AURIZON NETWORK

FY19 Capital Expenditure Report

31 October 2019

Table of Contents

Introduction

The Queensland Competition Authority (**QCA**) has approved a Regulatory Asset Base (**RAB**) for the Central Queensland Coal Network (**CQCN**). The 2017 Access Undertaking (**UT5**) provides for the QCA to approve any additions to the RAB. This approval process involves the annual assessment of Aurizon Network's Capital Expenditure submission.

In the financial year commencing 1 July 2018 and concluding 30 June 2019 (**FY19**) Aurizon Network commissioned 50 capital projects representing a total investment of **$130,106,248** excluding Interest During Construction (**IDC**), or **$130,455,047** including IDC. This value encompasses **50** projects across the CQCN, details of which are outlined in Appendix A: Capital Expenditure Project List.

This report details Aurizon Network's submission for capital expenditure to be assessed and accepted by the QCA into the RAB in accordance with clause 2 of Schedule E of UT5.

The purpose of this submission is to provide evidence to support the QCA's assessment of whether the capital expenditure is prudent and efficient under clause 2 of Schedule E of UT5, and in particular to provide clarity about the circumstances relevant at the time of making the decision to incur the capital expenditure.

Delineating Between Capital and Operating Expenditure

For the purposes of delineating between capital expenditure and operating expenditure, the criteria applied by Aurizon Network to define scope of works as capital expenditure are in accordance with Australian Accounting Standard AASB 116 Property, Plant and Equipment.

Those costs which have been categorised as capital expenditure for work commissioned in FY19 are included in this submission for inclusion in the Regulatory Asset Base and are discussed in detail in the Capital Project Disciplines section of this report.

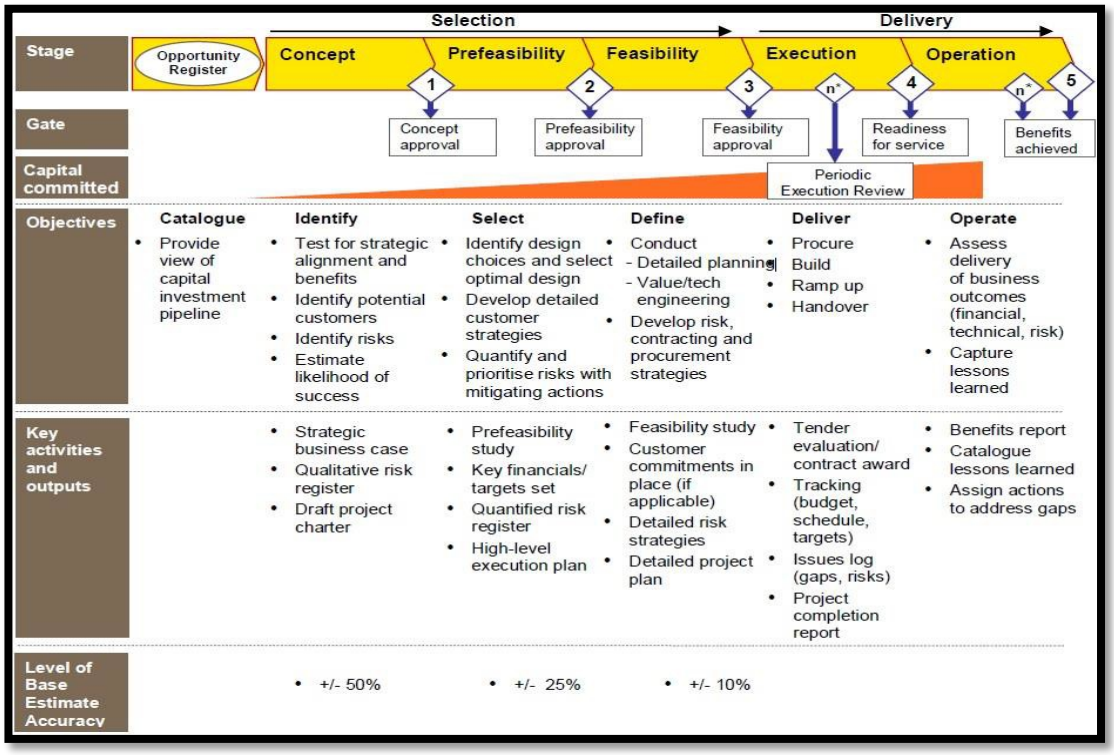
Investment Framework

Aurizon Network follows a rigorous regime prior to the commitment of capital investments. This is governed by a process known as the Aurizon Investment Framework. The purpose of the investment framework is to facilitate sound investment decisions and to ensure:

- Investments have a high degree of success;
- Investment decisions are made on a consistent basis;
- Capital is optimised; and
- Learnings from investments are recorded and improved approaches to manage investment opportunities are realised.

