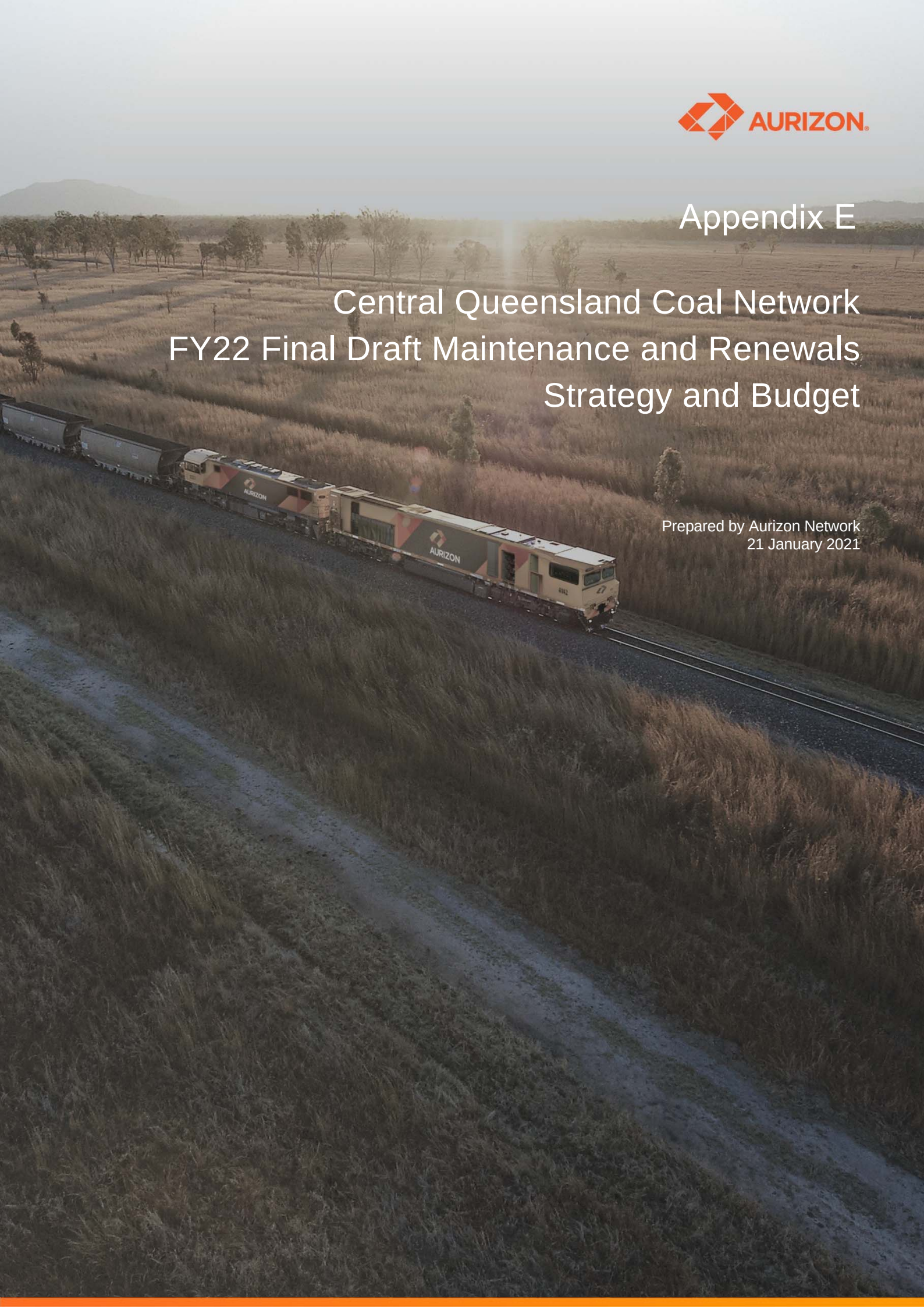

Appendix E

Central Queensland Coal Network FY22 Final Draft Maintenance and Renewals Strategy and Budget

Prepared by Aurizon Network
21 January 2021

Aurizon Network
FY22 Final Draft Maintenance and Renewals Strategy and Budget
Central Queensland Coal Network

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Appendices

Introduction

Aurizon Network Pty Ltd (**Aurizon Network**) is the accredited Rail Infrastructure Manager (**RIM**) of the Central Queensland Coal Network (**CQCN**), the largest open-access coal rail network in Australia and one of the country's most complex rail freight networks. The CQCN is comprised of over 2,670 kilometres of heavy haul railway track, linking more than forty mines to five coal export terminals across four major Coal Systems and the Goonyella to Abbot Point Expansion (**GAPE**).

On 19 December 2019, the Queensland Competition Authority (**QCA**) approved Aurizon Network's 2017 Access Undertaking (**UT5**). The approval of UT5 has provided a unique opportunity for Aurizon Network and its Customers to adopt a new approach to working together; one that promotes greater collaboration and creates mutually beneficial outcomes. A key aspect of the new arrangements is the opportunity to enable greater customer involvement in the development and assessment of Aurizon Network's Maintenance and Renewal Strategies and Budgets on an annual basis. The new arrangements will enable increased transparency over the execution of the maintenance and renewals programs and the improvement initiatives that Aurizon Network undertakes.

This is a significant and positive change to the way in which multi-year maintenance and renewals allowances have historically been set and managed. Aurizon Network is working to adjust its systems and processes to reflect these new arrangements and enable greater transparency and customer engagement in the planning and forecasting process.

During the development of the FY21 Maintenance and Renewals Strategies and Budgets for each Coal System (**FY21 Approved Strategy and Budget**) Aurizon Network made a number of commitments to the Rail Industry Group (**RIG**) to improve transparency and engagement which have been progressively implemented since approval was received. This included proactive engagement with RIG members to deliver:

- Customer consultation and information sessions to ensure alignment of FY22 possession plans and provide summary information in relation to maintenance and renewal requirements, delivery strategy and costs;
- A series of engagements with the RIG Chair and Advisors to provide more detailed explanations of the maintenance and renewal requirements, delivery methods and proposed submission content;
- A 'Ballast Deep Dive' review, including the identification of delivery options, subsequent discussions and responses to formal questions; and
- Provision of a Quarterly Report based upon initial feedback from the RIG, which contained an update on scope delivery, financial outcomes, and system health metrics that provide information on how the CQCN infrastructure is performing relative to previous periods.

This engagement has informed the development of the final draft Maintenance and Renewals Strategies and Budgets for each Coal System for the Financial Year ending 30 June 2022 (**FY22 Final Draft Proposal**). It has also enabled planning and delivery options to be explored and provided increased transparency on the asset condition and cost build-up of the maintenance and renewal budgets.

Aurizon Network recognises early and meaningful engagement with the RIG and our Customers is critical to the successful implementation of solutions that will deliver mutual benefits for all stakeholders within each Coal System and appreciates that opportunities to improve the engagement process will continue to arise as these new arrangements are fully embedded.

Aurizon Network is committed to building and maintaining a collaborative working relationship with the RIG to support providing Access Holders, their Customers and Train Operators with safe and reliable Rail Infrastructure in each Coal System and a high degree of operational certainty.

Aurizon Network welcomes the opportunity to submit the FY22 Final Draft Proposal to the RIG for consideration.

Structure of Aurizon Network's FY22 Final Draft Proposal

Part A – Aurizon Network's FY22 Final Draft Proposal

Part A outlines Aurizon Network's proposed strategies and budgets for maintenance and renewal activity in each Coal System. Part A is structured as follows:

- Key assumptions underpinning the FY22 Final Draft Proposal (Chapter 1);
- Stakeholder Engagement (Chapter 2);
- Key Improvement Initiatives (Chapter 3);
- Maintenance Strategy and Budget and Renewals Strategy and Budget for the:
  - Blackwater System (Chapter 4);
  - Goonyella System (Chapter 5);
  - Moura System (Chapter 6);
  - Newlands System and GAPE (Chapter 7); and
- Four-year forward indicative cost forecast (Chapter 8).

Part B – Asset Management Framework

Part B provides high level insight into the asset management process. It seeks to demonstrate how Aurizon Network intends to deliver asset activity in each Coal System in a way that is consistent with the UT5 Maintenance Objectives. Part B is structured as follows:

- Guiding Principles and Context (Chapter 9);
- Aurizon Network's legislative and regulatory requirements (Chapter 10);
- How we identify and prioritise scope (Chapter 11);
- How we plan asset activity and assess capacity impacts (Chapter 12);
- How we set budgets for asset activities (Chapter 13); and
- How we deliver asset activity (Chapter 14).

In this FY22 Final Draft Proposal, except to the extent a term is expressed to the contrary, capitalised terms have the meaning given in UT5.

Aurizon Network has engaged with the Rail Industry Group and Customers in developing the FY22 Final Draft Proposal and seeks to meet the UT5 Maintenance Objectives

The objective of Aurizon Network's FY22 Final Draft Proposal is to safely and efficiently deliver:

- the appropriate level of asset renewal and maintenance activity;
- at the right time to ensure continuity of service;
- in a manner that seeks to maximise supply chain throughput; and
- at a cost which is efficient and prudent.

This approach helps to promote the efficient use of the CQCN for the benefit of the entire supply chain.

Aurizon Network has developed its FY22 Final Draft Proposal for each Coal System having regard to the relevant matters as outlined in UT5, including the Maintenance Objectives. In accordance with the Maintenance Objectives, Aurizon Network must ensure that Maintenance Work is undertaken in a manner that has regard to the matters set out in the first column in Table 1 below:

Table 1 Steps Aurizon Network has taken to seek to achieve the Maintenance Objectives

Maintenance Objective	Treatment
(a) seeks to ensure that Committed Capacity is delivered.	Aurizon Network is implementing a planning process that aims to improve its ability to preserve the Committed Capacity for the year and to meet Customer train orders. This will see a more disciplined approach to allocating capacity for train operations and taking advantage of paths between Train Services to undertake maintenance activities.
(b) appropriately balances cost, reliability and performance of the Rail Infrastructure in the long and short term.	Aurizon Network prioritises asset activity based on asset condition and criticality and considers planning and delivery constraints, as well as customer feedback, when determining how best to maintain or improve the cost, reliability and performance of Rail Infrastructure in each Coal System. Aurizon Network continues to refine and develop the processes and systems which allow the identification, prioritisation, planning and delivery of asset activities.
(c) coordinates outages with other Supply Chain Participants wherever reasonably possible with a view to maximising throughput.	Engagement on the FY22 access plan commenced earlier than in prior years, which provided for a greater degree of engagement with other Supply Chain Participants to better understand their plans for major infrastructure outages. Aurizon Network has sought to align the delivery of high impact network activities in FY22 with major infrastructure outages relevant to each Coal System. In doing so, Aurizon Network seeks to maximise throughput by minimising the impact of below rail asset activity on the supply chain.

Aurizon Network considers the FY22 Final Draft Proposal provides an appropriate level of asset activity that will promote the safety, reliability and performance of Rail Infrastructure and, therefore, deliver a service that seeks to ensure that Committed Capacity is delivered.

Aurizon Network's approach to asset management aims to deliver consistent network performance

Aurizon Network seeks to provide Committed Capacity by adopting an asset management approach which focusses on delivering the appropriate levels of asset availability and sustained, reliable below rail performance at the most efficient cost of ownership throughout the asset life cycle.

Over the last five years this approach has sought to facilitate increased throughput while maintaining below rail operational performance, as demonstrated through mean time to failure, Temporary Speed Restriction (**TSR**) delays and improving cost efficiency.

Operational highlights by Coal System

Figure 1 Million Net Tonnes per annum

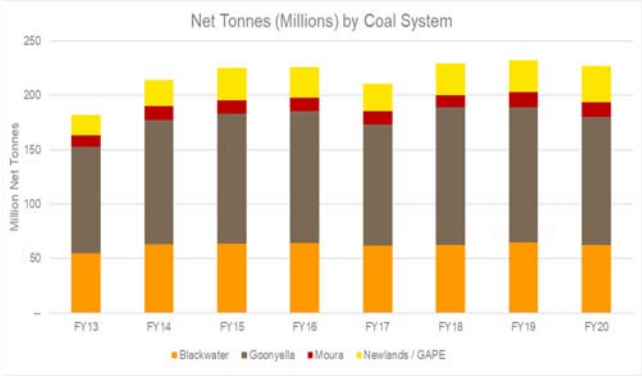


Figure 2 Mean Net Tonne Kilometres to Failure – Non Electric[1]

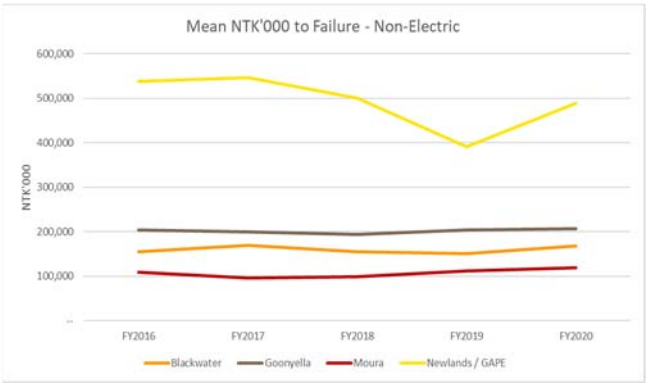


Figure 3 Mean Net Tonne Kilometres to Failure - Electric

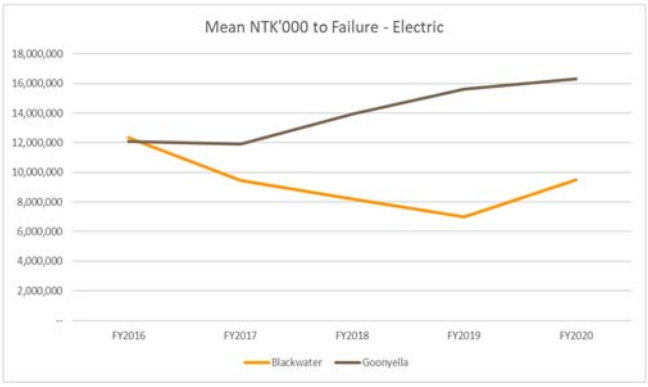
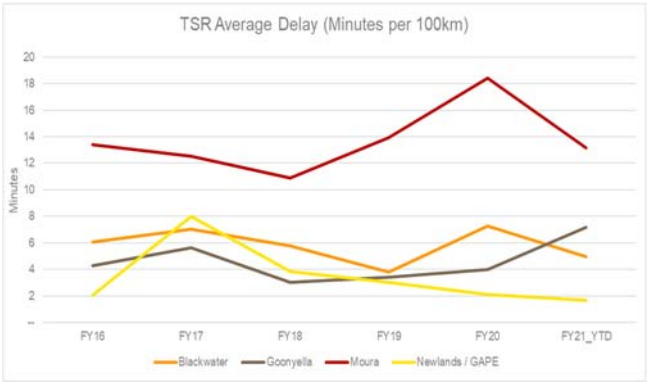


Figure 4 Average Temporary Speed Restriction Delay



[1] In this context, a 'Failure' is deemed to occur when a Form 42 is issued by Network Control. The Form 42 provides notification of a disruption to the Daily Train Plan, but it should be noted that such disruption may not always be attributable to an infrastructure fault, e.g. depending on severity of impact, it is possible that a Form 42 could also be issued in the event of collision with wildlife.

Figure 5 Maintenance and Renewal Expenditure ($Real)

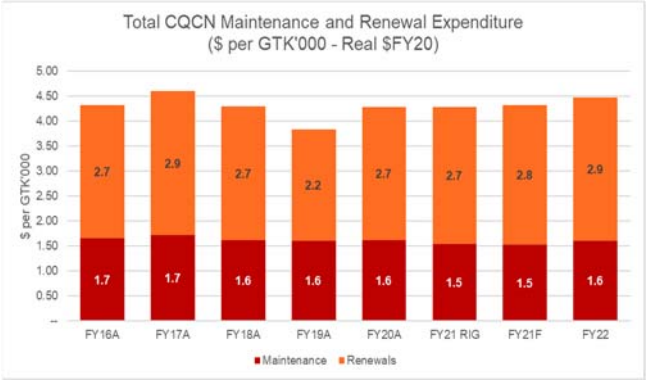


Figure 6 Overall Track Condition Index[2]

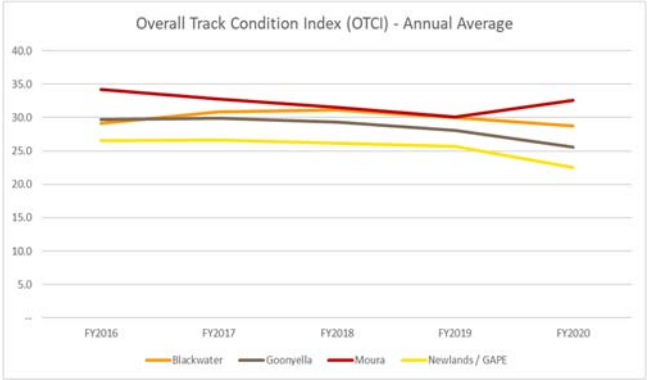
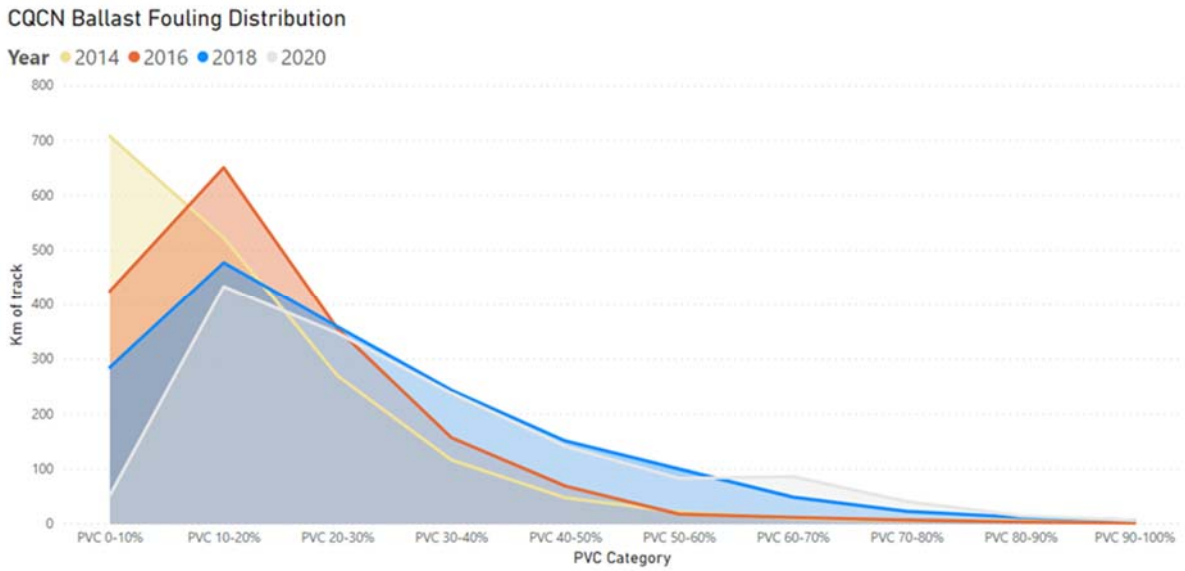


Figure 7 – Indicative FY2020 Ground Penetrating Radar outputs[3]



Aurizon Network continues to focus on identifying, trialling and implementing initiatives aimed at progressively enhancing the asset management program and operational performance for Customers. These initiatives have typically focussed on system and process improvements to enhance the quality and availability of data to support planning and decision making, improve operational discipline and reduce cost.

Key initiatives implemented, or in the process of being implemented, include the introduction and enhancement of the Network Asset Management System (**NAMS**) to track and plan maintenance activities, Movement Planner to enhance day of operations management, an Advanced Planning and Scheduling (**APS**) tool that will help to manage growing operational complexity, and a renewed focus on Disciplined Train Operations to better utilise available capacity to deliver train services and asset activities.

[2] The change in OTCI between FY2019 and FY2020 is, in part, attributable to the service provider transitioning to a new system and OTCI calculation method. This is evident in the OTCI results in May-20 for Blackwater, Goonyella and Newlands/GAPE, and in June-20 for the Moura System. The change in calculation method has seen OTCI values reduce without a material improvement in track condition; an outcome that has been field-validated by Aurizon Network. The new system cannot replicate the previous OTCI measures without manual manipulation. Aurizon Network is working with the service provider to adjust processes and outputs for the modernised track recording system.

[3] These GPR results are indicative only and are still being analysed by Aurizon Network. As per Aurizon Network commitments in s2.1.5, further detail will be provided as part of Commitment C.

Aurizon Network recognises continuous improvement is an ongoing journey and that there are further opportunities to improve the way in which it plans and conducts operations. Aurizon Network will continue to work with Customers to develop and implement initiatives in order to:

- Enhance Aurizon Network's ability to safely deliver on our Customer commitments in an increasingly complex CQCN;
- Improve the quality and transparency of Aurizon Network's engagement with and reporting to Customers; and
- Continually drive improvements in cost and scope delivery performance.

Summary of Aurizon Network's FY22 Final Draft Proposal

The FY22 Final Draft Proposal provides a level of asset activity and funding that Aurizon Network considers is appropriate to deliver a fit for purpose, sustainable, reliable and safe rail network; one that meets the needs of Customers in each Coal System and seeks to maximise supply chain throughput.

It has been prepared following engagement with the RIG and Customers and takes into consideration capacity related information provided by other Supply Chain Participants. Aurizon Network considers the FY22 Final Draft Proposal will allow it to deliver the required asset activity consistent with the Maintenance Objectives provided for in UT5.

In aggregate, Aurizon Network's FY22 Final Draft Proposal for the CQCN provides for a maintenance budget (excluding ballast undercutting plant depreciation) of $144.6m, which is $5.2m below the FY21 allowance proposed by the QCA in its UT5 Final Decision and includes efficiency benefits that limit the impact of cost escalations and scope variations compared to the latest FY21 forecast.

The FY22 Final Draft Proposal also provides for a renewals budget of $275.1m, which is $3.2m above Aurizon Network's full year forecast for FY21 and an $8.6m increase on the FY21 Approved Strategy and Budget. This increase is partially driven by the renewals of aging infrastructure such as optical fibre, as well as the increased cost of ballast cleaning ($3.3m) resulting from the assumed introduction of dual Ballast Cleaning Machine Operations in Q4 FY22 (which is assumed in the FY22 Proposal but remains subject to final approval).

The respective values for each Coal System are outlined in Table 2 and Table 3 below.

Table 2 FY22 Final Draft Proposal – Direct Maintenance Cost Allowance ($m)

System ($m)	FY18 Actual	FY19 Actual	FY20 Actual	FY21 Approved Budget	FY21 Full Year Forecast	FY22 Draft Budget
Direct Maintenance Costs						
Blackwater	59.8	64.0	63.0	59.1	61.3	62.0
Goonyella	54.2	57.0	56.9	56.9	57.6	58.0
Moura	14.3	11.8	12.0	12.5	11.8	12.3
Newlands / GAPE	12.0	13.8	13.2	13.7	11.9	12.3
Total (excl ballast plant depreciation)	**140.4**	**146.7**	**145.1**	**142.2**	**142.6**	**144.6**
UT5 FD Allowance	*n/a*	*n/a*	*147.2*	*149.8*	*149.8*	*n/a*
Ballast Plant Depreciation	*n/a*	*n/a*	*n/a*	6.5	5.1	6.6
Total CQCN	**140.4**	**146.7**	**145.1**	**148.7**	**147.7**	**151.2**

Table 3 FY22 Final Draft Proposal - Renewals Allowance ($m)

System ($m)	FY21 Approved Budget	FY21 Full Year Forecast	FY22 Draft Budget
Blackwater	116.1	121.5	117.1
Goonyella	113.5	112.0	120.9
Moura	15.4	16.6	11.8
Newlands / GAPE	21.4	21.8	25.3
Total CQCN	**266.4**	**271.9**	**275.1**

Given the current uncertainty resulting from COVID-19, the FY22 Final Draft Proposal has been based on assumed volumes of 227mt, in line with FY20 actual results. Potential implications for maintenance and renewals activities resulting from volumes above this level, the findings of the Independent Expert's Initial Capacity Assessment Report (**ICAR**), which is expected to be delivered in 2H FY21, or extreme weather events have not been reflected in the proposed strategies and budgets. Any subsequent amendments will be addressed with the RIG through the change management process.

A detailed breakdown of the asset activity that is proposed in each Coal System is provided in Part A of this FY22 Final Draft Proposal.

Rail Industry Group Feedback – 1 January 2021

On 30 December 2020, the Chair of the RIG, on behalf of a Special Majority of End Users, provided Aurizon Network with a list of almost 50 comments, queries and proposed amendments in relation to the FY22 Draft Proposal (**Proposed Amendments**) as well as a request for additional commitments from Aurizon Network. These were contained within three sections being:

- Section A – Critical issues;
- Section B – Detailed Questions and Comments; and
- Section C – 2021 Commitments.

Where possible, Aurizon Network has responded to the Proposed Amendments by providing additional information in this FY22 Final Draft Proposal. A detailed written response addressing the individual comments and queries raised has also been provided to the RIG and a summary of the response to key issues and requested commitments is provided in chapter 2.1 below.

As noted, Aurizon Network is supportive of pursuing opportunities to enhance collaboration with the RIG and customers in relation to the Maintenance and Renewals Program in recognition of the value exchange agreed in the UT5 Agreement. In response to the requests contained in the Proposed Amendments, Aurizon Network therefore makes the following key commitments to the RIG:

(a) To refine budgeting and forecasting processes to enable a driver based build-up of maintenance costs where appropriate;

(b) To work with the RIG to continue to refine and enhance quarterly reporting and performance metrics taking into consideration both specific feedback on the initial Quarterly Report (yet to be received) and the monthly reporting which is to be provided by the Independent Expert;

(c) To provide additional information in relation to the condition of ballast throughout the Network (including the analysis of the 2020 GPR results) and to work with the RIG to explore initiatives to address any decline (including fouling mitigation strategies);

(d) To continue to work with the RIG to increase user understanding of Aurizon Network's planning, procurement and execution of Maintenance and Renewals activities; and

(e) To review the capital allocation methodology for Newlands and GAPE system users.

Aurizon Network will engage with the RIG where these additional obligations are expected to require increased cost or investment and notes the potential overlap or interdependency of some of these additional obligations with the Independent Expert's role to report on network performance and assess capacity impacts.

Next Steps

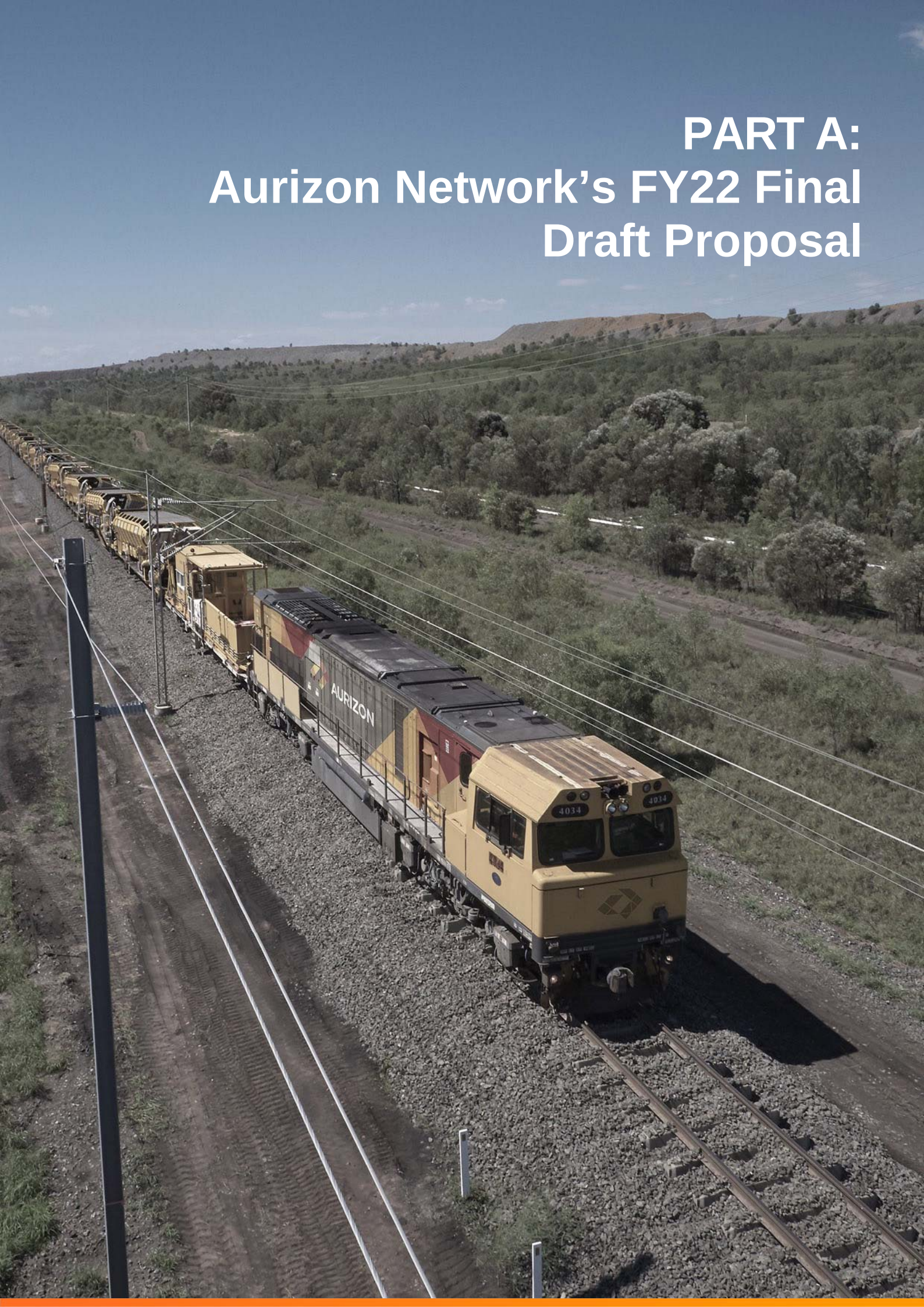
Following submission, the key milestones in relation to the FY22 Final Draft Proposal are outlined below.

Table 4 Regulatory milestones relating to the FY22 Final Draft Proposal

Date	Milestone	Description
30 November 2020	Draft Submission	Aurizon Network submits its FY22 Draft Proposal for each Coal System to the Chair of the RIG, Customers and non-coal Access Holders.
Week commencing 7 December 2020	Customer Briefings	Aurizon Network to present summaries of the FY22 Draft Proposal for each Coal System to the RIG and give the opportunity for the RIG to seek clarification or provide initial feedback.
1 January 2021	Due date for feedback on the FY22 Draft Proposal	The Chair of the RIG, on behalf of End Users, may give Aurizon Network a notice which specifies amendments to the FY22 Draft Proposal that members of the RIG consider reasonably necessary (giving reasons).
21 January 2021	Aurizon Network submits FY22 Final Draft Proposal	Aurizon Network to respond to any proposed amendments (giving reasons if Aurizon Network does not accept them) and provide its FY22 Final Draft Proposal to the Chair of the RIG.
14 February 2021	Notification of voting outcomes	The Chair of the RIG notifies Aurizon Network and the QCA as to whether a Special Majority of End Users for each Coal System has approved Aurizon Network's FY22 Final Draft Proposal.

Aurizon Network welcomes the opportunity to discuss any aspect of this FY22 Final Draft Proposal in further detail with the RIG, its Advisers, Customers and/or non-coal Access Holders.

PART A: Aurizon Network's FY22 Final Draft Proposal



1. Key assumptions underpinning the FY22 Final Draft Proposal

In order to prepare the FY22 Final Draft Proposal, Aurizon Network has made a number of key assumptions, including in relation to:

- The potential impact of changes resulting from the ICAR for each Coal System;
- The market demand outlook for Australian coal exports and the coal tonnages expected to traverse the CQCN; and
- The scope and cost of asset activity. The execution of planned asset activities presented in the FY22 Final Draft Proposal may not occur for another 18 months, during which time changes in asset condition may result in refinements to scope.

1.1 Interaction between the FY22 Final Draft Proposal and the ICAR

At the time of drafting, the Independent Expert has not published its ICAR. The ICAR will, amongst other things, assess Deliverable Network Capacity and whether an Existing Capacity Deficit exists in a Coal System. The resulting consultation between Aurizon Network, End Users, Customers, Access Holders and Train Operators may determine that the most effective and efficient way of addressing the Existing Capacity Deficit is for Aurizon Network to make changes to the operation and maintenance practices for Rail Infrastructure in a relevant Coal System. In developing the ICAR, the Independent expert will also publish the System Operating Parameters. While intended to be based on historic performance, finalisation of the System Operating Parameters may also impact future strategies and budgets for maintenance and renewal activities, including for FY22.

Consequently, it should be noted that maintenance and renewal practices, scope, budgets and access requirements may be subject to change as a result of the ICAR and any agreed Transitional Arrangements. Furthermore, the timing differences between the ICAR and the FY22 Final Draft Proposal will mean that outputs of the latter are unlikely to be taken into consideration as part of the Independent Expert's assessment.

The results of the ICAR and any impact on the FY22 Final Draft Proposal will be managed through the reporting and change processes and will be considered in the development of the FY23 Maintenance Strategy and Budget and Renewals Strategy and Budgets.

1.2 Coal Market Demand Outlook and Volume Forecast

Metallurgical Coal

Australia exported 176mt of metallurgical coal in FY20, down 4% against the prior year. China was Australia's largest metallurgical coal export market with export volume of 50mt (28% share), followed by India at 40mt (22% share) and Japan at 32mt (18% share). Although not impacting crude steel production in China (increasing by 2% in the six months to June) steel capacity in both India and Japan was curtailed as a result of COVID-19 with production reducing by -24% and -17% respectively over the same period. The average hard coking coal price in FY2020 fell by 30% (compared to the prior year) to US$145/t. In the 12 months to June, metallurgical coal exports from the United States (the second largest metallurgical coal export nation behind Australia) decreased by 20%.

In the first quarter of FY21, Australia exported 42mt of metallurgical coal, down 7% against the same period of the prior year. A softer first half of the financial year was expected due to the difficult economic conditions resulting from COVID-19 which has impacted coal demand. China has also curtailed aggregate coal import volume to maintain a similar annual result to the prior calendar year. Overall, exports are expected to improve in the second half of the financial year as steel capacity continues to come back online in key export markets, however, some uncertainty remains.

Thermal Coal

Australia exported a record 213mt of thermal coal in FY20, up 1% against the prior year. Japan remained Australia's largest thermal coal export market with export volume of 74mt (35% share), followed by China at 52mt (24% share) and South Korea at 32mt (15% share). This was a record result for China and also Vietnam, with the export volume for the latter at 13mt (+78%yr). The average Newcastle benchmark thermal coal price in FY2020 fell by 35% (compared to the prior year) to US$65/t.

In the first quarter of FY21, Australia exported 47mt of thermal coal, down 15% against the same period of the prior year. This decrease was partly due to lower demand from China as a result of aggregate coal import curtailments, coupled with higher hydro electricity generation caused by heavy rainfalls reducing demand for competing thermal power generation. Demand from other key Asian nations remained subdued as their economies continue to recover from COVID-19 related restrictions.

Figure 8 below outlines the Australian export volumes and price trends[4] for Metallurgical and Thermal coal over time.

