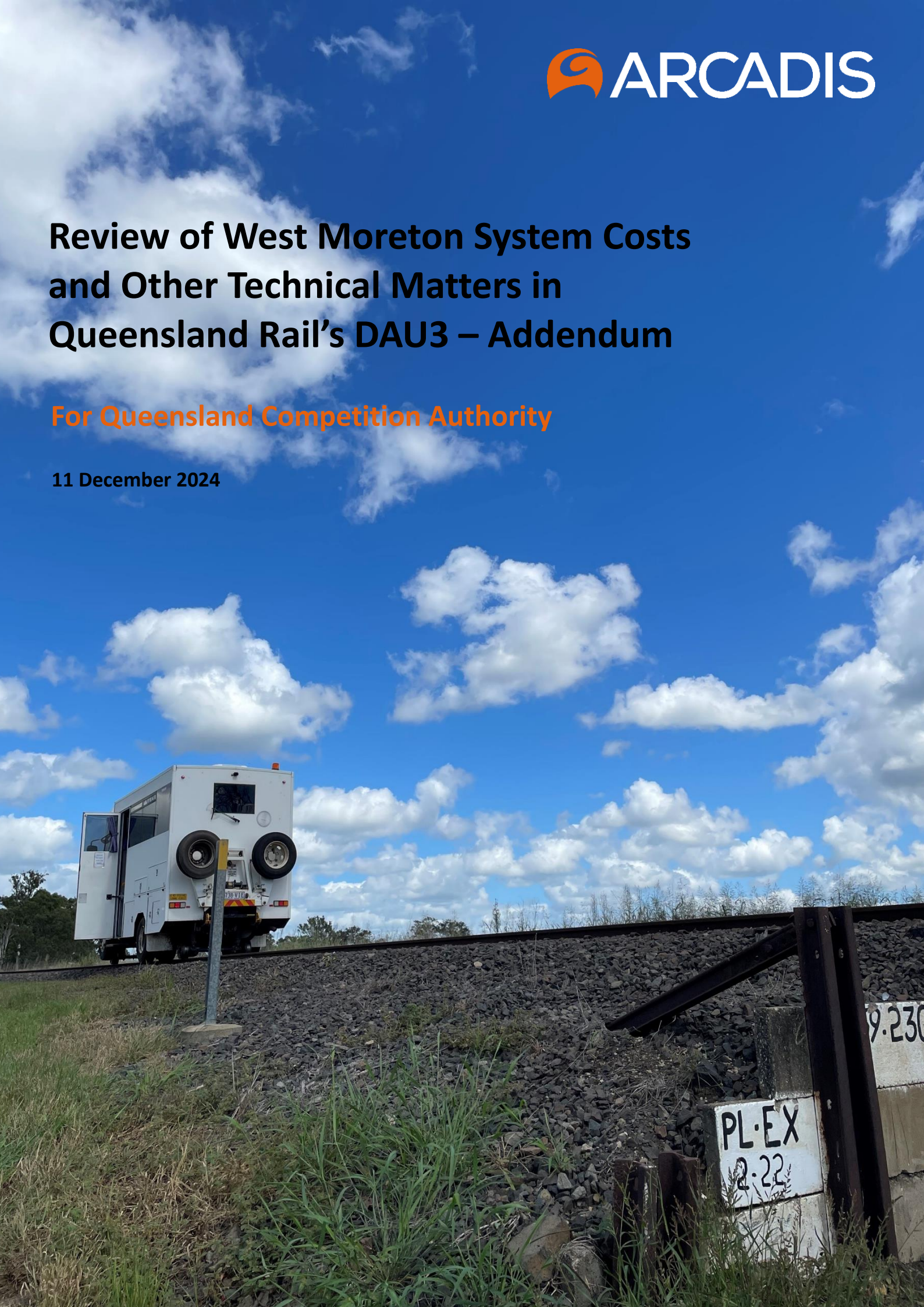
Review of West Moreton System Costs and Other Technical Matters in Queensland Rail's DAU3 – Addendum

For Queensland Competition Authority

11 December 2024



Review of West Moreton System Costs and Other Technical Matters in Queensland Rail's DAU3 – Addendum

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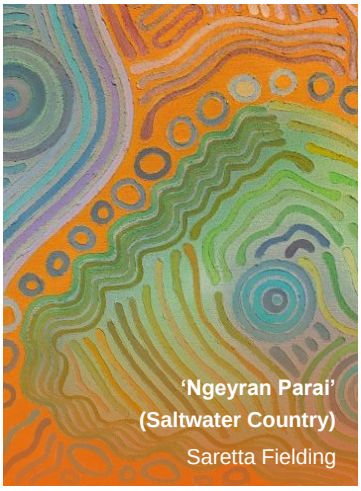

Arcadis acknowledges the Traditional Custodians of the land on which we work and live throughout Australia and recognize their continuing connection to Lands, Waters and Communities. We pay our respects Aboriginal and Torres Strait Islander Cultures and to Elders past, present and emerging.

Arcadis is committed to driving inclusion and diversity across our business. This includes specific and actionable policies that aim to make a positive impact on Aboriginal and Torres Strait Islander employment, education and a broader cultural change. Approved by Reconciliation Australia, Arcadis' Reconciliation Plan contains detailed and transparent strategies, targets and measurable actions. We continue to build respect, support education and create employment opportunities with Aboriginal and Torres Strait Island employees within our business.

Further information is available here.

REVISIONS

Revision	Date	Details	Prepared by	Reviewed by	Issued to
A	06/12/2024	Draft	V Thayananthan	C Owen	QCA
B	11/12/2024	Draft	V Thayananthan	C Owen	QCA

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EXECUTIVE SUMMARY

Background

The Queensland Competition Authority (QCA) is an independent statutory body responsible for implementing competition policy in Queensland. As part of this role, it regulates third-party access to rail infrastructure operated by Queensland Rail. QCA has appointed Arcadis to review Draft Access Undertaking 3 (DAU3) which was prepared by Queensland Rail (QR) for years FY25-26 to FY29-30. DAU3 relates to the West Moreton System (WMS), which is one of seven networks within the QR network. It consists of mainline and loop track and is divided into three sections:

- Rosewood to Toowoomba
- Toowoomba to Jondaryan
- Jondaryan to Miles

The West Moreton System is multi-use, with coal, bulk freight and passenger train services using its track. Currently, it has three coal customers. From Rosewood to Toowoomba, coal dominates traffic on the system and is the key driver for asset strategies in the wider system.

Objective

The key objectives of this report include:

- Providing robust technical advice and assessment to assist QCA with making an informed decision regarding the approval of the DAU3 reference tariff.
- Assessing the operational capacity of the WMS and determine a sustainable maximum tonnage that can be delivered.
- Conducting an independent assessment of WMS costs, considering commercial and performance needs, while remaining adaptable to accommodate future changes and transparency in our modelling approach. We have applied engineering expertise and industry knowledge to ensure a technically sound and valuable reasonableness assessment for the benefit of all relevant stakeholders.

DAU3 submission

Queensland Rail is proposing the following spend forecasts across FY25-26 to FY29-30:

Scenario 1a – 9.6 mtpa:

- Capital expenditure: $346.9m[1] (excluding interest during construction)
- Operating expenditure: $85.3m
- Maintenance expenditure: $172.5m

Scenario 2 – 7.5 mtpa:

- Capital expenditure: $256.6m[2] (excluding interest during construction)
- Operating expenditure: $74.6m
- Maintenance expenditure: $141.3m

This expenditure is stated to be driven by a need to upgrade out-dated infrastructure as well as an expected increase in coal tonnage during the DAU3 period, compared to the significantly lower tonnage hauled during DAU2 (2.17 mtpa in FY2022-23).

Operational capacity

[1] All dollar values are denoted in FY2025-26 dollars unless specified otherwise.
[2] All dollar values are denoted in FY2025-26 dollars unless specified otherwise.

Arcadis has conducted an exercise to determine a sustainable capacity for the WMS over the DAU3 period. This was completed by assessing the most constrained section of WMS which was identified to be between Rangeview and Spring Bluff, i.e. the crossing of the Toowoomba Range.

Arcadis' analysis determined the maximum theoretical capacity for coal transport, using 100% infrastructure utilisation as a baseline. Although globally accepted International Union of Railways (UIC) recommended occupancy rate of 67%, we note that, given that the majority of traffic will consist of homogenous coal services and that Queensland Rail (QR)'s investment is intended to enhance infrastructure resilience, we consider a 75% capacity utilisation during operation more appropriate. By reducing the operating hours, it is possible to provide for the maintenance windows and contingencies, however this then presents a balancing act for the Infrastructure Manager to provide both sustainable operating capacity and sufficient access for maintenance and capital programs.

Our analysis indicates that under scenario 1a, the stated required possession hours would push the system to operate at almost full capacity, with no contingency for weather or other unexpected events, thereby making the goal of hauling 9.6 mtpa a doubtful scenario for an extended period. However, in scenario 2, if efficiencies and programs can be implemented to reduce possession hours by approximately 2,500 hours per annum, hauling 7.5 mtpa appears to be a more feasible target.

Overall, if QR is able to implement schemes which reduce its possession requirement to 2,555 hours per year, while maintaining its proposed work programs, it is reasonable to expect QR to sustainably haul 7.5 mtpa under ideal conditions.

Expenditure Results

Table 0-2 and Table 0-3 reflect the values that Arcadis deems as reasonable as per our review of DAU3, when tonnage is adjusted from 7.5 mtpa during the DAU3 period. Operating expenditure has been extrapolated to the DAU3 period of 5 years.

Table 0-2 – Summary of DAU3 submission and Arcadis' findings

Expenditure Type	Arcadis Value ($2025-26 million)
Coal Tonnage	***7.5 mtpa***
Capital Expenditure	256.6
Operating Expenditure	74.6
Maintenance Expenditure	135.8

Source: QR DAU3, Arcadis

In addition to the above, our assessment has identified the following observations:

- The Above-rail operator and users raised numerous issues with Rail Capacity in the Brisbane Metropolitan system and the way this constrains movement of non-passenger traffic.
- There is a likely misalignment between the time window where services cannot contract for access to the Metropolitan Network and the network maintenance access windows meaning that service reductions may be amplified.
- QR has stated the condition of the network has changed in recent years, however numerous elements of the input information have not been reviewed or formally documented by QR for a number of years. There is an opportunity to undertake a formalised review of the

infrastructure data and then recalculate the running times utilising the updated information and undertaking a comparison to actual recorded data.

- Based on site visits and QR provided testimonial and documentation, it is noted that WMS assets are significantly deteriorated, and may pose substantial safety risks. QR has emphasised these risks. For example, QR has stated that without certain capital projects, such as track reconditioning across the entire system, risk of derailment is untenable. Arcadis recommends that by applying a risk-based approach to safety and consideration of the level of service requirements across network sections, priority areas for improvement can be clearly identified and addressed in a timely manner.

1 INTRODUCTION

1.1 Background

The Queensland Competition Authority (QCA) is an independent statutory body responsible for implementing competition policy in Queensland. As part of this role, it regulates third-party access to rail infrastructure operated by Queensland Rail. QCA has appointed Arcadis to review Draft Access Undertaking 3 (DAU3) which was prepared by Queensland Rail (QR) for years FY25-26 to FY29-30. DAU3 relates to the West Moreton System, which is one of seven networks within the QR network. It consists of mainline and loop track and is divided into three sections:

- Rosewood to Toowoomba
- Toowoomba to Jondaryan
- Jondaryan to Miles

The West Moreton System is multi-use, with coal, bulk freight and passenger train services in operation, currently, it has three coal customers. From Rosewood to Toowoomba, coal dominates traffic on the system and is the key driver for asset strategies in the wider system.

