5 CHR on a two-lane rural road*

*Source: Figure 7.7, Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections.

The channelised right turn shown in the concept design is based on values shown in Table 1.

Table 1 CHR Design Parameters

Dimension	Adopted Value
W – Nominal through lane width (m)	3.5
Wt – Nominal width of turn lane (m)	3.5
B – total length of auxiliary (m)	190
D – diverge / deceleration length (m)	120
T – taper length (m)	30
S – storage length (m)	70
V – design speed of major road approach (km/hr)	90
X – distance based on design vehicle turning path (m)	15

A – lateral movement length (m)	90
R – desirable radius (m)	350

3.3.3 Acceleration and Deceleration Auxillary Treatments

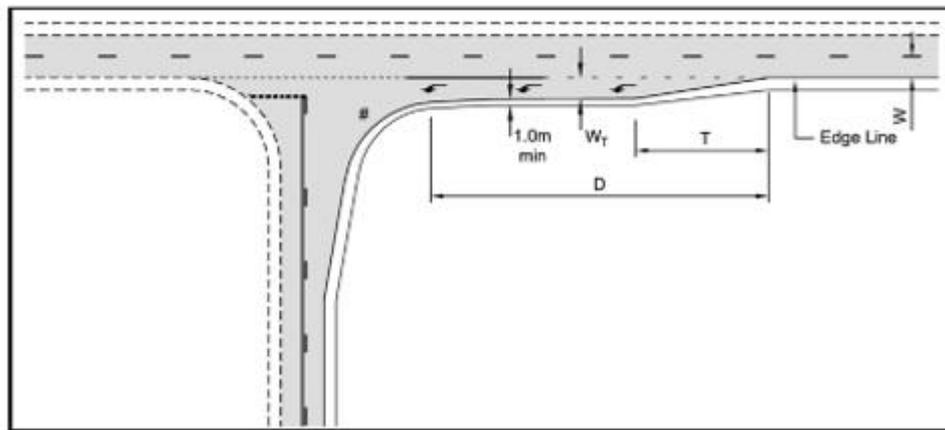


Figure 6 Rural Auxillary Left-turn Treatment on the Major Road

*Source: Figure 8.3, Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections.

The auxillary left turn from the major road (Rum Jungle Road) shown in the concept design is based on values shown in Table 2.

Table 2 Auxillary Left-turn (deceleration) Design Parameters

Dimension	Adopted Value
W – Nominal through lane width (m)	3.5
Wt – Nominal width of turn lane (m)	3.5
D – length of deceleration, including diverge taper (m)	120
T – physical taper length (m)	30

The auxillary left turn onto the major road (Rum Jungle Road) shown in the concept design is based on values shown in Table 3.

Table 3 Auxillary Left-turn (acceleration) Design Parameters

Dimension	Adopted Value
W – Nominal through lane width (m)	3.5
Wt – Nominal width of turn lane (m)	3.5
A – length of acceleration, including merge taper (m)	320
T – physical taper length (m)	30

3.3.4 Concept Design Documentation

Concept design sketches (SK001 & SK002) are provided in Appendix A. Sketches showing the turning movement swept paths for an A-triple road train is also provided (SK003 & SK004).

3.4 Potential Issues

3.4.1 Services

Based on the available information as documented within this report, the presence of existing services is not anticipated to present major issues for the development of the proposed intersection.

It is recommended that a minimum clearance of 14 m is maintained between the centreline of the new access road and the existing power poles. Vertical clearance is assumed to be sufficient. Consideration of clear zone requirements should be made during the detailed design.

At this concept stage, it is assumed that the depth of the existing Telstra assets allows sufficient cover for construction of the proposed new access road to Rum Jungle mine site without realignment. However, the location and depth of the existing cables should be verified as part of the detailed design phase in order to identify any required protection or relocation works.

3.4.2 Land tenure & other clearances

No land tenure issues are identified for the proposed intersection. Note that the scope of work has excluded investigation into environmental, heritage and cultural clearances, including an AAPA certificate. The design of the proposed new access road to Rum Jungle mine site is being completed by another consultant.

3.4.3 Existing road pavement

As previously noted, the condition of the existing road pavement along Rum Jungle Road appears to be in poor condition. As such, the cost estimate has included an allowance to upgrade the existing pavement by removing the existing seal and installing 150 mm of Type 2 gravel base (subject to geotechnical investigation) and reinstate with prime & 14 mm single seal.

3.4.4 Street lighting

There are no street lighting requirements for the proposed intersection. It is assumed that the rehabilitation works will be undertaken during daylight, and it is noted that overall pedestrian and vehicle traffic is low. Unlit treatment is consistent with the existing conditions along Rum Jungle Road, although it is noted that street lighting is a mechanism for improving road safety.

3.4.5 Authority Engagement

At this stage, stakeholder engagement with approval authorities has not been undertaken. It is recommended that this is undertaken from the commencement of detailed design, particularly with NTG Department of Transport and Telstra SANT.

4. Cost Estimate

The preliminary cost estimates presented in this section has been developed for the purpose of preliminary budgeting and is based on the preliminary design. As the scope of the works has not been fully defined, the estimates are not warranted by GHD. These estimate is typically developed based on previous budget quotes for some items, extrapolation of recent similar project pricing and GHD experience. The accuracy of the estimate is not expected to be better than about $\pm 30\%$ for the items described in this report.

Table 4 Cost Estimate

Description	Amount
Miscellaneous Provisions	\$234,400.00
Provision for Traffic	\$62,000.00
Environmental Management	\$36,550.00
Earthworks	\$111,468.00
Pavement	\$162,094.70
Conformance Testing	\$6,300.00
Road Furniture and Traffic Control Devices	\$36,656.15
Contingency	\$154,272.37
10% GST	\$92,563.42
TOTAL	\$1,018,197.64

A detailed breakdown of the cost estimate is provided in Appendix B.

5. Future Works

The following future works have been identified for the detailed design phase:

- Geotechnical investigation including CBR for existing pavement and pavement design.
- Detailed engineering survey suitable for detailed design, including services location.
- All Telstra assets must be located, validated and protected prior to commencing construction. Expose existing Telstra assets by potholing by hand or using non-destructive vacuum extraction methods to validate presence, location and depth. A Telstra Accredited Plant Locator must be used to access Telstra network for locating purposes.
- Environmental, heritage and cultural clearances including AAPA certificates.
- Stakeholder engagement with approval authorities, particularly NTG Department of Transport and Telstra SANT.
- Traffic Impact Report
- Stage 3 Detailed Design Road Safety Audit.

Appendices

Appendix A – Concept Design Sketches

SK001	Rum Jungle Intersection, Concept Design Plan Layout – Sheet 1 of 2
SK002	Rum Jungle Intersection, Concept Design Plan Layout – Sheet 2 of 2
SK003	Rum Jungle Intersection, Concept Design – Vehicle Swept Path
SK004	Rum Jungle Intersection, Concept Design – Vehicle Swept Path

Appendix B – Cost Estimate

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