Figure 8 Australian Metallurgical and Thermal Coal - Export Volumes and Price

Outlook for FY22

The Office of the Chief Economist is projecting[5] a recovery in global crude steel production of 4.5% in 2021 and 4% in 2022 driven by economic recovery after a COVID-impacted 2020. Global thermal coal import demand is expected[6] to grow, albeit weakly, with Australian thermal coal export volume expected to be approximately 2% lower in FY21 than the prior year as Australian producers cut output in response to low prices.

Given the current volatility of the coal market and the timing of the FY22 Final Draft Proposal, Aurizon Network considers it premature to make any volume-based adjustment to its renewals and maintenance regime for FY22.

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[4] Source: Export Volume – Australian Bureau of Statistics (Customised Report). Hard Coking Coal Price – Platts (Peak Downs Region product). Thermal Coal Price - Intercontinental Exchange (Newcastle 6,300 kcal/kg Gross As Received product).

[5] Office of the Chief Economist, Resources and Energy Quarterly, September 2020, Department of Industry, Science, Energy and Resources.

[6] Ibid

Aurizon Network has assumed forecast volumes for FY22 will remain in-line with actual railings in each Coal System for FY20 (as outlined in Table 5 below). FY20 provides the most recent indication of full year throughput in each Coal System. If a material change (e.g. change in mine coal volume output) occurs between now and the start of the FY22, Aurizon Network will engage with the RIG and QCA to establish a more appropriate coal volume forecast.

Table 5 Proposed volume forecast for FY22 – Million Net Tonnes (mnt)

System	FY20 Actual (mnt)	FY21 – Regulatory Forecast (mnt)	Proposed forecast for FY22 Final Draft Proposal (mnt)
Blackwater	62.6	66.1	62.6
Goonyella	117.7	124.5	117.7
Moura	13.6	16.5	13.6
Newlands	14.1	13.2	14.1
GAPE	18.8	18.9	18.8
Total CQCN	**226.9**	**239.2**	**226.9**

Table 6 Proposed volume forecast for FY22 – Gross Tonne Kilometres (GTK'000)

System	FY20 Actual (GTK'000)	FY21 – Regulatory Forecast (GTK'000)	Proposed forecast for FY22 Final Draft Proposal (GTK'000)
Blackwater	36,305,071	37,815,876	36,305,071
Goonyella	38,123,204	40,176,589	38,123,204
Moura	3,570,347	4,294,067	3,570,347
Newlands	2,881,963	2,691,284	2,881,963
GAPE	9,283,662	9,579,993	9,283,662
Total CQCN	**90,164,247**	**94,557,809**	**90,164,247**

Impact of minor volume variations on asset activity

In the short term, minor volume variations are not expected to have a material impact on the proposed scope and budgets for maintenance and renewal activities. For most activities, volumes would typically have to vary by a material amount and for a longer period of time to start to impact maintenance and renewal requirements to a larger extent.

For maintenance activities, slight variations in products that are driven by volume-based intervention thresholds may occur where a change in tonnage forecast alters the financial year in which the intervention is required. For example, in relation to Resurfacing, Rail Grinding or Ultrasonic testing. The other maintenance products tend to be periodic maintenance, again it would take a longer period of time to start to see general maintenance reduce in any significant way.

The scope of asset renewal activities planned for FY22 has been assessed based on its condition and criticality. A minor change to FY22 volume forecasts is unlikely to change this requirement.

Aurizon Network would welcome the RIG's feedback on the proposed FY22 volume forecasts, and depending on the materiality of any suggested amendments, would be happy to work with the RIG to assess any associated impact on maintenance products. Given the uncertainty in global markets and the likely release of the Initial Capacity Assessment Report (ICAR), Aurizon Network also notes the potential benefits of confirming regulatory volume

forecasts closer to the commencement of the new financial year and will continue to progress this opportunity with the QCA and relevant stakeholders.

1.3 Other Assumptions

The scope, access and cost requirements outlined in Aurizon Network's FY22 Final Draft Proposal are based on the following assumptions:

- The closure hours outlined within this FY22 Final Draft Proposal represent integrated closures only and do not include activities completed in the shadow of other activities or in-between trains.
- Aurizon Network confirms its FY22 possessions planning process and associated consultation has taken the requirements of non-coal traffic into consideration when seeking to ensure that Committed Capacity is delivered.
- The budgets and forecasts included within the FY22 Final Draft Proposal relate to Coal Train Services only as these values are required for the reset of FY22 Reference Tariffs. Aurizon Network has not made any provision within the maintenance or renewal budgets for any costs associated with non-coal traffic.
- The RM902 ballast undercutting machine is assumed to be operational from July 2021 with improved production rates. Aurizon Network has also planned for the operation of two ballast undercutting machines, commencing in FY22 Q4. This operation is subject to both RIG and internal approvals to complete the refurbishment of the existing RM900 machine. The impact of this assumption is outlined in Chapter 13.
- The value of asset renewal activities represented within the FY22 Final Draft Proposal reflects the capital expenditure Aurizon Network expects to incur while delivering these works in FY22. These values may differ from the values that Aurizon Network will seek to include in the Regulated Asset Base (**RAB**) via the Annual Capital Expenditure Claim (UT5, Schedule E), which reflects the cost of assets that have been *commissioned* during the financial year.
- Maintenance costs outlined within the FY22 Final Draft Proposal reflect the Direct Maintenance Costs only.
- There can be a substantial timing difference (of up to 18 months) between planning and execution of works. It should be noted that estimates are made based on current information and that asset conditions may change prior to delivery. As such, refinements to the scope or cost of works presented in the FY22 Final Draft Proposal may be required.

1.4 Extreme weather and Review Event expenditure

The scope of maintenance activities that can be delivered by Aurizon Network each year can be impacted by external events, such as prolonged or extreme weather. Given the uncertainty surrounding the occurrence of such events, Aurizon Network has not included any contingency in its FY22 Final Draft Proposal for such external events.

Similarly, the FY22 Final Draft Proposal does not make any provision for costs associated with Rail Infrastructure repair or rectification costs following a Force Majeure Event, such as an extreme weather event, flooding cyclone or bushfire.

Where the Force Majeure Event and associated cost of rectification constitutes a Review Event under UT5, Aurizon Network will seek QCA-approval to recover any incremental costs (which may include ordinary labour costs where they are not already recoverable) through the UT5 process (Schedule F, Clause 5.3).

2. Stakeholder Engagement

This chapter presents a summary of Aurizon Network's engagement with stakeholders during the development of the FY22 Draft Proposal.

In developing the FY22 Draft Proposal, Aurizon Network sought to increase its level of engagement with the RIG and Customers, delivering on the commitments made during development of the FY21 Approved Strategy and Budget and with a view to promoting greater transparency and understanding of key processes and asset activities.

Aurizon Network also provided opportunities for Customer input to be considered when developing the proposed FY22 access plan. Aurizon Network's access planning process is critical in the context of ensuring Committed Capacity can be delivered. It provides all stakeholders (Aurizon Network and Other Supply Chain Participants) with the opportunity to coordinate and align planned outages wherever reasonably possible.

Table 7 summarises Aurizon Network's engagement with the RIG and Customers during calendar year 2020.

Table 7 Summary of Customer Consultation for the FY22 Draft Proposal

Month	Subject
Customer and RIG Consultation	
July	FY22 Access Planning – Phase 1
October	FY22 Access Planning – Phase 2
RIG Specific Consultation – Various Topics	
April, June, July, September and October	FY21 Cost and KPI Reporting
May	Resurfacing - detailed discussion and response to questions of the elements comprising this item and how the activities are planned, performed and recorded
July, August, September and October	Ballast Undercutting Information Paper, GPR data and options discussions
August	General Track Maintenance – detailed response to questions of the elements comprising this item how the activities are planned, performed and recorded.
September	Provision of access to UT5, Part 10 reporting for RIG Expert Adviser
September	Scope Prioritisation Model
RIG Specific Consultation – Topics related to the Maintenance and Renewal Strategy and Budget	
October	Permanent Way
October	Structures
October	Electrical
October	Control Systems
November	Civil and Corridor
November	Mechanised Maintenance
November	Summary of the FY22 Draft Proposal
December	Individual System presentations on FY22 Draft Proposal
January 2021	Consideration of RIG feedback received on the FY22 Draft Proposal

2.1 Rail Industry Group Feedback – 1 January 2021

On the 30 December 2020, the Chair of the RIG advised Aurizon Network under clause 7A.11.3.(f) of UT5, on behalf of a Special Majority of End Users of their proposed amendments to the FY22 Draft Proposal (Proposed Amendments). The Proposed Amendments were contained within three sections, being:

- Section A – Critical issues, which included 4 issues relating to:
    - The definition of 'item' under clause 7A.11.5(f)(ii)(B)(2);
    - Rail Grinding costs;
    - Newlands/Gape matters; and
    - Ballast Condition and Ground Penetrating Radar (GPR) results.
- Section B – Detailed Questions and Comments
    - Over 40 specific comments and questions in relation to the FY22 Draft Proposal and Aurizon Network's Maintenance and Renewals programs generally.
- Section C – 2021 Commitments
    - As part of the Proposed Amendments, the RIG also sought a range of additional commitments from Aurizon Network to deliver upon during 2021.

Where possible, Aurizon Network has responded to the Proposed Amendments with additional information included in this Final Draft Maintenance Renewal Strategy and Budget. A detailed written response addressing the individual comments and queries raised has also been provided to the RIG.

A summary of the response to the Section A matters and the 2021 commitments is outlined below.

2.1.1 Definition of 'item' under clause 7A.11.5(f)(ii)(B)(2)

Under this clause, the QCA considers whether material variations in the actual cost of delivering an "item" which is contained within the Approved Maintenance Strategy and Budget for the Year for a Coal System are prudent and efficient. UT5 does not provide a definition of an "item" for the purpose of determining materiality thresholds. The RIG has suggested that:

- For Moura and Newlands/GAPE, the maintenance budget in its entirety should be considered an 'item'; and
- For Blackwater and Goonyella, the product areas of Resurfacing, Rail Grinding, General Track Maintenance, 'Signalling and Telecoms' and Electrical should be considered as items. The remaining product areas should be considered a single item (Structures and Facilities, Trackside Systems, Other Civil Maintenance, Other General Maintenance).

Aurizon Network confirms that the above levels of cost breakdown suggested by the RIG are to be considered as 'items' in the FY22 Final Draft Proposal for the purposes of Clause 7A.11.5(f)(ii)(B)(2) of UT5. Aurizon Network has made drafting amendments within the relevant systems FY22 Maintenance Strategy and Budget sections of this FY22 Final Draft Proposal.

2.1.2 Rail Grinding Costs

Due to the confidentiality arrangements in the rail grinding contract, Aurizon Network will provide further detail to both the Chair of the RIG and its Expert Advisors on a confidential basis prior to the end of January 2021.

[redacted]

[redacted]

[redacted]

2.1.3 Newlands/Gape matters

Aurizon Network has included section 7.5, which provides additional detail to clarify Aurizon Network's proposed approach to allocating the FY22 Maintenance and Renewals Budgets for each user group.

UT5 provides for separate Allowable Revenues and Reference Tariffs for Newlands System and for GAPE End Users. GAPE is not, however, a geographically distinct coal system. In addition to the construction of greenfield track between North Goonyella Junction and Newlands Junction (**GAPE Link**), the scope of the GAPE Project included significant upgrades and renewal of Newlands System Rail Infrastructure (**Newlands System Enhancements**). As such, information in relation to the Newlands System and GAPE has been presented together in this FY22 Final Draft Proposal.

In response to the Proposed Amendments, and to enable a separate vote on the FY22 Final Draft Proposal for each of the Newlands System and GAPE End User groups under 7A.11.3 of UT5, Aurizon Network has clarified the location of individual renewal projects and provided additional information in Table 166 within section 7.5, which includes:

1. An estimate of the shares of the proposed Maintenance Budget which would be recovered from each of the Newlands System and GAPE under current pricing arrangements (**Maintenance Indicator**); and
2. An in-principle summary of the extent to which assets in the proposed Renewals Budget would be allocated to each of the Newlands System and GAPE RABs (**Capital Indicator**).

Aurizon Network maintains that the current treatment of Asset Replacement and Renewal Expenditure for common-user Rail Infrastructure in the Newlands System results in economically efficient Allowable Revenues and Reference Tariffs for both Newlands and GAPE Train Services.

However, Aurizon Network recognises that Customers have a range of views in relation to the way in which future asset replacement and renewal expenditure on the shared rail corridor should be allocated to the respective RABs for Newlands and GAPE Train Services.

Following the QCAs approval of the prudency and efficiency of any annual capital expenditure, Aurizon Network must submit a Regulatory Asset Base roll-forward report in-line with clause 1.3(b) of Schedule E of UT5 (**RAB Rollforward**). The RAB Rollforward report is to contain specific detail 'separately reported for each Coal System'. It is at this stage of the overall capital approval process that a proposed allocation methodology is to be provided to the QCA and this is therefore considered the appropriate regulatory process to review and confirm the capital allocation approach. As the RAB Rollforward is a distinct regulatory process to the setting of the Renewals Strategy and Budget, and noting the competing views of End Users, **End User approval of this FY22 Final Draft Proposal will not be considered as endorsement of the current allocation and pricing methodology.**

Given the complexity of the issues and the range of alternate views, Aurizon Network commits to engage with the RIG, relevant Users and the QCA to review the allocation methodology relevant to Newlands System and GAPE as part of the FY2020 RAB Roll-Forward process. Prior to this process, Aurizon Network will provide a detailed listing of the proposed asset renewals on the common rail infrastructure by asset program if required.

The Independent Expert is yet to take on the obligation of advising of the End-User voting arrangements. Therefore, when advising the RIG's returning officer of the End User Voting Rights, Aurizon Network will separate the Newlands and GAPE voting rights.

2.1.4 Ballast Condition and Ground Penetrating Radar (GPR) results

Aurizon Network confirms that it has completed a GPR run in 2020 and that analysis of this information is still being conducted. As indicated, the nature and volume of the information collected means that this analysis can take months in order to verify and the data, assess its implications and determine potential responses.

However, Aurizon Network recognises the RIG's interest in this area and has committed to provide the results of the analysis to RIG members during FY2021. This commitment remains and the results will be provided in Q1 of calendar year 2021. In the interim, Aurizon Network has provided indicative FY2020 results into the introduction section of the FY22 Final Draft Proposal. The results are indicative as we are still analysing the data to verify the results and ensure comparability across the runs.

In developing the FY22 Ballast program and scope requirements, Aurizon Network has utilised the 2018 GPR information, in conjunction with other data points including maintenance history (e.g. resurfacing events), track geometry information, visual inspection results and Operator feedback. Aurizon Network will consult with the RIG in relation to any potential changes to the FY22 Draft Proposal that may be considered appropriate following completion of the FY20 GPR analysis.

Aurizon Network notes the concerns highlighted by the RIG in relation to the trend of Ballast condition over time. Aurizon Network has previously proposed a further study to understand the current contribution of the causes of coal ballast fouling in order to better understand the costs and benefits of potential mitigation options within the CQCN. This proposal was provided to the Queensland Resources Council in August 2019. Discussions with members of the RIG have indicated that there may now be an appetite to explore and trial potential coal fouling mitigation options. Aurizon Network is happy to work with the RIG to explore appropriate supply chain responses which incorporate the results of the FY20 GPR analysis.

With respect to the requirement for the proposed FY22 GPR run, Aurizon Network notes the importance of the collection of this data in order to both identify trends and understand ballast condition at a System level and for use as an input into the development of location based annual scope. Without this information, Aurizon Network would lose the ability to monitor system wide ballast condition over time in order to identify trends and assess the effectiveness of the program and changes to it. Aurizon Network would also then have to rely on increased levels of intrusive manual inspections and subjective field staff observations in setting the annual scope, which may result in a less effective program. Aurizon Network has provided further details within the individual system ballast cleaning section of this FY22 Final Draft Proposal outlining the benefits of completing CQCN wide GPR run and not missing parts of the network that have been recently undercut

2.1.5 2021 Commitments:

A response to each of the nine proposed commitments is provided in Aurizon's detailed response to the Proposed Amendments.

As noted in the introduction, Aurizon Network is supportive of pursuing appropriate opportunities to enhance collaboration with the RIG and customers in relation to the Maintenance and Renewals Program in recognition of the value exchange agreed in the UT5 Agreement.

Aurizon Network therefore makes the following key commitments to the RIG:

(a) To refine budgeting and forecasting processes to enable a driver-based build-up of maintenance costs where appropriate;

(b) To work with the RIG to continue to refine and enhance quarterly reporting and performance metrics taking into consideration both specific feedback on the initial Quarterly Report (yet to be received) and the monthly reporting which is to be provided by the Independent Expert;

(c) To provide additional information in relation to the condition of ballast throughout the Network (including the analysis of the 2020 GPR results) and to work with the RIG to explore initiatives to address any decline (including fouling mitigation strategies);

(d) To continue to work with the RIG to increase user understanding of Aurizon Network's planning, procurement and execution of Maintenance and Renewals activities, including through the provision of Case Studies; and

(e) To review the capital allocation methodology for Newlands and GAPE system users.

Aurizon Network will engage with the RIG where these additional obligations are expected to require increased cost or investment and notes the potential overlap or interdependency of some of these additional obligations with the Independent Expert's role to report on Network performance and assess capacity impacts.

3. Key Improvement Initiatives

This chapter presents a summary of key improvement initiatives that Aurizon Network has implemented, or is in the process of implementing, in order to improve the way asset activity is identified and prioritised, to release capacity for greater throughput, or to enable more efficient cost outcomes and greater transparency through to end-users, all while maintaining our focus on our safety goal of protecting ourselves, each other and our communities.

Additional information for each of these initiatives is provided below and, where relevant, an allocation of the required implementation funding to each Coal System is outlined in the respective Coal System chapters. While these initiatives are a good start, Aurizon Network recognises that continuous improvement is a journey, and that further opportunities to improve the performance of the supply chain and engagement with Customers will arise in coming years.

3.1 Safety

Safety incidents can have an unacceptable impact on the lives of employees, contractors, their families and the general public. On the CQCN, safety incidents can also materially impact the throughput and efficiency of the system. Aurizon Network's safety strategy provides the organisation with a framework and set of priorities to improve our safety culture and performance generally, but also specifically in the context of infrastructure maintenance and renewals activity. Aurizon Network has recently launched several safety initiatives with a focus on our Critical Commitments; a set of clear personal commitments to help ensure focus on the highest risks and behaviours relevant to our business.

Aurizon Network has developed, enhanced and/or brought forward several safety initiatives that align closely to our broader Safety and Performance Culture Program and focus on effective and safe maintenance practices in the CQCN. These initiatives are key to Aurizon Network ensuring that the Maintenance Objectives are achieved, while maintaining our focus on our safety goal, and include:

- A review of pre-start effectiveness and pilot of electronic pre-start briefings. The electronic pre-start briefings will better support workers in identifying the material risks associated with the activities to be performed, thereby enabling more focused and effective discussion around risk mitigation while working in the rail corridor;
- Trial of phone activated electronic locks. This initiative requires all workers to take ownership and be accountable for ensuring the appropriate track protection is in place prior to the commencement of work so that the work can be carried out in a safe and efficient manner;
- Development of Responsible Worker Training, which provides workers with the knowledge and skills to more effectively fulfil their role as Responsible Workers;
- The implementation of the Critical Commitments to safety framework. These commitments have been developed to clearly define safety expectations whilst working in the rail corridor and are an integral part of Aurizon Network's safety value "We Know Safe, We Choose Safe". In addition, Aurizon Network is developing a Consequence Management Guideline, which will enable leaders to manage any deviation from the Critical Commitments; and
- The launch of a Safety Culture survey to gain a better understanding from the workforce on how Aurizon Network can continue to make progress on its safety journey. The results from this survey will be used to inform Aurizon Network's future safety strategy and plans.

3.2 Advanced Planning and Scheduling

Aurizon Network has implemented its Advanced Planning and Scheduling (**APS**) solution and the final phase went live in October 2020. APS seeks to transform the way Aurizon Network undertakes planning and scheduling,

replacing legacy systems and manual processes with an automated planning and scheduling platform which integrates with Aurizon Network's Day of Operations platform, Movement Planner.

APS will enable Aurizon Network to support its current and future traffic management task which in the past 10 years has become increasingly complex due to the growth in coal volumes, increased mine & port combinations, Cross System Train Services and an increased number of Train Operators.

As noted in Chapter 1.1 above, the ICAR will determine the Deliverable Network Capacity for each Coal System, having regard to the way in which that Coal System operates in practice. Deliverable Network Capacity takes account of all the key supply chain constraints, asset maintenance requirements and system operating parameters to provide clarity and transparency to Customers on the capacity which is usable for coal haulage services.

In this context, Aurizon Network has an obligation to seek to ensure that Committed Capacity is delivered in each Coal System. APS will improve Aurizon Network's ability to deliver this commitment to Customers by providing greater transparency of the impact of planned maintenance and renewals activity on Useable Capacity. This will help Aurizon Network to preserve Committed Capacity when planning asset activity. This functionality will also help Aurizon Network to better understand the impact of branch line maintenance activities on the supply chain and cross system capability, thereby providing a more complete train cycle impact assessment. As such, APS provides Aurizon Network's planners with additional information to better coordinate Customer demand and asset activity.

APS will deliver several key benefits to Customers, including:

- Increased capability for Aurizon Network to manage growing operational complexity and traffic volumes;
- The ability to efficiently manage and preserve usable capacity for Customers by optimising the scheduling of maintenance and renewal activities across main lines, branch lines and mine/port infrastructure;
- Timely updates across various operational and planning horizons to assist with train service allocations;
- Scenario assessment capability to develop multiple plans and determine the most suitable outcomes; and
- A Reporting Portal which provides Customers with more transparent, timely and informative reporting.

3.2.1 Movement Planner Upgrade

During FY22, Aurizon Network is also required to update the Movement Planner software that is critical to the Day of Operations and movement of coal trains within the CQCN.

Aurizon Network is currently using Movement Planner v0.5, this version will no longer be supported by the vendor. Upgrading to v1.5 is required to enable ongoing support to the platform by ensuring the software, operating systems, databases, hardware and architecture are current. The new version incorporates enhancements to product resilience, system health monitoring and data exchange capabilities, as well some improvements to functionality and the user interface, including in relation to train and constraint planning and management.

The original investment into Movement Planner was approved by the QCA as part of the FY2016 and FY2017 Capital Claim's which was a total approval amount of $17.5m. A breakdown of the future FY22 capital expenditure in relation to the required Movement Planner upgrade is outlined in Table 8:

Table 8 Movement Planner Costs – FY22

	Cost ($m)	Notes
Vendor	2.1	Vendor software development/implement services
Infrastructure	0.2	Hardware and Support Tools (physical hardware)
Aurizon Network	1.8	System integration, testing and project management
Support Costs	0.2	Travel and support
Total	**4.3**	

The amounts are capitalised in accordance with the requirements of the Australian Accounting Standards and Interpretations and will be subject to the usual ex-post review of prudency and efficiency conducted as part of the capital claims process.

Ongoing Movement Planner support costs are treated as an operating expense.

3.3 Disciplined Train Operations

Disciplined Train Operations is a continuous process improvement project which is designed to improve throughput outcomes for Aurizon Network's Customers by leveraging updated technology platforms such as APS and Movement Planner to enable better planning outcomes and improve the disciplined execution of train plans.

"Better planning" relates to the use of evidence and planning decisions supported by technology to extract the optimum number of train cycles from the rail system in order to satisfy unconstrained demand signals presented to Aurizon Network by Train Operators. As a scheduled network, where Train Operators are incentivised to adhere to the published schedule, it follows that by being able to schedule more train cycles, an initial opportunity is created to improve throughput outcomes within the day of operations.

Scheduling a higher number of train cycles only manifests as a throughput improvement if the train plan is executed with a high degree of discipline. Aurizon Network continues to work with Train Operators to understand the causes of variation which results in a departure from the agreed schedule. Through this process and supported by data, Train Operators are then able to pursue improvement initiatives with their Customers to reduce or eliminate the sources of variation.

A central theme of Disciplined Train Operations is that performance of all supply chain assets is a critical determinant of planned and executed throughput outcomes. This also relies on the CQCN assets being both available in the planning/scheduling phase and reliable in the execution phase. This initiative therefore promotes a high level of discipline in supporting below rail maintenance planning and execution in addition to promoting disciplined train operations.

3.4 Maintenance Rostering

Currently the civil infrastructure maintenance team operates on a Monday to Friday roster. Analysis has suggested that limiting maintenance activities to weekdays could be impacting Coal System throughput due to a 'clumping' of train paths that in turn cannot be made available to Customers.

In response, the Gracemere Depot in the Blackwater System has commenced a trial that seeks to distribute maintenance activities more evenly across 7 days. It is expected that the trial will demonstrate that changes to maintenance scheduling can reduce the impact that track maintenance has on throughput albeit with some additional cost. The trial is also expected to identify if there are any unintended consequences of such a change. Operating a 7-day roster has the potential to impact response times to emergency call outs as track worker fatigue limits are increased.

At the time of writing, the trial is still in progress.

3.5 Improving efficiency and data for decision making

Underlying any continuous improvement program is the availability of data to inform decision making. Aurizon Network has commenced several initiatives aimed at improving the quality and availability of data and the efficiency of operations generally. Aurizon Network will provide updates to the RIG on the progress of these initiatives and any potential impact on the maintenance and renewals strategy and forecasts, through the quarterly reporting. These initiatives include:

- The Network Asset Management System (**NAMS**) renewal which aims to improve data quality by replacing legacy, disconnected and manual asset management process with interrelated systems and activities that work together to provide a digital representation of the asset life cycle. NAMS is currently used for maintenance activities and in FY21, the NAMS Next project phase commenced, which will see all asset replacement and renewal activity progressively transitioned to the system. This initiative will continue into FY22 through a proposed $2.4m investment to:
    - Standardise the use of the system across all maintenance and renewal tasks to improve the transparency of scope and costs against individual assets;
    - Include all maintenance and renewal scope in a centralised system improving planning and alignment of works in common locations; and
    - Ensure clear visibility of completed tasks against plan via standardised reporting to improve transparency and insights to enable more effective asset management and investment decisions.
- The **Standard Work** initiative which seeks to improve the consistency and predictability of maintenance delivery by standardising the planning, completion and reporting of routine tasks including time, skills and competencies, material, plant and equipment. This initiative is intended to drive efficiency over the medium to long term and improve planning and forecasting outcomes.
- The commencement of a Condition Based Maintenance (**CBM**) trial in civil infrastructure for defects that are identified and prioritised for repair over a period of more than 3 months. Importantly, CBM will provide additional information to assist planners in prioritising civil infrastructure maintenance work and enable work to be undertaking during times of lower impact to capacity for Customers.

  The new Civil CBM Process authorises qualified employees to determine that the condition of a defect should be monitored rather than immediately nominated for repair within a certain timeframe. It leverages NAMS to provide data to support prioritisation of defects, across a range of activities, aligned to the Civil Engineering Track Standards (**CETS**) requirements and enable flexibility in planning of defect remediation. For example, a ballast defect previously identified to be repaired within 3 months, can be nominated to be monitored and re-prioritised which could allow planners to align the repair to the ballast undercutting program.
- The Automated Track Inspection System (**ATIS**) initiative which seeks to measure track and overhead line alignment via locomotive-mounted equipment using lasers to achieve precise measurements at line speed. Aurizon Network currently utilises a track recording car to obtain these measurements, with the service provided by a third party and consuming paths that could otherwise be used by Train Services. It is intended that this system will enable an increase in the timeliness of data allowing a move to a condition-based track resurfacing scope, tracking of defects and the ability to trend degradation to predict future failure points or intervention triggers. Other benefits may include reduced cost and improved access by removing the requirement to utilise the track recording car. ATIS is currently being trialled in relation to track geometry testing. Aurizon Network's FY22 Final Draft Proposal includes $0.7m related to funding the next stage of the ATIS program. The possible further rollout of the full program may commence in FY22. This will be dependent on further support being obtained from the RIG via the change process, which includes provision of relevant documentation, as this future investment is currently not a consideration of this FY22 Final Draft Proposal.

Figure 9 ATIS Track Geometry unit mounted to diesel locomotive

Figure 10 Condition Based Maintenance (CBM) – Example of output from the Rail Wear Analyser

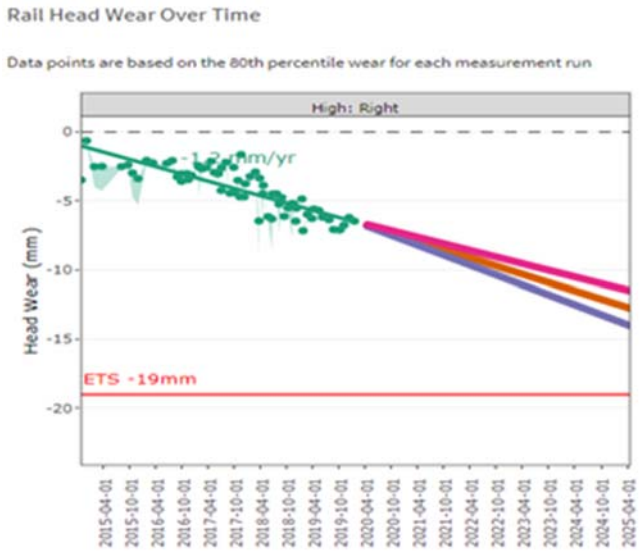


Figure 10 above illustrates the output of Aurizon Network's Rail Wear Analyser (RWA) model, which is used to predict the scope of rail renewal activities. Such data supports Aurizon Network's CBM initiative through the ability to monitor asset performance in real time through integrated data sources. Ultimately this level of sophistication allows for asset planning to be optimised utilising any trending data that is available.

3.6 Dual Ballast Cleaning Machine Operation

Aurizon Network has engaged with the RIG on a potential opportunity to extend the life of the existing ballast cleaning machine (**RM900**) which is due to retire upon the commissioning of the RM902. Currently, mainline ballast cleaning is undertaken with only one ballast cleaning machine and excavator undercutters, with the required scope completed both within system closures and single line possessions. Having two machines operate in parallel is expected to enable the majority of work to be performed within system closures. Whilst the potential benefits of this option includes the release of capacity that would have been previously held for maintenance activities, there is a cost associated with both the re-life works as well as ongoing operations of two machines.

For the purposes of this FY22 Final Draft Proposal, Aurizon Network has included this Dual Ballast Cleaning Machine opportunity as operational in Q4 FY22 and has included costs associated with both the RM902 and the RM900 during this period.

Aurizon Network is currently completing further analysis of the costs and benefits of this strategy to inform a stage-gated decision making and approvals process. The scope of this analysis will consider:

- the cost of extending the life of the RM900;
- costs of supporting assets and infrastructure;
- incremental operating costs; and
- logistical constraints and access impacts.

The RIG will be presented the detailed analysis in H2 FY21.

If the RIG determines that it does not want to progress with this option, or the feasibility analysis determines that the incremental costs will vary from those assumed in the FY22 Final Draft Proposal (as outlined in Chapter 13), then the change management process will be enacted to revise the approved Maintenance and Renewals Strategies and Budgets.

For the purposes of this Submission:

- Moura
- Blackwater; and
- Goonyella systems

have been removed from this document

‘FY2022 Final Draft Maintenance Strategy & Budget and Final Draft Renewals Strategy & Budget’

Newlands System

7. Newlands System and GAPE

This chapter presents Aurizon Network's Draft Maintenance Strategy and Budget and Draft Renewals Strategy and Budget for the Newlands System and the Goonyella to Abbot Point Expansion (**GAPE**) during FY22. In line with 7A.11.3 of UT5, this section will be subject to vote by the relevant Newlands and GAPE End Users.

Aurizon Network's FY22 Final Draft Proposal for the Newlands System and GAPE provides for:

- **A Direct Maintenance Cost Allowance (excluding ballast undercutting plant depreciation) of $12.3m**
  - This represents an increase of $0.4m compared to Aurizon Network's current FY21 full year maintenance forecast and a decrease of $1.4m compared to the FY21 Approved Maintenance Strategy and Budget.
  - The proposed allowance is $2.1m lower than the FY21 maintenance allowance approved by the QCA in its UT5 Final Decision.
- **A Renewals Allowance of $25.3m**
  - This represents an increase of $3.5m compared to Aurizon Network's current FY21 full year renewals forecast and an increase of $3.9m compared to the FY21 Approved Renewals Strategy and Budget.

Aurizon Network understands that the allocation of the FY22 Direct Maintenance Cost Allowance and the Renewals Allowance between Newlands and GAPE Train Services is a matter of interest to Customers. This will be addressed through the QCA's regulatory process in relation to the FY22 Annual Review of Reference Tariffs, due to be submitted on 28 February 2021.

7.1 Newlands System - Characteristics and Corridor Strategy

The Newlands System is located at the northern end of the Bowen Basin connecting to the port at Abbot Point. The system serves mines located in the Newlands System, as well as an increasing number of mines located in the Goonyella System via the GAPE Link. The Newlands System and GAPE are not electrified.

Maintenance and renewal activities in the Newlands System and GAPE are primarily delivered from depots located in Moranbah and Merinda, with mobile mechanised plant based in Yukan and Rockhampton.

Aurizon Network's depots are strategically located to enable incident response times across the Newlands System within approximately two and half hours, depending on whether significant travel is required within the rail corridor. Mechanised plant (e.g. resurfacing) is typically able to respond to an urgent defect (e.g. a buckle or geometry defect) in the Newlands System within 2 days.

Figure 67 Depot Locations – Newlands System and GAPE

Aurizon Network has considered asset conditions specific to this Coal System when developing the FY22 Final Draft Proposal, particularly in relation to:

- **Civil Assets** – The GAPE project built a 65km greenfield connection between the Goonyella and existing Newlands Systems in 2012. This project also upgraded the sections of the pre-existing Newlands System designed to carry loaded traffic from 20 tone axle load to 26.5 tonne. These upgrades included rail replacements, formation strengthening and structure renewal. Current activity is centred around the sections that were not upgraded in 2012 which include sections of 53kg rail and fist fastener sleepers associated with the original 20 tonne axle load operations.
- **Control Systems Assets** – This asset class was also modernised during the GAPE project and is the only fully digitised control system within the CQCN. Like the civil assets, these upgrades are intermixed with aged assets. For Control Systems, these aged assets include the section of non-Remote Controlled Signalling (**RCS**) controlled track between the Newlands Junction section and Collinsville.

The non-upgraded sections of the Newlands System attract most of the maintenance and renewal activity given these assets are aged and there are sections of 53kg rail and fist fastener sleepers associated with the original 20 tonne axle load operations.

Corridor Strategy:

- The Newlands System is a mix of new, recently upgraded and original assets. As such most of the maintenance and renewal efforts are focused on the aged assets not upgraded or renewed during the Goonyella the Abbott Point Expansion (**GAPE**).
- The asset management strategy for the Newlands System is to hold availability required in a fit for purpose manner. The Newlands System is being maintained for forecast tonnages and not name plate capacity.
- The maintenance approach is consistent with the other Coal Systems being planned inspection with planned corrective maintenance to address identified defects and reactive maintenance to address service interrupting asset failures and incident response.
- Asset Renewals seek to renew aged assets ahead of failure or obsolescence to minimise supply chain interruption.

7.2 Newlands System and GAPE - Integrated Closure Plan

Aurizon Network has engaged with the RIG and Customers to better understand their requirements and has taken the following into consideration when developing the FY22 Final Draft Proposal Integrated Closure Plan:

Specific Newlands Supply Chain considerations:

- **Port alignment:**
  - Major scope delivery is typically aligned with port outages and is packaged and executed in extended Integrated System Closures once or twice per year (scope dependent).
- **Reducing impact of major closures:**
  - Major scope delivery is packaged and executed in extended Integrated Closures.
  - All other planned maintenance activities are completed in scheduled maintenance blocks or in-between trains.
- **Closure timing:**
  - December and June are avoided to provide the opportunity for maximise railings for the end of calendar and financial year respectively.