Arcadis has previously provided the QCA with a Reasonableness Assessment for the West Moreton system aimed to provide robust technical advice and assessment to assist QCA with making an informed decision regarding the approval of the DAU3 and efficiency of the reference tariff.

The QCA regulates the reference tariff for coal-carrying services on Queensland Rail's West Moreton and Metropolitan networks. The reference tariffs are determined from Queensland Rail's Regulatory Asset Base (RAB), which is governed by the cost of maintenance, restorations and upgrades of their infrastructure. To ensure that these tariffs are charged fairly and for works deemed necessary, Queensland Rail is subject to regulation under the Queensland Competition Authority Act 1997 (QCA Act) and the Queensland Competition Authority Regulation 2007 (QCA Regulation).

In this report, Arcadis will assess the operational capacity of two scenarios put forward by QR:

- Scenario 1a: Proposes to haul maximum forecast tonnage of 9.6 mtpa. This scenario is in line with a previous submission put forward by QR. Expenditure across 5 years is as follows:
    - Capital expenditure: $346.9m
    - Operating expenditure: $85.3m
    - Maintenance expenditure: $172.5m
- Scenario 2: Proposes to haul 7.5 mtpa. Expenditure across 5 years is as follows:
    - Capital expenditure: $256.6m
    - Operating expenditure: $74.6m
    - Maintenance expenditure: $141.3m

For scenarios that are reasonable from an operational capacity perspective, an assessment of its proposed capital, maintenance and operating expenditure will be completed.

Using our technical expertise and rail experience, this report completes the following activities:

- Estimate the operational capacity of the West Moreton System
- Review forecast capital expenditure to ensure reasonableness in sustaining the capacity of the infrastructure considering forecasts at adjusted tonnage
- Assess the reasonableness of Queensland Rail's operating and maintenance costs at adjusted tonnage

1.2 Objectives

This report will assess the operational capability of the West Moreton System as a standalone system. It will then establish a proposed maximum tonnage according to the capacity of the network and use this tonnage to determine reasonable capital expenditure, operating expenditure and maintenance expenditure for the network for the period FY25-26 to FY29-30. We note that these costs impact the West Moreton system reference tariff and it is QCA's objective to regulate and promote efficiency of this tariff.

The key objectives of this report include:

- Providing robust technical advice and assessment to assist QCA with making an informed decision regarding the approval of the DAU3 and efficiency of the reference tariff.
- Conducting an independent and well-informed assessment of West Moreton system costs, considering commercial and performance needs while remaining adaptable to accommodate future changes and transparency in our modelling approach. We have applied engineering expertise and industry knowledge to ensure a technically sound and valuable reasonableness assessment for the benefit of all relevant stakeholders.
- Estimating a reasonable amount of product to sustainably haul over the DAU3 period.
- Assess the reasonableness of the capital, maintenance and operating expenditure proposed by QR for the DAU3 period. The basis of the assessment of expenditure will be according to QR's scenario 2 proposal, whereby Arcadis' believes that the hauling of 7.5 mtpa is reasonable.

1.3 Methodology

Arcadis has conducted comprehensive analysis of Queensland Rail's operational capacity of the West Moreton System. This informs QCA of a sustainable tonnage that QR can haul over the DAU3 period. After this, Arcadis have used estimated tonnage and consider the proposed capital program and maintenance and operating expenditure that QR has put forward. This analysis was performed in the context of the information provided to us on Queensland Rail's commercial forecasts and performance requirements. Additionally, we considered Queensland Rail's Civil Engineering Track Standards (CETS), Civil Engineering Structural Standards (CESS), approaches by other rail agencies, and good asset management and engineering practice. Furthermore, we leveraged our expertise in rail asset management, drawing on insights and best practices from our own Rail Performance Maintenance Contract AssetRail - a company formed by Arcadis to maintain parts of the Dutch rail network.

1.4 Limitations

In preparing this report, Arcadis has relied upon meetings, data, analyses, plans and other information provided by Queensland Rail and other individuals and organisations, most of which are referred to in the Report.

Except as otherwise stated, Arcadis has not verified the accuracy or completeness of the data and certain assumptions have had to be made. To the extent that the statements, opinions, facts, information, conclusions and/or observations are based in whole or part on the data, these are contingent upon the accuracy and completeness of the data.

Arcadis will not be liable in relation to incorrect conclusions being drawn should any data, information or condition be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to Arcadis.

To the best of Arcadis' knowledge, the facts and matters described in this report and attached appendixes reasonably represent the conditions at the time of writing. However, the passage of time, the manifestation of latent conditions or the impact of future events (including a change in applicable law) may result in a variation to the conditions and assumptions. Arcadis will not be liable to update or revise the memo to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the memo.

1.5 Other considerations

In undertaking this exercise of understanding the operational capacity of the WMS, a number of items which fall outside the scope of Arcadis' engagement have been identified or raised by stakeholders in discussion, feedback, and comment. This section notes these and, where appropriate, provides a brief commentary on both their impact and possible future areas for further investigation or consideration.

- It is noted that there are discrepancies between the quoted net tonnage capacity of trains on the WMS between the information sources supplied from Queensland Rail and the Providers. For the purpose of this exercise, we have remained consistent with the mass quoted in the Queensland Rail Draft Undertaking documentation (DAU3 Maintenance Expenditure Submission, Section 4.6, Table 11, document page 235), whereby coal trains are assumed to be fully loaded and therefore have a standard mass of 2,008 tonnes net.
- There is a likely misalignment between the time window where services cannot contract for access to the Brisbane Metropolitan Network and the network maintenance access windows meaning that service reductions due to improved capex and opex may be amplified.
- Based upon historical information provided by Queensland Rail on the level of unutilised preserved paths, there may be the opportunity to provide up to 0.7 mtpa of haulage capacity for coal traffic on an ad-hoc basis. This could be formalised by a revised daily timetabling process whereby all paths are included in the base timetable but reallocated on an as-required commercial basis similar to the "*Day A for C*" process used for commercial freight traffic in the UK.
- The Capacity Constraints presented by the WMS have been examined in isolation from those presented by the wider Brisbane Metropolitan system. The Above-rail operator and users raised numerous issues with Rail Capacity in the Brisbane Metropolitan system and the way this constrains movement of non-passenger traffic. They considered that in practical terms the Brisbane metropolitan system was a greater constraint on capacity than the Toowoomba Range in the way this constrains movement of non-passenger traffic. A particular comment was around the lack of clarity of the impacts on freight services following the opening of Cross River Rail and the revised sectorisation that this will bring.
- Comments were raised about the overall timetable planning process and the ways in which engineering works (both Capex and Maintenance) are reflected in the train plan. There is an opportunity to improve outcomes via an integrated planning system which supports coordinated timetable and possession planning. This will become more pertinent as additional data requirements placed upon timetabling systems become apparent through the ongoing roll-out of European Train Control System (ETCS) signalling and the Traffic Management System (TMS) deployment.
- As all coal services ultimately operate to and from Fisherman Island as a Pit to Port cycle, this examination presents an incomplete overview of the capacity and operational challenges experienced by these services. A future iteration of this work with a wider scope could be planned to undertake a full analysis of capacity for Coal services between the West Moreton coal mines and the Port of Brisbane.
- It is noted that QR has stated the condition of the network has changed in recent years, however numerous elements of the input information have not been reviewed or formally documented for several years. This particularly concerns the details of the WMS itself as contained in the System Information Pack but also the calculation, construction, and presentation of Sectional Running Times (SRTs). There is therefore an opportunity to undertake a formalised review of the infrastructure data and then recalculate the running times utilising the updated information and undertaking a comparison to actual recorded data.
- Comments were raised over the performance monitoring and reporting of delays appearing to be a very manual process. As a part of a TMS deployment it is possible that this will become more automated depending on the precise nature of the systems being deployed to Queensland Rail and the rollout timeline. This would also be an opportunity to review system performance KPIs and redevelop reporting structures.

Based on stakeholder feedback, there is significant opportunity and requirement to examine freight capacity and performance in the Brisbane metropolitan area. It is unclear if TMR or Queensland Rail

have plans for this assessment, but there is strong interest and a belief among stakeholders that such an examination would be beneficial. We recommend moving forward with this analysis.

2 OPERATIONAL CAPACITY

2.1 Methodology

The modelling process utilised inputs from Queensland Rail and other stakeholders to build a RailSys model of the West Moreton System Infrastructure. The primary source was the Queensland Rail West Moreton System Information Pack - Issue 3.1 - October 2016 (link) with the key information identified as being:

- Location data as shown in the diagrams on pages 36 to 38.
- Speed information as shown in pages 48 to 52.
- Gradient and Curvature data as shown in the diagrams on pages 52 to 65.
- QR published runtimes as shown in Appendix F pages 66 to 69.

This information was supplemented by details provided during, and following, conversations facilitated by the QCA with Queensland Rail and industry stakeholders.

Using this information, Arcadis has implemented a three-stage process to determine the operational capacity of the system (Figure 1-1).

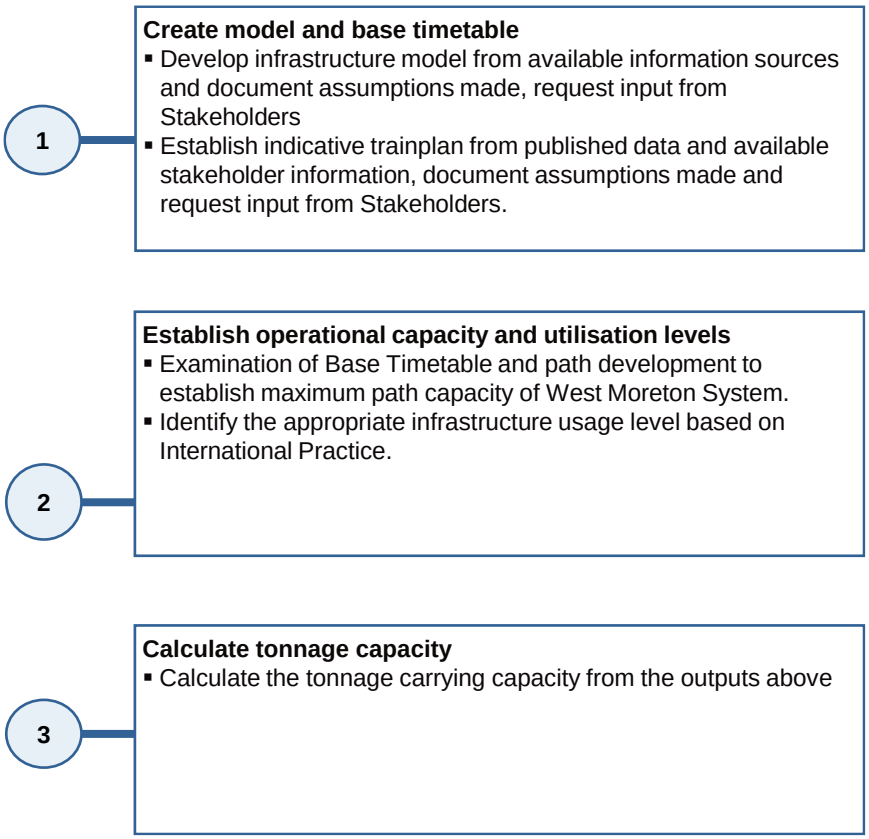

Figure 2-1 Overall Methodology

2.2 Results

Arcadis has determined WMS's operational capacity by understanding its maximum theoretical capacity at its most constrained part of the system. The RailSys Investigation revealed that the section between the Rangeview and Spring Bluff was the most constrained section and limited capacity to approximately one train per hour in each direction (noting that the scope of this engagement excludes the Brisbane metropolitan area which may present other capacity challenges). The observation of the most constrained part of the network is in line with QR's assertion in the DAU that the "Toowoomba Range is the capacity constraint on the West Moreton System".

Utilisation

The maximum theoretical capacity (at 100% of infrastructure utilisation) is therefore 168 return paths per week (excluding any possession time) taking a Coal Service as the reference train, equating to an annual net product tonnage of 17.54 mtpa. However, in practice, railway systems are not run at 100% of infrastructure capacity as operating a railway system at 100% of capacity utilisation does not allow for recovery from any disruption events. In this situation, even minor delays will propagate throughout the system and degrade performance until at least one service has to be cancelled in order to generate an operational firebreak and recover the plan.

The WMS is a mixed traffic system, which transports coal, grain, livestock and passengers. Application of the International Union of Railways (Union Internationale des Chemins de fer, or UIC) suggests a mixed traffic network occupancy rate level of 67% (refer UIC 406 leaflet). This rate is accepted globally as industry good practice, and its application on the WMS results in a total of 112 return paths per week, equating to an annualised maximum net product tonnage of 11.69 mtpa.

Advice from Queensland Rail suggests that there is up to seven hours each day where the service structure of the Metropolitan Network precludes coal services from contracting paths through the Metropolitan system from the WMS, this represents a structural reduction of 35 return paths per week. In our exercise this is accounted for in the reduction of paths by the capacity utilisation levels

and is not separately examined. The application of capacity limitations on the Metropolitan Network dictates the structure of paths available on the WMS but the reduction required is not in excess of that required to ensure reliable operation of the WMS (i.e. the Metropolitan Network restriction results in a reduction of 35 return paths per week whilst the reduction to 67% utilisation removes 56 return paths per week). However, the overall impact would need to be examined through a detailed capacity exercise including the Metropolitan Network as well as the WMS.

As noted above, an accepted capacity utilisation level for a mixed traffic system such as the WMS is around 67%, However, given the vast majority of traffic will be relatively homogenous coal services, and that Queensland Rail's proposed investment is designed to improve infrastructure performance resilience, we consider that a capacity utilisation in the order of 75% will likely prove to be appropriate for the proposed operation. These calculations account for capital expenditure improvements and fixed and variable maintenance activities. However, unforeseen disruptions such as weather-related shutdowns are not accounted for in these calculations.

We recognise that these shutdown events can cause significant ongoing disruption, in Queensland Rail's Collaborative Submission on DAU3 they state:

> *During the 16-month period beginning January 2020, there were 17 events resulting in the cancellation of 143 services and delay of a further 154 services on the Toowoomba Range for over 100,700 minutes. The average service delay was 11 hours.*

Additionally, they confirm that the February/March 2022 wet weather event resulted in a 19-day shutdown of the WMS. This level of disruption is outside the normal operational resilience considered by the capacity exercise we have undertaken as such events are highly unpredictable and variable in their severity.

It is anticipated that, as part of its activities as the Rail Infrastructure Manager, Queensland Rail will develop Disruption Recovery Plans for a range of disruption events which include solutions such as, but not limited to:

- Temporary utilisation of capacity reserved for resilience to recover services (i.e. more intensive use of the network for a short period of time)
- Revised train plans implemented either through control or by a temporary variation to the Master Train Plan
- Single Line Working or Wrong Direction Working
- Flighting of Services

Tonnage Estimates

The table below illustrates the net tonnage able to be hauled after accounting for preserved paths within the WMS. The dark grey boxes highlight a tonnage range (9.4-9.8 mtpa) that can be hauled in scenario 1a, as per QR's submission, and the orange boxes highlight a tonnage range (7.3-7.7 mtpa) that can be hauled in scenario 2. It illustrates that it is technically possible to haul this amount utilising the operational capacity provided on the WMS. In practice the tonnage capacity able to be hauled is provided by making a trade-off between operating hours and capacity utilisation (i.e. performance resilience). To provide 9.6 mtpa of tonnage and ensure more than 3,102 hours of available possession hours, a capacity utilisation of 100 per cent is required. On the other hand, hauling 9.6 mtpa at the 75% capacity utilisation level we consider reasonable, would only allow 730 hours of possession hours which we believe is a very low number given the maintenance and capital works required in the DAU3 submission. Therefore, based on figures presented by QR in the post collaboration submission, 9.6 mtpa cannot be sustainably hauled as forecasted by QR. Given the low available possession hours, achieving this volume would require operating the system at 90-100% capacity utilisation, without accounting for any potential disruptions that could be caused by weather, which is not reasonable.

On the other hand, scenario 2, hauling 7.5 mtpa, is more realistic, relative to hauling 9.6 mtpa. As per table 2-1 below, capacity utilisation of 75 per cent provides 2,555 hours of possession access per annum when moving 7.5 mtpa. This access availability of 2,555 hours per annum at 7.5 mtpa is

greater than that provided by hauling 9.6 mtpa at 75 per cent capacity utilisation which, as noted above, results in just 730 hours for possession access (or 22 operating hours per day).

It is vital to understand the delta between the annual possession hours required when tonnage is at 7.5 mtpa and the availability provided following the allocation of the number of train paths required to move this tonnage. Required possession hours has increased substantially relative to scenario 2[3] showing that approximately 4,161 annual possession hours would be required for maintenance and capital works. However, when crew is equal in scenario 1a and scenario 2, maintenance hours decrease by 2,000 when tonnage is reduced to 7.5 mtpa in the Jondaryan to Rosewood section.

Based on our analysis, in order to achieve the forecast volumes at these possession hours, it is understood that 100% capacity utilisation for all hours outside the possession windows was applied.

Table 1-1 –Capacity Utilisation by Hours of Operation

Daily Operating Hours	Annual Posession Hours	Capacity Utilisation %												
		100%	95%	90%	85%	80%	75%	70%	67%	65%	60%	55%	50%	45%
24	0	15.87	14.93	14.10	13.16	12.32	11.49	10.55	10.02	9.71	8.77	7.94	7.10	6.16
23	365	15.14	14.20	13.37	12.53	11.69	10.86	10.02	9.50	9.19	8.35	7.52	6.68	5.85
22	730	14.41	13.57	12.74	11.90	11.17	10.34	9.50	9.08	8.77	7.94	7.10	6.37	5.53
21	1095	13.68	12.84	12.11	11.28	10.55	9.82	8.98	8.56	8.25	7.52	6.68	5.95	5.22
20	1460	12.95	12.22	11.49	10.75	10.02	9.29	8.56	8.04	7.83	7.10	6.37	5.64	4.91
19	1825	12.22	11.49	10.75	10.13	9.40	8.67	8.04	7.62	7.31	6.58	5.95	5.22	4.49
18	2190	11.49	10.75	10.13	9.50	8.77	8.14	7.52	7.10	6.79	6.16	5.53	4.91	4.18
17	2555	10.75	10.13	9.50	8.88	8.25	7.62	7.00	6.58	6.37	5.74	5.12	4.49	3.86
16	2920	10.02	9.40	8.77	8.25	7.62	7.10	6.47	6.16	5.85	5.33	4.70	4.18	3.55
15.5	3102	9.61	9.08	8.46	7.94	7.31	6.79	6.16	5.85	5.64	5.12	4.49	3.97	3.34
15	3285	9.29	8.67	8.14	7.62	7.10	6.47	5.95	5.64	5.43	4.91	4.28	3.76	3.24
14	3650	8.56	8.04	7.52	7.00	6.47	5.95	5.43	5.12	4.91	4.39	3.86	3.45	2.92
13	4015	7.83	7.31	6.79	6.37	5.85	5.43	4.91	4.59	4.49	3.97	3.55	3.03	2.51
12.6	4161	7.52	7.00	6.58	6.06	5.64	5.22	4.70	4.49	4.28	3.76	3.34	2.92	2.40
12	4380	7.10	6.58	6.16	5.74	5.33	4.91	4.39	4.18	3.97	3.55	3.13	2.71	2.19
11	4745	6.37	5.95	5.53	5.12	4.70	4.28	3.86	3.65	3.55	3.13	2.71	2.30	1.88
10	5110	5.64	5.22	4.91	4.49	4.18	3.76	3.45	3.13	3.03	2.71	2.30	1.98	1.57
9	5475	4.91	4.49	4.18	3.86	3.55	3.24	2.92	2.71	2.51	2.19	1.88	1.57	1.25
8	5840	4.18	3.86	3.55	3.24	2.92	2.71	2.40	2.19	2.09	1.78	1.46	1.25	0.94
7	6205	3.45	3.13	2.92	2.61	2.40	2.09	1.88	1.67	1.57	1.36	1.04	0.84	0.63
6	6570	2.71	2.40	2.19	1.98	1.78	1.57	1.36	1.25	1.15	0.94	0.73	0.52	0.21
5	6935	1.98	1.78	1.57	1.36	1.25	1.04	0.84	0.73	0.63	0.52	0.31	0.10	0.00
4	7300	1.25	1.04	0.94	0.73	0.63	0.52	0.31	0.21	0.21	0.00	0.00		
3	7665	0.52	0.31	0.21	0.10	0.00	0.00							
2	8030													
1	8395													
0	8760													

As per scenario 1a, Queensland Rail's future Annual Possession Hours availability of 3,121 hours as quoted in the DAU documentation[4] aligns with an average daily operating period of 15.5 hours per day over the year (8.5 hours wheels free per day equals 3,102 hours per year). As compared to scenario 2, which hauls 7.5 mtpa, where an annual possession regime of 4,168hrs is available, equating to roughly 11.4hrs of possession access per day[5]. We note that utilising these available hours assumes that Queensland Rail make significant improvements to maintenance and capex processes resulting in this forecast network access time being half (or less) of the current and historical wheels-free network access provision.

For this reason, we have examined a range of capacity utilisation levels for an operational window averaging 15.5 hours per day and 12.6 hours per day. Table 2-1 shows tonnage at 75% capacity utilisation according to daily hours of operation. According to the scenarios provided by QR, we can deduce the following results at 75% capacity utilisation:

- Scenario 1: Allowance for the maintenance window of approximately 3,102 hours per year, at the 75% utilisation rate equals and a net annual tonnage of 6.8 mtpa.
- Scenario 2: Allowance for the maintenance window of approximately 4,161 hours per year, at the 75% utilisation rate equals to a net annual tonnage of 5.2 mtpa.