Table 130 below outlines the proposed closure hours for FY22. This provides for a slight reduction in System Closure hours of 2 hours compared to the FY21 Approved Strategy and Budget.

Table 130 Planned integrated closures, branch closures and BCM – Newlands System

Newlands	2021			2022									
(Hours)	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	**Total**
System Closure	**--**	**--**	**108**	**--**	**--**	**--**	**--**	**--**	**--**	**36**	**--**	**--**	**144**
BCM – Inside System closure	--	--	108	--	--	--	--	--	--	--	--	--	**108**

It should be noted that in addition to the integrated System closures outlined in Table 130 above, smaller maintenance closures in specific locations will be planned during the year (as required by the asset) consistent with the relevant System Operating Parameters.

Aurizon Network schedules such activities in a way that seeks to minimise any impact to the supply chain operations. Where the delivery of maintenance activities requires the track to be temporarily closed to traffic, Aurizon Network seeks to mitigate any associated throughput impacts by scheduling such activities into integrated closures wherever possible. Furthermore, an internal governance process is triggered in the event that an outage may have the potential to impact Aurizon Network's capability of delivering committed capacity.

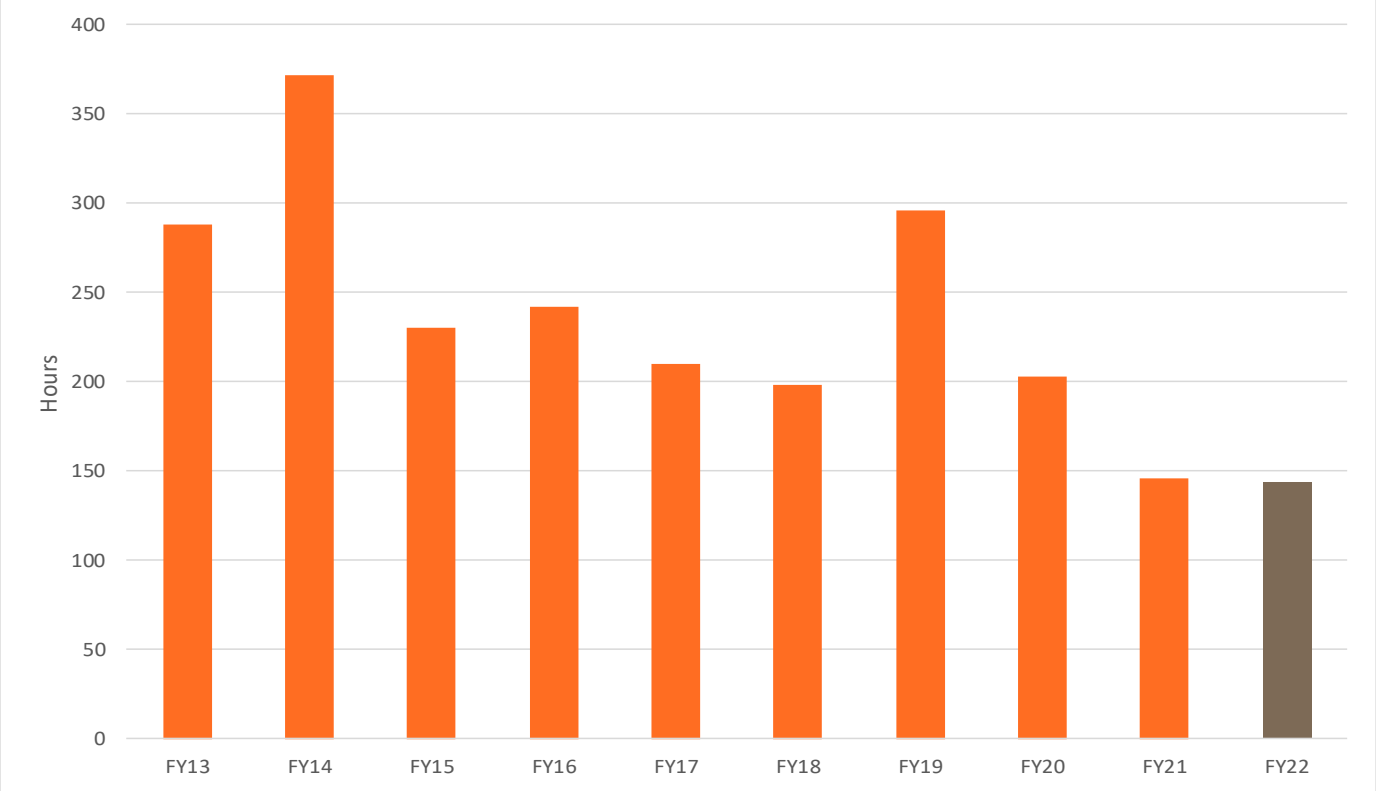
The following critical path activities have determined the duration of the planned integrated possessions in the Newlands System during FY22:

Table 131 Critical Path Activity in the Newlands System

Critical Path Activity
• Bridge 5 Mile Creek Buckley – Armuna (remove and replace). Formation repair Buckley – Armuna • Track upgrades Briaba – Collinsville. Sleeper replacement Buckley to Armuna • Ballast Undercutting Cockool – Havilah and Briaba – Almoola

Figure 68 below compares the Newlands System and GAPE Closure (i.e. Integrated Closure) hours within the FY22 Final Draft Proposal to the historical number of integrated closure hours between FY13 and FY21. Please note that the FY21 hours are as per the FY21 Approved Strategy and Budget.

Figure 68 Trend of Integrated Possessions Hours from FY13 to FY22 – Newlands System and GAPE



The reduction in integrated closure hours from FY20 onwards reflects the introduction of maintenance blocks where maintenance is scheduled for a maximum duration on a set day in a specific zone of the network that is repeated week in and week out. If no work is required for a particular maintenance block, it is relinquished for Train Services.

7.3 Newlands and GAPE - FY22 Maintenance Strategy and Budget

Aurizon Network has developed its Draft Maintenance Strategy and Budget for the Newlands System and GAPE having regard to all relevant matters outlined in clause 7A.11 of UT5, including the Maintenance Objectives. Aurizon Network considers that its draft proposal provides an appropriate level of asset activity that will promote the safety, reliability and performance of Newlands System and GAPE Rail Infrastructure and ensure that Committed Capacity is delivered.

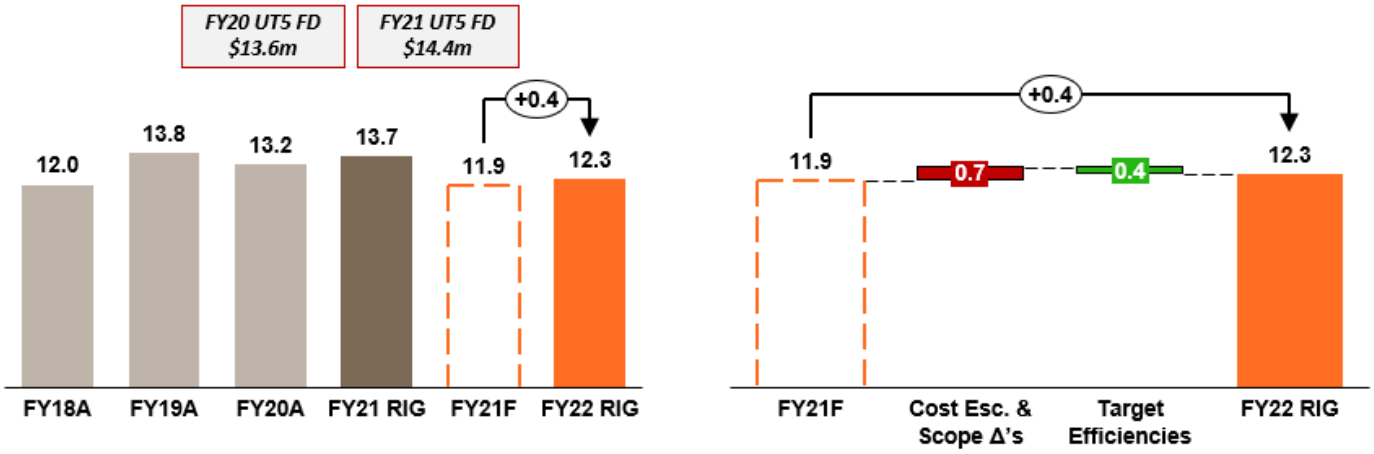
7.3.1 Summary of Historic, Forecast & FY22 Maintenance Strategy & Budget

Aurizon Network's FY22 Draft Maintenance Strategy and Budget for the Newlands System and GAPE provides a Direct Maintenance Cost Allowance of $12.3m (excluding ballast undercutting plant depreciation) which is:

- $2.1m lower than the FY21 allowance proposed by the QCA in its UT5 Final Decision;
- $1.4m lower than the FY21 Approved Maintenance Strategy and Budget; and
- $0.4m higher than Aurizon Network's current FY21 full-year forecast.

Figure 69 below provides a summary of historic direct maintenance costs as well as the proposed direct maintenance cost allowance in respect of FY22. To ensure comparability with prior periods, the direct maintenance costs shown in the chart below exclude depreciation on ballast undercutting plant.

Figure 69 Newlands System Direct Maintenance Costs (excluding ballast undercutting plant depreciation)



As noted in the Quarterly Report for Q1 FY21, the current forecast for FY21 direct maintenance costs excluding ballast undercutting plant depreciation is $11.9m (at 30 September 2020). This is $2.5m lower than the UT5 Final Decision approved allowance for FY21 and $1.4m lower than the FY21 RIG-approved maintenance budget of $13.7m. The forecast takes account of actual conditions and run rate costs in FY20 and Q1 FY21, including variances to estimates that underpinned the initial submission to the RIG in November 2019. The reduction in spend against the FY21 Approved Maintenance Strategy and Budget primarily driven by reduced General Track maintenance spend ($1.1m). None of the individual item variances is greater than the indicative materiality thresholds set in UT5.

The proposed direct maintenance cost allowance for FY22 (excluding ballast undercutting plant depreciation) is $12.3m, $0.4m higher than the current FY21 direct maintenance cost forecast, which has been used as the basis for developing the FY22 Final Draft Proposal. This increase reflects the net impact of assumed cost escalations, scope changes and target efficiencies.

An overview of the methodology used to establish the FY22 maintenance cost budget is provided in Chapter 13. Chapter 7.3.2 below provides a summary of the maintenance scope and budget for the Newlands System and GAPE in FY22 for each maintenance item.

7.3.2 FY22 Maintenance Strategy and Budget

As detailed in Chapter 11.2, Aurizon Network's Asset Management approach is based on achieving the appropriate level of asset availability at the most efficient cost of ownership, through the entire asset life cycle, which will best meet the customer requirements in each Coal System.

In the Newlands System and GAPE, Aurizon Network's reliability centred maintenance approach holds the system fit for purpose for forecast tonnages. The planned and preventative maintenance activities and inspections, as well as the planned mechanised production scope, are derived in line with the intervention periods as detailed in the Asset Maintenance & Renewal Policy. This Policy determines the inspection regime and period based on asset type condition and location.

The proposed FY22 maintenance scope and budget for the Newlands System and GAPE is outlined in Table 132. Please note that the totals presented in the tables below may not add due to rounding.

Table 132 FY22 Proposal – Newlands System and GAPE Maintenance

Maintenance Item	Scope Units	FY21 Forecast Scope	FY21 Forecast ($m)	FY22 Scope	FY22 Budget ($m)
Resurfacing			**1.5**		**1.7**
- Mainline	*Km*	*188*	*1.4*	*188*	*1.4*
- Turnout	*Site*	*21*	*0.1*	*21*	*0.2*
Rail Grinding			**1.2**		**1.6**
- Mainline	*Km*	[redacted]	[redacted]	[redacted]	[redacted]
- Turnout	*Site*	[redacted]	[redacted]	[redacted]	[redacted]
General Track Maintenance			**4.2**		**3.9**
- General Track	*Activity*		*3.9*		*3.6*
- Track Recording	*Km*	*645*	*0.2*	*521*	*0.2*
- Ultrasonic Testing Car	*Km*	*1,558*	*0.1*	*915*	*0.1*
Signalling and Telecoms			**2.6**		**2.7**
- Signalling Corrective	*Activity*		*0.6*		*0.6*
- Signalling Preventative	*Inspection*		*1.4*		*1.5*
- Telecoms Corrective	*Activity*		*0.0*		*0.1*
- Telecoms Preventative	*Inspection*		*0.5*		*0.5*
Electrical Overhead					
Structures and Facilities			**1.0**		**1.0**
Trackside Systems			**0.2**		**0.2**
Other Civil Maintenance			**0.2**		**0.2**
Other General Maintenance			**1.0**		**1.0**
- Asset Management & Inventory			*0.3*		*0.3*
- On Call			*-*		*-*
- Security			*0.7*		*0.7*
Sub-Total			**11.9**		**12.3**

Maintenance Item	Scope Units	FY21 Forecast Scope	FY21 Forecast ($m)	FY22 Scope	FY22 Budget ($m)
Ballast Undercutting Plant Depreciation			0.2		0.3
Total			**12.1**		**12.6**

For the Newlands System:

- **Direct maintenance costs** (excluding ballast undercutting plant depreciation) are budgeted to increase by $0.4m from the current FY21 forecast to $12.3m in FY22. The movement in cost between periods reflects the net impact of cost escalation and scope changes ($0.7m) partially offset by estimated target efficiencies ($0.4m). Key movements in RIG maintenance categories are summarised below.
    - **Resurfacing (+$0.2m)** - increase primarily reflects cyclic maintenance costs. Resurfacing plant has varying annual maintenance cycles such that costs of maintaining the equipment will vary year on year for the life of the plant.
    - **Rail Grinding (+$0.4m)** - increase primarily reflects an increase in mainline scope given increased volumes as well as an uplift in the mainline grinding rate per kilometre [redacted]
    - **General Track Maintenance (-$0.3m)** - category represents approximately 30% of overall maintenance costs in the Newlands System. Cost reduction reflects delivery of estimated targeted efficiencies primarily across labour and contractor cost categories.
    - **Signalling & Telecoms (+$0.1m)** - increase primarily reflects annual escalation and inclusion of Fault Control Centre costs (previously recognised in Other General Maintenance.
- **Ballast Undercutting Plant Depreciation (+$0.1m)** - with the assumed introduction of the RM902 within the cost base for the full year, ballast undercutting plant depreciation is forecast to increase.
- In aggregate, these changes result in an increase in total direct maintenance costs of $0.5m from $12.1m in FY21F to $12.6m in FY22.
- The scope of planned corrective and reactive maintenance tasks is heavily dependent on the faults identified via the planned inspection programs. Consequently, scope for these activities cannot be defined. Aurizon Network has assumed that in FY22, this Coal System will see a similar level of faults that require planned corrective or immediate maintenance response as in prior years.
- For the Newlands System and GAPE, the following activities are to be considered as an aggregated single “item” for the purpose of UT5, clause 7A.11.5(f)(ii)(B)(2) - Resurfacing, Rail Grinding, General Track Maintenance, ‘Signalling and Telecoms’, ‘Structures and Facilities’, Trackside Systems, Other Civil Maintenance and Other General Maintenance.

Set out in Figure 70 below is a summary of historic, forecast and budgeted direct maintenance costs by maintenance category. To ensure comparability between periods, the direct maintenance costs presented in the chart exclude depreciation on ballast undercutting plant.

Figure 70 Newlands Direct Maintenance Costs (excluding Ballast Plant Depreciation)

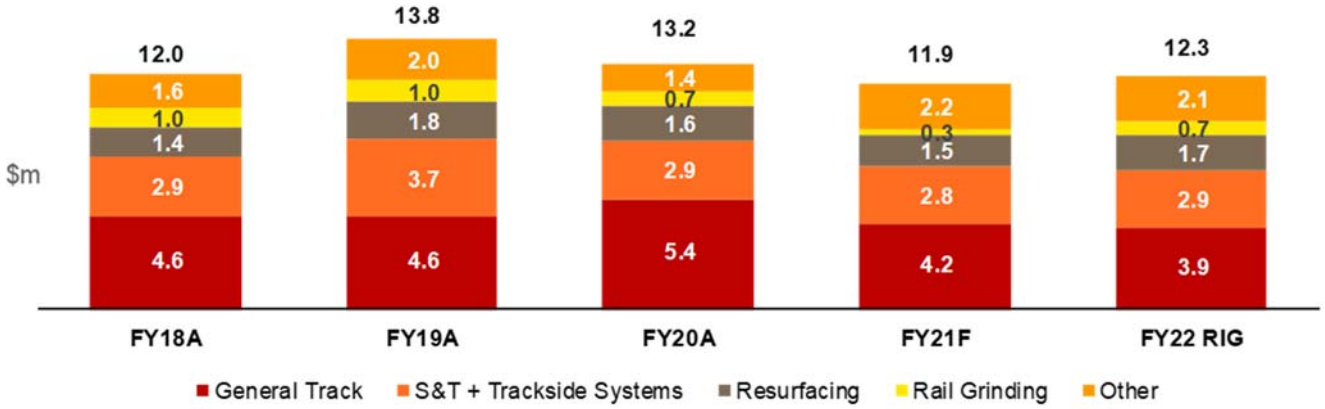
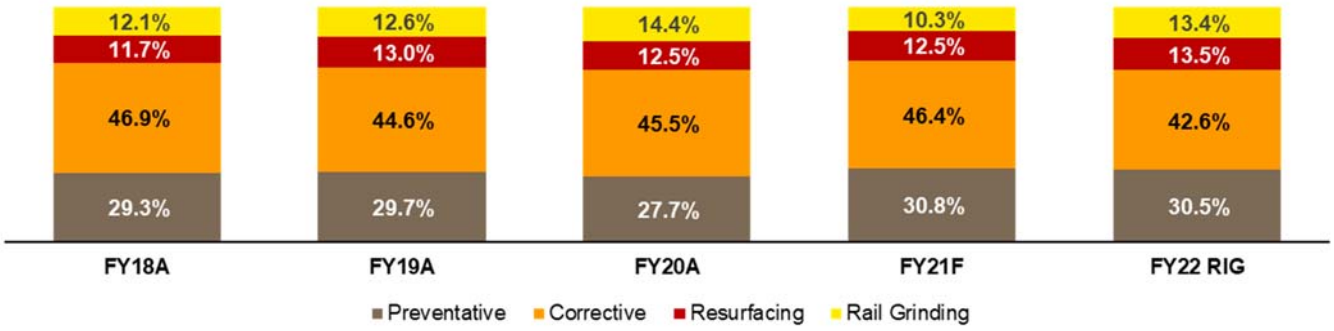


Figure 71 below illustrates the proportion of preventative and corrective maintenance expenses in the Newlands System and GAPE over time. The cost of both Rail Grinding and Resurfacing maintenance activities have been categorised as preventative in nature. Approximately 57% of the Newlands System and GAPE maintenance spend in FY22 is expected to be preventative in nature.

Figure 71 Newlands System – Preventative / Corrective Maintenance Spend Composition



Further information in relation to the costing methodology used by Aurizon Network in the development of the FY22 Final Draft Proposal is outlined in Chapter 13. Additional detail in relation to the make-up of costs for each maintenance activity has been provided to the RIG Expert Advisor.

7.3.3 Alternative maintenance options considered

Aurizon Network notes there are a number of options available as to how and when asset renewal and maintenance is performed. When implemented, each option may have an associated flow on impact to other Supply Chain Participants. Aurizon Network's access planning process endeavours to optimise impacts through appropriate access planning. Aurizon Network welcomes further discussions to explore alternative options.

As detailed in Chapter 11.2, Aurizon Network applies several different approaches with regards to maintaining the Rail Infrastructure. These approaches lead to the application of the maintenance task across the system. A summary of alternate considerations is detailed in

Table 133 below. Aurizon Network welcomes the opportunity to work with Customers and other Supply Chain Participants to further explore alternate maintenance approaches.

Table 133 Maintenance Considerations

Activity	Description	Alternative maintenance option
Mainline & Turnout Resurfacing	Track alignment can be symptomatic of an underlying defect. Resurfacing sites are recorded to understand which track sections have seen multiple resurfacing interventions as this is a key consideration when determining whether ballast cleaning and formation renewal work is required. Resurfacing activities are currently delivered in a way that provides operational flexibility with these activities currently scheduled after Customer train orders. Planned works are delivered in the shadow of other maintenance activities and/or where customer demand permits. An alternative approach could be to deliver this in a less flexible manner.	Delivering this activity in a way that focuses on asset productivity and cost minimisation will likely require changes to operating practices, and negatively impact Access by increasing response times to identified defects and providing less flexibility to schedule around Train Services. At this stage, Aurizon Network considers that its current approach delivers the most appropriate outcomes for the supply chain. If this activity is not undertaken it is likely to lead to adverse impacts on access and the ability to meet Committed Capacity. There will likely be an increase in the number and duration of speed restrictions and a reduction in the reliability of the track assets.
Rail Grinding	The rail grinding approach through the CQCN seeks to address surface-borne rail defects under a preventative regime. Intervention thresholds are based on throughput tonnage thresholds which are translated into a time-based frequency. These frequencies are dictated by the 'tightness' of the curve. Rail grinding is also undertaken in a reactive way to remedy identified rail defects that if left untreated will lead to rail breaks and an increase in derailment risk.	On a face grinding (not recommended) – starting at a location and grinding rail in a continuous run. While this approach will maximise production rates, it may result in a reduction in rail life because grinding would be completed across entire track sections, even where it is not always required. Aurizon Network recommends that its current approach to rail grinding remains appropriate. A reduction from the proposed scope will likely see an increase in rail defects leading to speed restrictions and an increase in rail replacements due to rail defects causing failures.
General Track	Current approach is a mix of Track Recording Car, Ultrasonic Test Car, High Rail Vehicle inspection, walking inspections and non-destructive hand testing as detailed in the Asset Maintenance & Renewal Policy.	Reduce inspection frequencies to minimum required for the safety of the rail operations and revert to additional fix on fail methodology. A move to reduce the frequency of inspections would require consultation and approval from the Rail Safety Regulator. This option is not recommended and would likely lead to an increase in unplanned delays and increased cost to rectify in an unplanned manner. Aurizon Network could also seek to reduce the use of temporary rectifications such as plating rail breaks or TANC restrictions. This may reduce the number of maintenance interventions and therefore cost, however, would impact the operational performance of the Rail Infrastructure. Aurizon Network is currently trialling ATIS, an alternative option to the Track Recording Car outlined in Chapter 3.5. The results of this trial and possible effect on the frequency of general track inspections will be discussed with the RIG in due course.
Control Systems	Maintenance is based on defined time-based inspection of equipment items (e.g. points, level crossings) and of equipment enclosures and power supplies.	1. Maintain only on failure – not recommended and would likely lead to an acceleration of faults which will reduce the reliability of the systems which in turn reduces the capacity of the railway. 2. Planned frequency (current approach): recommended. The current planned frequencies are reviewed on an

Activity	Description	Alternative maintenance option
	The frequency of inspection varies between equipment types and is based on failure modes and criticality. Frequency and tasks are reviewed annually for effectiveness based on observed asset condition, fault performance, and impact on rail services.	annual basis to align the required inspections to the condition of the assets. 3. Increased inspection frequency and/or accelerated replace and refurbish to reduce the likelihood of service affecting failures: this is considered annually in conjunction with maintenance check sheet review. Frequencies and activities are adjusted where it is believed that the in-service performance will be materially improved. Any change to the inspection frequencies requires consultation and approval from the Rail Safety Regulator.

7.4 Newlands System – FY22 Renewals Strategy and Budget

Aurizon Network has developed its Draft Renewals Strategy and Budget for the Newlands System having regard to all relevant matters outlined in clause 7A.11 of UT5. Aurizon Network considers that its draft proposal provides an appropriate level of asset activity that will promote the safety, reliability and performance of Newlands System Rail Infrastructure and ensure that Committed Capacity is delivered.

7.4.1 Supply Chain Benefits of the Renewal Program

In addition to an optimised cost outcome, Aurizon Network's renewal program seeks to provide the following benefits for the Newlands System supply chain.

Table 134 Supply Chain Benefits of the Renewal Program

Renewal Activity	Benefit Type	Description
Permanent Way	Asset reliability	Reduce network delays associated with unplanned asset activity.
	Throughput	Renewing in a planned manner within identified closure pattern avoiding unplanned outages and associated throughput losses.
	Safety	Reduce derailment risk with trains by managing asset condition.
Ballast Cleaning	Asset reliability	Reduce network delays associated with asset failure linked to poor ballast condition such as top and line defects and mud holes.
	Throughput	Renewing in a planned manner within identified closure pattern avoiding unplanned outages and associated throughput losses. Limits TSR's caused by ballast condition.
Civil Assets	Asset reliability	Reduce network delays associated with asset failure.
	Throughput	Renewing in a planned manner within identified closure pattern avoiding unplanned outages and associated throughput losses.
	Safety	Reduce derailment risk with trains by managing asset condition. Removal of redundant assets reduces the risk of rail staff accessing the rail corridor and members of the public accessing no longer required live crossings.
Transmission and Data Networks	Asset reliability	Given these assets do not wear but rather age to a point where they are no longer supported renewal ahead of failure is required to retain the assets reliability.
	Throughput	Renewal and system improvements to best move trains through the system in an efficient and safe way.
	Safety	Ensuring the critical signalling and train control systems are robust and effective in the separation of trains. Providing clear communications functionality across the CQCN systems.

7.4.2 Summary of FY22 Renewals Strategy and Budget

A summary of the FY22 renewals budget for the Newlands System is outlined in Table 135. Please note that the totals presented in the tables below may not add due to rounding.

Table 135 FY22 Proposal – Newlands System Renewals

Renewals Item ($m)	Assets Include:	FY21 Approved Budget	FY21 Full Year Forecast	FY22 Draft Budget
Civil Assets		18.9	19.4	20.1
Permanent Way	*Rail, Track, Sleeper, Turnouts*	11.0	11.0	9.0
Ballast Cleaning	*Mainline and Turnout Undercutting, Bridge ballast*	3.2	3.1	3.7
Structures	*Culverts, Bridges*	3.0	3.4	4.9
Civil Renewals	*Formation, Level Crossings, Access Points*	1.7	1.9	2.4
Control System Assets	*Safe Working, Train Control and Detection, Interlocking, Telecoms, Power Resilience, Transmission*	2.0	1.9	4.6
Technology		0.5	0.5	0.3
Total		**21.4**	**21.8**	**25.0**

Table 136 FY22 Proposal – GAPE Renewals

Renewals Item ($m)	Assets Include:	FY22 Draft Budget
Civil Assets		0.3
Permanent Way	*Rail, Track, Sleeper, Turnouts*	0.1
Ballast Cleaning	*Mainline and Turnout Undercutting, Bridge ballast*	0.2
Structures	*Culverts, Bridges*	0.0
Civil Renewals	*Formation, Level Crossings, Access Points*	0.0
Control System Assets	*Safe Working, Train Control and Detection, Interlocking, Telecoms, Power Resilience, Transmission*	0.0
Technology		0.0
Total		**0.3**

7.4.3 Details of the FY22 Renewals Strategy and Budget

This section provides detailed information in relation to the individual scope items selected for renewal in FY22, along with the rationale for those selections and alternative options considered, in response to requests for that information from the RIG and Customers.

Aurizon Network notes that the prioritisation of renewals scope is made on the basis of currently available information and that this prioritisation may change over the period prior to execution (of up to 18 months) as a result

of environmental factors, relative degradation rates or other considerations. Changes to the proposed scope will be dealt with through the reporting and change management processes as appropriate.

Civil Assets – Permanent Way

Permanent Way Renewal Program

Aurizon Network's FY22 Final Draft Proposal provides $9.1m to deliver the scope of permanent way renewals in the Newlands System. Table 137 summarises the scope and budget for each relevant renewal item.

Table 137 FY22 Permanent Way Renewals - Newlands

Description	FY22 Scope	Scope Unit	FY22 Budget ($m)	Description
i. Rail Renewal	1.9	Km	1.5	The rail renewal and track upgrade programs will see 2.2% of total Newlands System rail replaced.
ii. Sleeper Renewal	3.1	Km	2.8	The sleeper renewal and track upgrade programs will see 2.5% of total Newlands System sleepers renewed.
iii. Track Upgrade	4.9	Km	3.2	1 Track Upgrade planned and assigned to planned closures.
iv. Turnout Renewal	1	Turnout	0.9	Equates to 1.3% of turnouts in the Newlands System. Scope is coordinated between all asset disciplines given the interplay between civil, electrical and control assets
v. Turnout Components		Fix on Fail	0.5	Same allocation made to major component renewal as in FY21
vi. Turnout Designs			0.1	Designs for locations to be renewed in FY23 and FY24
vii. Permanent Way Other		Fix on Fail	0.1	Glued Insulated Joints (GIJ's) & Rail Lubrication installation and fix on fail scope.
TOTAL			**9.1**	

The remainder of this section provides further details of the specific scope that Aurizon Network intends on delivering during the period.

i. Rail Renewal

The FY22 rail renewal program in Newlands will see rail renewals carried out at 1 site that is near its wear limit. Rail identified for renewal has either reached (or is near) its wear limit or has seen tonnages that indicate a heightened risk of near-term failure due to rail fatigue.

The location and extent of these works for FY22 are outlined in the following table.

Table 138 FY22 Rail Renewal Program - Newlands

Ref	Track Section		Start Km	Finish Km	Length (km)	Rails
1	Havilah	Newlands	142.265	144.209	1.944	36

Scope comments:

- The scope at this location is driven by rail wear.
- The 6.8 kilometres of rail being renewed in this program and the Track Upgrade program equates to 2.2% of the total rail in the Newlands System (316 track km).

"Rail fatigue" refers to the failure mechanism due to an increase in rail defects which are caused through millions of wheels cycling over the rail (analogous to continuous bending of a paperclip). Rail fatigue generally only manifests itself in straight track where the rail has been in service for significant periods of time.

"Rail wear" is the progressive loss of steel in the rail head caused by the very high lateral forces within curved track under train operations and preventative grinding. The rail wears to the point where it is not sufficiently strong enough to sustain the heavy axle loads and generally only manifests itself in curved track. Generally speaking, the sharper (i.e. tighter) the curve, the higher the wear rate.

Aurizon Network's planned unit length of rail is typically 108m, as this is the nominal longest length of rail that can be transported around the rail network. In certain circumstances lesser lengths can be used.

Figure 72 Rail Renewal Sites Newlands FY22

ii. Sleeper Renewals

A total of 4,552 sleepers are programmed for renewal in the FY22. The location and extent of these works for FY22 are outlined in the following table.

Table 139 FY22 Sleeper Renewal Program - Newlands

Ref	Track Section		Start Km	Finish Km	Length (km)	Sleepers
1	ARMUNA	ARMUNA	23.202	23.76	0.558	815
2	ABERDEEN	BINBEE	38.63	38.71	0.080	123
3	BUCKLEY	ARMUNA	12.51	13.72	1.210	1770
4	BUCKLEY	BUCKLEY	9.227	10.698	1.263	1844
	TOTAL				**3.111**	**4,552**

Scope Comment:

- The scope at locations 1,2 & 4 are renewals of aged Fist Clip sleepers with new concrete 26.5tal sleepers.
- Location 2 is also a fist clip replacement but given location to the coast will include galvanised clips on new concrete 26.5tal sleepers.
- The 8 kilometres of sleepers being renewed in this sleeper renewal program and the Track Upgrade program (below) equates to 2.5% of the total sleepers in the Newlands System (316 track km).

Figure 73 Sleeper Renewal Sites Newlands FY22

iii. Track Upgrades

A total of 4.9 kilometres has been identified for track upgrade in the FY22. The location and extent of these works for FY22 are outlined in the following table.

Table 140 FY22 Track Upgrade Program - Newlands

Ref	Track Section	Start Km	Finish Km	Length (km)	Rails	Sleepers
1	KAILI	1161.600	1162.025	0.380	4	555
2	BRIABA	59.780	62.1790	2.400	25	3212
3	COLLINSVILLE	73.123	74.5	1.380	7	1754
4	COLLINSVILLE	74.833	75.601	0.768	8	1104
	TOTAL			**4.928**	**44**	**6,625**

Scope Comment:

- All the locations for FY22 are aged 53kg rail on fist clip sleepers. This will be renewed with 60kg rail on new concrete 26.5tal sleepers.
- The track being upgraded under this program equates to 1.6% of total track in the Newlands System.

Figure 74 Track Upgrade Sites Newlands FY22

iv. Turnout Renewal

The location and extent of these works for FY22 are outlined in the following table.

Table 141 FY22 Turnout Renewal Program - Newlands

Ref	Station	Points	Km Location
1	Sonoma	SA7A	84.75

Scope Comment:

- The turnout renewal scope at Sonoma will see the aged turnout renewed with fully prefabricated units. This reduces the install duration footprint as the elements are built on site adjacent to the intended location and simply lifted in and connected.
- The single turnout being renewed in this program equates to 1.3% of the total turnouts in the Newlands System (76 turnouts).

Figure 75 Turnout Renewal Sites Newlands FY22

v. Turnout Component

The FY22 Turnout Component scope is an allocation of $0.5m for the Newlands System. Component renewal is a standard asset management practice which allows Aurizon Network to maximise the overall asset's useful life. Component replacements typically include switch and stock replacement or vee/crossing replacement.

vi. Turnout Design

The FY22 Final Draft Proposal for Newlands will see turnout design completed during FY22 at four sites. Designs will be completed for turnouts in the following locations.

Table 142 Turnout Design Scope Locations - Newlands

	Station	Points
1	LEICHARDT RANGE	LR12A
2	LEICHARDT RANGE	LR7A
3	EAGLEFIELD CK	EC12A
4	EAGLEFIELD CK	EC7A

Scope Comments:

- The design effort on the four turnouts outlined in Table 142 will look to change the turnout mechanism in these locations from a Vee to a Swing Nose crossover.
- The Vee is a static contact point for the train wheels in a turnout and have a typical life under traffic at line speed of 7 to 9 years. The Swing Nose arrangement has proven a more reliable and longer lasting arrangement across the CQCN as it moves under the train opposed to the fixed Vee.
- These turnouts were installed as part of the Goonyella to Abbot Point Expansion (GAPE) in 2012.
- These four sites will be planned for renewal in FY23.