[3] As per Draft Access Undertaking 3 Explanatory Document, (8 November 2024), Queensland Rail, Section 4.5.3

[4] Queensland Rail's Draft Access Undertaking 3 (DAU3) Explanatory Document, Section 2.10.2, Figure 11, Page 42

[5] Draft Access Undertaking 3 Explanatory Document, (8 November 2024), Queensland Rail, Section 4.5.3, Figure 10, Page 37

Table 2-1 – 75% Capacity Utilisation by Hours of Operation

Possession Days	Possession Hrs per Yr	Daily Hours of Operation	Weekly Coal Paths		Coal Service Gross Tonnage			Coal Net Tonnage		
			Up	Down	Up	Down	Total	Up	Down	Total
0	0	24	110	110	16,216,200	4,730,440	20,946,640	11,485,760	0	11,485,760
15.21	365	23	104	104	15,331,680	4,472,416	19,804,096	10,859,264	0	10,859,264
30.42	730	22	99	99	14,594,580	4,257,396	18,851,976	10,337,184	0	10,337,184
45.63	1095	21	94	94	13,857,480	4,042,376	17,899,856	9,815,104	0	9,815,104
60.83	1460	20	89	89	13,120,380	3,827,356	16,947,736	9,293,024	0	9,293,024
76.04	1825	19	83	83	12,235,860	3,569,332	15,805,192	8,666,528	0	8,666,528
91.25	2190	18	78	78	11,498,760	3,354,312	14,853,072	8,144,448	0	8,144,448
106.46	2555	17	73	73	10,761,660	3,139,292	13,900,952	7,622,368	0	7,622,368
121.67	2920	16	68	68	10,024,560	2,924,272	12,948,832	7,100,288	0	7,100,288
129.27	3102.5	15.5	65	65	9,582,300	2,795,260	12,377,560	6,787,040	0	6,787,040
136.88	3285	15	62	62	9,140,040	2,666,248	11,806,288	6,473,792	0	6,473,792
152.08	3650	14	57	57	8,402,940	2,451,228	10,854,168	5,951,712	0	5,951,712
167.29	4015	13	52	52	7,665,840	2,236,208	9,902,048	5,429,632	0	5,429,632
173.38	4161	12.6	50	50	7,371,000	2,150,200	9,521,200	5,220,800	0	5,220,800
182.5	4380	12	47	47	6,928,740	2,021,188	8,949,928	4,907,552	0	4,907,552
197.71	4745	11	41	41	6,044,220	1,763,164	7,807,384	4,281,056	0	4,281,056
212.92	5110	10	36	36	5,307,120	1,548,144	6,855,264	3,758,976	0	3,758,976
228.13	5475	9	31	31	4,570,020	1,333,124	5,903,144	3,236,896	0	3,236,896
243.33	5840	8	26	26	3,832,920	1,118,104	4,951,024	2,714,816	0	2,714,816
258.54	6205	7	20	20	2,948,400	860,080	3,808,480	2,088,320	0	2,088,320
273.75	6570	6	15	15	2,211,300	645,060	2,856,360	1,566,240	0	1,566,240
288.96	6935	5	10	10	1,474,200	430,040	1,904,240	1,044,160	0	1,044,160
304.17	7300	4	5	5	737,100	215,020	952,120	522,080	0	522,080
319.38	7665	3	0	0	0	0	0	0	0	0
334.58	8030	2	0	0	0	0	0	0	0	0
349.79	8395	1	0	0	0	0	0	0	0	0
365	8760	0	0	0	0	0	0	0	0	0

In addition to these figures, Queensland Rail have noted that geotechnical issues in the Toowoomba range have seen multiple shutdowns in the past decade, with the most recent closure lasting for 19 days[6]. While these events cannot be forecasted, from these calculations it is also possible to provide a rough order figure of the daily lost tonnage potential for days where a major disruption event causes the network to be closed. Should there be a shutdown, the loss of a day's operation would see up to 17,700 tonnes of coal unable to be moved per day.

Therefore, our assessment indicates that a reasonable ideal scenario would result in QR hauling 6.8 mtpa consistently for the DAU3 period, FY25-26 to FY29-30. Further information of the operational capacity workings is outlined in **Appendix A** of this report.

Our analysis indicates that under scenario 1a, the stated required possession hours would push the system to operate at almost full capacity, with no contingency for weather or other unexpected events, thereby making the goal of hauling 9.6 mtpa a doubtful scenario for an extended period.

[6] Queensland Rail's Draft Access Undertaking 3 (DAU3) Explanatory Document, Attachment 2, Page 15

However, in scenario 2, if efficiencies and programs can be implemented to reduce possession hours by approximately 2,500 hours per annum, hauling 7.5 mtpa appears to be a more feasible target.

3 IMPACT ON CAPEX, MAINTENANCE AND OPERATING EXPENDITURE

3.1 Scope of expenditure assessment

Following our operational capacity assessment, Arcadis has found that scenario 1a, tonnage of 9.6 mtpa is improbable from an operational perspective. On the other hand, provided that QR can deliver its works program in 2,555 hours per annum, provided no significant weather events or unforeseen circumstances substantially impact network operations during the period, scenario 2 of hauling tonnage of 7.5 mtpa is deemed reasonable. Therefore, Arcadis will assess capital expenditure, maintenance and operating expenditure based on scenario 2. Prior to completing the operational capacity review, we previously assessed QR's expenditure for scenario 1a (9.6 mtpa)[7]. Refer to this report for the assessment of scenario 1a. Note that this scenario has not been reassessed given that we do not deem scenario 1a viable from an operational capacity perspective.

3.2 Methodology

Arcadis has implemented a three-stage process to refine their conclusions put forward in its earlier review of Queensland Rail's DAU3 (Figure 3-1).

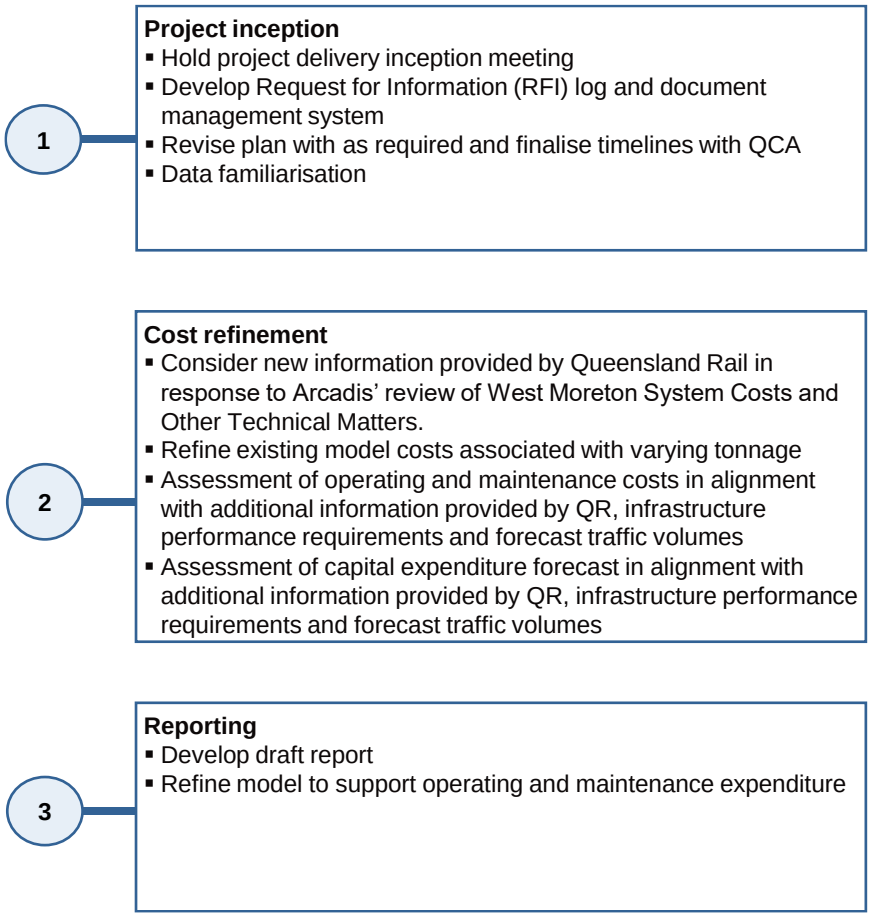

Figure 3-1 Summary of the process for the supplementary review of Queensland Rail's DAU

[7] Arcadis, *Review of West Moreton System Costs and Other Technical Matters in Queensland Rail's 2025 DAU* (19 April 2024)

3.3 Reasonableness assessment

In this assessment, reasonableness is defined as a rational, justifiable, and logically based approach using professional judgment and informed decisions supported by available data. It considers compliance requirements such as CETS, CESS, and safety, as well as the organisation's strategic objectives and performance requirements. When distinguishing between maintenance and capital expenditure, reasonableness involves applying sound judgment to determine if an activity aligns with the criteria for each category. This includes assessing the nature, scope, and impact of the expenditure on the asset's functionality and value. Evaluating the necessity, frequency, extent, and potential benefits to the asset's useful life, productivity, and revenue generation capacity is also part of reasonableness.

In summary, our assessment of reasonableness involves considering the pertinent financial, regulatory, and strategic aspects of the submission investment. Overall reasonableness entails that investment decisions must consider a balance between Queensland Rail's strategic objectives, forecasts, asset condition and life expectancy, operational risk and safety, and customer needs synergistically. Our assessment of reasonableness in line with the above has drawn upon:

- The information provided to us from QCA and Queensland Rail
- Our expertise in similar projects, extensive knowledge of industry best practices, and deep understanding of the West Moreton system

3.4 Capital expenditure

Table 3-1 outlines Arcadis's reasonable assessment of capital expenditure under scenario 2, which hauls net tonnage of 7.5 mtpa. Overall, Arcadis has deemed all capital expenditure projects as reasonable, including 4 additional projects in scenario 2.

Table 3-1 – Capital Expenditure – Arcadis Reasonable Assessment

Project name	DAU3 Amount	Arcadis Commentary
Coal Tonnage	***7.5 mtpa***	***7.5 mtpa***
Slope Stabilisation	-	Cost has risen by $2.2m. Per discussion with QR, this is driven by revised estimate of project costs. We additionally note that works have been spread across 4 years instead of 2. Although it would be more efficient to complete this in a shorter time period we deem this reasonable at volume of 7.5 mtpa
Culvert Renewals	-	It appears the removal of track reconditioning west of Jondaryan has reduced the number of culverts requiring replacement. This is reflected in the reduction of capital spend on culverts. We deem this reasonable at volume of 7.5 mtpa
Track Reconditioning	-	QR will need to balance the time made available for possessions to recondition versus the desire to run more trains as the capacity increases. Careful staging of works will allow trains to optimise the new works and increase availability, this is not necessarily fixing the worst sections first. It will require a strategic approach and geographical approach. We deem this capex as reasonable
Formation Strengthening	-	We classify this as a safety requirement as this project relates to track stability. We note that formation strengthening is also tonnage dependent as per QR's submission. Noting that these projects are in the constrained areas and assists with reliability, we deem this as reasonable.
Curve Transitions	-	Curve transitions are only on the Toowoomba Range. QR states that these works are not tonnage dependent. However, section 4.6 of DAU3 Maintenance Expenditure Submission (Nov 2024) states that curve transitions are tonnage dependent. Arcadis deems this as tonnage dependent as the increase in trains goes down the range, the more stress there is on the track. Therefore the assumption is that the capital cost has decreased as a result of the tonnage decreasing. We deem these works as reasonable at 7.5 mtpa.
Re-sleepering	-	From QR's response to QCA's draft decision, our understanding is that if higher tonnes are hauled, the availability to replace sleepers becomes untenable. Therefore, we have noted that QR's responses clarified that re-sleepering is a time dependent issue. We deem these works as reasonable.
Re-railing	-	These works see end of life 41kg/m rail replaced with 50kg/m rail. The works are tonnage dependent, therefore the capital cost has decreased as a result of the tonnage decreasing. These works are deemed reasonable.
Level Crossing Transitions	-	Not tonnage dependent and addresses safety concerns. These works are deemed reasonable at 7.5 mtpa.
Ballast Undercutting	-	Ballast undercutting still required to address track stability at 7.5 mtpa. Deem works as reasonable.
Bridge Pier Replacement	-	From QR's response to QCA's draft decision, additional information provided outlined that a shortage of staff and timber

Project name	DAU3 Amount	Arcadis Commentary
		material exists and it is therefore difficult to complete maintenance for specified bridges. We consider that the reduction is due to bridge pier replacement out west, where there is little increase in tonnage relative to prior period. We deem these works as reasonable.
Signalling Cables	-	Expired assets are not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Digital Telemetry	-	The replacement of expired and aged assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
SER/PER Upgrade	-	The replacement of expired assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
LED Upgrade	-	The replacement of expired assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Re-signalling	-	The replacement of obsolete assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Interlocking Renewal	-	The replacement of expired assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Refurbishment	-	The replacement of end of life equipment is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Bridge Strike Protection	-	The proposed works are to install steel protection beams to five bridges at risk of being struck by vehicles. Increasing traffic volumes and vehicle sizes has led to more incidents of bridges being struck. Installing protection beams has been deemed more effective than warning devices alone which are often ignored/not heard. At approximately $1m per bridge, presumably including beams and signage on both approaches, this is a reasonable cost and will provide great value if it deters/prevents strikes.
Range drones	-	Remote sensing is valuable technology and removes workers from the track which is a priceless saving. This is particularly relevant on the Toowoomba Range where access is difficult and time consuming. Capital works deemed reasonable.
Heat sensors	-	The ability to measure track temperature is key to the efficiency of the WMS. Direct measurement using remote sensing, improves the reliability of data and will help avoid 'false alarms' and remove workers from the track, provided they are installed correctly and located in the optimal sections of track. Capital works deemed reasonable.
LX protection upgrades	-	These works consist of replacing signalling equipment on a like-for-like basis to avoid equipment becoming obsolete. Maintaining equipment that is no-longer 'off the shelf' is an expensive

Project name	DAU3 Amount	Arcadis Commentary
		proposition and should be avoided. Capital works deemed reasonable.
Total	**-**	

Source: Arcadis

Note: Final total figure subject to rounding

3.5 Operating expenditure

Arcadis has completed a high-level assessment on operating expenditure for the DAU3 period through a linear model. In addition to this, we have assessed each line item relative to that of our previous assessment at 9.6 as well as our own estimation that was estimated at 7.5 mtpa.