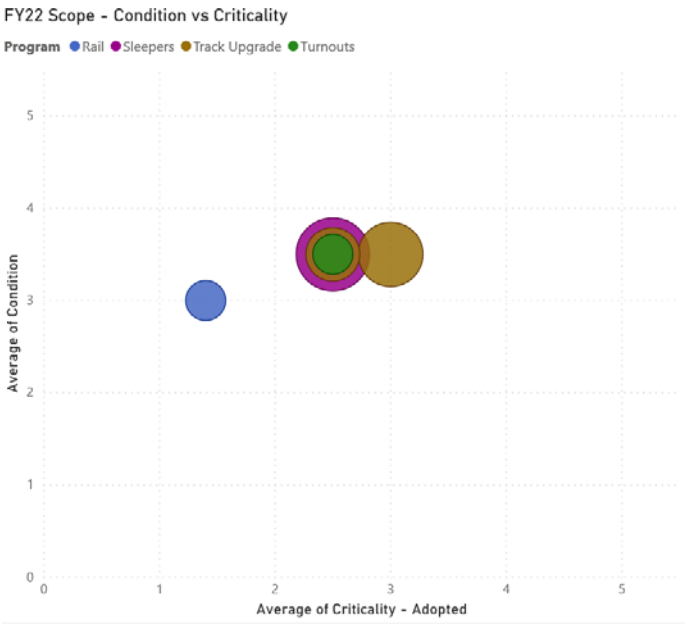
vii. Permanent Way Other

- Glued Insulated Joints:
  - An amount of $0.1m for the renewal of defective Glued Insulated Joints (GIJ) has been included in the proposed FY22 scope of works. Renewal of 4-hole GIJ's to 6-hole GIJ's to improve robustness, resilience and mitigate rail failure points from aged joints. In track sections that utilise axle counters, GIJ are redundant so will be removed prior to failure and renewed with a rail weld.
- Rail Lubrication:
  - Rail lubricators deliver the grease to the rail in small portions over a larger area and facilitate better wheel pick up, this will limit rail and wheel wear and reduce noise related to wheel squeal.
  - An allocation of $0.01m has also been made for fix on fail requirements for the mobile lubrication units.
  - There are 16 lubricator units in the Moura System.

Permanent Way FY22 Scope - Asset Condition and Criticality Assignment

The following graphic plots the permanent way renewals against asset condition and location/operational criticality. As can be seen all planned FY22 renewals are either advance in wear or degradation.

Figure 76 Permanent Way – FY22 Scope Priority Ratings - Newlands



Interpretation:

This chart represents the current condition and criticality of assets targeted for renewal in FY22. For each scope item:

- *The location of the bubble indicates the SPM ranking for Asset Condition and Location/Operational Criticality; and*
- *The size of the bubble represents the number of sites / tasks.*

Section 11.1.3 of the FY22 Final Draft Proposal provides further detail on how Asset Condition and Criticality is used to determine whether scope is Critical, required for System Reliability or Strategic.

Permanent Way FY22 Program - Options Considered

Table 143 Permanent Way Program Options

Option	Description	Retained Asset Risk	Impact
Complete the proposed scope	This scope is typically completed within existing integrated closures. When more time is required, construction typically takes single line closure extensions to complete works. Turnout components and removals are not complete renewals, they can be	Low	The renewal or upgrade will provide enhanced system reliability through the avoidance of unplanned outages and re-life the renewed assets. Component renewal will extend the life of assets.

Option	Description	Retained Asset Risk	Impact
	carried out in the shadow of other activities within integrated closures		Removal of surplus or redundant assets will reduce the associated maintenance costs with the inspection and service of assets.
Defer some of the proposed scope	Deferral of worn components could result in asset failure that requires unplanned rectification and added delay. Given these works are often completed in the shadow of other major tasks or between trains there would be little increase in throughput. Deferred works are moved to next available period so capacity gain through deferral is eroded by having to complete the scope later.	Medium	Deferral of the renewal of worn components can lead to unplanned failure and will need to be renewed in a future year. This option will incur additional ongoing maintenance costs.
Do not complete proposed scope	Worn components that are not replaced will eventually result in failure, unplanned rectification and delays. The benefit of any short-term access reduction is likely to be offset by the impact of future unplanned closures in the event of asset failure.	Medium to High	Failure to renew worn components will lead to unplanned failure. This option will incur additional ongoing maintenance costs.
Always replace both rails	Limited impact on throughput as time taken to replace both rails is minimal within the closure required. Replacing both rails would negate the need to go back to the same site in a future year to replace the other rail The lower rail in a curve wears at a higher rate given the loads are increased on the lower rail. Current practice is to renew the rail closest to the wear limit and assess the other rail to determine its remaining life.	Nil	Replacing both rails will have the effect of replacing some rail prematurely in that rail would be replaced that had significant life left. There is an opportunity to cascade this rail to yards and low speed locations but would require freight charges to reposition the rail.
Complete track upgrade instead of individual rail or sleeper replacement	Sleepers and rail have differing wear rates and expected lives hence why they are currently treated as separate assets. Current practice is to assess the need for sleeper or rail replacement at the same site during the planning phase and where applicable bring required rail and required sleeper upgrade together as a Track Upgrade.	Nil	Always replacing sleepers will result in sleepers being replaced prematurely. Sleeper life is typically far in excess of rail life. As such, rail replacement is generally the predominant trigger for track upgrade. This will have the effect of an increase in short-term cost with longer-term efficiencies brought about through single mobilisation and reduced track access.

Civil Assets - Ballast Cleaning & Renewals

Ballast Cleaning Renewal Program

In FY22 Aurizon Network proposes to undertake $3.9m of Ballast Cleaning in the Newlands System. Table 144 below summarises the scope and budget for each relevant renewal item.

Table 144 Ballast Cleaning Program - Newlands

Description	FY22 Scope	Scope Unit	FY22 Budget ($m)	Comments
i. Mainline Undercutting	6.9	Km	2.8	Scope delivery for FY22 assumes the use of both the high production ballast undercutting machine and excavator undercutter.
ii. Turnout Undercutting	3	Unit	0.4	Ballast cleaning in turnouts and level crossings or in shorter locations to reinstate the drainage properties of the ballast
iii. Bridge Rollout	1	Site	0.5	Full renewal of ballast on bridge structures to reinstate the drainage properties of the ballast
iv. Ground Penetrating Radar (GPR)			0.2	GPR data used to understand the level of fouling and determine future years scope locations
TOTAL			**3.9**	

The remainder of this section provides further details of the specific scope that Aurizon Network intends on delivering during the period.

i. Mainline Undercutting

The FY22 mainline undercutting program will see 6.9km of scope planned for delivery for a forecast cost of $2.8m in aggregate. The scope will be delivered using the Ballast Undercutting Machine (C01) and excavator undercutter (C14).

Table 145 Mainline Undercutting - Newlands

Renewal Item	FY22 Scope	Scope Unit	FY22 Budget ($m)
Mainline Undercutting (C01)	5.0	Track Km	2.2
Mainline Excavator Undercutting (C14)	1.9	Track Km	0.6
TOTAL	**6.9**		**2.8**

The location and extent of these works for FY22 are outlined in the following table.

Table 146 Location of Mainline Undercutting - Newlands

Track Section		Start Km	End Km	Length (Km)
DURROBURRA	KAILI	1161.600	1162.00	0.4
BRIABA	ALMOOLA	58.834	60.834	2.0
BRIABA	ALMOOLA	72.941	74.941	2.0
COCKOOL	HAVILAH	113.650	114.650	1.0
Unallocated Scope				1.5
TOTAL				**6.9**

The scope of ballast undercutting is based on the identification of track sections with a rate of fouling above the Acceptable Fouling Rate (**AFL**). The AFL is expressed as a percentage of ballast voids that are fouled. At a level of over 38% fouling, the ballast draining properties are diminished so that effects of sodden formation will start to manifest as track alignment concerns.

Aurizon Network utilises Ground Penetrating Radar (**GPR**) to determine the level of fouling. The review and analysis of the FY20 GPR run data is currently ongoing. These results will be used along with local condition data from field teams to determine if a change in strategy and scope is required to address coal fouling.

Scope Comments:

- The sites at Briaba to Almoola and Cockool to Havilah will be delivered by the Ballast Undercutting Machine (C01). The site at Durroburra will be delivered using Excavator undercutters given it is a short section and not economic to utilise the C01 machine.
- The 7 kilometres of ballast being cleaned in this program and Bridge Rollout scope equates to 2.2% of the total ballast in the Newlands System (316 track km).
- An unallocated scope of 1.5km has been added to the FY22 program. This is to react to sites that require ballast cleaning as sites degrade ahead of expectation or present with little notice. In prior years the planned scope was changed to accommodate the fix on fail sites. In FY22 the plan for the identified sites is planned into closures and will not be disrupted in the event of a fix on fail scope site presenting. Rather excavator undercutters or the Ballast Undercutting Machine will be deployed, dependant on the availability of plant and the location of the failed section.

The current mainline scope is based upon data up until the 2018 GPR run and the capacity of the existing fleet. In 2020, a further GPR run was completed and provides for a further data set to compare against, to determine the rate of coal ballast fouling throughout the CQCN. It is expected that the results of this GPR run will be available in early 2021.

In addition to the GPR results, Aurizon Network has proposed a further study to understand the causes of coal ballast fouling and potential mitigations within the CQCN. The study proposal has been provided to the Queensland Resources Council. Discussions with members of the RIG have indicated that there is an appetite to explore potential coal fouling controls through appropriate trials.

Aurizon Network will engage with the RIG on both the GPR results and any coal fouling study and/or trials throughout 2021.

ii. Turnout Undercutting

3 turnouts are proposed to be undercut via the excavator undercutter in FY22. The location and extent of these works for FY22 are outlined in the following table.

	Turnout Location	Point
1	COLLINSVILLE	10A/B
2	DURROBURRA	10AB
3	DURROBURRA	12AB

iii. Bridge Rollout

The proposed FY22 program for bridge rollouts in the Newlands System is 1 bridge for a total of 45 metres. The location and extent of these works for FY22 are outlined in the following table.

Start Station	End Station	Waterway	Start km	End Km	Length (metres)
BRIABA	COLLINSVILLE		72.2	72.3	45

Figure 77 Ballast Cleaning & Bridge Rollout Sites Newlands FY22

Ground Penetrating Radar

To further the refinement of ballast cleaning scope, Aurizon Network seeks to perform an additional GPR survey in FY22. This will be the 5th run of its type (2014, 2016, 2018 & 2020) and will allow Aurizon Network to not only identify sites that required cleaning, but to also trend locations over the period to understand degradation rates with a view to predict future renewal requirements and locations.

The costs of the GPR survey have been allocated between systems in proportion to the GPR survey kilometres planned in each Coal System. This results in a cost allocation to the Newlands System of $0.2m.

The proposed FY22 GPR survey will be targeting all Mainline track within the CQCN (i.e. Trunk routes, Branch Lines and Spurs - the track carrying increased risk due to higher line speeds and throughput) and select Yard Track that is high-frequency and / or critically located. The intent is to enable a data-driven assessment of the overall condition of the ballast using a risk-based approach to determine future undercutting requirements.

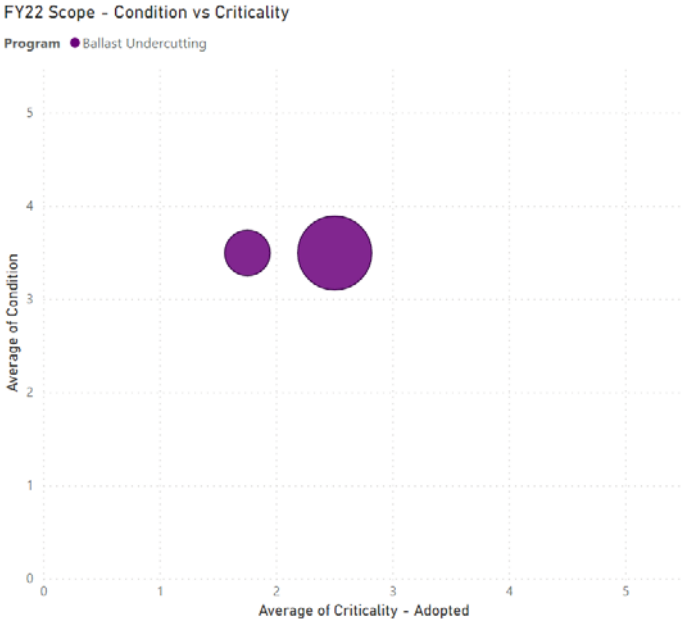
Aurizon Network considers it necessary to continue to collect GPR data (including in recently undercut sections) in order to assess and understand the System and localised change in ballast condition over time. In particular, the inclusion of recently undercut sections enables an understanding of the overall fouling status of each System; excluding these sections would result in a skewed view of the fouling status. Similarly, if recently undercut sections were not surveyed, the time period between successive datasets would increase from ~24 months to ~48 months and become less valuable in the context of the undercutting scope development and subsequent planning. This would compromise Aurizon Network's ability to manage its ballast asset over the long-term.

In any event, the on-track vehicle collecting GPR survey data would otherwise need to traverse the recently undercut sections and therefore, no throughput benefit is gained (nor loss suffered) through 'missing' localised and recently undercut sections. Aurizon Network would not expect any cost savings as a result of omitting these sections.

Ballast Cleaning FY22 Scope - Asset Condition and Criticality Assignment

The following graphic plots ballast renewals against asset condition and location/operational criticality. This illustrates that all identified scope has a current condition of 3 or above with advanced fouling and will degrade further without intervention.

Figure 78 Ballast Cleaning – FY22 Scope Priority Ratings - Newlands



Interpretation:

This chart represents the current condition and criticality of assets targeted for renewal in FY22. For each scope item:

- *The location of the bubble indicates the SPM ranking for Asset Condition and Location/Operational Criticality; and*
- *The size of the bubble represents the number of sites / tasks.*

Section 11.1.3 of the FY22 Final Draft Proposal provides further detail on how Asset Condition and Criticality is used to determine whether scope is Critical, required for System Reliability or Strategic.

Ballast Cleaning FY22 Program - Options Considered

Table 147 Ballast Cleaning Program Options

Option	Description	Residual Asset Risk	Impact
Complete the proposed scope	Proposed scope is taken into the system-wide planning process to balance scope system throughput with scope requirements.	Low	All identified scope has a current condition of 3 or above with advanced fouling and will degrade further without intervention. The Residual risk categorisation is somewhat subjective, but has been assessed on the basis of the proposed and planned scope and available data at the time of preparation. The cleaning of each site as per the proposed plan will remove the most fouled locations whilst balancing production rates and track time of the undercutting machine against throughput capacity demand.
Defer some of the proposed scope	Deferral of works will push requirement into future years with ballast condition becoming more fouled in deferred locations. Given the capacity impact of the ballast cleaning operation some throughput would be returned to the supply chain, but this would be eroded by operational restrictions and unplanned delays caused by degraded ballast condition	Medium	Locations identified for cleaning are already at a high level of fouling. Deferral will see condition worsen and may require a full ballast replacement rather than an undercut and screen. The condition could worsen through the development of mud-holes and compromised track geometry, leading to speed restrictions
Do not complete proposed scope	Not completing the scope will see the ballast continue to foul and the associated impacts increase. This will lead to unplanned outages and delays that will reduce system capacity at the planned renewal sites	Medium	Locations identified for cleaning are already at a high level of fouling. Not completing the works will see condition worsen and may require a full ballast replacement rather than an undercut and screen.

Option	Description	Residual Asset Risk	Impact
Move to 100% ballast replacement	Slightly higher production rate of the mainline undercutter as ballast is not screened and returned but would require additional ballast at undercut site through additional ballast train (work train) hauls to deliver / stockpile	Low	Mainline undercutter consist includes several ballast spoil wagons but these would be filled quickly, and the rest of the ballast would be ejected to track side to be stockpiled for future removal. The removal of the excess ballast would need to be costed back to the mainline undercutting program and pass through to access tariffs.
Slabtrack all bridges to reduce Bridge ballast replacement	Slabtrack design and installation is both expensive and time consuming to execute. It will however eliminate the need to renew ballast on bridge decks and has positive capacity benefits in the long-term due to reduced renewal and maintenance activity. Aurizon Network has installed Slab Track on the Cooling channel bridge in Gladstone and continues to look at this as an option for other critical bridges.	Nil	If the bridge and/or slabtrack infrastructure is structurally damaged through derailment or bridge strike (e.g. from an over-height vehicle), the ability to recover from such an event is heavily compromised and would require new reconstruction techniques and stocks of large inventory items (e.g. slab track panels or bridge girders)
Shoulder Cleaning	Reduced short-term throughput impact to execute work (i.e. higher production in a given time) albeit medium-term throughput impacts due to potential TSRs from ballast fouling immediately beneath track.	Medium	Shoulder cleaning has been shown to provide short-term benefits however the intervention thresholds are very narrow, intervening too soon may result in benefits not being realised, whilst intervening too late will result in wasted effort and loss of capacity due to the need to execute a full undercut and the likely imposition of TSR's to manage the short-term geometry degradation.
Cleaning of turnouts using a Vacuum Truck	Vacuuming of turnouts is appropriate in certain areas. It remains a slow process and in areas of high fouling is used to manage the otherwise high likelihood that components will be unable to be inspected and unplanned failure rates will increase.	Medium	Vacuuming of turnouts does not address the underlying level of fouling and will not negate the need to undercut ballast in turnouts but rather ensure that components are able to be inspected and remain lubricated and functional. Aurizon Network is aware of Plasser's and other vacuum-based technologies which include on-track vacuum machines, with the ability to remove all fouled ballast, and off-track vacuum trucks which do not have this capability and, as a consequence, can only manage surface contamination. Aurizon Network does make use of off-track vacuum-trucks to manage heavy surface fouling at critical locations. Enquires in relation to this technology identified that a bespoke on-track machine would likely need to be designed and manufactured for Aurizon Network's narrow gauge railway, requiring investment in new plant. Aurizon Network also understands that the production rates of vacuum machines are lower than excavator undercutters. On-track machines will also face constraints such as the ability to store the necessary spoil.

Option	Description	Residual Asset Risk	Impact
			Essentially, use of such a machine would result in increased cost (investment in new plant either Network-owned, Leased or Contracted Machines and Labour) for a negligible change in production rate relative to the existing excavator undercutter approach.

Civil Assets - Structures Renewals

Structures Renewal Program

The Newlands System has a total of 52 bridges and 691 culverts which are designed to allow the natural flow of water through the rail network. In FY22 Aurizon Network proposes to undertake $4.9m of structures renewal works in the Newlands System. The location and extent of these works for FY22 are outlined in the following table.

Table 148 Structures Renewal Program - Newlands

Description	FY22 Scope	Scope Units	FY22 Budget ($m)	Comments
i. Bridges	2	Site	3.0	Upgrade of load loading at 1 site and repair of cracked bridge pylons. Equates to 3.9% of bridges in the Newlands System.
ii. Culvert Renewal	5	Site	1.7	Equates to 0.7% of culverts in the Newlands System.
iii. Culvert Design	1	Site	0.2	Release of design packages for identified sites to be renewed in future years
TOTAL			**4.9**	

The remainder of this section provides further details of the specific scope that Aurizon Network intends on delivering during the period.

i. Bridges

Aurizon Network proposed to undertake renewals or repairs of 2 bridges in the Newlands System as part of its FY22 Final Draft Proposal. There may also be additional bridge design work for bridges that require renewal in future years.

Bridges are long life assets and several assets in the Newlands System are operating at loads beyond their initial design parameters. The bridges for renewal and repair in FY22 are 20 tonne axle load structures servicing 26.5 tonne axle load traffic.

Several structures in Newlands were upgraded as part of the GAPE project as they were already seeing degradation. The sites for upgrade in FY22 were not identified as requiring renewal as part of GAPE scope.

Table 149 Bridge Renewals - Newlands

Activity	Location	Start Km	Description
Repair	Saltwater Creek	12.879	Defect - Vertical severe cracking in all piers. Renewal - Underwater crack repair required to piers and headstocks and carbon fibre encasement
Repair	5 Mile Creek	16.200	Defect - 60 kph Speed restriction as bridge carrying loads above the original design rating. Minor to moderate cracking through various components.

Scope comments:

- As detailed in Table 149, the bridge at 5 Mile Creek is currently holding a 60km/h speed restriction to manage the risks associated with the bridge carrying loads above the original design rating. The completion of this scope will result in the TSR being removed.
- Both bridge renewals have indicative estimates based on construction experience. Both sites will have detailed design completed by February 2021. Once this is completed the works will be put to tender and a bottom up estimate finalised. Any change as a result of the detailed estimate will be addressed through the change management process.
- The 2 bridges being renewed in this program equate to 3.9% of the total number of bridges in the Newlands System (52 bridges).

ii. Culvert Renewals

The culverts used in the railway are typical of concrete culverts and corrugated metal pipes used in civil construction and maintenance in other heavy civil uses (roads, Mines, airport runways etc). Given this the design activity for culvert renewals is outsourced to design houses with demonstrated experience in site specific design matching standard units to local conditions to achieve the required hydrology functionality.

In FY22, 5 culvert renewals are proposed in the following locations:

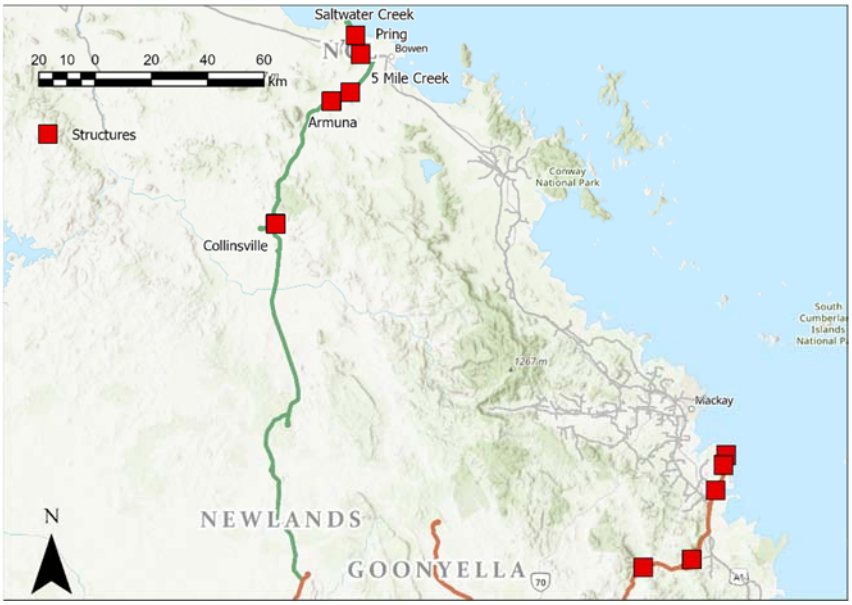
Table 150 Culvert Renewals - Newlands

	Culvert Renewal Location	Km Point
1	COLLINSVILLE	75.75
2	ARMUNA	23.73
3	PRING	2.69
4	COLLINSVILLE	75.9
5	ARMUNA	23.57

Scope comments:

- Sites 1,2 & 3 are removals and replacements of failed or degraded concrete culverts.
- Sites 4 & 5 are lining of concrete pipes to remedy cracking defects.
- These 5 culverts being renewed in this program equates to 0.7% of the total culverts in the Newlands System (691 culverts).

Figure 79 Structures Renewal Sites Newlands FY22



iii. Culvert Design

Aurizon Network also proposes to undertake culvert design works at 1 location in the Newlands System for future years construction. The location of the culvert is outlined in Table 151.

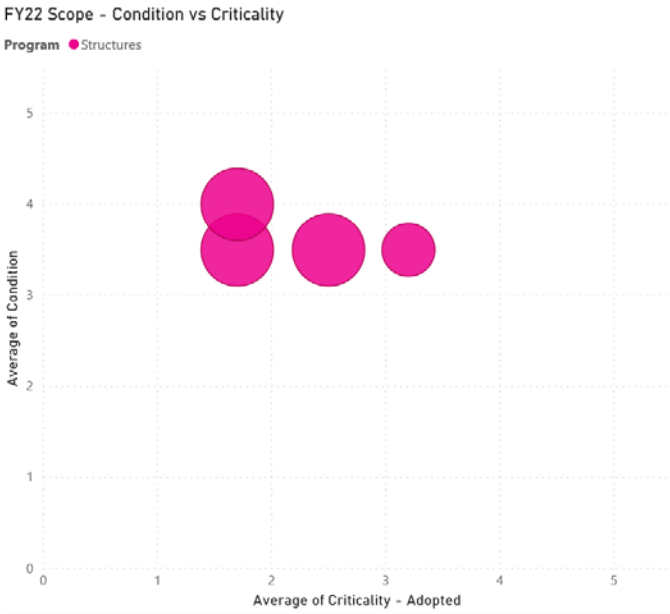
Table 151 FY22 Culvert Design Scope Location - Newlands

	Culvert Design Location	Km Point
1	PRING	6.75

Structures FY22 Scope - Asset Condition and Criticality Assignment

The following graphic plots the Structures against asset condition and location/operational criticality. As can be seen all planned FY22 renewals have poor to near end of life condition with an average condition for the FY22 program of 3.6.

Figure 80 Structures – FY22 Scope Priority Ratings - Newlands



Interpretation:

This chart represents the current condition and criticality of assets targeted for renewal in FY22. For each scope item:

- *The location of the bubble indicates the SPM ranking for Asset Condition and Location/Operational Criticality; and*
- *The size of the bubble represents the number of sites / tasks.*

Section 11.1.3 of the FY22 Final Draft Proposal provides further detail on how Asset Condition and Criticality is used to determine whether scope is Critical, required for System Reliability or Strategic.

Structures FY22 Program – Options Considered

Table 152 Structures Renewal Program Options

Option	Description	Residual Asset Risk	Impact
Complete the proposed scope	Renewing in a planned manner allows for optimal access planning and track occupancy for the required renewal works. Where applicable Aurizon Network sleeves pipe culverts so the renewal works can occur under traffic not requiring a possession.	Low	In order to line a culvert, it needs to be in the proper alignment, and not deformed out of shape. The planned renewals in FY22 are currently in a condition that lining is achievable
Defer some of the proposed scope	Deferral will push the renewal requirement to a future year and increase the risk of failure during the period of extension.	Medium	Deferral of renewal of worn components can lead to unplanned failure. Deferral can see further alignment degradation negating the opportunity for lining of pipes.
Do not complete proposed scope	Failure to renewal planned scope will remove faulty structures that if not treated will fail in the near term and effect the alignment of the railway such that emergency possessions will be required to remedy or a TSR would be required until a renewal could be planned.	High	Failure to renew worn components will lead to unplanned failure and increase derailment risk related to track misalignment at defective structure sites.

Civil Assets - Civil Renewals

Civil Assets Renewal Program

In FY22 Aurizon Network proposes to undertake $2.4m in renewals for these assets. Table 153 below summarises the scope and budget for each relevant renewal item.

Table 153 Civil Assets Renewal Program - Newlands

Description	FY22 Scope	Scope Unit	FY22 Budget ($m)	Comments
i. Formation Renewal	0.7	Km	1.7	Equates to 0.2% of formation length.
i. Formation Reactive		Fix on Fail	0.4	Fix on fail scope allocation to accommodate formation that fails in a yet to be known location
ii. Level Crossing Design	1	Site	0.03	Design of identified renewal sites to be completed in future years.
ii. Level Crossing Other		Fix on Fail	0.2	Fix on fail scope allocation to accommodate level crossing elements that fail or reduce the safety of the road rail interface
iii. Access Roads & Access Points		Fix on Fail	0.1	Fix on fail to reinstate access roads and Corridor Access Points that are below standard due to local conditions or degradation
iv. Corridor Fencing & Security		Fix on Fail	0.1	Fix on fail allocation to reinstate required corridor fencing to sperate the rail corridor from neighbouring land.
TOTAL			**2.4**	

NB: The totals presented in the table above may not add due to rounding.

The remainder of this section provides further details of the specific scope that Aurizon Network intends on delivering during the period.

i. Formation

The location and extent of these works for FY22 are outlined in the following table.

Table 154 FY22 Formation Scope Locations – Newlands

Works	Location	Start Km	End Km	Distance (Km's)
Renewal	BUCKLEY – ARMUNA	14.600	14.825	0.225
Renewal	BUCKLEY – ARMUNA	14.925	15.400	0.475
TOTAL				**0.700**

Scope comments:

- Soil and geotechnical studies to be completed to determine the level of unsuitable material.
- Estimated time to complete works, scope and cost subject to minor change from current proposal. Effect could be negative or positive.
- Studies to be completed by February 2021.
- The 0.7 kilometres of formation renewal in this program equates to 0.2% of the total formation in the Newlands System (316 track km).
- An allocation of $0.4m has been made for fix on fail formation sites in Newlands.
    - Each site as identified by the local Track Inspection staff is assessed by the District Engineer.
    - A site estimate is developed and draws down of the fix on fail allocation.

ii. Level Crossing

There are 93 level crossings in the Newlands System. Crossings with active protection require coordination into the localised signalling system and therefore require a level of design works. In FY22, Aurizon Network's Level Crossing program for the Newlands System that includes:

- Level Crossing Design – Crossings with active protection require coordination into the localised signalling system and therefore require a level of design works. The designs are for delivery in future years.

The location and extent of these works for FY22 are outlined in the following table.

Table 155 FY22 Level Crossing Design - Newlands

Activity	Location	KM point	Description
Design	Durroburra	1,166.1	Design for works to be executed in FY23

Scope comment:

- An allocation of $0.150m has also been made for fix on fail or unplanned safety upgrades for level crossings in the Newlands System.

Figure 81 Formation& Level Crossing Renewal Sites Newlands FY22

iii. Access Points and Access Roads

There are approximately 800 known access points across the Newlands System. Corridor access points are locations where Train Crew and Aurizon Network workers and contract staff need to leave the public road network to access the rail corridor. In Newlands the railway and the road network are quite aligned for most of the network except for the Newlands Junction to North Goonyella section. As such these turnoffs include turns at formed intersection and undefined turnoffs. These undefined or un engineered turn off pose a significant risk. Aurizon Network has been working with local road authorities (TMR & local Council) to better sign access points. A focus is to progressively illuminate unsafe or high-risk access points and to better define and identify the controlled access points.

Access Points Scope Comments:

- An allocation of $0.02m has been made in FY22 for fix on fail works relating to Access Points

Access Roads Scope Comments:

- There is 685km of access roads in the Newlands System.
- Access Roads – an allocation of $0.1m has been proposed for fix on fail access road works.
- Post rain events, sections of access roads will require renewal and reinstatement. Additionally, sections are graded if the road has degraded across all longer section.

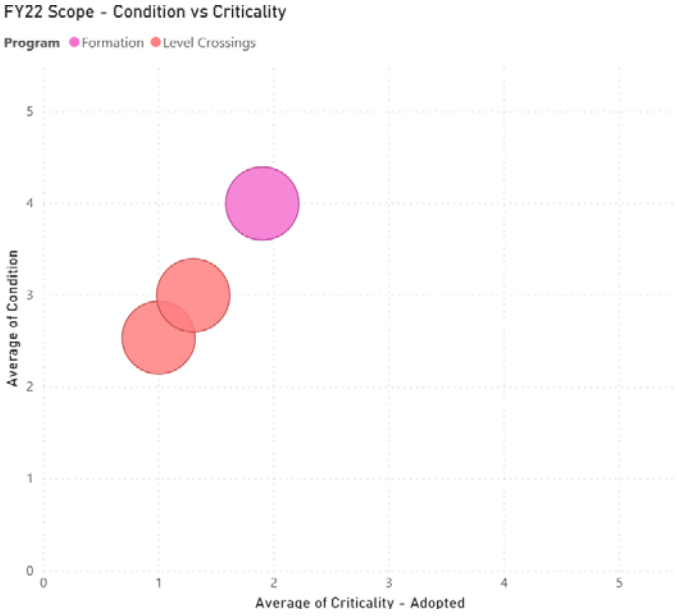
iv. Corridor Fencing and Security

There is 211km of fencing in the Newlands System. An allocation for fix on fail fencing has been made in the FY22 program of $0.1m. This will be allocated to address failed fencing in locations as identified by the local Infrastructure teams or via Aurizon's Community Engagement team in consultation with neighbouring land holders.

Civil Renewals FY22 Scope - Asset Condition and Criticality Assignment

The following graphic plots the Civil renewals against asset condition and location/operational criticality. As can be seen the single formation site in this system is already at a condition rating 4.

Figure 82 Civil Renewals – FY22 Scope Priority Ratings - Newlands



Interpretation:

This chart represents the current condition and criticality of assets targeted for renewal in FY22. For each scope item:

- *The location of the bubble indicates the SPM ranking for Asset Condition and Location/Operational Criticality; and*
- *The size of the bubble represents the number of sites / tasks.*

Section 11.1.3 of the FY22 Final Draft Proposal provides further detail on how Asset Condition and Criticality is used to determine whether scope is Critical, required for System Reliability or Strategic.

Civil Renewals FY22 Program - Options Considered

Table 156 Civil Renewal Program Options

Option	Description	Residual Asset Risk	Impact
Complete the proposed scope	Formation renewals treat formation sections that have failed and are causing track alignment issues leading to speed restrictions and the need to complete resurfacing works. Completing the scope at these locations address the underlying formation issue avoiding future operational delays.	Low	Completing the scope will maintain the assets performance across these asset classes. For example, effective rail lubrication extends the life of rail and wheels to maximise the life from these assets and avoid early renewal requirements.
Defer some of the proposed scope	Deferral of identified scope could result in failure that requires unplanned rectification and added delay. Deferral of formation works will result in additional track resurfacing activity at these sites to restore track geometry and associated operational delays.	Medium	Failure to renew aged assets can lead to unplanned failure.
Do not complete proposed scope	Not completing the scope will result in unplanned outages when these assets fail or require an extended period to rectify from faults.	High	Failure to renew worn components can lead to unplanned failure.
Formation – Lime Slurry Injection	Aurizon Network has in the past used the injection of lime slurry that hardens as a way to fill voids that were identified in the formation with some success.	Medium	Lime slurry injection only treats the visible issues, given the issues are mostly not visible it has only a limited effect in the short term. The more efficient process is to re-life the asset by removal and rebuild.

Control Systems Assets

Control Systems Renewal Program

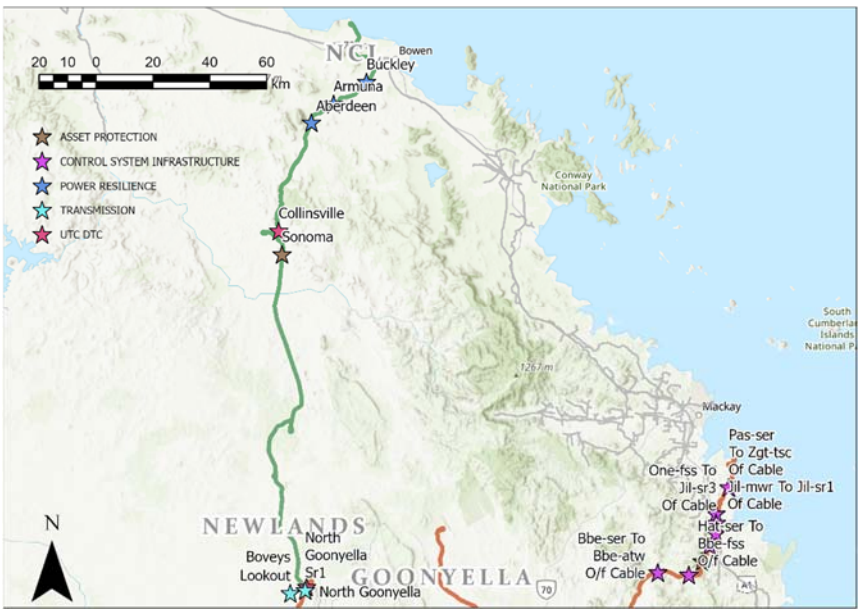
In FY22 Aurizon Network proposes to undertake $4.6m of Control system renewals or enhancements in the Newlands System. Table 157 below summarises the scope and budget for each relevant renewal item.

Table 157 Control Systems Program - Newlands

Renewal Item	FY22 Scope	Scope Unit	FY22 Budget ($m)	Description
i. Safeworking Systems – Asset Protection	2	Sites	0.9	Installation of track side devices to monitor rollingstock and railway interfaces looking for faults and pre fault conditions
ii. Safeworking Systems - Minor	4	Unit	0.1	Ongoing renewal of lower valued assets forming part of the system, to maintain average asset condition
iii. Power Resilience	14	Sites	1.2	Uninterrupted power supplies and battery pack renewals
iv. Transmission & Data Renewal	4	Sites	0.6	Back-up power supplies and Corridor Equipment Room (CER) Renewal
v. UTC/DTC Systems Upgrades	2	Sites	0.4	Upgrades for the train control system
vi. Other Control Systems Renewals	9	Sites	1.4	Design costs associated with Power Resilience and Interlockings
TOTAL			**4.6**	

The remainder of this section provides further details of the specific scope that Aurizon Network intends on delivering during the period.

Figure 83 FY22 Control Systems Renewals



i. Safeworking Systems – Asset Protection Renewals

In FY22 Aurizon Network proposes to undertake $0.9m of asset renewals in the Newlands asset protection system. The location and extent of these works for FY22 are outlined in the following table.

Table 158 Asset Protection Renewals - Newlands

Activity	Scope Units	FY22 Scope	FY22 Budget ($m)	Description
WEIGHBRIDGE	Site	1	0.5	Renewal of the rail weighbridge components at Sonoma. These units are used to detect over loaded wagons at the point of loading
Wheel Impact Load Detector (WILD)	Site	1	0.4	Install of a new WILD. The WILD identifies the impact force of flat wheels. Flat wheels if left untreated to exert enough force to break or damage rail that will require replacement or additional grinding.
TOTAL			**0.9**	

ii. Safeworking Systems – Minor

The FY22 program is mainly around asset protection assets installed to provide real time measurement of rollingstock and railway interface to identify rollingstock that are operating out of normal operations.

Table 159 Minor Safeworking System Renewals - Newlands

Scope	Description	Qty	Unit
RAIL BAM CMS	**Bearing Acoustic Monitor** - detects potential bearing failure. Scope is to replace centralised server	1	SITE
WEIGHBRIDGE	Renewal of weighbridge. These units are used to detect over loaded wagons at the point of loading	1	SITE
IAMPS	**Integrated Asset Monitoring and Protection System** - consolidates alarms from multiple systems to present to UTC. Scope is various minor updates.	1	UNIT
VSH CNMS NG RAB CHECKPOINT	**Virtual Server Host** - telecommunications network management SCADA - replacement server and checkpoint firewall	1	UNIT

iii. Power Resilience

This scope is required to improve the general power resilience across the Newlands System. Mains power is required to operate the electric switching and components housed in the track side equipment rooms. This asset family included emergency power systems to keep the vital train control, signalling and telecommunications operating if the local power supply is interrupted.

In FY22 $1.2m is proposed for this asset class to deliver scope as per the following table:

Table 160 Power Resilience Scope - Newlands

Scope	Description	Quantity	Unit
Power Resilience – Signalling Batteries Upgrade	Renewal of battery banks that provide backup power in the event of mains power failure	1	UNITS
Power Resilience – DIEF Controller	Remote management device for monitoring stand by generator status	10	UNITS

Scope	Description	Quantity	Unit
Power Resilience – SI Replacement*	Renewal of Signal Interlocking	3	STATION

**This table has been updated to include the renewal of 3 signal interlockings that were omitted from the FY22 Draft Proposal. The inclusion of these items does not change the Newlands budget amount.*

iv. Transmission & Data Network Renewals

Transmission & Data Networks consist of:

- Data Network - the infrastructure and electronics required to provide the data network across the CQCN
- Transmission – digital and microwave radio systems

In FY22 Aurizon Network proposes to undertake $0.6m of asset renewals in the Newlands System for Transmission & Data Network renewals. The location and extent of these works for FY22 are outlined in the following tables.

Table 80 Data Network Renewal

	Scope	Qty	Unit	Location
1	Data Routers	1	Unit	Various

Table 161 – Transmission Renewal

	Scope	Qty	Unit	Location
1	Digital Microwave Radio Dish Renewal	2	UNIT	BOVEY'S LOOKOUT
2	Power Supply Renewal	1	UNIT	BRIABA

v. UTC/DTC Systems Renewals

In FY22 Aurizon Network proposes to undertake $0.4m of asset renewals in the Newlands System Train Control systems. This included in field digital modernisation of the life expired analogue telemetry that receives the control message via the Train Control system and safety and application enhancements to the UTC system. These upgrades are scope prioritised by the Train Control team to improve the safety functions of UTC or to reduce potential scheduling and process errors.

The location and extent of these works for FY22 are outlined in the following table.

Table 162 UTC / DTC System Renewals - Newlands

Scope		Location	Qty	Unit
UTC CODE AND SAFE WORKING	RENEWAL	SYSTEM WIDE		
DIGITAL TELEMETRY	RENEWAL	COLLINSVILLE	1	SITE

vi. Other Control Systems Renewals

In FY22 design of sites for future renewal across Power Resilience and Signal Interlockings is captured as Control Systems Other. These design works completed in FY22 will be installed in FY23. In FY22 the following designs are to be progressed:

Table 163 FY22 Other Control System Renewals - Newlands

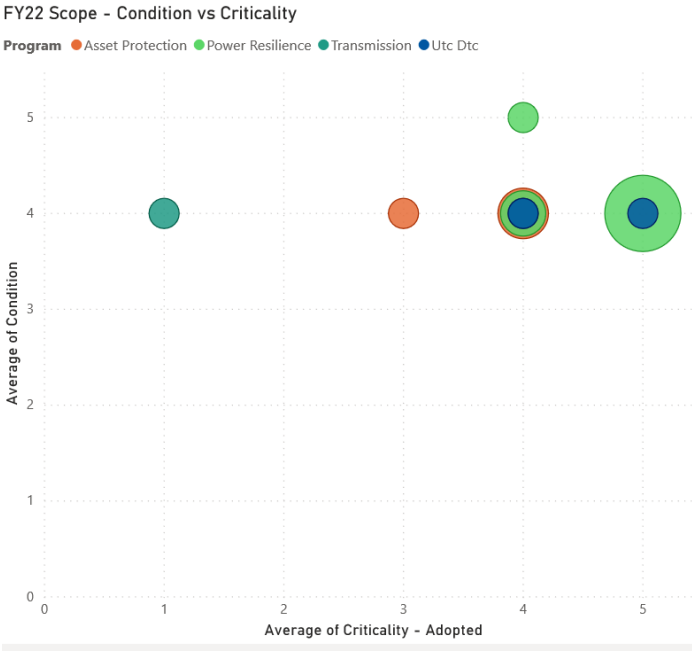
Scope	Location	Qty	Unit
Interlocking – Relay to Power Based Interlocking Design	MCNAUGHTON	1	Design
Interlocking – Relay to Power Based Interlocking Design	COLLINSVILLE	1	Design

Scope	Location	Qty	Unit
Power Resilience – SI Replacement	ALMOOLA	1	Design
Power Resilience – SI Replacement	BINBEE	1	Design
Power Resilience – SI Replacement	BRIABA	1	Design
Power Resilience – SI Replacement	ALMOOLA	1	Design
Power Resilience – SI Replacement	BINBEE	1	Design
Power Resilience – SI Replacement	BRIABA	1	Design

Control Systems Renewals FY22 Scope - Asset Condition and Criticality Assignment

The following graphic plots the Control Systems renewals against asset condition and location/operational criticality. All scope items across all items are listed as condition rating 4. This reflects the age of assets targeted for renewal in FY22. Control Systems assets are mostly electronic, so renewal is a trigger of support, spare parts or software obsolescence. As such condition is more a matter of asset age against design life rather than a physical demonstration of wear.

Figure 84 Control Systems – FY22 Scope Priority Ratings - Newlands



Interpretation:

This chart represents the current condition and criticality of assets targeted for renewal in FY22. For each scope item:

- *The location of the bubble indicates the SPM ranking for Asset Condition and Location/Operational Criticality; and*
- *The size of the bubble represents the number of sites / tasks.*

Section 11.1.3 of the FY22 Final Draft Proposal provides further detail on how Asset Condition and Criticality is used to determine whether scope is Critical, required for System Reliability or Strategic.

Control System Assets FY22 Program - Options Considered

For each asset class, the following options are considered when determining the FY22 scope.

Table 164 Control System Program Options

Option	Description	Residual Asset Risk	Impact
Plan scope over a multi-year program, managing asset performance risk	Planning objective is to maintain or reduce network service delays relative to current levels.	Low	The proposed scope nominally targets this level of obsolescence risk. Other options are considered only when other factors (opportunities or costs) associated with the practicability of

Option	Description	Residual Asset Risk	Impact
	The proposed scope is able to be completed within planned possession constraints.		program implementation outweigh the capacity benefit associated with this renewal objective.
Defer some or all of the proposed scope, taking asset performance risk	Deferral may increase the near-term risk of unplanned disruption due to increasing failure frequency, or delay to return to service after failure. A future acceleration of renewal to redress the deficit may require an increase in the number or duration of possessions.	Medium	This option is considered for assets where asset performance remains satisfactory, and where spares inventory can be sustained through a recover and reuse strategy to ensure return to service upon failure. It is used to reduce the demand for track possessions to within target levels in the planned year, or to moderate demand for finite execution resources.
Accelerate scope, to eliminate obsolescence risk	While the availability of assets may improve, any significant acceleration may require an increase in track possession beyond the annual budget, eroding annual throughput.	Low	This option is typically considered when there is an efficiency associated with the bundling of renewals within a geographical location, or to remove a category of equipment from a maintenance district (possibly supporting deferral of renewal in another district through replenishing of obsolete spares). It may also be used where a capacity impact is observed from a previous deferral of renewals.
Modernisation	Reduce delays due to failures through deployment of resilient systems and architectures using modern technologies	Low	This alternative complements the 3 scheduling alternatives described above. In conjunction with the scheduling of asset renewals, alternative modern technologies and resilient system architectures are considered to ensure advantages of networked digital assets.
Alternative Fibre Optic Cable installation	Options: OPGW (Optical Ground Wire) fibre optic cable, installed in lieu of the traction earth wire. Air Dielectric Self Supporting (ADSS) fibre installed on traction masts.	Medium	These options would be more expensive to install and maintain given interaction with OHLE, however is considered in certain circumstances where appropriate.
Digital Microwave Radio	As a replacement for fibre optic cable, it introduces a significant capacity constraint, and increases exposure to cyclone and storm events due to equipment exposed on structures.	High	Digital Microwave Radio provides limited capacity between 2 points. It is a highly precise focal beam technology requiring substantial tower structures (height and strength) to sustain connection. Microwave Digital Radio is not considered sufficient for baseline capacity requirements.
5G mobile data network	Not practicable	N/A	5G options were not deemed appropriate as the 5G network is not commercially available for use in the CQCN.

Technology Projects

Technology Projects

As detailed in Chapter 2.1 of this FY22 Final Draft Proposal, Aurizon Network is progressing several technology projects to renew existing systems or better understand, analyse and identify scope across the CQCN assets. These projects improve Aurizon Network's ability to make data driven decisions regarding the management of the rail assets on the behalf of the network Customers, Stakeholders and Safety Regulators.

In FY22, Aurizon Network is seeking endorsement from the RIG to invest in these systems, which will ultimately help to enhance the maintenance and renewal programs for the benefit of all CQCN Customers. The costs outlined in Table 165 reflect an allocation of total project costs in FY22 to each Coal System.

Table 165 FY22 Technology Projects - Newlands

Project	FY22 Scope	Allocation to Newlands ($m)	FY22 Total Project Spend
NAMS	Standardisation and development of SAP process to manage all works in the centralised system. SAP functionality to plan all works in SAP to improve planning transparency and timing. Automated scope generation for ballast and ATIS data sets. Training of NAMS users to standardise processes.	0.1	2.4
Movement Planner	The Movement Planner software has been in operation since FY16 when it was first introduced into the Day of Operations process. An upgrade to the latest version 1.5 will be required.	0.2	4.3

7.5 Identification and allocation of costs between Newlands and GAPE Train Services

UT5 provides for separate Allowable Revenues and Reference Tariffs for Newlands System and for GAPE End Users. GAPE is not, however, a geographically distinct coal system. In addition to the construction of greenfield track between North Goonyella Junction and Newlands Junction (**GAPE Link**), the scope of the GAPE Project included significant upgrades and renewal of Newlands System Rail Infrastructure (**Newlands System Enhancements**). As such, information in relation to the Newlands System and GAPE has been presented together in this FY22 Final Draft Proposal.

In response to the Proposed Amendments, and to enable a separate vote on the FY22 Final Draft Proposal for each of the Newlands System and GAPE End User groups under 7A.11.3 of UT5, Aurizon Network has clarified the location of individual renewal projects and provided additional information in Table 166 below, including:

1. An estimate of the shares of the proposed Maintenance Budget which would be recovered from each of the Newlands System and GAPE under current pricing arrangements (**Maintenance Indicator**); and
2. An in-principle summary of the extent to which assets in the proposed Renewals Budget would be allocated to each of the Newlands System and GAPE RABs (**Capital Indicator**).

Aurizon Network maintains that the current treatment of Asset Replacement and Renewal Expenditure for common-user Rail Infrastructure in the Newlands System results in economically efficient Allowable Revenues and Reference Tariffs for both Newlands and GAPE Train Services.

However, Aurizon Network recognises that Customers have a range of views in relation to the way in which future asset replacement and renewal expenditure on the shared rail corridor should be allocated to the respective RABs for Newlands and GAPE Train Services.

Following the QCAs approval of the prudency and efficiency of any annual capital expenditure, Aurizon Network must submit a Regulatory Asset Base roll-forward report in-line with clause 1.3(b) of Schedule E of UT5 (**RAB Rollforward**). The RAB Rollforward report is to contain specific detail 'separately reported for each Coal System'. It is at this stage of the overall capital approval process that a proposed allocation methodology is to be provided to the QCA and this is therefore considered the appropriate regulatory process to review and confirm the capital allocation approach. As the RAB Rollforward is a distinct regulatory process to the setting of the Renewals Strategy and Budget, and noting the competing views of End Users, **End User approval of this FY22 Final Draft Proposal will not be considered as endorsement of the current allocation and pricing methodology**.

Given the complexity of the issues and the range of alternate views, Aurizon Network commits to engage with the RIG, relevant Users and the QCA to review the allocation methodology relevant to Newlands System and GAPE as part of the FY2020 RAB Roll-Forward process. Prior to this process, Aurizon Network will provide a detailed listing of the proposed asset renewals on the common rail infrastructure by asset program if required.

Additional information in relation to the Newlands System and GAPE

- **Maintenance Indicator**
  - The estimated allocation of the FY22 Maintenance Budget to Newlands System and GAPE has been determined in proportion to GTK forecast for Newlands and GAPE Train Services, with the GTK for GAPE Train Services being measured from North Goonyella Junction to Abbot Point.

- **Capital Indicator**
  - Asset Replacement and Renewal Expenditure between North Goonyella Junction and Newlands Mine Junction (the GAPE Link) has been identified and these costs are included in the GAPE Capital Indicator. Specifically, civil design costs for four turnouts located Leichardt Range and Eaglefield Creek;
  - Asset Replacement and Renewal Expenditure on common-user Rail Infrastructure geographically located in the Newlands system but constructed as part of the GAPE project (i.e. the Newlands System Enhancements) has been identified and these costs are included in the GAPE Capital Indicator. Specifically, the cost of undercutting turnouts at Collinsville and Durroburra that were upgraded in 2011; and
  - All remaining Asset Replacement and Renewal Expenditure on common-user Rail Infrastructure geographically located in the Newlands system, have been identified and included in the Newlands System Capital Indicator.

- **This approach results in the following allocations of Maintenance and Renewals expenditure**

Table 166 Proposed allocations of Maintenance Indicator and Capital Indicator

	Maintenance Indicator ($m)	Capital Indicator ($m)
Newlands System	3.8	25.0
GAPE	8.8	0.3
Total	**12.6**	**25.3**

8. Four-year forward indicative cost forecast

This chapter outlines Aurizon Network's indicative cost forecasts for Maintenance and Asset Renewal activity in each Coal System. Information is provided for FY22 (as outlined in the FY22 Final Draft Proposal) plus a forecast period of a further four-years; i.e. FY23 – FY26.

8.1 Blackwater System – Four-Year Forecasts

Table 167 Blackwater System – FY22 plus four-year Maintenance Cost Forecast

Blackwater System Maintenance Item ($m)	FY22	FY23	FY24	FY25	FY26
Resurfacing	8.7	8.7	8.8	8.8	8.9
Rail Grinding	8.0	8.3	8.6	8.6	9.4
General Track Maintenance	22.0	22.4	22.9	23.3	23.8
Structures & Facilities Maintenance	1.9	1.9	1.9	2.0	2.0
Other Civil Maintenance	2.4	2.5	2.5	2.6	2.6
Signalling & Telecommunications Maintenance	9.9	10.1	10.3	10.5	10.7
Trackside Systems Maintenance	0.8	0.8	0.8	0.8	0.8
Electrical Overhead Maintenance	6.1	6.1	6.3	6.5	6.6
Other General Maintenance	2.3	2.3	2.3	2.4	2.4
Total Direct Maintenance Costs (excl. Ballast Plant Depreciation)	**62.0**	**63.2**	**64.4**	**65.4**	**67.4**
Ballast Plant Depreciation	3.0	3.2	3.1	3.1	3.1
Total Direct Maintenance Costs	**65.0**	**66.4**	**67.5**	**68.5**	**70.5**

Table 168 Blackwater System – FY22 plus four-year Renewals Cost Forecast ($m)

Renewals Item ($m)	Assets Include:	FY22	FY23	FY24	FY25	FY26
Civil Assets		**87.5**	**104.1**	**98.4**	**98.4**	**99.8**
Permanent Way	*Rail, Track, Sleeper, Turnouts*	30.5	38.3	33.2	33.2	32.6
Ballast Cleaning	*Mainline and Turnout Undercutting, Bridge ballast*	38.8	44.4	45.5	46.2	47.5
Structures	*Culverts, Bridges*	9.5	10.5	10.5	10.5	10.5
Civil Renewals	*Formation, Level Crossings, Access Points*	8.7	10.9	9.2	8.6	9.2
Control System Assets	***Safe Working, Train Control and Detection, Interlocking, Telecoms, Power Resilience, Transmission***	**20.3**	**19.0**	**19.3**	**16.5**	**12.6**

Renewals Item ($m)	Assets Include:	FY22	FY23	FY24	FY25	FY26
Electrical Assets	***Overhead Line Equipment and Power Systems***	**6.0**	**7.8**	**13.1**	**12.0**	**16.2**
Technology		**3.3**	**--**	**--**	**--**	**--**
Total		**117.1**	**130.9**	**130.7**	**126.9**	**128.5**

Notes

- The increase in ballast cleaning costs in FY23 reflects the full year impact of the Dual Ballast Cleaning Machine operating strategy. In the event that the RIG decides that it does not want to progress with the Dual Ballast Cleaning Machine operating strategy, the estimated reduction in asset renewal Ballast cleaning costs to Blackwater System users would be approximately $1.5m in FY22 and $6.9m in FY23. Refer to Chapter 13.2.3 of this Draft Proposal for further detail on the key assumptions underpinning the concept level cost estimates and system cost allocations.
- The forward forecast for AIS renewals is based on a high-level model of the CQCN Electrical asset with some speculative smoothing
- . The Concept phase for the AIS renewals has commenced in FY21 and will continue in FY22 and the deliverables will include more comprehensive estimating. The results of the Concept phase will be shared with the RIG as part of the FY23 Renewal Strategy and Budget process.

8.2 Goonyella System – Four-Year Forecasts

Table 169 Goonyella System – FY22 plus four-year Maintenance Cost Forecast

Goonyella System Maintenance Item **($m)**	FY22	FY23	FY24	FY25	FY26
Resurfacing	9.3	9.4	9.4	9.4	9.5
Rail Grinding	8.5	9.0	9.3	9.3	10.1
General Track Maintenance	16.3	16.6	16.9	17.3	17.7
Structures & Facilities Maintenance	1.7	1.7	1.8	1.8	1.8
Other Civil Maintenance	2.6	2.6	2.7	2.7	2.7
Signalling & Telecommunications Maintenance	9.7	9.9	10.1	10.3	10.5
Trackside Systems Maintenance	1.7	1.7	1.7	1.8	1.8
Electrical Overhead Maintenance	6.1	6.2	6.3	6.5	6.6
Other General Maintenance	2.2	2.2	2.3	2.3	2.3
Total Direct Maintenance Costs (excl. Ballast Plant Depreciation)	**58.0**	**59.3**	**60.5**	**61.4**	**63.3**
Ballast Plant Depreciation	3.1	3.6	3.6	3.6	3.6
Total Direct Maintenance Costs	**61.1**	**62.9**	**64.1**	**65.0**	**66.9**

Table 170 Goonyella System – FY22 plus four-year Renewals Cost Forecast ($m)

Renewals Item ($m)	Assets Include:	FY22	FY23	FY24	FY25	FY26
Civil Assets		**88.9**	**96.7**	**96.4**	**96.8**	**97.5**
Permanent Way	*Rail, Track, Sleeper, Turnouts*	37.4	36.6	35.7	35.6	35.0
Ballast Cleaning	*Mainline and Turnout Undercutting, Bridge ballast*	36.5	43.0	43.9	45.2	46.2
Structures	*Culverts, Bridges*	5.4	7.0	7.0	7.0	7.0
Civil Renewals	*Formation, Level Crossings, Access Points*	9.6	10.0	9.8	9.0	9.3
Control System Assets	***Safe Working, Train Control and Detection, Interlocking, Telecoms, Power Resilience, Transmission***	**21.1**	**22.0**	**18.5**	**17.2**	**12.3**
Electrical Assets	***Overhead Line Equipment and Power Systems***	**7.4**	**12.3**	**20.8**	**19.1**	**25.9**
Technology		**3.5**	**--**	**--**	**--**	**--**
Total		**120.9**	**131.0**	**135.7**	**133.1**	**135.7**

Notes

- The increase in ballast cleaning costs in FY23 reflects the full year impact of the Dual Ballast Cleaning Machine operating strategy. In the event that the RIG decides that it does not want to progress with the Dual Ballast Cleaning Machine operating strategy, the estimated reduction in asset renewal Ballast cleaning costs to Goonyella System users would be approximately $1.7m in FY22 and $7.7m in FY23. Refer to Chapter 13.2.3 of this Draft Proposal for further detail on the key assumptions underpinning the concept level cost estimates and system cost allocations.
- The forward forecast for AIS renewals is based on a high-level model of the CQCN Electrical asset with some speculative smoothing. The Concept phase for the AIS renewals has commenced in FY21 and will continue in FY22 and the deliverables will include more comprehensive estimating. The results of the Concept phase will be shared with the RIG as part of the FY23 Renewal Strategy and Budget process.

8.3 Moura System – Four-Year Forecasts

Table 171 Moura System – FY22 plus four-year Maintenance Cost Forecast

Moura System Maintenance ($m)	FY22	FY23	FY24	FY25	FY26
Resurfacing	1.4	1.4	1.4	1.4	1.4
Rail Grinding	0.7	0.4	0.4	1.2	0.4
General Track Maintenance	5.0	5.1	5.2	5.3	5.4
Structures & Facilities Maintenance	0.6	0.7	0.7	0.7	0.7
Other Civil Maintenance	0.9	0.9	1.0	1.0	1.0
Signalling & Telecommunications Maintenance	3.0	3.0	3.1	3.2	3.2
Trackside Systems Maintenance	0.3	0.3	0.3	0.3	0.3
Other General Maintenance	0.3	0.3	0.3	0.3	0.3

Moura System Maintenance ($m)	FY22	FY23	FY24	FY25	FY26
Total Direct Maintenance Costs (excl. Ballast Plant Depreciation)	**12.3**	**12.1**	**12.4**	**13.3**	**12.8**
Ballast Plant Depreciation	0.1	0.1	0.1	0.1	0.1
Total Direct Maintenance Costs	**12.4**	**12.2**	**12.5**	**13.4**	**12.9**

Table 172 Moura System – FY22 plus four-year Renewals Cost Forecast ($m)

Renewals Item ($m)	Assets Include:	FY22	FY23	FY24	FY25	FY26
Civil Assets		**9.6**	**10.6**	**10.2**	**10.3**	**10.3**
Permanent Way	*Rail, Track, Sleeper, Turnouts*	3.5	4.3	4.1	4.1	4.0
Ballast Cleaning	*Mainline and Turnout Undercutting, Bridge ballast*	2.4	2.4	2.3	2.5	2.3
Structures	*Culverts, Bridges*	0.9	1.5	1.5	1.5	1.5
Civil Renewals	*Formation, Level Crossings, Access Points*	2.8	2.5	2.3	2.2	2.5
Control System Assets	***Safe Working, Train Control and Detection, Interlocking, Telecoms, Power Resilience, Transmission***	**2.0**	**3.6**	**3.9**	**3.9**	**2.6**
Electrical Assets	***Overhead Line Equipment and Power Systems***	**--**	**--**	**--**	**--**	**--**
Technology		**0.2**	**--**	**--**	**--**	**--**
Total		**11.8**	**14.2**	**14.1**	**14.2**	**12.9**

8.4 Newlands System and GAPE – Four-Year Forecasts

Table 173 Newlands System and GAPE – FY22 plus four-year Maintenance Cost Forecast

Newlands System Maintenance ($m)	FY22	FY23	FY24	FY25	FY26
Resurfacing	1.7	1.7	1.7	1.7	1.7
Rail Grinding	1.6	1.7	1.8	1.9	1.9
General Track Maintenance	3.9	4.0	4.1	4.1	4.2
Structures & Facilities Maintenance	1.0	1.0	1.0	1.1	1.1
Other Civil Maintenance	0.2	0.2	0.2	0.2	0.2
Signalling & Telecommunications Maintenance	2.7	2.7	2.8	2.8	2.9
Trackside Systems Maintenance	0.2	0.2	0.2	0.2	0.2
Other General Maintenance	1.0	1.0	1.0	1.0	1.0
Total Direct Maintenance Costs (excl. Ballast Plant Depreciation)	**12.3**	**12.5**	**12.7**	**13.0**	**13.3**

Newlands System Maintenance ($m)	FY22	FY23	FY24	FY25	FY26
Ballast Plant Depreciation	0.3	0.3	0.3	0.3	0.3
Total Direct Maintenance Costs	**12.6**	**12.8**	**13.0**	**13.3**	**13.6**

Table 174 Newlands System – FY22 plus four-year Renewals Cost Forecast ($m)

Renewals Item ($m)	Assets Include:	FY22	FY23	FY24	FY25	FY26
Civil Assets		**20.4**	**21.5**	**21.5**	**21.5**	**21.8**
Permanent Way	*Rail, Track, Sleeper, Turnouts*	9.1	10.2	10.0	9.9	9.8
Ballast Cleaning	*Mainline and Turnout Undercutting, Bridge ballast*	3.9	3.6	3.7	3.9	4.0
Structures	*Culverts, Bridges*	4.9	4.0	4.0	4.0	4.0
Civil Renewals	*Formation, Level Crossings, Access Points*	2.4	3.7	3.8	3.7	4.0
Control System Assets	***Safe Working, Train Control and Detection, Interlocking, Telecoms, Power Resilience, Transmission***	**4.6**	**4.8**	**4.7**	**2.1**	**2.0**
Electrical Assets	***Overhead Line Equipment and Power Systems***	**--**	**--**	**--**	**--**	**--**
Technology		**0.3**	**--**	**--**	**--**	**--**
Total		**25.3**	**26.2**	**26.2**	**23.6**	**23.8**

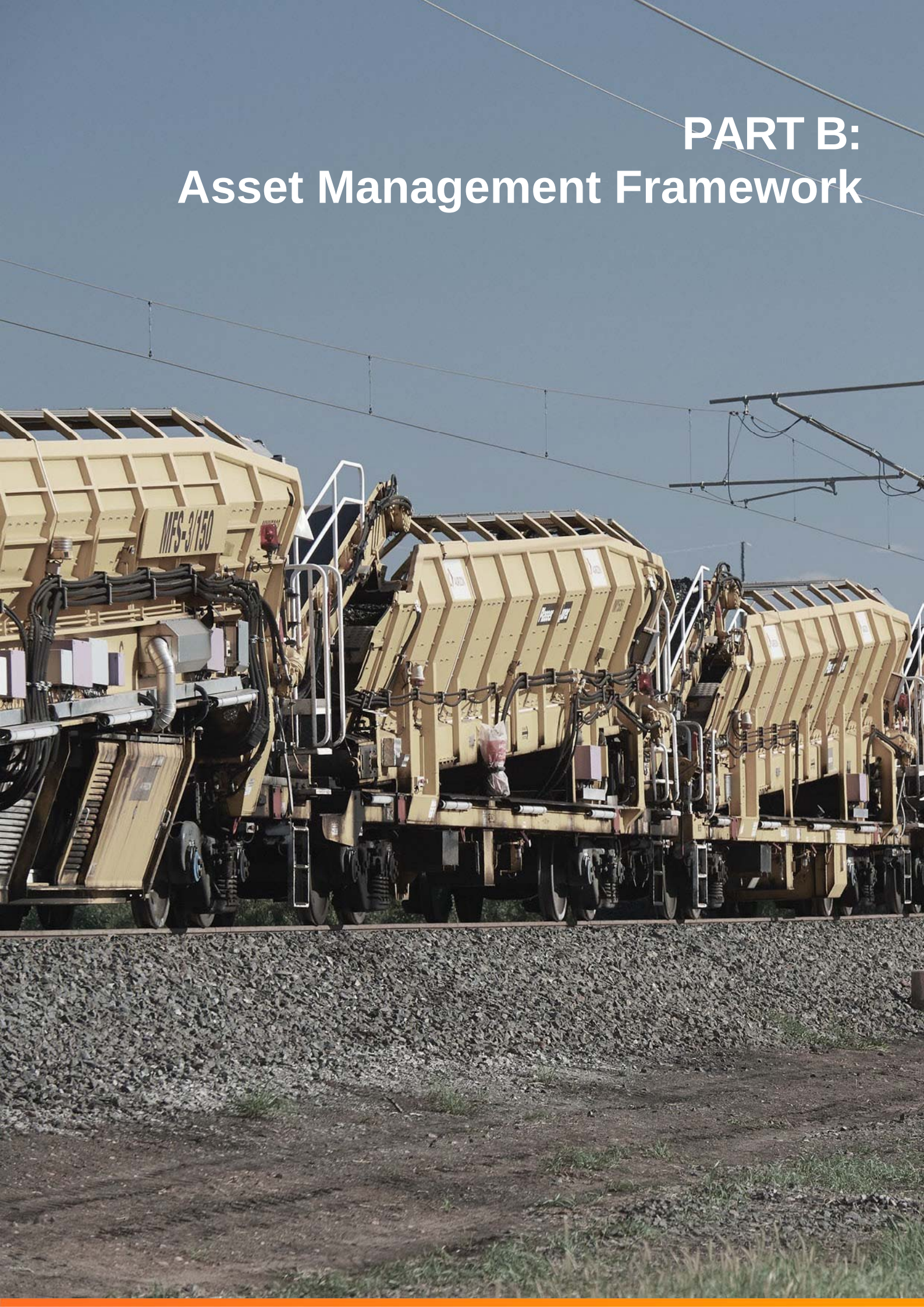
8.5 Comments relating to the forecast period

Table 175 Comments on the four-year indicative forecast

Activity	Comment
Civil Assets	
Permanent Way	• $67m of scope has been identified to date in the FY23 year and is in the Scope Priority model. • Some increase in rail and sleepers scope offset by reduction in track upgrade. This mix may move as detailed planning is applied to the scope and opportunities for works alignment are identified. • Turnout spend will be informed further by the Callemondah alignment through the interlockings project which may adjust the turn out spend in Blackwater.
Ballast Undercutting	• Mainline ballast cleaning uplift due to utilisation of two machines together offset by reduced footprint to deliver required scope. • Expected increase for Bridge Ballast renewals in Goonyella and Blackwater to achieve alignment to the Asset Renewal Strategy. • Aurizon Network continues to review the FY20 GPR data to further determine future scope requirements across the CQCN. On completion of this analysis Aurizon Network will provide detail to the RIG on any change from the current forecast with regards to any scope and associated capacity and cost changes.
Structures	• Investment is staying relatively consistent for the period with bridge renewals being limited to 1 short span bridge in the Newlands System for each of the 5 future years.

Activity	Comment
	• A study of the condition and degradation of M220 bridges (Bridges with a design load rating of 20tal operating at 26.5tal) will be conducted in FY22 that will inform the future scope with the results of this study shared with the RIG in FY22. • Blackwater has the oldest number of structures and as such attracts the highest level of scope and spend in comparison to the other Systems. • Goonyella structures are younger and are holding condition so some gradual reduction of spend in the outer years is expected.
Civil Renewals	• Program remaining constant over the period with some increase in 'level crossings in FY23 offset by reduction in other civil items. • Formation renewal remains constant with a move to reduce fix on fail scope and deliver more planned scope to achieve unit rate savings.
Control Systems	
Optic Fibre Train Detection	• Increase from FY22 in FY23 and FY24 with continuation of the Optic Fibre renewal program and Interlocking renewals in Blackwater and Goonyella. • Continued Train Detection (Track Circuits to Axle counters) in all systems except Newlands. • Reduction in program forecast with the completion of the Optic Fibre program from FY24 onwards.
Electrical	
Power Systems	• Some increase to the OHLE and Power systems programs with additional installation of motorised isolators and fault detectors to provide flexibility for fault management. • Air Insulated Switchgear: –The forward forecast for AIS renewals is based on a high-level model of the CQCN Electrical asset with some speculative smoothing. –The Concept phase for the AIS renewals has commenced in FY21 and will continue in FY22 and the deliverables will include more comprehensive estimating. –The results of the Concept phase will be shared with the RIG as part of the FY23 Renewal Strategy and Budget process.

PART B:
Asset Management Framework



9. Guiding Principles and Context

This chapter presents the guiding principles of Aurizon Network's approach to asset maintenance and renewal activities. Aurizon Network uses these principles and the needs of other Supply Chain Participants to inform what scope is required, when it will be undertaken and how it will be delivered. Information in this section is intended to address feedback from Customers who were seeking a greater understanding of Aurizon Network's asset management strategy and to provide further information in relation to the characteristics and delivery of the specific maintenance and renewal tasks.

9.1 Guiding Principles

Aurizon Network's asset activities are designed and managed in order to deliver Committed Capacity, maintain or improve reliability and deliver efficiency and rail infrastructure performance (each in the long and short term). The guiding principles of Aurizon Network's asset management philosophy outlined in Table 176.

Table 176 Guiding Principles of Aurizon Network's Asset Management philosophy

Guiding Principle	Description
Minimise the impact of asset activity	Aurizon Network has developed its FY22 Final Draft Proposal in support of Customers' Committed Capacity being safely and sustainably delivered. To achieve this: • Aurizon Network seeks to minimise the supply chain impact of major asset renewal activity by appropriately scheduling these works in a series of planned, integrated closures. • Aurizon Network engages with other Supply Chain Participants (including Access Holders, Customers, Railway Operators and destination port operators) to understand their respective shut-down timetables and, wherever possible, seeks to coordinate the delivery of planned maintenance and renewal works with these participants. • Aurizon Network aims to deliver fewer closures (but of longer duration) and maximise the number maintenance and renewal activities planned for delivery during those closures. Planned maintenance activities outside of closures are scheduled in such a way as to minimise impacts on the relevant supply chain.
Promote below rail asset reliability	• Aurizon Network's asset management strategy is structured around a preventative maintenance regime, the goal of which is to identify, plan and rectify asset failures before they occur. • Rail infrastructure is renewed based on the requirement for it to be in a fit for purpose condition and will be inspected, maintained and replaced to minimise unplanned failures.
Cost Effective	• Maintenance and renewal activities are carried out in a way which seeks to maintain or improve cost, reliability and performance (both in the long and short term). • Aurizon Network procurement is market-tendered to ensure competitive rates for outsourced labour, services and materials.