Table 3-3 shows the operating expenditure for all operating costs that were previously deemed reasonable. Overall, the operating expenditure at 7.5 mtpa is deemed reasonable. We note that various items did not decrease relative to tonnage, such as train control, planning and system and operations administration. Similarly, other expenses did not increase relative to tonnage. Previously, Arcadis could not deem corporate overhead expenditure as reasonable in the 9.6 mtpa scenario and we requested more information. Under scenario 2, at 7.5 mtpa tonnage, the corporate overheads are deemed reasonable, noting the increase in labour costs that Arcadis has seen in the Queensland rail sector over the past four years, paired with other factors that have been noted by QR.

Table 3-3 Operating Expenditure – Assessment at 7.5 mtpa

Operating expense type	Differences in QR and Arcadis DAU3 Amount FY25-26 ($000s)	Arcadis assessment at 7.5 mtpa
Tonnage	***7.5 mtpa***	***7.5 mtpa***
Train Control, planning & systems and ops administration	-	✓
Monitoring Systems	-	✓
Engineering Support	-	✓
Management Support	-	✓
Network Infrastructure Material Logistics	-	✓
Assurance and Capability (Asset Maintenance)	-	✓
Regional Asset Delivery	-	✓
QCA Fees	-	✓
Program on Costs	-	✓
Other regional costs	-	✓
Telecommunications Backbone	-	✓
Corporate Overhead	-	✓
Total Operating Expenses (incl. depreciation)	-	
Return on buildings, plant, software and inventory	N/A	**Not assessed by Arcadis**
Total Operating Expenses (incl. depreciation)	-	

Source: QR DAU3, Arcadis

Note: Differences in total figures may occur due to rounding

3.6 Maintenance expenditure

Arcadis has completed a high-level estimation on maintenance expenditure for the DAU3 period.

We used a two-step approach to deem costs are reasonable:

1. Assess fixed costs
2. Assess the reasonableness of each maintenance cost category with tonnage stated in scenario 2 of 7.5 mtpa.

Fixed costs

Arcadis assumes that QR's fixed costs per year for DAU3 are based on the average historical fixed costs that occurred in FY21-FY23 (*figure 3-1*). The change in fixed costs over the historical years is expected to reflect the tumultuous variation in costs of materials over the past five years. Therefore +-25% in costs are not unreasonable. It is noted that projected yearly fixed maintenance costs are $0.12m higher than the average of FY21-23 actuals. This reflects that QR have projected relatively consistent fixed maintenance costs for DAU3.

From this analysis, Arcadis deems fixed costs for repairs and fixed other maintenance expenditure costs as reasonable.

Maintenance Expenditure Results

The table below outlines maintenance expenditure assessed for scenario 2 (7.5 mtpa). Our analysis for maintenance costs shows that maintenance expenditure looks reasonable, when reduced by $5.5 million in repairs. Therefore, the total maintenance expenditure that we deem reasonable is $135.8 million. QR's post collaboration submission has provided greater transparency in its maintenance forecasts, which has enabled a more efficient assessment of maintenance costs. Costs denoted in the maintenance expenditure submission are in in FY24 dollar. The main body QR's post collaboration report denotes maintenance expenditure in FY25 dollars. All expenditure costs in this report are in FY25 dollars.

Table 3-2 - Maintenance Expenditure – Assessment at 7.5 mtpa

Maintenance expense type	Differences in QR and Arcadis Amount ($ millions)	Commentary
Tonnage	***7.5 mtpa***	
Mechanised Resurfacing	-	The forecast annual spend is only slightly higher than previous year results despite higher tonnage. We expect that the decrease in spend per net tonne is driven by a reduced amount of required resurfacing in the eastern section of WMS. These would be offset by cost increases in recent years that have exceeded inflation.
Rail Stress Adjustment	-	Considering the anticipated increase in tonnes (this expense type is tonnage dependent) and cost escalations in recent years, this appears to be reasonable. We expect that the capital works will alleviate some of the effects of rail stress.
Repairs - fixed	-	Aligned with historical fixed costs. Amount deemed reasonable.
Repairs - variable	-5.5	FY21-23 costs averaged $2.0m p.a. Yearly forecasted costs are $2.4m. We do not deem this reasonable as it appears to double-up on compliance inspection activities. Additionally, it is expected that capital works would have alleviated some of the required repairs. Using table 18 in the Maintenance Expenditure submission, we have applied a 40% reduction in variable repairs. We deem $5.5m less than proposed amount, a reasonable variable repairs amount.
Sleeper Management	-	Considering predicted tonnage increases, sleeper management amount is deemed reasonable.
Maintenance Ballasting	-	Reduced proportionately from 9.6 mtpa scenario. FY21-23 costs averaged $1.1m p.a. Forecast FY26-30 average $1.5m per year is reasonable considering increased tonnage.
Rail Joint Management	-	Annual costs are relatively aligned with FY21-23. They appear to be reasonable.
Top & Line Spot Resurfacing	-	Considering predicted tonnage increases this amount seems reasonable.
Signalling	-	Aligned with historical fixed costs. Amount deemed reasonable.
Assets Comp Insp/Svc	-	Aligned with historical fixed costs. Amount deemed reasonable.

Fire & Vegetation Management	-	Aligned with historical fixed costs. Amount deemed reasonable.
Renewals	-	Aligned with historical fixed costs and reasonable variable cost. Amount deemed reasonable.
Asset Inspections Non Compliance	-	Aligned with historical fixed costs. Amount deemed reasonable.
Consulting/Technical Advice	-	Aligned with historical fixed costs. Amount deemed reasonable.
Telecoms	-	Aligned with historical fixed costs. Amount deemed reasonable.
Earthworks - Non Formation	-	Not tonnage dependent and a reasonable sum considering the amount of non-rail drainage and earthworks requiring regular maintenance. Aligned with historical fixed costs. Amount deemed reasonable.
Turnout Maintenance	-	Tonnage dependent and a reasonable amount.
Electrical	-	Aligned with historical fixed costs. Amount deemed reasonable.
Lubrication	-	Minor amount deemed reasonable
Other - fixed	-	Aligned with historical fixed costs. Amount deemed reasonable.
Other - variable	-	Allocated across other items in this report
Mechanised resleepering	-	Immaterial
Rail grinding	-	Amount deemed reasonable
Total	**-5.5**	

Source: QR, Arcadis

4 CONCLUSION

Through an operational capacity exercise of the WMS, we have confirmed that 168 paths are available at 100% capacity utilisation, not accounting for possession hours. We have deemed that 75% capacity utilisation is an appropriate percentage for the WMS given its near-homogonous nature in the product it hauls. Therefore, although scenario 1a is possible, it is not reasonable due to the small number of available possession hours (730 hours per year) at 75% capacity utilisation. On the other hand, we deem scenario 2 as reasonable, provided that the required possession hours is reduced to match the approximately 2,555 hours available.

Applying the reasonable tonnage as per scenario 2, we have assessed capital expenditure, operating expenditure and maintenance expenditure. Arcadis has calculated the results in table 4-1 table 4-2 and 4-3 below.
Overall, capital expenditure is deemed reasonable. This is driven by the following factors:

- Multiple assets are obsolete, for example, signalling assets expired years ago.
- QR has underscored that numerous safety risks persist, even in instances where tonnage levels are decreased compared to the original forecasts in DAU3.
- QR has stated that sections of the network pose a significant derailment risk and require works to mitigate safety risks in response to and preparation for increased tonnage.

Operating expenses is deemed reasonable and maintenance expenses is reasonable with the exception of $5.5 million which relates to variable repairs that we expect should be reduced due to increased capital expenditure investment paired with inspections and compliance noted in other maintenance expense types.

Table 4-1 – Summary of DAU3 submission for years 2025-2030 and Arcadis' findings

Expenditure Type	DAU3 Value ($2025-26 million)	Arcadis Value ($2025-26 million)
Capital Expenditure	256.6	256.6
Operating Expenditure	74.6	74.6
Maintenance Expenditure	141.3	135.8

Source: QR DAU3, Arcadis
Note: Figures relate to scenario 2

Table 4-4 – Summary of Capital Expenditure per year as per Arcadis findings ($FY2025-26 million)

Section	FY25-26	FY26-27	FY27-28	FY28-29	FY29-30	Total
Rosewood-Jondaryan	23.7	41.8	63.1	20.1	14.3	**163.0**
Jondaryan - Macalister	12.7	10.6	6.6	14.4	27.4	**71.7**
Macalister-Miles	6.9	0.0	1.8	0.8	12.3	**21.9**
Total	**43.3**	**52.4**	**71.5**	**35.3**	**54.1**	**256.6**

Source: QR DAU3, Arcadis

Note: Figures relate to scenario 2

Table 4-3 – Summary of maintenance and operating expenditure per year as per Arcadis findings ($FY2025-26 million)

Expenditure type	FY25-26	FY26-27	FY27-28	FY28-29	FY29-30	Total
Maintenance	25.5	25.7	28.6	28.3	27.8	**135.8**
Operating	14.9	14.9	14.9	14.9	14.9	**74.6**

Source: QR DAU3, Arcadis
Note: Figures relate to scenario 2

ARCADIS Design & Consultancy for natural and built assets

APPENDICES

A. OPERATIONAL CAPACITY MEMO

SUBJECT: West Moreton System – Indicative Operational Capacity

DATE: 07/07/2023

TO: Queensland Competition Authority

AUTHOR	Ken Farms	Signature

This report has been prepared for the Queensland Competition Authority in accordance with the terms and conditions of appointment for Queensland Competition Authority dated 7 July 2024. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

Arcadis has relied on information provided to it by Queensland Competition Authority and Queensland Rail to produce the report and arrive at its conclusions. The report is based upon information obtained on or before the report's completion (date above). Circumstances and events may occur following this date beyond our control and may affect the findings or projections contained in the report. We may not be held responsible for such circumstances of events and expressly disclaim any responsibility.