9.1.1 Maintenance and Renewal Activities

Aurizon Network applies a coordinated approach to managing the CQCN rail infrastructure by applying maintenance and renewal strategies that are designed to complement each other through each stage of the asset's life cycle.

Maintenance of rail infrastructure refers to the:

- inspection, testing, identification of faults; and
- subsequent adjustment or repair of the asset.

Renewal of railway infrastructure refers to the replacement of an asset that is either:

- life-expired; or
- obsolete and replaced or reconfigured with the modern-day equivalent asset.

There are a wide variety of assets that make up the Rail Infrastructure. These assets wear and degrade at differing rates due to a variety of factors, which may include:

- location;
- climate;
- construction material;
- use or movement (e.g. tonnage railed over a rail section);
- movements of mechanical parts; and/or
- obsolescence - either as a result of operating systems no longer being supported, a reduction in spare part availability or advances in alternate technologies.

To manage variability Aurizon Network applies several approaches to inspect, test, measure deterioration and ultimately, respond to asset condition in a manner that seeks to minimise disruption to Train Services.

9.1.2 Considerations towards asset management activities

Guided by the principles listed in Table 176, Aurizon Network's asset management approach is based around appropriately considering several factors when delivering asset activity. These considerations are described in Table 177 below.

At the core of this, Aurizon Network is committed to safely meeting its contractual obligations to its Customers. The level of asset activity proposed by Aurizon Network and the way in which it is delivered must be appropriate for maintaining and operating a safe, fit-for-purpose rail network that can deliver the Committed Capacity in each Coal System.

Table 177 Asset Management Considerations

Factor	Description
Safety	Maintaining or renewing assets in a way that meets the requirements of Aurizon Network's Safety Management System, thereby ensuring the safety of track workers (both internal and external), rail operations and public interfaces.
Asset Condition	A change in asset condition could impact the reliability and performance of the Rail Infrastructure. It may be appropriate for condition between Coal Systems to vary to reflect the level of service, reliability and flexibility required by Customers.
Risk of unplanned Outage or Incident	Aurizon Network has varying levels of risk tolerance which take into consideration the condition, location and criticality of assets in each system. Aurizon Network considers this when setting asset management strategies for different asset types within each Coal System. At all times, Aurizon Network's approach seeks to mitigate the risk of rail incidents (such as derailment or collision) that could result in serious injury, fatality or cause significant throughput disruption and recovery costs.
Planned Track Possessions	Aurizon Network carefully manages the time required on track to deliver the required asset activity.
Cost	Aurizon Network strives to ensure that the level of expenditure required to deliver asset activity is appropriate in the context of the level of service and flexibility required by its Customers.

There is an inter-relationship between each asset management consideration listed in Table 177. While Aurizon Network endeavours to take each of these factors into consideration as part of its overall asset management approach, its decisions are ultimately informed by data or qualitative information from experienced staff, available to it at the time of making the decision.

The asset management philosophy underpinning Aurizon Network's maintenance and renewal programs is to maintain the rail infrastructure in a manner that is safe, fit-for-purpose whilst considering reliability and rail infrastructure performance with regard to the factors outlined in the above table.

9.1.3 Asset management life cycle models

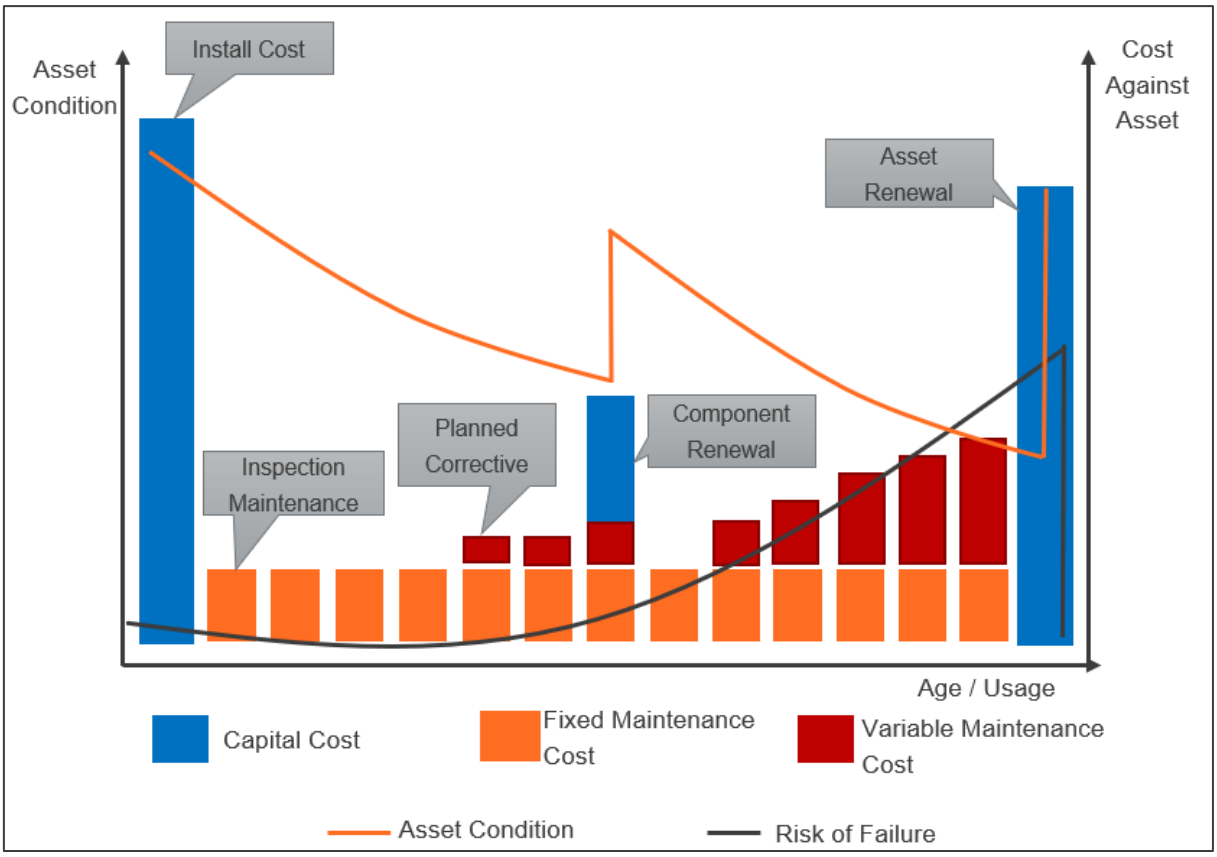
Aurizon Network designs and applies appropriate asset management strategies to match the characteristics of the various components of the Rail Infrastructure. In general, these strategies reflect two broad categories of asset life cycle models:

- Type 1 - Assets that gradually wear through use, e.g. Rail, sleepers and turnouts
- Type 2 - Assets which operate until a point where there is a marked increase in asset failures, e.g. Electrical

Aurizon Network's asset management strategy for Type 1 assets is focused on achieving the appropriate level of asset availability, at the most efficient cost of ownership, throughout the asset life cycle in accordance with the defined Maintenance Objectives

Type 1 assets typically wear in a predictive manner over time and use, therefore, have a life cycle similar to that represented in Figure 85. Aurizon Network's asset management strategy for these assets is focused on identifying each asset's preventative maintenance requirements and planning the required intervention in a way that meets the supply chain objectives e.g. availability.

Figure 85 Type 1 asset management life cycle model showing failure risk

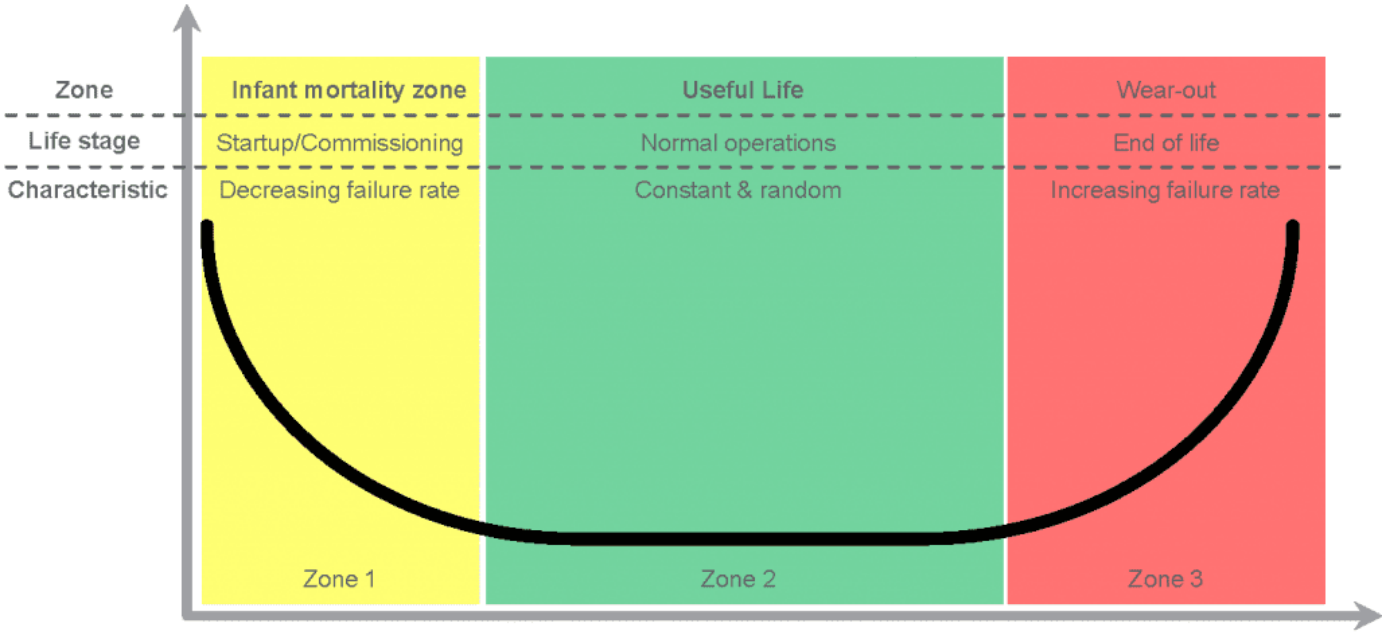


Aurizon Network's maintenance strategy for Type 2 assets is focused on inspecting and maintaining the assets to prolong the useful life stage; and to monitor the assets to identify the commencement of the wear-out stage. The process begins with understanding the design life and Aurizon Network monitoring the asset condition and failure trends.

Type 2 assets typically have a life cycle as represented in Figure 86. These assets are characterised by having a level of failure on install as latent defects are identified followed by a stable period where the rate of failure is relatively low and constant. As components wear out and reach the end of their service life, the rate of failure rapidly increases. Additionally, obsolescence of vendor supply support and componentry parts can trigger the end of life and the need to modernise the asset.

The inherent nature of these assets is such that the exact point of failure is unknown. To promote reliability of operations, a level of redundancy can be typically built into these systems. Renewals are targeted where the rate of failure increases to a point where unacceptable throughput losses may occur.

Figure 86 Type 2 asset management life cycle model showing failure risk[7]



[7] Source: https://blog.se.com/machine-and-process-management/2016/07/20/effective-maintenance-strategies-begin-understanding-assets-fail/ Accessed on 8 September 2020.

10. Aurizon Network's legislative and regulatory requirements

This chapter provides an overview of the legislative and regulatory requirements, which will inform the scope of maintenance and renewals activity that Aurizon Network will deliver in each Coal System. This activity is informed by Aurizon Network's:

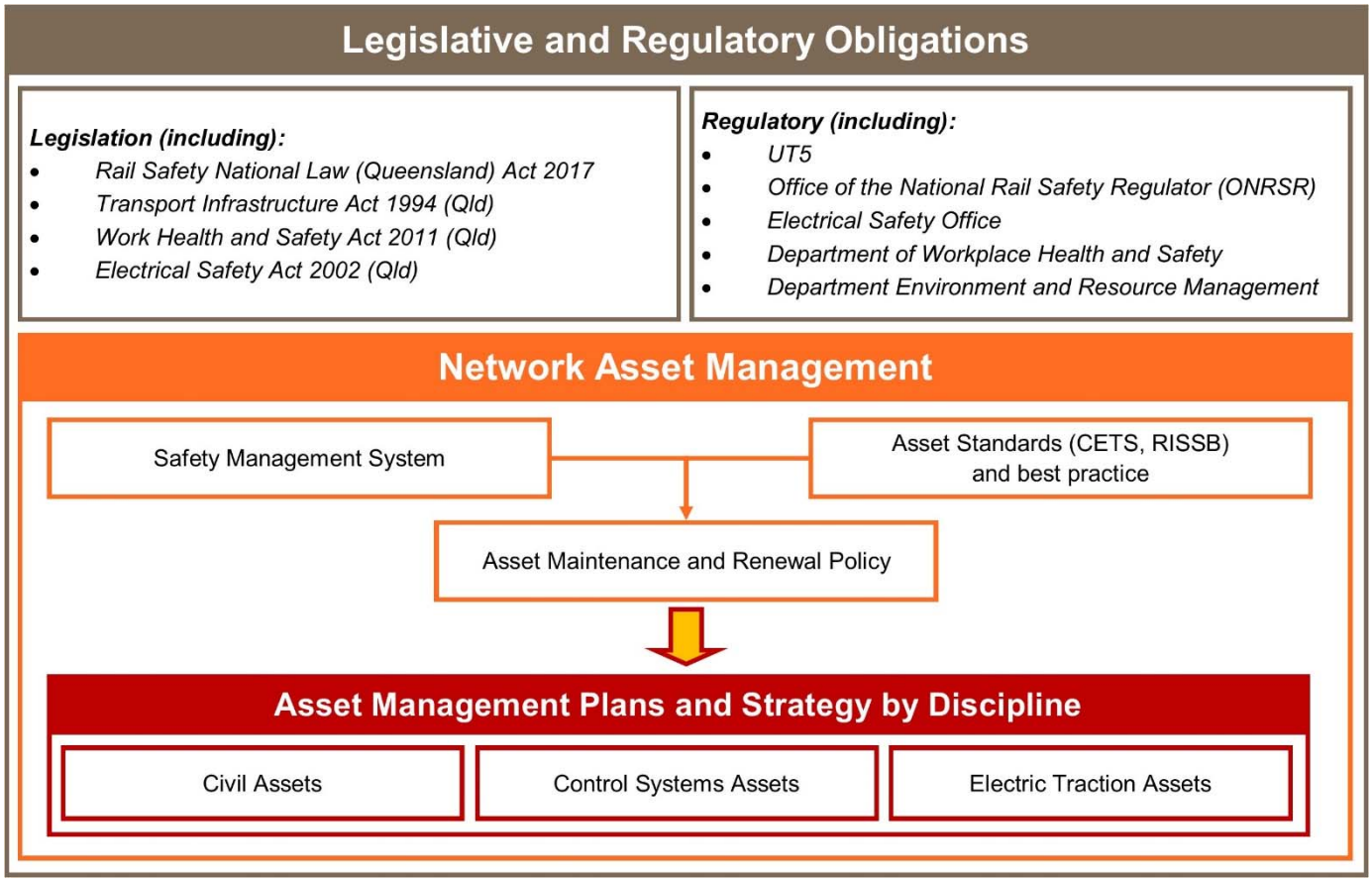
- Legislative and regulatory obligations;
- Safety Management System (**SMS**), which it must maintain as a condition of its licence to operate the CQCN; and
- Asset Maintenance and Renewal Policy, which details how Aurizon Network gives effect to the SMS when delivering asset activity.

While the above provides the overarching requirements for determining the minimum level of asset activity to be delivered in each Coal System, Aurizon Network must consider the requirements of other Supply Chain Participants, and the specific requirements of rail infrastructure in each Coal System. This is discussed further in Chapter 11 and Chapter 12.

10.1 Legislative and regulatory obligations inform asset policies

Aurizon Network is the accredited RIM of the CQCN and is required to deliver maintenance and renewal activities in a manner that is consistent with its legislative and regulatory obligations. Aurizon Network's asset management plans and strategies have been developed in such a way as to ensure compliance with these obligations. This process can be represented as follows:

Figure 87 Aurizon Network's approach to asset management is informed by its legislative and regulatory obligations



10.1.1 Legislative and regulatory obligations

In addition to complying with the provisions of UT5, Aurizon Network's asset management approach is underpinned by relevant sections under the *Rail Safety National Law (Queensland) Act 2017* (**RSNL**), the *Transport Infrastructure Act 1994* (Qld), the *Work Health and Safety Act 2011* (Qld) and the *Electrical Safety Act 2002* (Qld).

In order to undertake RIM tasks in the CQCN, Aurizon Network must be accredited by the Office of the National Rail Safety Regulator (**ONRSR**) and may only undertake such tasks in accordance with an SMS that has been approved by ONRSR.

Under the RSNL, Aurizon Network must ensure, so far as is reasonably practicable, rail safety is not affected by the carrying out of its prescribed railway operations.

A breach of Aurizon Network's statutory rail safety duty as a 'rail transport operator' may lead to ONRSR determining to suspend, revoke or impose conditions upon Aurizon Network's accreditation. Given that Aurizon Network may only conduct its railway operations in accordance with the terms of its accreditation, any such measures by ONRSR could bring Aurizon Network's railway network to a temporary or permanent standstill or lead to regulator-imposed operational constraints or restrictions.

Any contractor performing rail safety work on behalf of Aurizon Network must also comply with the SMS, failure to do so can constitute an offence for both Aurizon Network and the relevant contractor.

10.1.2 Safety Management System (SMS)

Aurizon Network has safety duties under the RSNL and its SMS provides, in part, the mechanism for Aurizon Network to meet its specific obligations. The detail for the safe design, construction, testing, commissioning and operation of the railway is contained in Aurizon Network's SMS which, amongst other things, includes:

- systems and procedures for eliminating, or reducing, the risks to safety caused by railway operations; and
- a documented set of engineering standards for monitoring, maintaining and repairing rail infrastructure.

Aurizon Network's SMS is subject to periodic assurance audits by ONRSR and annual review by the Electricity Regulator (as a prescribed electrical entity). In addition, Aurizon Network operates a targeted self-assurance program to assess the quality of delivered works against the SMS.

Consequently, Aurizon Network's FY22 Final Draft Proposal includes a level of asset activity that is consistent with its safety obligations and complies with the SMS that is statutorily applicable to Aurizon Network.

10.1.3 Asset Standards (Asset Maintenance and Renewals Policy)

Aurizon Network's Asset Maintenance and Renewals Policy (**AMRP**) is the manifestation of Aurizon Network's practical application of the SMS.

The AMRP is a collation of information about the maintenance and renewal processes that are relevant to each class of asset. This includes Aurizon Network's policies on how each asset will be managed though its useful life. Furthermore, the AMRP provides the rationale for the intervention frequency levels necessary for each activity. It should be noted that these intervention frequency levels may vary between individual Coal Systems to account for, amongst other things, the level of service (e.g. reliability) and flexibility that is required by Customers.

Defined intervention frequency levels can include:

- usage-based, e.g. track resurfacing is required every 50 million gross tonnes;
- time-based, e.g. for example, turnouts requiring weekly visual inspections and a detailed annual inspection;
- age-based, e.g. 22.5 tonne axle load PSC concrete sleepers being replaced every 40 years; or

- fix on failure.

All preventative maintenance activities and resulting asset operating parameters must conform to the AMRP, which was developed in accordance with the engineering standards and technical specifications necessary to ensure Aurizon Network's compliance with its legislative and regulatory obligations.

Ultimately, the underlying scope of asset activity (both maintenance and renewals) outlined in the FY22 Final Draft Proposal is a function of well-defined standards and processes, that have been designed to ensure Aurizon Network can comply with its safety, legislative and regulatory obligations and can deliver the Committed Capacity in each Coal System.

11. How we identify and prioritise scope

This chapter outlines Aurizon Network's key considerations when setting the scope for maintenance and renewal activity for a particular year.

The development of the maintenance and renewal strategies for each Coal System informs the forecast scope of asset activity, that is expected to be delivered in the relevant year.

11.1 Asset Renewal Scope identification, Prioritisation and Planning

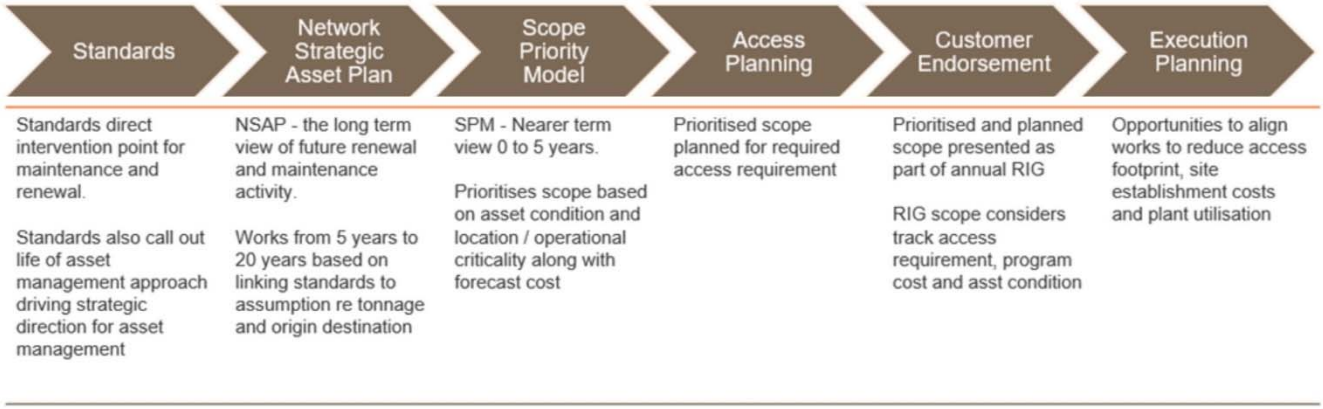
The development of scope for maintenance and renewal activities is an iterative process, which ensures that Aurizon Network can deliver both the Committed Capacity and the required level of maintenance and renewal activity in each Coal System.

The scope of maintenance and renewal activity in each Coal System is identified and prioritised through a process which takes into consideration supply chain requirements, asset condition, strategic principles, relevant standards, design processes, resource and access planning, detailed execution planning and delivery optimisation.

Furthermore, this process ensures that maintenance and renewal activities are planned in a coordinated manner, which promotes efficiency of cost and of delivery.

Figure 88 below outlines the development process for maintenance and renewal activity, which ultimately provides the forward-looking "budget" for scope, track access and cost for each Coal System.

Figure 88 Maintenance and renewal activity development process



A description of each step in the process is discussed in further detail below.

11.1.1 Standards

Aurizon Network's asset standards underpin the maintenance and renewal scope requirements through setting the relevant investment triggers for each asset activity. These triggers are summarised in Aurizon Network's Asset Maintenance & Renewal Policy (**AMRP**) and are supported by asset-specific strategies and plans. Aurizon Network's asset management documentation is aligned to the Asset Management Council of Australia's, Asset Management Body of Knowledge (**AMBoK**)[8] and ISO55000: Asset Management.

[8] https://www.amcouncil.com.au/knowledge/asset-management-body-of-knowledge-ambok.html

11.1.2 Network Strategic Asset Plan

Aurizon Network uses its Network Strategic Asset Management Plan (**NSAP**) to calculate a static, long-term forecast of future maintenance and renewal scope requirements in each year. Where possible the static scope for each year is combined with item unit rates to provide an indication of the long-term investment requirements for asset classes in each Coal System.

For renewal activities, NSAP initially estimates the expected renewal date for each asset as:

Installation Date + Expected Design Life = Indicative Renewal Date.

The model also takes into consideration asset condition trends and, by applying these trends to the Expected Design Life, determines a **Condition-based Life**. It should be noted, however, that this approach can lead to some assets having a condition-based life which exceeds its design life (e.g. Air Isolated Switch Gear) and some assets with a practical life shorter than design life (e.g. 20 tonne axle load (**tal**) structures operating at 26.5tal).

Long-term investment profile across Coal Systems

Many assets were installed in a series of system expansions. As such, there are large populations of like assets with similar installation dates, resulting in significant renewal peaks as these similar assets become due for renewal at similar times.

Aurizon Network endeavours to identify the investment peaks early and smooth the 'raw' renewal scope of work over the longer term, which seeks to provide a level of consistency year-on-year in terms of track access and investment capital needs. This approach is an important consideration for ensuring Aurizon Network can deliver the longer-term renewal requirements and continue to meet Committed Capacity in each year. One such example of this is Aurizon Network's rail renewal strategy, which sees a consistent rate of 115km of rail renewed across the CQCN each year.

11.1.3 Scope Priority Model

Aurizon Network's Scope Priority Model (**SPM**) combines asset condition (informed by maintenance, inspections and engineering activities) and asset criticality scores to prioritise asset renewal scope in each Coal System.

Assessing asset condition as part of the SPM

The identification and assignment of asset condition is the key prioritisation metric used for asset renewal scope selection. Asset condition provides a measure of how far away an asset is from the end of its useful life. Aurizon Network applies a 5-level rating system to assign condition ratings to assets. The assessment criteria for each condition state are described in Table 178 below.

Table 178 Description of Asset Condition Ratings within the SPM

Condition Score	Rating Description
1	• Free of defects with little or no deterioration evident. • 100% of Asset Life remaining.
2	• Free of defects affecting performance, integrity and durability. • Deterioration of a minor nature that can be remedied via preventative maintenance practices.
3	• Defects that are beginning to affect the durability/serviceability, which may require monitoring and/or remedial action or inspection. • Some components or elements show quantitative signs of advancing deterioration. • Maintenance Intervention is normally required. • Condition based failures have a probability of failing once in the next 2 to 5 years.
4	• Significant defects affecting the performance and structural integrity of the asset are present.

Condition Score	Rating Description
	• Such defects require immediate intervention including an inspection by a civil / structural / electrical / signal / telecommunications / control (Op Sys) / district engineer / subject matter expert, if major components are affected. • Component or element shows advanced deterioration and/or evidence that it is acting differently to its intended design mode or function. • Operational restrictions such as Temporary Speed Restriction (TSR) may be required (Civil) or Planned Replacement (Electrical, Signal, Telecommunications, Control (Op Sys)).
5	• The asset has failed or has impending failure to one or more primary functions. • Structural integrity is severely compromised, and the asset or asset component must be taken out of service until inspected, repaired and/or monitored as appropriate.

Location and operational criticality as part of the SPM

The identification and assignment of locational and operational criticality is the second key prioritisation metric used for asset renewal scope selection. An asset's criticality score takes the following factors into consideration:

- Tonnage – the base Criticality Score is determined using Net Tonnes on a Track Segment;
- Traffic Purpose – the base Criticality Score will increase if the traffic over the Track Segment includes passenger trains (i.e. North Coast Line and Central West Line (Blackwater System)). This metric varies based on the maximum speed of those passenger trains over a Track Segment; and
- Capacity Impact – potential loss of throughput at reduced capacity caused by asset failure.

Condition / Criticality Ranking Number (CRN)

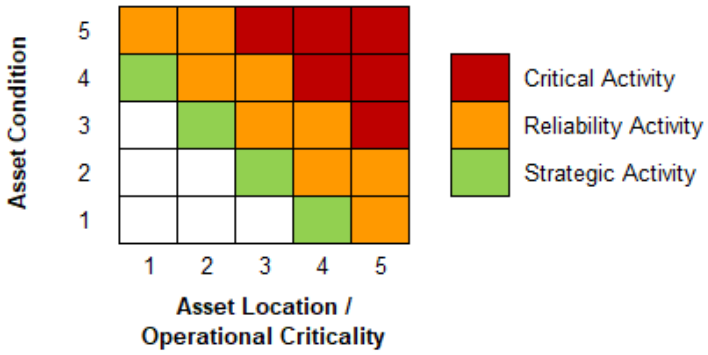
The application of both the asset condition and criticality scores allow Aurizon Network to rank and prioritise asset renewal requirements into one of the three categories shown in Table 179 below. This provides the process through which asset renewal requirements for each Coal System are assessed for the year.

Table 179 Identify the rationale for renewal activities

Rationale for Renewal Activity	Description
Critical Activity	Renewal of this asset is critical. Asset is in a poor condition and in a critical location. If not renewed, the asset would be expected to fail in the near term.
Activity to promote Reliability	Renewal of this asset is required to promote system reliability. • Assets in a moderate condition in a critical location that are not expected to break but if did would cause outage on critical track sections; or • Assets that are in poor condition in a noncritical location that are expected to break but would still have an impact on one or more Customers.
Strategic Activity	Renewal of this asset is recommended for strategic reasons. For example, to smooth future peaks in investment or asset activity.

The Figure 89 illustrates how the CRN scoring matrix aligns to the respective rationale outlined in Table 179 above.

Figure 89 Asset Renewal prioritisations



11.1.4 Access Planning

Once the scope has been identified and prioritised through the SPM, it is then subject to a detailed review to align the required scope with the capability and capacity of Aurizon Network and its suppliers. This process considers the requirements of other Supply Chain Participants and assesses both the plant and indicative time-on-track requirements for completing the works.

During the access planning process, Aurizon Network will identify the critical items of scope that drive closure lengths and will align these works with planned system closures wherever possible. Similarly, scope may shift between financial years where appropriate to do so. For example:

- Scope may be brought forward into an earlier year to align with a planned closure in a certain location. This allows Aurizon Network to package other activities in that same (or similar) location; or
- Scope may be deferred to a later year (if asset condition allows) so that Aurizon Network can appropriately manage the combined track access impacts of delivering Committed Capacity.

Aurizon Network must also consider any additional maintenance holding costs of deferring scope identified through the SPM including:

- additional inspections;
- temporary speed restrictions;
- risk of failure and consequential impacts of failure if deferred; and/or
- reliability, performance and impact to the Committed Capacity.

The Access Planning process is discussed in further detail in Chapter 12 of this submission.

11.1.5 Customer Endorsement

As part of the Annual Maintenance Strategy and Budget and Renewals Strategy and Budget process, approval from the individual Coal System End Users is sought. The process allows for high levels of engagement and collaboration whilst providing opportunities to provide a level of understanding of what individual end-users want from the below rail asset.

11.1.6 Execution Planning

As highlighted to Customers through the Access Planning customer forums, Aurizon Network undertakes several activities that are intended to inform and refine the scope of work prior to execution. These activities will take into consideration detailed design and delivery methods relevant at each specific job site.

It should be noted that there can be a substantial timing difference (of up to 18 months) between planning and execution of works. Considering, it is expected that these refinements may result in variations between the scope of work presented to the RIG and the detailed scope that will eventually be delivered.

11.1.7 Understanding Scope Change

Aurizon Network notes that scope identification is an iterative process. Rail Infrastructure in each Coal System is exposed to extreme forces through the passage of rollingstock, climatic extremes, and localised geological and hydrological conditions. It is expected that asset condition will change over time and therefore, scope will need to be amended in line with those changes.

Aurizon Network is seeking to better understand the level of change with a view to continuously improving its Asset Renewal Scope identification, Prioritisation and Planning processes. If there is a material change throughout the year, Aurizon Network will look to engage with the RIG and where appropriate seek endorsement for a change in approach.

11.1.8 Future renewal activities that may require profile smoothing

Table 180 below provides additional information on specific infrastructure programs where Aurizon Network considers it may be prudent to smooth the investment instead of being subject to peaks and troughs between years. During FY22, Aurizon Network will be developing the tactical renewals plans for the below mentioned assets with the objective to appropriately manage current condition, future scope requirements and size of the investment.

More detail on each of these future renewals will be shared with the RIG in due course.

Table 180 Future renewal activities that may require smoothing

Program	Investment trigger / Requirement
Air Insulated Switch (AIS) Gear	Aurizon Network has commenced planning for the renewal of the 21 AIS substations. The full execution of this strategy is envisaged to be a 10-year program resulting in simple, robust and remotely operated substations with minimal maintenance requirements. The objective of this program is to maintain the Traction Power System's "N-1" redundancy capability. The scope of renewals falls into two broad streams of work: • targeted renewals of the AIS secondary systems to sustain reliability of the ageing AIS substations as they await full renewal; and • full site renewal of the AIS substations in a priority order which is determined on each site's location criticality, age and available power system redundancy in the region.
M220 Bridges	Across the CQCN there are 357 bridges and 4,030 culverts. These structures can be categorised by their design load ratings. The installation dates of these structures range from the early 1960's (Blackwater) to recent installations as a result of system expansions and renewals. These assets are concrete structures and, as such, have design lives of up to 100 years. An emerging issue is a number of these structures are operating above their design load capacity. Each Coal System is currently a 26.5tal operation (110t wagon across 4-wheel sets = each axle loaded at 26.5tal). Structures in situ have load ratings from as low as 15tal reinforced corrugated metal pipes and 20tal and 22tal concrete culvert and bridges. This overloading of structures increases the rate of deterioration to the asset, which Aurizon Network is monitoring. As with all structural assets the condition of the asset is still the primary driver for renewal. In FY22 Aurizon Network will continue its condition assessment of aged structures to develop a renewal plan of these assets operating above design load capacity.
Callemondah Turnouts	Callemondah rail yard is located near Gladstone. Blackwater and Moura train services traverse the yard and are staged into the RG Tanner coal export terminal. While the yard has expanded over time as tonnages have increased, it is land-locked by waterways and Gladstone Airport. As a consequence, the yard can experience significant congestion.

Program	Investment trigger / Requirement
	Any infrastructure works in the yard precinct require closure of the road that is being renewed as well as adjacent roads to maintain safe working conditions. In addition, the electrical circuiting and signal interlockings are such that taking an isolation of either will remove power or signalling from significant areas of the yards. Again, this has the effect of reducing throughput capacity for the duration of the works. Aurizon Network has identified that 4 turnouts require renewal and the 1970's relay-based signal interlocking requires an upgrade. The separate delivery of these activities would cause substantial operational interruption. In FY22, Aurizon Network will design a delivery plan that achieves the required scope whilst seeking to minimising the supply chain impact of the yard outage. The project team will also consider future scope in the area with a view to aligning these activities into the shadow of the further interlocking & turnout closure.
Signalling Interlockings	Aurizon Network uses both Relay Interlockings and Processor Based Interlockings (PBI). Relay interlockings are typically the more aged interlockings in the system and have a nominal life of 35 years. They have been proven in the Aurizon Network context to operate with minimal disruption out to 40 years. Relay interlockings and the older PBI interlockings installed in the 1990's is currently under review for renewal having reached their nominal service life. Failure of these assets will have a significant throughput impact on the effected section that the interlocking manages. The work around would see trains having to travel on manual proceed authority (forms), which would have adverse operational impacts compared to the interlocked system. Additionally, the time to remedy is approx. 6 weeks to 3 months to procure install and commission the replacement assets.

11.2 Maintenance approach

Aurizon Network's approach to maintenance is based on the concept of Reliability Centred Maintenance, which seeks to minimise unplanned response or intervention and, consequently, provides the best opportunity for Aurizon Network to deliver Committed Capacity.

11.2.1 Maintenance approach differs by asset type

There are a wide variety of assets that make up the rail infrastructure in each Coal System and they degrade at differing rates due to their construction materials and their location. To manage the variability in asset degradation, Aurizon Network applies several maintenance approaches to minimise supply chain disruption due to asset condition.

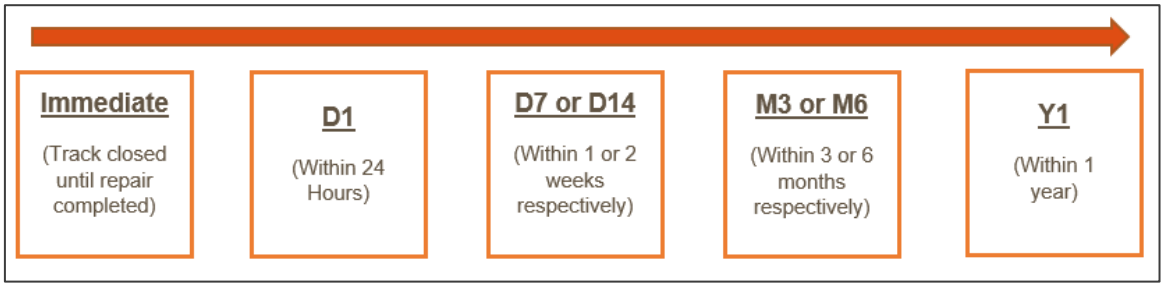
Preventative maintenance is conducted at the intervention levels specified in Aurizon Network's AMRP, which are based on intervals of time, condition and usage. Due to their predictive nature, Aurizon Network seeks, wherever possible, to align the delivery of preventative maintenance activities with the requirements of the supply chain.

As a result, preventative maintenance generally has a 'less-intrusive' impact on the supply chain, due to its planned and coordinated nature. Planned maintenance activities are packaged to maximise the amount of scope completed during planned closures in each location, which in turn can create access, delivery and cost efficiencies.

Not all activities can be planned however, and the forces exerted through the passage of rollingstock and Queensland's weather extremes will, on occasion, create the need for unplanned interventions. Unplanned maintenance includes fix-on-fail incidents or corrective maintenance that may occur during operations of the network.

Aurizon Network prioritises corrective maintenance activities based on tonnage, traffic purpose and capacity impact, which informs the rectification timeframe options as outlined in Figure 90 below.

Figure 90 Timeframes associated with corrective maintenance activities



Due to the unpredictable and, reactive in nature of these events, the maintenance budget is generally based on historical observations, more information on this is located in Chapter 13.

With the exception of mechanised maintenance activities, such as Rail Grinding and Resurfacing where scope can be clearly defined based on tonnage-based intervention rates, the forecast maintenance task for other corrective activities is highly variable. As specific scope items for most non-mechanised maintenance activities are unable to be identified prior to the commencement of a year, no definitive scope is provided for these maintenance items.

Further information on Aurizon Network's maintenance approach for different asset types is provided in Table 181.

Table 181 Maintenance approach

Maintenance Approach	Description	Applied to Assets	Maintenance Activity
Condition or Tonnage based intervention	Maintenance programmed to occur once a usage threshold is met. Maintenance can be programmed ahead of time due to forecast traffic movements.	Rail, turnouts and ballast.	Rail grinding – of both track and turnouts to return the rail profile to design and remove any minor faults Resurfacing – of both track and turnouts to maintain track to the design geometry and ensure track alignment
Planned Inspection and Service (**Preventative Maintenance**)	Periodic inspection of assets to understand condition and identify items that may cause a future fault. Period of inspection is known and can be planned.	Rail, sleepers, turnouts, ballast, formation, culverts and bridges	Track geometry recording – specialised track vehicles to measure geometric characteristics of track alignment Ultrasonic rail testing – non-destructive testing to identify internal rail faults On track inspection – road rail vehicle inspection of the rail corridor Structures inspection – inspection and testing of critical elements of the structures to measure and track condition
		Signals, interlockings, level crossing protection, optic fibre, standby power system, SCADA system, radio system	Control systems planned periodic inspection and minor servicing. Includes function testing, signal alignment testing, battery testing, cleaning and security check.
		Switching transformers, overhead line equipment	Electrical planned periodic inspections and minor servicing. Includes condition testing, oil sampling, switch testing and wire wear measurement
Planned Corrective Maintenance [9]	Planned rectification of faults found from inspections or remote monitoring. Period to rectify is dependent on the severity of the fault or risk to operations.	Rail, sleepers, turnouts, ballast, formation, culverts and bridges	Rail joint maintenance – rail welding, rail plating and lifting and lining rail joints Maintenance Ballast – small section ballast repair / replacement, removal of mud holes and squats Sleeper cluster management – spot insertion of sleepers to repair damaged sleepers, sleeper testing, fastening repairs and sleeper respacing Rail stress adjustment – rail stress testing and adjustment to manage compression and expansion of the rail Top and line resurfacing – hand track tamping and small machinery tamping Structures repairs – minor concreting works, kerb repair, walkway repair, bridge drain cleaning

[9] Most of the 'Planned Corrective Maintenance' effort is found in the general track maintenance and corrective signalling maintenance items. The nature of the works typically involves responding to faults identified by track inspection, specific asset inspection and rollingstock operators. Activity can be planned according to the severity and the time period for fault remedy of the identified fault.

Maintenance Approach	Description	Applied to Assets	Maintenance Activity
			General earthworks maintenance – embankments and cutting repair, drain cleaning and access road maintenance
		Signals, interlockings, level crossing protection, optic fibre, standby power system, SCADA system, radio system	Control systems maintenance and component repair.
		Switching transformers, overhead line equipment	Electrical general maintenance and component repair
Reactive Maintenance	Immediate remedy of faults that have disrupted operation of the rail network	Rail, sleepers, turnouts, ballast, formation, culverts and bridges	Rail repairs – immediate repair of broken rails or failed welds Formation repair – rectification of track formation that has failed due to a slip or shear. Mud hole removal – saturated formation sections dug out and repaired to maintain track alignment
		Signals, interlockings, level crossing protection, optic fibre, standby power system, SCADA system, radio system	Communication failure response – rectification of a brake in the telecommunication chain across the CQCN. This can be a fibre optic breakage, microwave radio fault or digital radio issue Wayside equipment alarm response – investigation as to the trigger of an alarm such as a dragging equipment detector or bearing acoustic detector Power failure response – rectification of mains power to signalling and wayside equipment. Solar and generator provide immediate power but for limited periods
		Switching transformers, overhead line equipment	Dewirement repair – infrastructure requiring replacement as a result of a dewirement Trip investigation – to understand the cause of electrical trips and to remedy fault ahead of re-energisation Transformer replacement – in the event of a transformer letting go or failing it is switched out to maintain the integrity of the electrical network

12. How we plan asset activity and assess capacity impacts

Aurizon Network understands that asset activities may directly impact the ability for Train Operators and Customers to undertake above rail operations in each Coal System. Effective asset management has the task of managing asset activities and the impact this work has on Committed Capacity. Aurizon Network is acutely aware that engagement and consultation on our access planning processes is important to Customers and will enhance Aurizon Network's ability to align maintenance and renewal activities with their requirements. Such alignment will result in a better Access Plan for all supply chain stakeholders.

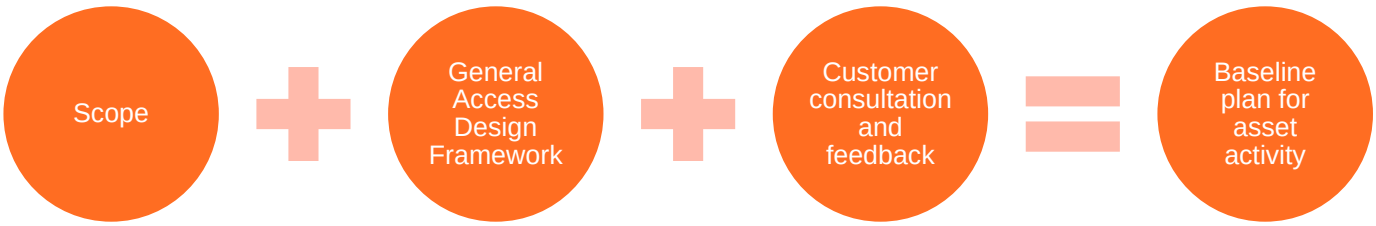
12.1 Access Planning Strategy

The overall strategy for Access Planning has been driven by:

- Maximising access for customer train services to support delivering committed capacities;
- Coordinate closures with Other Supply Chain Participants, including mine, above rail and destination port closures;
- Maximising work conducted during closures as defined by the critical scope duration;
- Maximising the work undertaken during integrated closures;
- Targeting asset reliability and safety requirements of the rail infrastructure; and
- Promoting the prudency and efficiency of costs.

Possession planning is typically undertaken based on the asset management scope requirement and resulting level of customer impact. Through an interactive process, Aurizon Network assesses the customer impact of undertaking each element of scope and attempts to complete these in singe line possessions. If, due to the level of customer impact or access required, this is not possible, these items are added to an integrated system closure. The high-level process of developing the Access Plan is outlined as:

Figure 91 Overview of Access Plan



12.2 General Access Design Framework

The General Access Design Framework establishes the overarching structure of the possessions plan by identifying strategic requirements and seeks to incorporate requests from other Supply Chain Participants to develop the Access Plan. This is synonymous with a 'basis of design' on engineering projects.

For the FY22 Final Draft Proposal, key assumptions of the design framework are outlined in Table 182 below.

Table 182 Assumptions of the Access Design Framework

Description	Realised benefits
Avoid June & December	Customers require these months to be kept free from major maintenance activities to allow for maximum railings for end of financial year and end of calendar year targets.
6 weekly cycles for Goonyella & Blackwater Systems	By planning integrated closures in 6 weekly cycles: • Aligns with major ports maintenance closures delivering supply chain coordination • Drives an overall reduction in frequency of closures allowing Customers to rail more coal.
Goonyella followed by Blackwater in closure sequence	This sequencing helps to reduce costs of delivery through improved resource utilisation and alignment with the Queensland Rail network (NCL) closures.
Alignment of major supply chain interfacing infrastructure outages (Port unloading closures, Train Loadout closures) with high impact Network activity and/or locations	We actively engage with Customers and unloading facilities on their interfacing infrastructure maintenance outage plans to look for opportunities to coordinate our maintenance activities, reducing customer impacts and maximising throughput for the supply chain.
Export terminals with overlapping major unloading/dump station	Early engagement with ports allows Aurizon Network to facilitate collaborative sessions to understand their requirements, align closures and identify opportunities that seek to ensure that Committed Capacity can be delivered.
Preservation of high pathing availability (clear days) pre and post full system closure possessions	By preserving pathing pre and post integrated closures, operators can re-gain efficiencies and productivity associated to the disruption of the integrated closure.
Spreading works across weeks/months	Spreading works over the period allows the supply chain opportunity to recover in a stable way across the year.

12.3 Access Planning Process

The publication of the Critical Asset Activity Calendar (**CAAC**) will provide transparency around the detail of the relevant years renewal plan and subsequently informs the Capability Train Plan. This process assists in the development of the FY22 Final Draft Proposal, which overall precedes the development of the Network Annual Access Strategy which provides notice of all possessions during the relevant period.

In the interest of simplifying our access planning processes, Aurizon Network has developed a three-phase process (outlined in Table 183 below), which represents the evolution of Access Planning and maturity of the plan.

Table 183 Key elements of access planning process

Maturity of planning lifecycle		What we know	What Customers see
Phase 1	Project Location (First draft CQCN Integrated Closure Plan)	Output of the SPM shows us where the work is required. From there, we can determine the level of impact those location have on Customers including an indication of required time on track.	Early engagement with QR and the Ports to work through any misalignment issues on large closures across the supply chain. Discussions with producers on demand projections over the year to determine high demand/low demand months. Output: Draft CQCN Integrated Closure Plan and highlighted major scope/renewal impact locations.
Customers provide feedback as part of consultation process on proposed CQCN Integrated Closure Plan.			

Maturity of planning lifecycle		What we know	What Customers see
Phase 2	Project Scope (Second draft CQCN Integrated Closure Plan)	Customer feedback from Phase 1 and what we need to consider as part of Phase 2. A high-level project scope design informed by engineers and site walkouts, providing a clearer picture of the scope requirement and any site-specific issues.	Provided updates to Customers on how their feedback will be considered as part of Phase 2. Output: Draft CQCN Integrated Closure Plan highlighting changes from Phase 1 and customer specific Branch line activities.
Customers provide feedback as part of consultation process on customer specific issues.			
Phase 3	Project Delivery (Maintenance Strategy and Budget, Renewals Strategy and Budget and CQCN Asset Activities Report)	A detailed design, delivery method and procurement methodology for some asset activities with maturity continuing to increase closer to execution. The Customers have provided feedback on the access plan, to inform the FY22 Final Draft Proposal.	Output: Draft Maintenance Strategy and Budget, Renewals Strategy and Budget Output: Customers now have access to PowerBI CQCN Asset Activities Report

12.4 How we plan asset activity to optimise time on track

The Access Planning Process relies on collaborative workshops across Aurizon Network planning teams working towards a common goal of maximising availability for our Customers. This approach tests customer impacts using 'real-life' experience drawn from multiple parts of the organisation. Planning in this way allows Aurizon Network to develop and refine an access plan that seeks to minimise disruptions to Customers while still completing the necessary scope of maintenance and renewal activity.

Asset activity is executed using a variety of track possession approaches outlined in Table 184 which are tested to minimising customer impacts whilst maximising safe access for people and plant.

Table 184 Summary of track possession types

Type	Definition	Key Objectives	Example
Integrated Possessions	When asset activity is required in high impact locations, requiring significant track time or results in significant capacity impacts.	To combine asset activities into an integrated closure to enable maximum works to be completed as efficiently as possible. Where possible, this is in line with other supply chain outages (i.e. port closures).	Culvert Replacement, Ballast Undercutting
Single line possessions	When asset activity can be completed on one track in a duplicated section whilst the other track is kept operational to allow for continuous train services.	To allow execution of scope that can't be completed in Integrated Possessions while allowing some services to continue, minimising network impact.	Ballast Undercutting
Shadow possessions	When asset activity can be completed in sections by taking advantage of areas of the network that are unviable for coal trains due to other renewal or maintenance activity occurring and doesn't consume any additional capacity.	To maximise scope being completed without consuming capacity.	Rail Stress Management
In-between train services	When smaller asset activity tasks can be undertaken in a safe and controlled manner on track whilst no trains are	To minimise the impact to capacity by working between trains. However, cost	Points Maintenance

Type	Definition	Key Objectives	Example
	present or by utilising capacity not required for coal services (in low demand weeks).	could increase due to inefficiencies (waiting access).	
As a scheduled rail service (moving maintenance or resources)	There are track vehicles or track machines requiring access to preform inspections or maintenance such as, but not limited to, recording cars, high rail inspections, grinding and movement of rail plant.	To complete scope / inspections as efficiently as possible without impacting rail traffic.	Mainline Track Resurfacing
Plan throughs (nil access required)	When asset activity or general maintenance is completed outside the operational areas of the railway having no impact to train services.	To complete scope with no impact to capacity.	Fault Inspection

12.4.1 Asset activity undertaken during Integrated Closures

Key to minimising the access impact of asset activities is maximising the works planned during integrated closures. This section identifies the location, timing and duration of these closures over the FY and describes the benefits of completing the works during this type of closure.

In planning an integrated closure, particularly for critical path work packages, consideration is given to the scope planned to be delivered, also in addition to work that could be undertaken prior to the closure. For example:

- splitting the activity across multiple closures;
- scheduling the work to commence whilst the system is in ramp up or ramp down, i.e. when consists are stowed;
- access to the work site;
- laydown areas or equipment pads;
- sources of material and their transport;
- performing activities in parallel; and/or
- interface management, e.g. isolations, protection etc.

Critical path activities

Each year, the closure pattern is driven by required renewals scope. For every integrated closure there is typically one significant renewal activity (i.e. the critical path activity) that will determine the length of the closure. Critical path activities are identified and distributed across the year during the access planning process.

Other scope in the impacted locations is subsequently identified and planned for delivery within the same possession to ensure that Aurizon Network can maximise the scope of work to be delivered during the time that the rail infrastructure is closed.

Internal resources, contractor availability and other support facilities (e.g. accommodation) are considered with work capped at around 100-150 independent activities per closure. Some spare capacity is maintained to allow for any corrective maintenance to occur within the possession. These activities are often not known until 84 to 28 days prior to the planned closure.

Other work may be added provided it can be completed safely, does not impact the resources or equipment that are required for the critical activity, and that it will not cause a delay in handing back the track at the expected end of the closure.

12.4.2 Asset activity undertaken outside of Integrated Closures

Not all asset activities can occur within integrated closures due to the limited duration of these possessions and the nature of delivering these activities.

Mechanised Maintenance and Renewal

Mechanised maintenance and renewal activities that are completed outside of integrated closures are managed in a way that seeks to minimise the impact on Committed Capacity. Table 185 outlines some of the principles Aurizon Network applies to minimise supply chain impacts when planning activities that take place outside of closures.

Table 185 Mitigating the capacity impact of works that take place outside of Integrated Closures

Task	Planning Principle
Ballast Undercutting	Planned activity to deliver identified scope on a cyclic basis to affect a system for only a limited period of the year. Pre and post works are conducted outside of the track closure to minimise on track time. Ballast undercutting scope is delivered inside and outside of closures. Supply chain impacts are minimised by planning the highest-impact locations for completion within closures.
Rail Grinding	Planned activity with frequency rates defined in track standards. Frequency is dependent on the track alignment, i.e. more grinding on curves then straights. Plan based on when track sections will reach usage triggers. Minimise capacity impact by considering annual program to ensure capacity and scope requirements are met. Rail Grinding is an ONRSR requirement, so it is planned as part of annual program on basis
Track Resurfacing	Planned task triggered by usage Planned maintenance task to rectify identified faults Planned as part of renewal activities where the track has been disturbed Planned between coal trains to minimise impact
Road Runs	On rail inspections as part of the planned inspection strategy. Cyclic activity conducted each 96 or 192-hours dependant on location Planned activity however optimised to only consume unutilised or part paths where possible.
Asset Inspections	Automated measurement of track geometry, overhead alignment (Blackwater and Goonyella), fault identification and ultrasonic rail testing. Considered and planned by Aurizon Network but may be adjusted at the start of the ITP process to minimise impacts on Train Orders

Non-mechanised asset activity

Where possible, Aurizon Network plans asset activity to take place in the shadow of other work to minimise potential adverse impacts on train operations or system capacity. This allows multiple activities to occur simultaneously without consuming additional capacity.

Asset activity may also be planned and delivered in-between trains on the day of operations. This is achieved once the train running schedule has been agreed or through direct consultation with train control. Where asset activities can be conducted efficiently and safely between trains, Aurizon Network's operational teams will opportunistically utilise this time to minimise the impact of required asset activity on supply chain operations. The maintenance that may be conducted in-between trains are those of short duration, and where there is no requirement to disrupt the track assets.

Asset activities that can be planned in this manner are outlined within Table 186 below.

Table 186 Activities that can be completed within the shadow of other asset activity or in-between trains

Activities		
• Inspections and walkouts	• Glued Insulated Joints (GIJ) management	• Fencing
• Preventative maintenance and repair of signalling, overhead and civil components (e.g. rail lubricators)	• Fire and vegetation management	• Drainage
• Top and line spot resurfacing	• Monument and signage maintenance	• Power systems
• Rail stress management	• Level crossing maintenance	

12.5 Risk controls to maintain Train Service operability

Aurizon Network may implement operational controls as a means of managing the risk of asset failure in each Coal System. Aurizon Network applies these temporary measures as means of allowing continued Train Service operability in the period between the fault being identified through to its rectification. These four types of controls are outlined within Table 187.

Table 187 Operational risk controls can allow continued train operation

Control	Description
Inspection Frequency	Aurizon Network completes additional targeted maintenance inspections to monitor the rate of degradation of the defect. The intent of this approach is to ensure that the defect does result in asset failure ahead of the planned date of intervention.
Temporary Speed Restriction (**TSR**)	Track alignment or asset quality issues that are identified via inspections will be assessed as requiring either immediate rectification or the assets can be managed via a TSR until a planned outage can be scheduled to rectify. Train speed is lowered during the period from fault identification to planned corrective action. This in turn, will reduce the risk of derailment or incident and the impact of dynamic forces caused by the passage of rollingstock. TSR's are also applied to manage risk of incident resulting from the environmental effects of heat or wet weather.
Temporary Authorised Non-Conformance (**TANC**)	A TANC is applied if an asset is operating outside its minimum operational standard. An engineering and safety risk assessment is undertaken to determine the appropriate treatment of these assets until the point that they can be rectified. Track speed may also be reduced, and the typical risk treatment is increased inspection to monitor asset performance.
Temporary track closure	If a fault has been identified on a section of track, it may be isolated by temporarily removing that section from service, and operating train services on alternate tracks around the fault. This is achieved by putting a coded block in the train control system to remove the ability to route a train into the affected area.

12.6 Meeting ongoing customer requirements

Aurizon Network's decision making during the access planning process is information by feedback received from Customers through planned and/or informal engagements. Aurizon Network's focus is on maintaining or improving cost, reliability and performance of the rail infrastructure, taking customer requirements into consideration wherever reasonably possible, particularly in relation to branch lines and cross system impacts.

Aurizon Network strives to continually improve our processes to fulfil customer requirements. In support of this, it has implemented a change management committee to oversee all change requests. The committee manages the escalation and endorsement process for any change requests that may materially impact agreed possession plans. Changes proposed by the RIG will also be assessed by this change management committee.

13. How we set budgets for asset activities

This chapter presents an overview of Aurizon Network's costing methodology for maintenance and renewal activities. It outlines the framework for setting the proposed budgets for each Coal System that are outlined in Part A of this FY22 Final Draft Proposal.

Aurizon Network confirms that it's methodology for allocating costs between operating expenses and maintenance / renewal activities is consistent with the QCA-approved approach under UT5. Furthermore, it should be noted that Aurizon Network's below rail regulatory financial statements are subject to an annual review by an external, QCA-appointed, auditor. The scope of this review includes any such cost allocations.

13.1 Budget development for maintenance activities

13.1.1 Overview

Aurizon Network's approach to setting the FY22 Draft Maintenance Budget varies according to the nature of the asset activity categories that are required to be presented under UT5. While some activities, such as mechanised activities, are predictable and have a clearly defined scope, other activities are corrective (e.g. fix-on-fail) in nature. This results in Aurizon Network utilising historical expenditure levels to inform annual budget forecasts.

The primary drivers of Aurizon Network's maintenance costs are outlined within Table 188 below:

Table 188 Composition of Maintenance Costs

Cost Category	Description
Labour & Indirect cost recovery	• **Labour** – cost of direct labour payroll as well as employee on-costs; • **Depreciation** – depreciation on minor assets used by employees to complete works, primarily tools and vehicles; • **Indirect Costs** – employee related consumable costs and planning costs that cannot be directly attributed to specific works, I.e. motor vehicle running costs, telecommunications charges and personal protective equipment
External contractor resources	Costs associated with external contractors, hire charges and trade services. Aurizon Network supplements its own labour and plant resources with externally procured contractors where specialist skills / equipment is required, or where a large volume of activity is delivered concurrently.
Materials and plant usage	Materials (ballast, rail, sleepers etc) used in project operations either charged directly or consumed from inventories stores and pass-through costs for Aurizon Network owned major plant. All costs associated with major plant (e.g. operational and plant maintenance) are charged to jobs via a unit rate.
Consumables / Other	Computer hardware and software, safety equipment, consultant fees, minor tools and plant, travel and accommodation, external freight and waste disposal.
Rail Grinding Costs	Costs paid to an external third party to perform rail grinding services in each Coal System and an allocation of internal support costs.

Aurizon Network ensures clear separation between the costs attributable to asset activities in each Coal System. Any costs associated with asset renewals, asset activities on Third Party Private Infrastructure and Review Events (such as extreme weather events where losses exceed $1 million) are separately captured. This enables Aurizon Network to exclude such costs in their entirety when forecasting the maintenance budgets for each Coal System.

Different methodologies are applied to determine the costs relevant to the various maintenance items. The appropriate method varies according to the individual maintenance activity. Due to the more routine nature of the major mechanised maintenance activities, these activities are budgeted at a more granular level than non-mechanised activities.

Aurizon Network is continuing to pursue opportunities to enhance our systems, data and processes in order to provide greater transparency of cost drivers and improve budgeting and forecasting process for future years.

13.1.2 Mechanised Activities

The costing methodology for the Aurizon Network's mechanised maintenance activities is summarised below.

Table 189 Summary of costing methodology for mechanised maintenance activities

Maintenance Activity	Costing Methodology
Rail Grinding	Budget for the forecast scope of works required in each Coal System reflect the contractual arrangements with the external Service Provider.
Resurfacing	Forecast costs for total resurfacing program with an allocation of cost between maintenance and capital activities.

Rail Grinding

Rail grinding activities throughout the CQCN are performed by an external service provider [redacted]

The budgeted cost of the rail grinding program in each Coal System is a function of the:

- forecast mainline and turnout grinding scope expected to be required in each Coal System; and
- grinding rates per unit [redacted].

The proposed budget also incorporates the costs associated with the removal and re-installation of signalling equipment from track before and after the rail grinding activity.

Resurfacing

Aurizon Network uses a fleet of four high production tampers and regulators and two Unimat tampers and regulators (collectively, the **Resurfacing Plant**) to deliver the resurfacing program of work required in each Coal System.

Aurizon Network's Resurfacing Plant was progressively put into operation between 2013 to 2016, to replace its aging fleet of tampers and regulators. The newer high production Resurfacing Plant are more efficient and can deliver the required scope of work with less track time.

The table below provides a complete list of the Resurfacing Plant that Aurizon Network will use to deliver the resurfacing scope of work outlined in the FY22 Final Draft Proposal.

Table 190 Aurizon Network's Resurfacing Plant

Asset Number	Manufacturer	Model	Machine Description	Current Age	Expected Life
394308	Plasser	Unimat 08-475/4	MMA 500 – High production switch tamper	7 years	20 years
394309	Plasser	SSP302	MMB 500 – High production ballast regulator	7 years	20 years
394311	Plasser	Unimat 08-475/4	MMA 501 – High production switch tamper	6 years	20 years
394310	Plasser	SSP302	MMB 501 – High production ballast regulator	7 years	20 years
353916	Plasser	09-2X Dynamic	MMA 503 – High production mainline tamper	5 years	20 years
347100	Plasser	SSP302	MMB 503 – High production ballast regulator	5 years	20 years

Asset Number	Manufacturer	Model	Machine Description	Current Age	Expected Life
345584	Plasser	09-2X Dynamic	MMA 504 – High production mainline tamper	5 years	20 years
347101	Plasser	SSP302	MMB 504 – High production ballast regulator	5 years	20 years
369487	Plasser	09-2X Dynamic	MMA 506 – High production mainline tamper	4 years	20 years
369486	Plasser	SSP302	MMB 506 – High production ballast regulator	4 years	20 years
369489	Plasser	09-2X Dynamic	MMA 507 – High production mainline tamper	4 years	20 years
369488	Plasser	SSP302	MMB 507 - High production ballast regulator	4 years	20 years

In addition to the resurfacing plant outlined in Table 190, Aurizon Network also has a dedicated resurfacing consist (MMA 505 Tamper and MMB 505 Regulator) for the ballast undercutting operation. The resurfacing costs associated with these two machines are included within the ballast undercutting program costs.

The Resurfacing Plant listed above are not dedicated to any individual Coal System. Each consist (comprised of an MMA and MMB machine) may be used to either:

- perform maintenance scope for the NMP (i.e. mainline and turnout resurfacing and civil support[10]); or
- support asset renewal activities, where resurfacing is required after all track disturbing works to consolidate ballast and restore top and line, therefore forming part of the track renewal program.

This means that resurfacing operations can be planned in a way that ensures the consist closest to the work site can complete the task wherever possible.

The flexibility afforded by this approach not only helps to reduce the supply chain impact of resurfacing activities but also helps to promote operational efficiency. It achieves these objectives by reducing consist travel between work locations, which ultimately:

- minimises the number of Train Paths consumed by Resurfacing Plant; and
- helps to maximise production time per labour shift.

It should be noted that the resurfacing cost base is materially fixed year-on-year, with approximately 80% of the forecast cost based comprised of:

- Labour cost of operating crew (approx. 45%); and
- Plant charges including components and depreciation (approx. 35%).

Consumables (approx. 20% of the cost base) may vary, however given that the scope in each Coal System is materially consistent year-on-year, Aurizon Network considers that historical costs provide the best forecast of expenditure for the FY22 resurfacing work program.

Resurfacing budget forecast

To set a budget for the FY22 resurfacing work program, Aurizon Network has:

- estimated a forecast budget for the entire resurfacing work program having regard to actual costs incurred in FY20 and forecast / budget costs in FY21; and

[10] Civil Support costs form part of the 'Other Civil Maintenance' cost category and relate to minor (non-mechanised) ballast undercutting works.

- apportioned the total forecast budget between maintenance (mainline resurfacing, turnout resurfacing and civil support) and renewals activities based on estimated activity planned for FY22.

The maintenance budget for mainline and turnout resurfacing in each Coal System is then determined by applying a standard unit rate to the scope (of mainline and turnouts) planned to be completed in each system.

The resurfacing cost of renewal support works are incorporated within the track renewal program and are allocated to Coal Systems based on the location of planned scope for completion.

13.1.3 Non-Mechanised Activities

The budget forecast of delivering non-mechanised maintenance activities have been developed with reference to the actual maintenance costs incurred in FY20 as well as Aurizon Network's FY21 full year rolling maintenance forecast.

Preventative Maintenance Activities

Budget forecasts for controllable or preventative maintenance expenditure categories have been set having regard to:

- Actual costs incurred on preventative activities during FY20 (captured for each maintenance activity at a work order level);
- Forecast costs for FY21 (at the end of September 2020) which incorporate the impact of targeted efficiencies; and
- Annual escalation on labour (2.25%) and other costs (1.25%).

Corrective Maintenance Activities

Corrective activities tend to vary year-on-year and are reactive in nature. Consequently, it is not practical / possible to develop an absolute scope for work for these activities. Aurizon Network has estimated the costs for corrective maintenance activities with reference to:

- Historical corrective activities and costs captured over the three-year period to 30 June 2020;
- Forecast costs for FY21 (at the end of September 2020) which incorporate the benefit of target efficiencies;
- The extent to which forecast asset renewals are expected to reduce the requirement for corrective activities;
- Annual escalation of labour (2.25%) and other costs (1.25%); and
- Efficiency targets resulting from improvement initiatives.

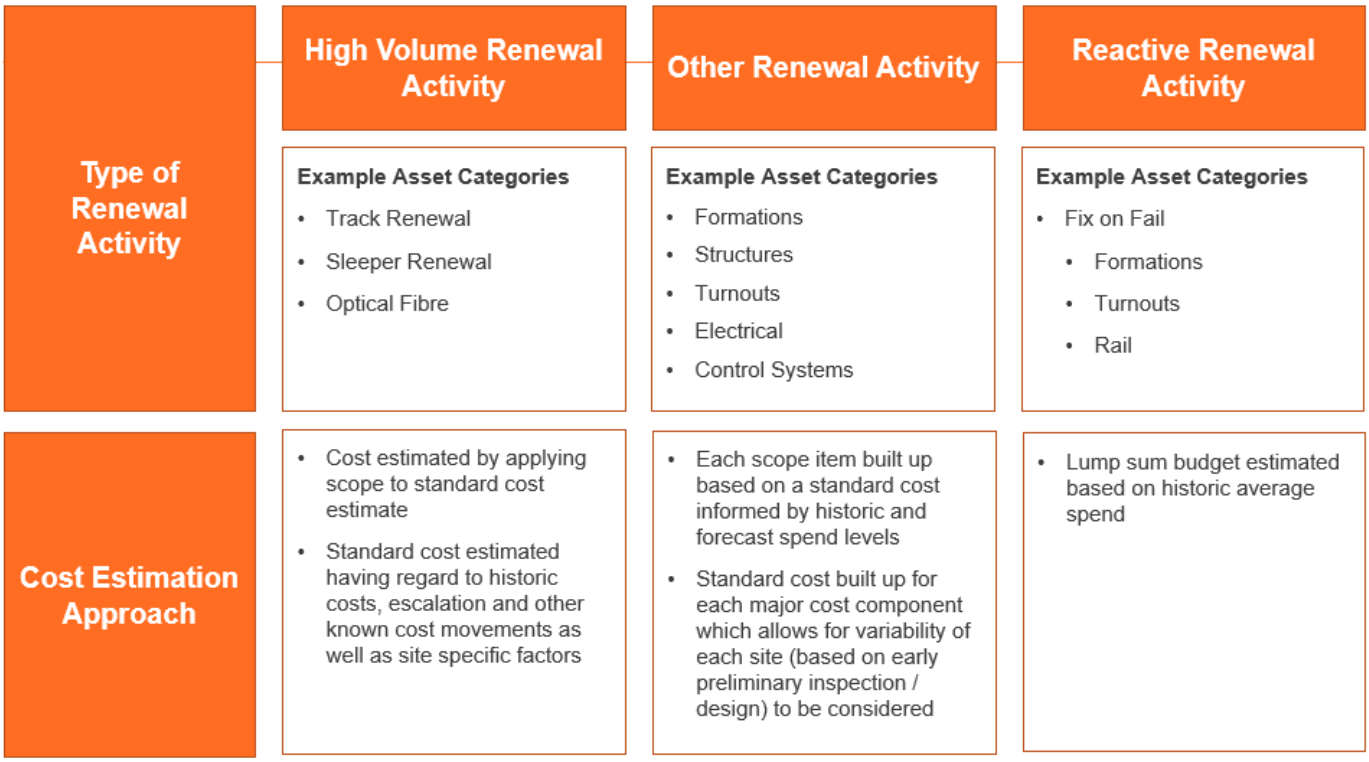
13.2 Budget development for renewal activities

13.2.1 Overview

Aurizon Network's budgeting approach for high-volume renewal activities, such as Track, Rail and Sleepers, typically relies on standardised rates. The unit rates for each renewal activity are determined at a CQCN level and then applied to the proposed scope locations to determine the budgets for each Coal System.

Budgets for other renewal activities rely on a combination of standard rates and adjustments to reflect common site-specific variables into account.

Figure 92 Summary of costing methodology for Renewal activities



13.2.2 Costing methodology for renewal activities

High Volume Asset Renewal Activity

Renewal activities such as track, rail and sleeper renewals are ongoing, annual programs of work that will generally see Aurizon Network undertaking a large volume of the same activity year-on-year.

These activities typically follow a standardised work methodology which includes:

- standard designs (that are adapted were necessary to account for site specific conditions); and
- a repeatable construction methodology at each work site.

Drivers of unit cost variability in this asset category include, but are not limited to the following:

- Scope quantity per site;
- Construction methodology – using plant such as the Track Laying Machine (**TLM**) allows for a greater amount of scope to be completed within a shorter timeframe, however, will incur plant costs;
- Weather impacts; and
- Available closure hours.

While there will be some cost variability between individual work sites, the level of standardisation and consistency within each respective renewal item has allowed Aurizon Network to develop a standard cost for each activity, based on the historic average cost per unit.

Other Renewal Activity

Other renewal activities include Civil Assets (such as formation, structures and turnout renewals), Control Systems Assets and Electrical Traction Assets. These activities generally have lower volumes of scope and require either a detailed, site specific design, or the assembly of standard design elements appropriate for a specific site.

The forecast budget for these asset renewal items is informed by historic spend levels on the relevant cost elements (e.g. design, construction labour, and key materials such as autotransformers or prefabricated concrete culverts) and where possible, takes into consideration factors or variables specific to the work site (e.g. location of the nearest access point, proximity other infrastructure).