1 INTRODUCTION

The Queensland Competition Authority (QCA) is an independent statutory body responsible for implementing competition policy in Queensland. As part of this role, it regulates third-party access to rail infrastructure operated by Queensland Rail. QCA has appointed Arcadis to review Draft Access Undertaking 3 (DAU3) which was prepared by Queensland Rail (QR) for years FY25-26 to FY29-30. DAU3 relates to the West Moreton System, which is one of seven networks within the QR network. It consists of mainline and loop track and is divided into three sections:

- Rosewood to Toowoomba
- Toowoomba to Jondaryan
- Jondaryan to Miles

The West Moreton System is multi-use, with coal, bulk freight and passenger train services in operation, currently, it has three coal customers. From Rosewood to Toowoomba, coal dominates traffic on the system and is the key driver for asset strategies in the wider system.

Arcadis has previously provided the QCA with a Reasonableness Assessment for the West Moreton system aimed to provide robust technical advice and assessment to assist QCA with making an informed decision regarding the approval of the DAU3 and efficiency of the reference tariff.

In support of this, Arcadis has been requested to provide indicative net tonnage levels for the West Moreton System by calculating the indicative path capacity and then extrapolating the tonnage levels based on the expected carrying capacity of each train.

To undertake this task, Arcadis has used a specialist subcontractor and the Operational Modelling tool (RailSys from RMCon International). This is an internationally recognised software tool providing timetabling, simulation, performance, and capacity analysis functionality and is used by Rail Infrastructure Managers and Operators such as Queensland Rail, TMR, TfNSW, Sydney Trains, and Network Rail to provide Operational Planning services across a range of disciplines and projects.

The deliverables/ outputs of this work are:

- Indicative Capacity of the West Moreton System from a train path perspective
- Prospective maximum contractable net tonnage carrying capacity based upon the pathing study
- Commentary on any issues raised by stakeholders as appropriate
- Any arising opportunities noted in carrying out the exercise
- Technical Memo of findings (this document)

We are indebted to representatives of Queensland Rail, Aurizon Operations, New Hope, and Yancoal for their engagement and the insights provided to support the preparation and delivery of this work. A register of the meetings held with the various stakeholders is recorded in Appendix A.

1.1.1 Purpose of this memo

The purpose of this memo is to communicate the Indicative Train Path Capacity of the West Moreton System for use by the wider Arcadis team to develop capital expenditure, maintenance expenditure and operating expenditure estimates for WMS. This memo will detail the RailSys modelling undertaken, the results thereof expressed in terms of the number of train paths available for coal services as well as an indicative tonnage. At the request of the QCA during development of the work, a high-level commentary has also been provided on the items raised by stakeholders during engagement sessions.

1.1.2 Limitations

In preparing this Memo, Arcadis has relied upon meetings, data, analyses, plans and other information provided by Queensland Rail and other individuals and/or organisations, most of which are referred to in the Report (the Data).

Except as otherwise stated, Arcadis has not verified the accuracy or completeness of the data and certain assumptions have had to be made. To the extent that the statements, opinions, facts, information, conclusions and/or observations are based in whole or part on the data, these are contingent upon the accuracy and completeness of the data.

Arcadis will not be liable in relation to incorrect conclusions being drawn should any data, information or condition be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to Arcadis.

To the best of Arcadis' knowledge, the facts and matters described in this memo reasonably represent the conditions at the time of writing. However, the passage of time, the manifestation of latent conditions or the impact of future events (including a change in applicable law) may result in a variation to the conditions and assumptions. Arcadis will not be liable to update or revise the memo to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the memo.

1.1.3 Inputs and Methodology

The modelling process utilised inputs from Queensland Rail and other stakeholders to build a RailSys model of the West Moreton System Infrastructure. The primary source was the Queensland Rail West Moreton System Information Pack - Issue 3.1 - October 2016 (link) with the key information identified as being:

- Location data as shown in the diagrams on pages 36 to 38.
- Speed information as shown in pages 48 to 52.
- Gradient and Curvature data as shown in the diagrams on pages 52 to 65.
- QR published runtimes as shown in Appendix F pages 66 to 69.

This information was supplemented by details provided during, and following, conversations facilitated by the QCA with Queensland Rail and industry stakeholders. The meetings held are listed in Attachment A to this memo. Following these meetings, information has been provided which has fed into the assumptions register which can be found as Attachment B to this memo.

The RailSys infrastructure model developed from the assumptions and data provided is shown in schematic form in Figure 1 below.

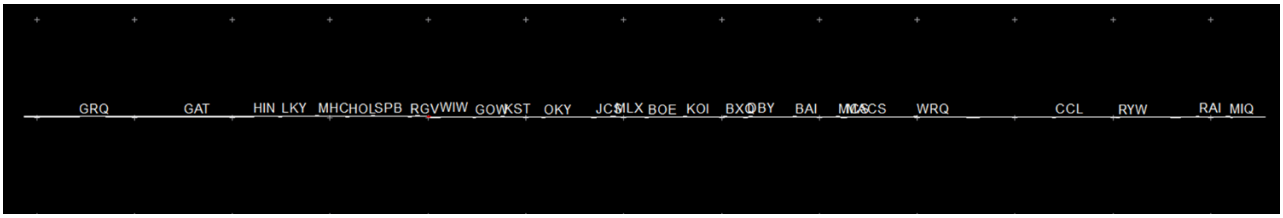

Figure 2 - Infrastructure Model Schematic Extracted from RailSys

The breakdown of tasks undertaken is as follows:

Table 5 - Agreed Task List

Ref	Task	Description
1.1	Create Model	Develop infrastructure model from available information sources and document assumptions made, request input from Stakeholders.
1.2	Create Base Timetable	Establish indicative trainplan from published data and available stakeholder information, document assumptions made and request input from Stakeholders.
2.1	Operational Capacity	Examination of Base Timetable and path development to establish maximum path capacity of West Moreton System.
2.2	Utilisation Levels	Identify the appropriate infrastructure usage level based on International Practice.

3.1	Tonnage Calculations	Calculate the tonnage carrying capacity from the outputs of Task 2.1 & 2.2.
4.1	Technical Memo on Findings	Memo development to support end deliverables.

By undertaking these tasks, the Capacity Exercise will, provide indicative tonnage levels for the wider Arcadis team to use in its estimates of DAU3 expenditure. It is noted that there are discrepancies between the quoted net tonnage capacity of trains on the West Moreton System between the information sources supplied from Queensland Rail and the Providers. For the purpose of this exercise, we have remained consistent with the mass quoted in the Queensland Rail Draft Undertaking documentation (DAU3 Maintenance Expenditure Submission, Section 4.6, Table 11, document page 235), whereby coal trains are assumed to be fully loaded and therefore have a standard mass of 2,008 tonnes net or 2,835 tonnes gross.

2 CAPACITY INVESTIGATION RESULTS

The high-level statements arising from the Indicative Capacity exercise are as follows, note to cater for any possible use of preserved paths by ad-hoc operation of coal services, we will refer to the gross tonnages as if all paths are utilised by coal services.

Assumptions

Below outlines the assumptions Arcadis has made for the capacity analysis of the West Moreton System:

1. Scope Boundary is the West Moreton system between Rosewood and Miles, no examination of the Brisbane Metropolitan area will be undertaken.
2. High-Level commentary on capacity implications of the Brisbane metropolitan area will be provided including, but not limited to, the impacts of issues such as the restrictions on peak time freight operations.
3. Yard infrastructure will not be included (e.g. Willowburn).
4. The latest available West Moreton System Information pack, Issue 3.1 – October 2016 (public information, available at link) has been used to develop the underlying model. The base assumptions are that:
    a. Location data is correct and as shown in the diagrams on pages 36 to 38.
    b. Speed information is correct and as shown in pages 48 to 52.
    c. Gradient and Curvature data is correct and as shown in the diagrams on pages 52 to 65.
    d. QR published runtimes are correct and as shown in Appendix F pages 66 to 69.
    e. QR published runtimes are inclusive of allowances for driver behaviour, minor variation in train performance and incorporate a resilience buffer.
5. It is assumed that the manually extracted curve and gradient data is interpreted correctly (we have made no amendments to enforce base data). The diagrams are in graphical format with a resolution that is too low for clear reading in some instances.
6. Simulation models for coal services are based upon the data provided by Aurizon on 28/07/2024, technical runtime calculations will be compared to QR published runtimes with QR values taking precedence.
7. QR published runtimes will be utilised for the first iteration of capacity calculation (see items 4.d and 4.e above).
8. QR services as published in the MTP (link) will be included in the first iteration of capacity calculation.

9. The date on which the MTP data was extracted will be recorded in the memo along with the applicable date of MTP data.
10. A stand-back distance of 20m is applied from all stopping positions (signals, stop boards etc).
11. Detailed signalling and route setting information is not available; therefore the following is assumed:
    a. Published timing points align to signalling locations and control points.
    b. A 2-minute margin is sufficient for movement authority to be provided and cover train controller actions in both Direct Traffic Control (DTC) and Remote Control Signalling (RCS) areas.
    c. Block sections will be between loops or timing points.
    d. For planning headways, Absolute Block principles will be applied, i.e. runtime of train plus 2 minutes will be sufficient for a following movement to be allowed to proceed (See Figure 1 below).

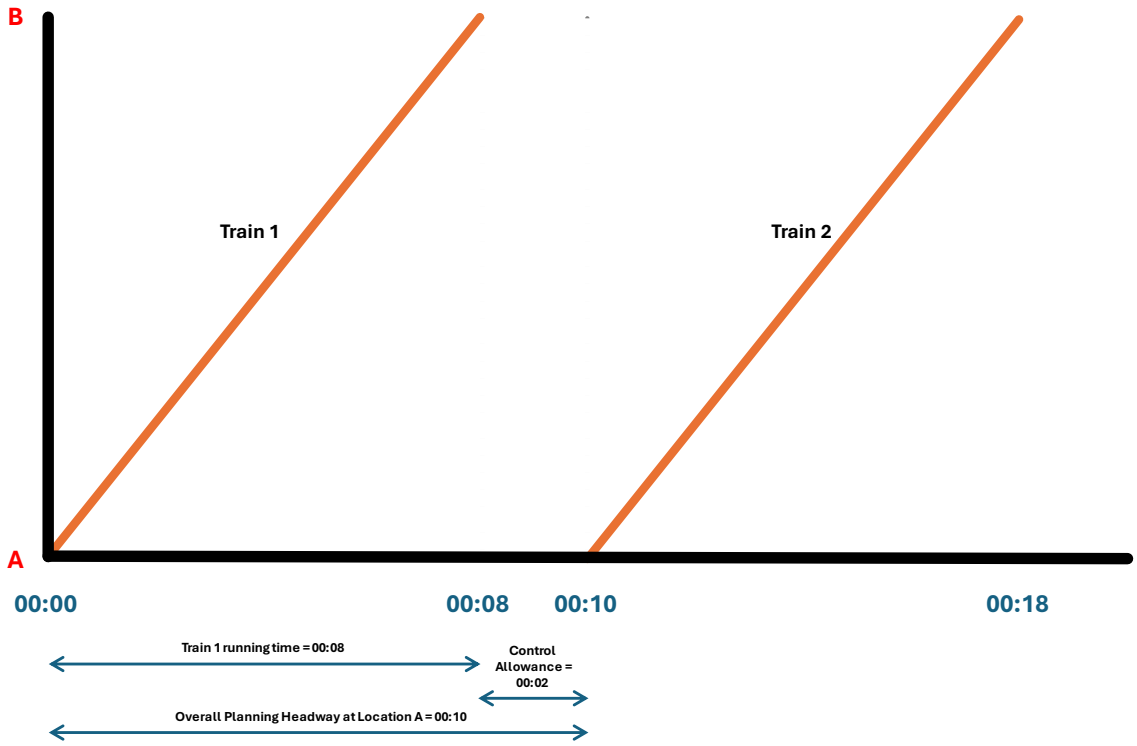

Figure 3 – Example of Indicative Planning Headway under Absolute Block Working principles

12. Arcadis makes the following assumptions for Cameby Downs train service capacity:
    a. Load time 105 mins (i.e., ~1,100tph) – assumes 42 wagon consist with max allowable net payload of 1,911t (noting that QR DAU uses 2,008 tonnes for a fully loaded service)
    b. Main line points to bin = 5mins
    c. Bin to main line junction = 4mins
    d. Minimum recharge time between trains = 30mins
    e. Max frequency of trains per day = 6
    f. Load point availability = 24x7

2.1.1 Maximum Theoretical Capacity

- Queensland Rail's assertion in the DAU that the "Toowoomba Range is the capacity constraint on the West Moreton System" is accurate, the RailSys Investigation reveals that the section between Rangeview and Spring Bluff is the ruling section (see Figure 2) and limits capacity to roughly one train per hour in each direction, noting that the scope of this engagement excludes the Brisbane metropolitan area which may present other capacity challenges.