Reactive Renewal Activity

Aurizon Network will, from time to time, experience asset failure in some renewal categories such as formations and turnouts. The failure or expected failure of these assets will be identified as part of routine asset inspections and will result in a reactive replacement of the asset. Wet weather is the single biggest driver of reactive renewal work.

Given the difficulties associated with accurately forecasting the occurrence of asset failure, Aurizon Network has made provision for 'reactive' works within the forecast budget for formations, turnout, level crossing, electrical overhead and corridor asset renewals. These amounts are broadly based on historical average spend on reactive activities in each individual Coal System.

13.2.3 Ballast Undercutting

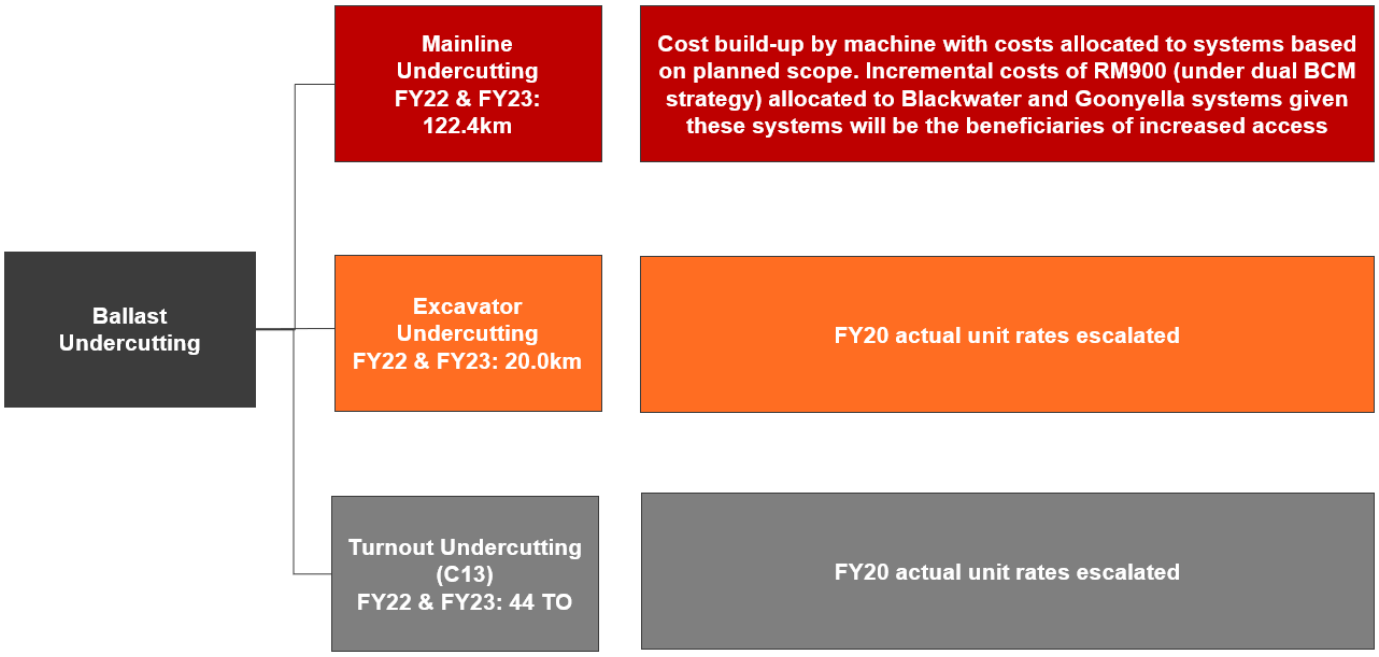
Ballast Undercutting is made up of three specific items being Mainline Undercutting, Excavator Undercutting and Turnout undercutting.

Mainline undercutting costs have been built up by machine (RM900 and RM902) with total forecast costs allocated to systems on the basis of forecast scope that is planned for completion each financial year. Key assumptions underpinning the cost build up are summarised below.

Budgeted costs for Excavator Undercutting and Turnout Undercutting have been determined by applying planned scope by system to unit rates achieved in FY20 adjusted for annual escalation.

A summary of the approach to developing the FY22 budget is outlined in Figure 93:

Figure 93 Approach to forecasting the budget for Ballast Undercutting



Mainline Ballast Undercutting Cost Build Up

Mainline Ballast Undercutting costs have been built up by machine (RM900 and RM902). Total forecast cost (excluding Ballast Undercutting plant depreciation) associated with the operation of the RM902 have been allocated to each Coal System on the basis of forecast scope that is planned for completion each financial year. Ballast Undercutting plant depreciation has been allocated to systems on the basis of the number of days that the RM902 is planned for operation in each system. The incremental cost associated with the operation of the RM900 (as part of the Dual Ballast Cleaning Machine operating strategy) have been allocated to the Blackwater and Goonyella Systems on the basis that users in these systems will be the beneficiaries of the improvements in track access.

As noted, the FY22 Final Draft proposal has been constructed on the basis of utilising two ballast undercutting machines from Q4 FY22 following consultation with the RIG and Customers. A full feasibility study of the costs and benefits of undertaking dual ballast cleaning machine operations is being conducted and will be submitted to the RIG for approval during 2H FY2021. In completing concept level analysis, a number of key assumptions have been made and risks identified. These include the costs of refurbishing the RM900, additional supporting infrastructure requirements and logistical constraints.

Should the dual ballast cleaning strategy not be approved following the completion of the feasibility study, a change request will be submitted to the RIG for endorsement and the associated costs removed from the budgets

For clarity, key assumptions underpinning the concept level cost build up are summarised in the Table 191.

Table 191 Mainline Undercutting Cost Assumptions

Assumptions	RM902 Only	RM902 and the RM900
Scope	FY22: 122.45km FY23: 122.45km	FY22: 122.45km FY23: 122.45km
Machine Operation	FY22: RM902 Full Year FY23: RM902 Full Year Production rate of 80m / closure hour for the RM 902	FY22: RM902 Full Year; RM900 from April 2022 FY23: RM900 & RM 902 Full Year Production rate of 80m / closure hour for the RM902 Production rate of 60m / hour for the RM900
Freight	1 dedicated train crew and 6 locomotives Freight contract expires on 30 June 2021. New contract to be negotiated therefore freight costs in current costing largely reflect current arrangements	2 dedicated train crew and 6 locomotives
FTE	No increase in FTE	15 additional FTE – detailed resourcing plan yet to be completed. Assumes additional FTE commence in November 2021 to enable sufficient time for training ahead of production commencement in April 2022
Plant Depreciation	No increase	RM900 refurbishment cost of $9m depreciated over 10 years Assumed no additional requirement for supporting resources* (key assumption subject to feasibility review)
Resurfacing Support	Utilise existing dedicated tamper and regulator	Increased requirement for a tamper and regulator consist for the RM900. Estimate assumes one of the consists from the resurfacing fleet is utilised, however, a full capacity analysis needs to be completed as part of the feasibility analysis
Ballast	Cost estimates based on FY20 screen-ability rates. Wet conditions will materially increase ballast costs.	Cost estimates based on FY20 screen-ability rates. Wet conditions will materially increase ballast costs

** The information within this table does not include the addition of supporting assets such as ballast wagons. An analysis into the capability of the existing resources is to be included within the scope of the feasibility study, with the outcomes including any need for additional resources to be present to the RIG at the appropriate time. This was outlined as a key point in the Concept level study provided to the RIG in September 2020.*

Set out in the table below is a summary of the estimated costs of mainline ballast undercutting for FY22 and FY23 under the 1 and 2 Ballast Cleaning Machine (BCM) scenarios. It is noted that cost estimates presented in the Table 192 are concept level only and will continue to be refined (along with expected access benefits) through to FY21.

Table 192 Ballast Undercutting – Mainline Cost Summary by Type

Mainline Undercutting (C01)	1 x BCM Strategy		2 x BCM Strategy		Variance	
($m)	FY22	FY23	FY22	FY23	FY22	FY23
Expenses by Type						
Labour	17.1	17.3	18.8	19.8	1.6	2.6
Plant Maintenance - Components	8.6	7.3	9.5	11.9	1.0	4.6
Ballast	3.8	3.8	3.9	4.3	0.2	0.5
Contracted Services	18.4	18.7	18.3	25.1	(0.1)	6.4
Signalling & Safeworking	2.3	2.3	2.1	1.9	(0.2)	(0.4)
Other	3.8	4.5	4.4	5.5	0.6	1.0
Total (excluding ballast plant depreciation)	53.9	53.9	57.0	68.5	3.1	14.6
Ballast Plant Depreciation	6.4	6.3	6.6	7.3	0.2	0.9
Total	**60.3**	**60.2**	**63.6**	**75.7**	**3.3**	**15.5**

In relation to the above, the following comments are made:

- **Labour** – includes labour relating to plant maintenance, plant operation, plant engineers, reliability and planning staff in the Network Operations team.
- **Plant Maintenance** – includes machine components. Noted that maintenance cycle varies each year due to componentry that needs to be changed out.
- **Ballast** – contracted via procurement process. Supplied from various quarries across the CQCN to reduce transport costs.
- **Contracted Services** – includes external work groups conducting pre and post earthworks, rail stressing, stress testing as well as freight costs for ballast trains and undercutter.
- **Signalling & Safe Working** – includes site safety, track protection and pre and post signalling system works.
- **Other** – includes travel, fuel and consumables relating to plant and labour.
- **Ballast Undercutting Plant Depreciation** – the cost of ballast undercutting plant depreciation is recouped via the maintenance cost allowance but is shown in the cost build up for completeness.

Mainline ballast undercutting costs by Coal System are outlined in Table 193.

Table 193 Mainline Undercutting Costs by System

Mainline Undercutting (C01)	1 x BCM Strategy		2 x BCM Strategy		Variance	
($m)	FY22	FY23	FY22	FY23	FY22	FY23
Mainline Undercutting Costs						
Blackwater	23.9	23.9	25.4	30.8	1.5	6.9
Goonyella	26.7	26.7	28.4	34.4	1.7	7.7
Moura	1.1	1.1	1.2	1.1	-	-
Newlands	2.2	2.2	2.2	2.2	-	-
Total	53.9	53.9	57.0	68.5	3.1	14.6
Ballast Plant Depreciation						
Blackwater	2.9	2.9	3.0	3.2	0.1	0.2
Goonyella	3.0	3.0	3.1	3.6	0.2	0.7
Moura	0.1	0.1	0.1	0.1	-	-
Newlands	0.3	0.3	0.3	0.3	-	-
Total Ballast Plant Depreciation	6.4	6.3	6.6	7.3	0.2	0.9
Total Mainline Undercutting						
Blackwater	26.8	26.8	28.4	33.9	1.6	7.1
Goonyella	29.7	29.7	31.6	38.1	1.8	8.4
Moura	1.2	1.2	1.2	1.2	-	-
Newlands	2.5	2.5	2.5	2.5	-	-
Total	**60.3**	**60.2**	**63.6**	**75.7**	**3.3**	**15.5**

NB: Figures may not add due to rounding.

14. How we deliver asset activity

This chapter outlines Aurizon Network's considerations to delivering and executing the asset activity required in each Coal System along with the supporting procurement. The way in which asset activity is delivered is a key factor in ensuring Aurizon Network can meet Committed Capacity.

14.1 Access planning considerations

During the development of the Access Plan, high level works planning considerations are incorporated to provide an indication of delivery planning, preparation, mobilisation, works duration, demobilisation and delivery risk. In preparation for the delivery of the project (either in a possession or outside of one), an execution strategy is developed which aims to create an optimal plan taking into consideration the competing interests of scope delivery, access and cost.

14.1.1 Works Planning governing principles

Aurizon Network considers key drivers across the asset works program as a whole and then as part of each major renewal activity. The governing principles that shape the execution strategy include:

Table 194 Works planning considerations

Matter for consideration	Description
Can work be packaged together (integrated)?	For example, ballast undercutting, rerail and overhead work all occurring within the same vicinity would be undertaken as one block of work utilising the same possession, track protection and electrical isolation.
Can the work be undertaken during an integrated possession?	Generally, work activities are planned during integrated possessions to the limit of available resources (people, machines and equipment and/or available contractors) and reducing the impact to Customers by minimising the footprints where possible.
Can the work be undertaken on a single line allowing trains to run on the adjacent track?	If the worksite is on duplicated track, a single line closure can be taken which would allow trains services to continue to operate on the adjacent track
Does the work need to be undertaken during daylight or under specific weather conditions?	For example, welding is influenced by track temperatures so is planned to occur early morning or early evening, particularly in the warmer months. Other activities are also limited to daylight hours for either safety or visibility reasons.
Does the activity require specialised skills not within the Aurizon Network workforce?	External contractors may be engaged to supplement the Aurizon Network workforce where there are capacity constraints, equipment constraints or specific skills required. For example, the bridge bearing replacement program will be delivered by specialist bridge contractors that have the specific skills and equipment required to undertake the tasks.
Is the activity urgent?	Regular inspections (of track or electrical assets) may identify faults that require urgent attention. These will often require emergency track possessions and potentially a diversion of resources from planned activities to undertake the repair. Where there is a diversion of resources, deferred work is replanned in a manner that minimises impacts on access and cost.
Does the activity require long lead-time items?	Some inventory has a 3 to 6-month lead time for delivery. Activities that have inventory risk are typically scheduled into the second half of the year.
Is the work activity fixed, flexible or can be undertaken between trains in the day of operations?	All work activities are categorised into one of the three categories with appropriate planning horizons applied. • Fixed: work activities that require large teams, involve major plant and equipment or require pre-delivered materials. This work is deemed fixed and is planned up to 12 months in advance. • Flexible: work activities that are flexible and could occur on different days of the week (with some notice). These activities are moved to minimise impact to train services.

Matter for consideration	Description
	• Between trains: work activities that are short in duration (e.g. inspections), don't involve breaking the track and could occur between trains in the day of operations.

The asset activities presented in the FY22 Final Draft Proposal may not be planned for execution for another 18 months. During that time, the scope and cost of the required activity may vary from the FY22 Final Draft Proposal, taking into consideration changes in asset condition, or as a result of other activities that are undertaken to refine the scope of work at each specific location prior to execution.

A summary of the activities undertaken closer to the execution of works is outlined below:

Table 195 Activities that may impact scope

Scope Refinement	Description of potential scope impact
Finalisation of detailed design	Completion of detailed design work may impact the assumed scope delivery method. For example, the initial design assumptions for a structure renewal may indicate that 4 cells of a culvert need to be renewed. The detailed design for the specific culvert may indicate that the renewal of 5 cells is required.
Site walkouts	Site walkouts may identify access issues/opportunities specific to the worksite. For example, the condition of access roads may be poor and require an upgrade in order to accommodate materials being transported to site. Alternatively, Aurizon Network may need to reach an agreement with private landowners prior to the works being completed.
Constructability review	Assumptions relating to the construction methodology and works plan may require amendment. For example, a turnout can be built within the track, or it could be built alongside the track and then lifted into place via franner cranes. Differences in construction methodology can impact resource requirements.
Sub grade (soil) and hydrology assessments	A variation in the expected sub grade and soil conditions compared with design assumptions may impact site access and construction methodology assumptions.

14.2 Procurement

14.2.1 Contractor resources

Aurizon Network seeks to apply the most efficient resources to deliver the scope derived by the maintenance and renewal strategies. It maximises the use of its internal Aurizon Network delivery teams and supplements resource requirements with pre-qualified contractor staff and plant.

If the scope requires a specific skill set or plant not held within the Aurizon Network group, or if resources are deployed on alternative more critical work activities, pre-qualified contractors are engaged to perform work either under supervision or if approved, as principal contractors for short periods. Aurizon Network has established a series of engineering and technical service contractor panels (managed through the enterprise procurement function) where competitive rates are pre-agreed with vendors. These include asset specific service panels, skilled labour hire, plant hire and plant transportation services.

Contractors are either engaged through these panel arrangements or one-off engagements for specific work packages. For one off engagements, tenders are called through Tenderlink or equivalent with tenders evaluated against set criteria including cost, capability, safety, construction methodology/program and contract departures. An evaluation panel determines a preferred vendor and following negotiation, contracts are awarded.

Depending on the activity, work is packaged to attract multiple vendors and competitive pricing. Packaging could include multiple sites over a specified duration or greater scope within the one site.

All internal and contract workers are required to be accredited Rail Industry Workers and hold the appropriate qualifications for the activity they are undertaking. Aurizon Network has an internal assurance program for external contractors to ensure they have the required business and safety processes and policies that align with Aurizon Network's requirements.

In developing the FY22 program, the availability of contractor resources has been considered. Where possible, larger packages of works planned for integrated possessions, have been planned for periods where there is minimal conflict with known Queensland Rail work activities.

14.2.2 Materials Procurement

Aurizon Network utilises its centralised enterprise procurement function to source the major materials required for the maintenance and renewal of the Rail Infrastructure.

Enterprise procurement has a performance-focused governance framework that ensures the right goods and services are procured to support Aurizon Network, at the right price, and quality ensuring delivery at the right place and time. The major materials utilised by Aurizon Network and their procurement approach are:

- Ballast – various quarries across Central Queensland are contracted to provide ballast and other rock and soil materials to defined Aurizon Network standards. Location is a critical consideration to reduce transit time and delivery cost
- Sleepers – Open tender contracted supplier producing and storing Aurizon Network specified sleepers in Central Queensland
- Rail – currently two international suppliers provide world leading rail. Rail is delivered to the port of Brisbane, welded into 110m lengths at the Aurizon Rail Weld Facility in Brisbane and then transported via dedicated rail delivery rollingstock to trackside locations as per renewal scope

Procurement of key inputs

Rail

Aurizon mainly purchase premium deep head hardened 60 kg Rail. The hardness of the rail has a direct impact on its usable life, while the weight of the rail is associated with the axle load of the train consists being run on the network.

Annual demand is roughly split between the following suppliers:

- Voestalpine Railway Systems - manufacturing out of Austria and been supplying Aurizon since 2013.
- JFE Shoji Trade Corporation - manufacturing out of Japan and supplying Aurizon since 2016.

Aurizon employs a dual supply strategy, to promote continuity of supply and price competitiveness throughout the contract life and optimal technical collaboration from both suppliers.

Aurizon's rail contracts with both suppliers were awarded through a competitive tender process and are both evergreen contracts. As noted above, Aurizon Network ensures price competitiveness through a dual supply arrangement. The relationships with both suppliers are strong and there is significant technical collaboration with both suppliers ensuring we have the optimal product installed.

Ballast

Aurizon Network currently has 21 suppliers of ballast who are spread throughout the Goonyella, Newlands and Blackwater/Moura Systems. The panel of ballast providers was re-negotiated in FY20. The review included a full market engagement to re-engage existing suppliers, identify potential new suppliers, negotiate the best possible ballast prices and improve the quality of contracts in place. Suppliers were selected on the basis of:

- Geographic proximity to the network to support improved network coverage of supply points, and preferably having multiple quarries/supply points to assist with disaster recovery plans and supply continuity;
- Compliance to the ballast quality and testing standards as set out in Aurizon Network's specifications;
- Competitive pricing against existing average rates of all suppliers and specifically regional competitors; and
- Understanding and compliance with chain of responsibility and more general safety standards.

The range of suppliers ensures adequate and reliable supply to meet Aurizon Network's demand for ballast. Each system has a rail siding and a contracted supplier providing loading, unloading and stockpile management services.

Aurizon Network ensures cost competitiveness of ballast through the multi-supplier arrangement and consolidated internal supply planning arrangements.

Fuel

Fuel expenditure within the Aurizon Group is significant. Aurizon's existing contractual arrangement for fuel was awarded to BP Australia following a competitive tender process. These arrangements are in place until late 2021.

Aurizon Network's maintenance and renewal activities comprise a relatively low proportion of the Aurizon Group's total fuel consumption, with the majority being consumed by the above rail business, and the maintenance and renewal program benefits from the ability to leverage the larger purchasing power of the Aurizon Group as a whole.

14.2.3 Inventory

Inventory is managed for each asset class. For asset renewal activities, inventory strategies are focused on reducing the number of types of assets installed, e.g. turnouts or points machines, to reduce the supporting component types required in inventory. Asset Managers also set emergency spares and component renewal inventory levels to ensure that a minimum amount of inventory is held with an ability to respond to emergencies. Control Systems inventory levels are managed to achieve system availability requirements and the renewals deployment schedule.

Specialist replacement inventory is typically held at depot sites to support response times required to return the Rail Infrastructure to service following an incident. Three centralised stores at Gracemere, Rockhampton and Paget are maintained for high volume consumables, and replacement stock for depot stores.

For maintenance activities, the quantity of maintenance replacement inventory is typically set by procurement lead time requirements and usage frequency. Additional inventory is held for equipment items that are becoming obsolete in the marketplace, to defer renewal based on obsolescence. Recovered obsolete components are retained in inventory to extend renewal intervals of components that are obsolete and beyond their economic life.

Appendices

A Description of practices used to carry out asset activity

This section provides a description of the key maintenance activities, maintenance practices and renewal activities that are used to carry out asset activity. It also provides a general overview of:

- the benefit of completing the works;
- the risks mitigated; and
- the relevant trigger for intervention.

Maintenance Activities

Table 196 Summary of CQCN maintenance activities

Activity	Description	Benefits and risks managed	Trigger for intervention	Access Management
Resurfacing	Restores geometry of the track and turnouts by lifting and lining to the appropriate level and alignment and compacting the ballast underneath the sleeper. This fleet is also utilised to complete tasks within the renewal program and ballast undercutting program.	Mitigates the need for temporary speed restrictions applied as a risk control prior to component renewal or full asset renewal.	Triggered by tonnage over a rail section. **Track resurfacing: 50 million gross tonnes (MGT)** **Turnout resurfacing: 80 MGT** Resurfacing to remedy geometry faults identified often required ahead of these limits.	Resurfacing tasks are typically managed between trains and planned after the ITP has been agreed. This minimises the impact to capacity and allows the work to be fluid and targeted for priority locations.
Rail Grinding	Grinding rail in track and turnouts to remove micro cracks and small surface faults from the rail, restoring a profile that spreads the contact band, and positions it for better wheel set tracking around the curves.	Reduces risk of severe defects (rail failure or breakage) and prolongs the life of the rail.	Triggered by tonnage over a rail section or curve. **Straights: 40 MGT** **Curves 1001m to 2500m radius: 40 MGT** **Curves less than 1000m radius: 20 MGT** **Turnouts: 40 MGT**	Annual programs are developed and negotiated to avoid conflicts with other regulated inspection vehicles.
General Track Maintenance	Encompasses the planned corrective maintenance effort, responding to faults identified by drivers, track inspection, specific asset inspection, and Track Recording and Rail Flaw Detection	Identification of faults through inspection – notification and prioritisation managed via the NAMS system to minimise impact on capacity	Time based inspection regimes for track geometry recording, ultrasonic testing and track inspections.	Tasks are planned in accordance to Network Maintenance Block rules. Predominately on nominated maintenance days or in shadow of existing renewal works.

Activity	Description	Benefits and risks managed	Trigger for intervention	Access Management
	inspections. Activity can be planned according to the severity and the time period for fault/fault remedy of the identified fault. Fault severity ranges from: - Immediate - Track closed until repair completed; to - 'Y1' – repair required within 1 year of identification	Faults managed to mitigate against infrastructure failure leading to unplanned outages Localised depots responding to infrastructure faults to reinstate operability of the network in a controlled manner	Planned corrective dependent on fault severity	
Other Civil Maintenance	Minor Activities on Track and Turnouts. Includes Minor Ballast Undercutting, a corrective maintenance activity to replace the fouled ballast and mud holes from beneath the sleepers for a length of track up to approximately equal or less than 40 sleeper bays (as a guide).	Identification of faults not visible via person inspections allows for fault rectification in a controlled manner prior to the fault resulting in a failure Undercutting Minor Activities Spot repair mudholes and small areas of ballast fouling which cause track defects and increase the risk of derailment and remove TSRs.	Dependant on defect severity and time to remedy	Tasks planned in accordance to Network Maintenance Block rules, predominately on nominated maintenance days or in shadow of renewal works.
Structures and Facilities Maintenance	Periodic inspection of bridge and culvert structures to monitor asset condition and performance	Trend of condition allows for component or renewal works to be forward programmed given the wear rate of the assets Faults managed to mitigate against infrastructure failure leading to unplanned outages	Ground based bridge decks – every 2 years Scaffolded inspection – every 10 years Under group pile exam – every 10 years Underwater Inspection – every 4 years	These tasks are planned in closures or in accordance to Network Maintenance Block rules, predominately on nominated maintenance days or in shadow of renewal works.
Signalling and Telecommunication Maintenance	Inspection and maintenance that is regularly performed on the signalling asset to lessen the likelihood of it failing. Performed whist the asset is in place and working so that it does not break down unexpectedly.	Faults managed to mitigate against infrastructure failure leading to unplanned outages	Time based – planned periodic inspection and repair activities Planned rectification works on identified faults to return equipment to working condition	These tasks are planned in closures or in accordance to Network Maintenance Block rules. Predominately on nominated maintenance days or in shadow of existing renewal works.
Trackside Systems Maintenance	Inspection and maintenance that is regularly performed on the wayside equipment assets to lessen the likelihood of it failing. Performed	Faults managed to mitigate against infrastructure failure leading to unplanned outages	Time based – planned periodic inspection, servicing and repair activities	Where these tasks have an impact to train running, these tasks are planned in closures or in accordance to Network

Activity	Description	Benefits and risks managed	Trigger for intervention	Access Management
	whist the asset is in place and working so that it does not break down unexpectedly.		Planned rectification works on identified faults to return equipment to working condition	Maintenance Block rules. Predominately on nominated maintenance days or in shadow of existing renewal works.
Electrical Overhead Maintenance	Inspection and maintenance that is regularly performed on the electrical substation and overhead line assets to lessen the likelihood of failure. Performed whist the asset is in place and working so that it does not break down unexpectedly.	Faults managed to mitigate against infrastructure failure leading to unplanned outages	Time based – planned periodic inspection and repair activities Planned rectification works on identified faults to return equipment to working condition	Tasks planned in accordance to Network Maintenance Block rules, predominately on nominated maintenance days or in shadow of renewal works.
Other General Maintenance	Asset Management and Inventory Management	Inventory is held and managed at specific location across the network so as materials required for recitation works are available	Critical spares determined by lead time to obtain parts, level of supplier support and availability of materials / component	Tasks planned in accordance to Network Maintenance Block rules, predominately on nominated maintenance days or in shadow of renewal works.

Renewal Activities

Table 197 Description of CQCN renewal activities

Activity	Description	Benefits and risks managed	Trigger for intervention
Ballast	Over time ballast becomes fouled through degradation, sub soil contamination and coal dust. Ballast undercutting removes these contaminants from the ballast to restore drainage and load distribution requirements. Ballast fouling is managed via the following approaches dependant on the location of the fouling: • Ballast Undercutting Machine - excavating the fouled ballast from beneath the sleepers by a dedicated ballast cleaning consist, • Ballast Replacement as part of a formation repair or track upgrade – ballast can be replaced as part of the formation repair or track upgrade activity. • Ballast Undercutting Turnouts - excavating the fouled ballast and mud holes from beneath a turnout by minor mechanised equipment such as an excavator • Bridge Ballast Roll Out – due to the width, height and environmental constraints on bridges fouled ballast on bridges is completely removed and new ballast added.	Restores the drainage and load management properties of the ballast moving water away from the formation and spreading loads across the track structure to reduce the risk of formation issues leading to track geometry faults	Ground Penetrating Radar (GPR) provides a measure of ballast fouling severity comparative to prior GPR runs. This provides both degradation rate and level of fouling. Scope is determined based on the most fouled locations or those showing the greatest degradation matched to the production of the Undercutting fleet.
Rail Renewal	Replacement of rail in a section of track due to rail fatigue (increased fault rates) and/or wear outside of Aurizon Network's engineering standard. Rail renewal includes rail stressing to match the tension of the track with the surrounding railway reducing risk of rail misalignment (buckles) and rail breaks	• Renewing rail in a planned way reduces rail breaks and rail faults that would otherwise lead to unplanned delays • Reduces derailment risk related to rail break or rail misalignments	The timing of renewal is dependent on the weight of the rail, its location in track (loaded / unloaded, on straights or curves) and rail compassion (head hardened, standard carbon on through hardened) Network utilises a rail condition analyser model to identify future years renewal requirements based on rail wear against standard to determine the required renewal intervention
Turnouts and Component Renewal	Turnouts (sometimes called Switches) allow trains to move between tracks in duplicated sections, as well to allow entry and exit from passing loops and to move from the main line into spurs and balloon loops. A turnout is a combination of	• Component renewal extends the life of the turnout • Full renewal and maintain operability of turnout providing operational flexibility	Renewal - Condition and location of assets and degradation rate

Activity	Description	Benefits and risks managed	Trigger for intervention
	civil assets being the steel rail and sleepers and Control Systems Assets being the points motors, rodding and electronics		Component – items within the turnout that require renewals based on asset component condition
Sleeper Renewal	Sleepers (or ties), along with sleeper clips, hold the rails to gauge and alignment. There is a variety of sleeper types across the CQCN with most being 28 tal concrete for 60kg/m rail. Other sleepers are older styles with different rail fastening (clips). In sidings and older track sections there are both timber and steel sleepers.	• Reduction in track alignment issues relating to gauge and rail twist leading to temporary speed restrictions or unplanned delays. • Reduces derailment risk cause by loss of gauge or rail twist	Sleepers are condition scored based on weight, material and condition. The sleeper renewal program is renewing aged underweight sleepers with the 28 tal concrete standard.
Structures Renewal	Structures are bridges and culverts that allow for the flow of water through the rail formation or for access under the track Bridges are located at large hydrological water flows (rivers, creeks etc) Culverts are located at low points allowing overland flows through the track infrastructure.	• Renewal of assets prior to failure to reduce unplanned delays or safety risks associated with structure failures • Strategy to review hydrology in renewal locations to reduce number of culverts.	Structures are inspected and assigned a condition rating and allotted a location criticality. Structures are then ranked based on condition and location scores
Control Systems Renewals	Control Systems assets are the physical and digital assets that provide, train control, telecommunications and wayside monitoring systems. These assets provide the capacity multiplier for the track assets, that is they allow for the safe movement of more train services over the track structure. The main classes within the control systems grouping are: • Train control Systems: signalling system, level crossing active protection, interlockings and point motors • Telecommunications: the data network required to connect assets to train control, includes the optic fibre network, digital radio and microwave radio systems • Wayside Systems: assets in the rail corridor that provide a level of monitoring and alarming to protect track and overhead assets	Train control: • Ensure the continuity of the train control systems and provides incremental improvement to the operability of the system Telecommunications: • Reduce telecommunication outages due to fibre faults and data flow interruptions • Ensure the integrity of the safe working systems • Ensure the track side equipment faults are being reported for cation Wayside systems: • Allows for real time monitoring across the 2600 km network to identify out of tolerance or non-controlled rollingstock interface issues and stop or reduce the impacts	Unlike Civil assets, the trigger for the renewal of Control System assets is predominantly driven by the age of the asset along its life cycle. These assets do not necessarily wear with tonnage, and often don't show degradation until the point of failure. Obsolescence of data systems or components is also a key trigger for asset renewal.
Electrical Renewals	Blackwater and Goonyella Systems are electrified, enabling the operation of electric rollingstock. The traction system comprises two main asset groups,	OHLE • Renewal of components cross the 2000km of OHLE to reduce the	Like Control systems assets renewal is driven by the age of the assets against their lifecycle, they do not wear with the

Activity	Description	Benefits and risks managed	Trigger for intervention
	- Overhead Line Equipment (OHLE) - infrastructure distributes traction power to trains on the system - Traction Substations - stations provide a means of connecting to the high voltage transmission network (Powerlink or Ergon) and converting the transmission voltage (132kV or 275kV) down to 50kV for the traction system All the traction substations which were built as part of the main line electrification in the 1980s are nearing the end of their service life. Aurizon Network is employing best-practice asset management techniques to further life-extend this infrastructure. In parallel with this Aurizon Network is actively investigating modern technology alternatives to traditional substations which would allow for more cost-effective electrification topologies. It is likely that future renewals of traction substations will employ these new technologies.	instances of faults causing disruptions and cancelations. Traction substations • Managing the risks associated with the control of high voltage electricity	passage of trains and don't show high levels of degradation ahead of failure Major renewals of traction substation assets will be required in line with the downstream renewals by the 132kv suppliers. Aurizon Network is working closely with these third parties to understand the timing and impacts to Aurizon Network's assets

B Glossary

Term	Definition
2017 Access Undertaking or UT5	Aurizon Network's 2017 Access Undertaking, as approved by the QCA on 191 December 2019, together with any subsequent changes approved by the QCA from time to time
Access Holder	A person or organisation that holds access rights to the Central Queensland Coal Network
AM	Asset Maintenance
AMRP	Asset Maintenance and Renewal Policy
APS	Advanced Planning and Scheduling
Aurizon Network	Aurizon Network Pty Ltd, the provider of access services in accordance with the 2017 Access Undertaking
AZJ	Aurizon Holdings Limited
Ballast	Ballast is the material that is laid on the rail bed under the sleepers, providing stability and drainage to the track structure
Capex	Capital Expenditure
CETS	Civil Engineering Track and Standards
CPI	Consumer Price Index
CQCN	Central Queensland Coal Network
DBCT	Dalrymple Bay Coal Terminal
DTS	Dynamic Track Stabilisers
egtk	Electric gross tonne kilometres
Electrical Safety Act	Electrical Safety Act 2002 (Qld)
FD	Final Decision
FTE	Full Time Equivalents
FY	Financial year
GAPE	Goonyella to Abbot Point Expansion
GPR	Ground Penetrating Radar – A non-destructive subsurface inspection technology that is used to measure the condition of Aurizon Network's Assets, in particular ballast.
gtk	Gross tonne kilometres
HPCT	Hay Point Services Coal Terminal
ICAR	Initial Capacity Assessment Report as defined the 2017 Access Undertaking
ITP	Intermediate Train Plan
Mt	Million tonnes
MGT	Million gross tonnes
MNT	Million net tonnes
Mtpa	Million tonnes per annum
NAMS	Network Asset Management System
NCL	North Coast Line
NSAP	Network Strategic Asset Plan
nt	Net tonnes

Term	Definition
ntk	Net tonne kilometres
OHLE	Overhead Line Equipment
Opex	Operational Expenditure
OTCI	Overall Track Condition Index – a measure of quality of the geometry of the track calculated from track geometry recording vehicle outputs
QCA	Queensland Competition Authority
PVC	Percent Void Contamination – calculated by dividing the volume of contaminates by the volume of voids within the ballast profile. PVC is determined in a compacted state to simulate actual track conditions
QCA Act	Queensland Competition Authority Act (Qld) 1997
QR	Queensland Rail Limited
QRC	Queensland Resources Council
RAB	Regulated Asset Base
RGTCT	RG Tanna Coal Terminal
RIM	Rail Infrastructure Manager
RM900	Mainline Ballast Undercutter Machine
RM902	High Production Mainline Ballast Undercutter Machine
Single line possessions	When asset activity can be completed on one track in a duplicated section whilst the other track is kept operational to allow for continuous train services.
SMS	Safety Management System
TRSA	Transport (Rail Safety) Act 2010
Turnout	A section of railway track-work that allows trains to pass from one track on to a diverging path
UTC	Universal Train Control
UT5	Aurizon Network's 2017 Access Undertaking, as approved by the QCA on 19 December 2019 and subsequently amended from time to time.
WICET	Wiggins Island Coal Export Terminal
WIRP	Wiggins Island Rail Project