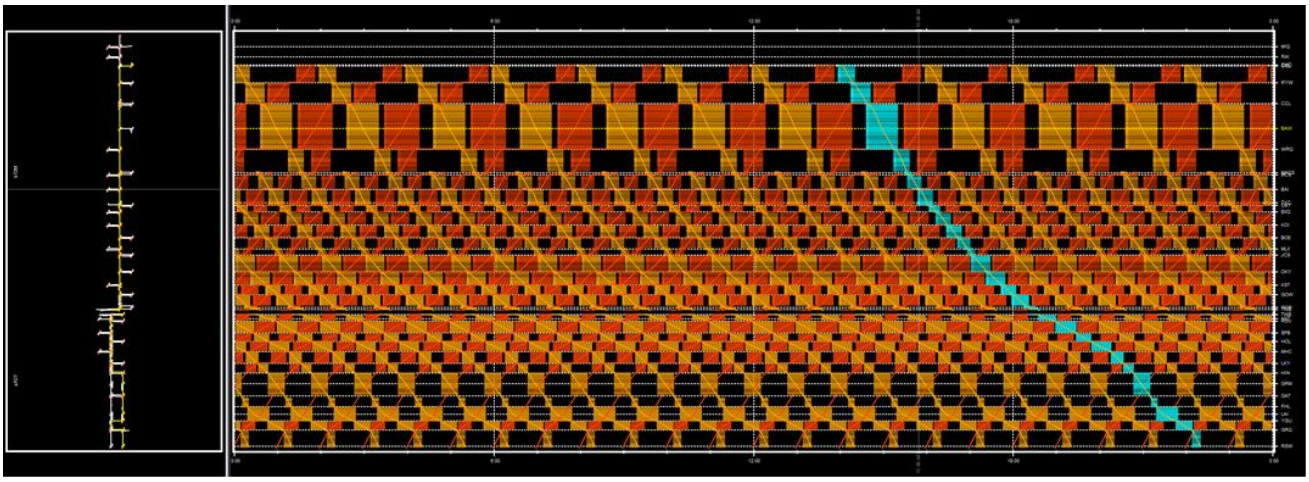

Figure 4 - RailSys Occupation Chart showing 100% Utilisation of West Moreton System

- The maximum theoretical capacity (at 100% of infrastructure utilisation) is therefore 168 return paths per week taking a Coal Service as the reference train, equating to an annual maximum gross tonnage of 31.99 mtpa or an annual net product tonnage of 17.54 mtpa.
- However, in practice, railway systems are not run at 100% of infrastructure capacity as operating a railway system at 100% of capacity utilisation does not allow for recovery from disruption events. In this situation, even minor delays will propagate throughout the system and degrade performance until at least one service has to be cancelled in order to generate an operational firebreak and recover the plan.
- Application of the International Union of Railways (Union Internationale des Chemins de fer, or UIC) suggested mixed traffic network occupancy rate level of 67% from their UIC 406 leaflet results in a total of 112 return paths per week, equating to an annualised maximum gross tonnage of 21.33 mtpa or an annual net product tonnage of 11.69 mtpa.
- Advice from Queensland Rail suggests that there is up to seven hours each day where the service structure of the Metropolitan Network precludes services from entering from the West Moreton System, this represents a structural reduction of 5 return paths per day. In our exercise this is accounted for in the reduction of paths by the capacity utilisation levels and is not separately examined.
- Application of Capacity Limitations on the Metropolitan Network dictate the structure of paths available on the West Moreton System but the reduction required is not in excess of that required to ensure reliable operation of the West Moreton System (i.e. the Metropolitan restriction results in a reduction of 35 loaded paths per week whilst the reduction to 67% utilisation removes 56 paths per week), however the overall impact would need to be examined through a detailed capacity exercise including the Metropolitan Network as well as the West Moreton System.
- As noted above, an accepted capacity utilisation level for a mixed traffic system such as the West Moreton System is around 67%, However, given the vast majority of traffic will be relatively homogenous coal services, and that Queensland Rail's proposed investment is

designed to improve infrastructure performance resilience, we consider that a Capacity Utilisation in the order of 75% will likely prove to be appropriate for the proposed operation.

- These calculations, however, do not account for total shutdowns arising from possession access or disruption events.

2.1.2 Limited Operating Hours

- We then undertook an examination of the impact of limiting the operating period on path capacity by reducing the Operating Window of the system at its critical point.
- An example utilising a 75% Capacity Utilisation can be seen in Table 2.

Table 6 – 75% Capacity Utilisation by Hours of Operation

Possession Days	Possession Hrs per Yr	Daily Hours of Operation	Weekly Coal Paths		Coal Service Gross Tonnage			Coal Net Tonnage		
			Up	Down	Up	Down	Total	Up	Down	Total
0.00	0	24	110	110	16,216,200	4,730,440	20,946,640	11,485,760	0	11,485,760
15.21	365	23	104	104	15,331,680	4,472,416	19,804,096	10,859,264	0	10,859,264
30.42	730	22	99	99	14,594,580	4,257,396	18,851,976	10,337,184	0	10,337,184
45.63	1095	21	94	94	13,857,480	4,042,376	17,899,856	9,815,104	0	9,815,104
60.83	1460	20	89	89	13,120,380	3,827,356	16,947,736	9,293,024	0	9,293,024
76.04	1825	19	83	83	12,235,860	3,569,332	15,805,192	8,666,528	0	8,666,528
91.25	2190	18	78	78	11,498,760	3,354,312	14,853,072	8,144,448	0	8,144,448
106.46	2555	17	73	73	10,761,660	3,139,292	13,900,952	7,622,368	0	7,622,368
121.67	2920	16	68	68	10,024,560	2,924,272	12,948,832	7,100,288	0	7,100,288
136.88	3285	15	62	62	9,140,040	2,666,248	11,806,288	6,473,792	0	6,473,792
152.08	3650	14	57	57	8,402,940	2,451,228	10,854,168	5,951,712	0	5,951,712
167.29	4015	13	52	52	7,665,840	2,236,208	9,902,048	5,429,632	0	5,429,632
182.50	4380	12	47	47	6,928,740	2,021,188	8,949,928	4,907,552	0	4,907,552
197.71	4745	11	41	41	6,044,220	1,763,164	7,807,384	4,281,056	0	4,281,056
212.92	5110	10	36	36	5,307,120	1,548,144	6,855,264	3,758,976	0	3,758,976
228.13	5475	9	31	31	4,570,020	1,333,124	5,903,144	3,236,896	0	3,236,896
243.33	5840	8	26	26	3,832,920	1,118,104	4,951,024	2,714,816	0	2,714,816
258.54	6205	7	20	20	2,948,400	860,080	3,808,480	2,088,320	0	2,088,320
273.75	6570	6	15	15	2,211,300	645,060	2,856,360	1,566,240	0	1,566,240
288.96	6935	5	10	10	1,474,200	430,040	1,904,240	1,044,160	0	1,044,160
304.17	7300	4	5	5	737,100	215,020	952,120	522,080	0	522,080
319.38	7665	3	0	0	0	0	0	0	0	0
334.58	8030	2	0	0	0	0	0	0	0	0
349.79	8395	1	0	0	0	0	0	0	0	0
365.00	8760	0	0	0	0	0	0	0	0	0

- This demonstrates that to meet the net tonnage requirement at 75% capacity utilisation of coal services, plus the 16 non-contracted paths, the West Moreton System must be available for traffic for an average of 121 hours per day over the course of the year.

- Queensland Rail's future Annual Possession Hours requirement of circa 3,200 hours as quoted in the DAU documentation (Queensland Rail's Draft Access Undertaking 3 (DAU3) Explanatory Document, Section 2.10.2, Figure 11, Page 42) aligns with an average daily operating period of 15 hours per day (9 hours wheels free per day equals 3,285 hours per year). We note that these hours assume that Queensland Rail make significant changes to maintenance and capex processes resulting in this forecast network unavailability time being half (or less) of the current and historical wheels-free network access provision.
- For this reason, we have examined a range of capacity utilisation levels for an operational window averaging 15 hours per day.
- Although not undertaken for this engagement, a future iteration of this exercise should carry out detailed perturbation modelling to examine the propagation of delays under the various capacity utilisation levels and provide a more accurate insight into the reliable system capacity level.
- Table 3 below shows a capacity comparison between the 67% and 75% utilisation levels mentioned above.

Table 7 - Number of Coal Paths and Tonnage Levels under UIC406 Standard and Arcadis West Moreton Scenarios

	% Capacity Utilisation	Weekly Coal Paths	Coal Service Gross Tonnage	Coal Net Tonnage
UIC 406 standard	67%	54	10,282,896	5,638,464
Arcadis West Moreton estimate	75%	62	11,806,288	6,473,792

- 75% Capacity Utilisation for an operating Window of 15 hours per day will equate to 62 contractable Return Coal Paths per Week (noting that 16 paths per week are preserved for non-coal traffic) and an annual net tonnage carrying capacity for coal of 6.47 mtpa.
- In order to provide the desired annual net tonnage of 9.6 mtpa carrying capacity for coal at a 75% Capacity Utilisation level, it would be necessary to increase the Operating Window to around 21 hours per day, noting that this will reduce the time available for engineering access to 1,095 hours annually representing around 1/3rd of the access level proposed by Queensland Rail in their DAU submission, it can be expected that this access reduction would present a flow on effect upon maintainability of the network.
- In addition to these figures, Queensland Rail have noted that geotechnical issues in the Toowoomba range have seen multiple shutdowns in the past decade, with the most recent closure lasting for 19 days (Queensland Rail's Draft Access Undertaking 3 (DAU3) Explanatory Document, Attachment 2, Page 15). While these events cannot be forecast, from these calculations it is also possible to provide a rough order figure of the daily lost tonnage potential for days where a major disruption event causes the network to be closed. The loss of a day's operation would see up to 17,700 tonnes of coal unable to be moved per day.

2.1.3 Observations and Comments

In undertaking this exercise, a number of items which fall outside of the immediate scope of the engagement have been identified or raised by stakeholders in discussion, feedback, and comment. This section notes these and, where appropriate, provides a brief commentary on both their impact and possible future areas for further investigation or consideration.

- There is a likely misalignment between the time window where services cannot contract for access to the Metropolitan Network and the network maintenance access windows meaning that service reductions may be amplified.
- Based upon historical information provided by Queensland Rail on the level of unutilised preserved paths, there may be the opportunity to provide upto 0.7 mtpa of haulage capacity for coal traffic on an ad-hoc basis. This could be formalised by a revised daily timetabling process whereby all paths are included in the base timetable but reallocated on an as-required commercial basis similar to the "*Day A for C*" process used for commercial freight traffic in the UK.
- The Capacity Constraints presented by the West Moreton System have been examined in isolation from those presented by the wider Metropolitan system. The Above-rail operator and users raised numerous issues with Rail Capacity in the Brisbane Metropolitan system and the way this constrains movement of non-passenger traffic. They considered that in practical terms the metropolitan system was a greater constraint on capacity than the Toowoomba Range and the way this constrains movement of non-passenger traffic. They considered that in practical terms the metropolitan system was a greater constraint on capacity than the Toowoomba Range. A particular comment was around the lack of clarity of the impacts on freight services following the opening of Cross River Rail and the revised sectorisation that this will bring.
- Comments were raised about the overall timetable planning process and the ways in which engineering works (both Capex and Heavy Maintenance) are reflected in the train plan. There is an opportunity to improve outcomes via an integrated planning system which supports coordinated timetable and possession planning. This will become more pertinent as additional data requirements placed upon timetabling systems become apparent through the ongoing roll-out of European Train Control System (ETCS) signalling and the Traffic Management System (TMS) deployment.
- As all coal services ultimately operate to and from Fisherman Island as a Pit to Port cycle, this examination presents an incomplete overview of the capacity and operational challenges experienced by these services. A future iteration of this work with a wider scope could be planned to undertake a full analysis of capacity for Coal services between the West Moreton coal mines and the Port of Brisbane.
- It is noted that QR has stated the condition of the network has changed in recent years, however numerous elements of the input information have not been reviewed or formally documented for a number of years. This particularly concerns the details of the West Moreton System itself as contained in the System Information Pack but also the calculation, construction, and presentation of Sectional Running Times (SRTs). There is therefore an opportunity to undertake a formalised review of the infrastructure data and then recalculate the running times utilising the updated information and undertaking a comparison to actual recorded data.
- Comments were raised over the performance monitoring and reporting of delays appearing to be a very manual process. As a part of a TMS deployment it is possible that this will become more automated depending on the precise nature of the systems being deployed to Queensland Rail and the rollout timeline. This would also be an opportunity to review system performance KPIs and redevelop reporting structures.

From the comments and observations received, it is noted that there is a significant opportunity to undertake an examination of freight capacity and performance through the Brisbane metropolitan area. It is unclear whether such an exercise is either planned or underway by either TMR or Queensland Rail but from the stakeholder comments received there is certainly a desire to engage in such an exercise and a belief that this would be beneficial.

2.1.4 Reference Documentation:

The following reference documents have been used to undertake this exercise:

- Queensland Rail West Moreton System Information Pack - Issue 3.1 - October 2016 (link)
- Queensland Rail Draft Access Undertaking 3 submission
- Aurizon Information Pack – Issued via QCA 28/07/24
- Queensland Rail Standard – MD-10-533 – Operational Route Manual
- UIC (link) Leaflet 406 - Capacity

2.1.5 Attachments:

- Assumptions Register
- Meetings List

B. EXPENDITURE TABLES

Table B-1 Capital Expenditure – assessed at 7.5 mtpa

Project name	DAU3 Amount	Arcadis Commentary
Coal Tonnage	***7.5 mtpa***	***7.5 mtpa***
Slope Stabilisation	[redacted]	Cost has risen by [redacted]. Per discussion with QR, this is driven by revised estimate of project costs. We additionally note that works have been spread across 4 years instead of 2. Although it would be more efficient to complete this in a shorter time period we deem this reasonable at volume of 7.5 mtpa
Culvert Renewals	[redacted]	It appears the removal of track reconditioning west of Jondaryan has reduced the number of culverts requiring replacement. This is reflected in the reduction of capital spend on culverts. We deem this reasonable at volume of 7.5 mtpa
Track Reconditioning	[redacted]	QR will need to balance the time made available for possessions to recondition versus the desire to run more trains as the capacity increases. Careful staging of works will allow trains to optimise the new works and increase availability, this is not necessarily fixing the worst sections first. It will require a strategic approach and geographical approach. We deem this capex as reasonable
Formation Strengthening	[redacted]	We classify this as a safety requirement as this project relates to track stability. We note that formation strengthening is also tonnage dependent as per QR's submission. Noting that these projects are in the constrained areas and assists with reliability, we deem this as reasonable.
Curve Transitions	[redacted]	Curve transitions are only on the Toowoomba Range. QR states that these works are not tonnage dependent. However, section 4.6 of DAU3 Maintenance Expenditure Submission (Nov 2024) states that curve transitions are tonnage dependent. Arcadis deems this as tonnage dependent as the increase in trains goes down the range, the more stress there is on the track. Therefore the assumption is that the capital cost has decreased as a result of the tonnage decreasing. We deem these works as reasonable at 7.5 mtpa.
Re-sleepering	[redacted]	From QR's response to QCA's draft decision, our understanding is that if higher tonnes are hauled, the availability to replace sleepers becomes untenable. Therefore, we have noted that QR's responses clarified that re-sleepering is a time dependent issue. We deem these works as reasonable.
Re-railing	[redacted]	These works see end of life 41kg/m rail replaced with 50kg/m rail. The works are tonnage dependent, therefore the capital cost has decreased as a result of the tonnage decreasing. These works are deemed reasonable.
Level Crossing Transitions	[redacted]	Not tonnage dependent and addresses safety concerns. These works are deemed reasonable at 7.5 mtpa.

Project name	DAU3 Amount	Arcadis Commentary
Ballast Undercutting	[redacted]	Ballast undercutting still required to address track stability at 7.5 mtpa. Deem works as reasonable.
Bridge Pier Replacement	[redacted]	From QR's response to QCA's draft decision, additional information provided outlined that a shortage of staff and timber material exists and it is therefore difficult to complete maintenance for specified bridges. We consider that the reduction is due to bridge pier replacement out west, where there is little increase in tonnage relative to prior period. We deem these works as reasonable.
Signalling Cables	[redacted]	Expired assets are not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Digital Telemetry	[redacted]	The replacement of expired and aged assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
SER/PER Upgrade	[redacted]	The replacement of expired assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
LED Upgrade	[redacted]	The replacement of expired assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Re-signalling	[redacted]	The replacement of obsolete assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Interlocking Renewal	[redacted]	The replacement of expired assets is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Refurbishment	[redacted]	The replacement of end of life equipment is not tonnage dependent and proposed capital expenditure is deemed reasonable at coal volume of 7.5 mtpa.
Bridge Strike Protection	[redacted]	The proposed works are to install steel protection beams to five bridges at risk of being struck by vehicles. Increasing traffic volumes and vehicle sizes has led to more incidents of bridges being struck. Installing protection beams has been deemed more effective than warning devices alone which are often ignored/not heard. At approximately [redacted] per bridge, presumably including beams and signage on both approaches, this is a reasonable cost and will provide great value if it deters/prevents strikes.
Range drones	[redacted]	Remote sensing is valuable technology and removes workers from the track which is a priceless saving. This is particularly relevant on the Toowoomba Range where access is difficult and time consuming. Capital works deemed reasonable.
Heat sensors	[redacted]	The ability to measure track temperature is key to the efficiency of the WMS. Direct measurement using remote sensing, improves the reliability of data and will help avoid 'false alarms' and remove workers from the track, provided they are installed correctly and located in the optimal sections of track. Capital works deemed reasonable.

Project name	DAU3 Amount	Arcadis Commentary
LX protection upgrades	[redacted]	These works consist of replacing signalling equipment on a like-for-like basis to avoid equipment becoming obsolete. Maintaining equipment that is no-longer 'off the shelf' is an expensive proposition and should be avoided. Capital works deemed reasonable.
Total	**256.6**	

Table B-2 – Operating expenditure – assessed at 7.5 mtpa

Operating expense type	DAU3 Amount FY25-26 ($FY2025-26 000s)	Arcadis assessment at 7.5 mtpa
Tonnage	***7.5 mtpa***	***7.5 mtpa***
Train Control, planning & systems and ops administration	4,739	✓
Monitoring Systems	[redacted]	✓
Engineering Support	[redacted]	✓
Management Support	[redacted]	✓
Network Infrastructure Material Logistics	[redacted]	✓
Assurance and Capability (Asset Maintenance)	[redacted]	✓
Regional Asset Delivery	[redacted]	✓
QCA Fees		✓
Program on Costs	1,090	✓
Other regional costs	248	✓
Telecommunications Backbone	1,359	✓
Corporate Overhead	2,517	✓
Total Operating Expenses (incl. depreciation)	13,305	
Return on buildings, plant, software and inventory	1,612	**Not assessed by Arcadis**
Total Operating Expenses (incl. depreciation)	**14,917**	

Source: QR DAU3, Arcadis

Note: Differences in total figures may occur due to rounding

Table B-3 Maintenance expenditure – assessed at 7.5 mtpa

Maintenance expense type	QR Amount FY25-26-FY29-30 ($ millions)	Arcadis reasonable-ness assessment	Commentary
Tonnage	***7.5 mtpa***	***7.5 mtpa***	
Mechanised Resurfacing	[redacted]	✓	The forecast annual spend is only slightly higher than previous year results despite higher tonnage.

			We expect that the decrease in spend per net tonne is driven by a reduced amount of required resurfacing in the eastern section of WMS. These would be offset by cost increases in recent years that have exceeded inflation.
Rail Stress Adjustment	[redacted]	✓	Considering the anticipated increase in tonnes (this expense type is tonnage dependent) and cost escalations in recent years, this appears to be reasonable. We expect that the capital works will alleviate some of the effects of rail stress.
Repairs - fixed	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Repairs - variable	[redacted]	[redacted]	FY21-23 costs averaged [redacted] p.a. Yearly forecasted costs are [redacted]. We do not deem this reasonable as it appears to double-up on compliance inspection activities. Additionally, it is expected that capital works would have alleviated some of the required repairs. Using table 18 in the Maintenance Expenditure submission, we have applied a 40% reduction in variable repairs. We deem [redacted] a reasonable variable repairs amount.
Sleeper Management	[redacted]	✓	Considering predicted tonnage increases, sleeper management amount is deemed reasonable.
Maintenance Ballasting	[redacted]	✓	Reduced proportionately from 9.6 mtpa scenario. FY21-23 costs averaged [redacted] p.a. Forecast FY26-30 average [redacted] per year is reasonable considering increased tonnage.
Rail Joint Management	[redacted]	✓	Annual costs are relatively aligned with FY21-23. They appear to be reasonable.
Top & Line Spot Resurfacing	[redacted]	✓	Considering predicted tonnage increases this amount seems reasonable.
Signalling	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Assets Comp Insp/Svc	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Fire & Vegetation Management	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Renewals	[redacted]	✓	Aligned with historical fixed costs and reasonable variable cost. Amount deemed reasonable.
Asset Inspections Non Compliance	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Consulting/Technical Advice	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Telecoms	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Earthworks - Non Formation	[redacted]	✓	Not tonnage dependent and a reasonable sum considering the amount of non-rail drainage and earthworks requiring regular maintenance. Aligned with historical fixed costs. Amount deemed reasonable.
Turnout Maintenance	[redacted]	✓	Tonnage dependent and a reasonable amount.
Electrical	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.
Lubrication	[redacted]	✓	Minor amount deemed reasonable
Other - fixed	[redacted]	✓	Aligned with historical fixed costs. Amount deemed reasonable.

Other - variable	[redacted]	✓	Allocated across other items in this report
	[redacted]	✓	Immaterial
Mechanised resleepering			
	[redacted]	✓	Amount deemed reasonable
Rail grinding			
Total	**141.5**	**135.8**	

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