The investment framework aligns with the requirements of UT5 in terms of prudency and efficiency of scope, standard and cost for capital expenditure. Figure 1 provides an overview of the capital investment stage gates that Aurizon Network utilises for its capital projects.

Figure 1. Aurizon Capital Investment Stage Gates



This stage gate process commences from the moment a capital investment opportunity is registered and moves to the concept phase. Following this, the investment opportunity is assessed at multiple stage gates (that is concept to prefeasibility, and then to feasibility). The costs committed to the investment opportunity increases after the passing of each stage gate. Conversely, the variance in the estimated cost of the investment opportunity reduces as it moves closer to execution phase. Capital Renewal submissions generally commence at the feasibility stage in the investment approval process.

Each stage gate contains an Investment Approval Request (**IAR**) that must be reviewed by the Network Investment Committee (**NIC**) and approved in accordance with the Financial Delegation Framework. All IAR's are also reviewed and endorsed by the Aurizon Investment Committee (**AIC**). The investment opportunity then translates into a capital project which is executed. Capital Renewal submissions are discussed in detail in the Capital Project Disciplines section.

The type of assessment process applied for renewal capital investments will depend on the project value, its level of risk and Aurizon Network's internal delegations from the Board to executive management. Lower value (IAR's less than $1m) and lower risk projects may go through a simplified version of the capital investment stage gates. Although the IAR is simpler, it still provides for robust review of proposed scope and cost, including options analysis and procurement details.

The structure of this process provides a robust methodology for assessing the potential scope of projects presented for investment approvals and ensure the costs which are then committed to the project are viable. This framework aids in the delivery of sufficient supporting evidence to determine the prudency and efficiency of the capital expenditure under clause 2 of Schedule E of UT5.

Regulatory Framework

Aurizon Network may provide the QCA with the details of capital expenditure that Aurizon Network considers should be included in the RAB with sufficient supporting evidence to determine the prudency and efficiency of the capital expenditure under clause 2 of Schedule E of UT5, including as applicable:

- Any relevant Business Case or Feasibility Study;
- Evidence of actual expenditure of the capital expenditure, commissioning of the associated assets; and
- Capacity Modelling, if any, undertaken as part of the Business Case or Feasibility Study and on commissioning of the asset.[1]

Details of key supporting documentation available to support of prudency and efficiency under clause 2 of Schedule E of UT5 are outlined in the Prudency and Efficiency section.

Information provided to the QCA under clause 1.3 of Schedule E of UT5 must be accompanied by a statement signed by Aurizon Network's Executive Officer confirming that, to the best of their knowledge, the information is, in all material respects, correct[2]. This Executive Officer Statement has been provided to the QCA.

Failure by Aurizon Network to obtain the QCA's approval of any matters under clause 2 of Schedule E of UT5 in relation to a capital expenditure project or part of the capital expenditure for a project, does not affect its right to seek approval under clause 2 of Schedule E of UT5 at a later time in respect of part or all of the capital expenditure[3].

The QCA must approve capital expenditure for inclusion into the RAB if that capital expenditure is for the prudent and efficient value of the assets that are used or intended to be used by Aurizon Network to provide the service taken to be declared under section 250(1)(a) of the Queensland Competition Authority Act 1997, (**Act**) namely "*the use of a coal system for providing transportation by rail*".

In determining the prudency and efficiency of capital expenditure, the QCA must have regard to the following:

- **Scope** of works for the project, including whether the requirement for the works is prudent and efficient.

- **Standard** of works for the project, including whether the standard could be expected to deliver the requirements for that project without it being overdesigned or likely to deliver a capital works project which is beyond the requirements of its scope.

- **Costs** of that project are prudent and efficient, having regard to the scope and standard of work undertaken or to be undertaken for the project, which must include having regard, where relevant, to a list of factors for each element of scope, standard and cost.

The QCA must assess, under clause 2.2(b) of Schedule E of UT5, whether the capital expenditure is prudent and efficient and in doing so, must consider only the circumstances relevant at the time of making the decision to incur the capital expenditure (or in relation to assessing prudency of costs, at the time when the costs were incurred, or the capital expenditure project was undertaken, as applicable)[4].

[1] Clause 1.3(a), Schedule E, UT5
[2] Clause 1.3(d)(i), Schedule E, UT5
[3] Clause 2.1(d), Schedule E, UT5
[4] Clause 2.2(g), Schedule E, UT5

This FY19 Capital Expenditure submission provides the QCA with the details of capital expenditure that Aurizon Network considers should be included in the RAB in accordance with clause 2 of Schedule E of UT5.

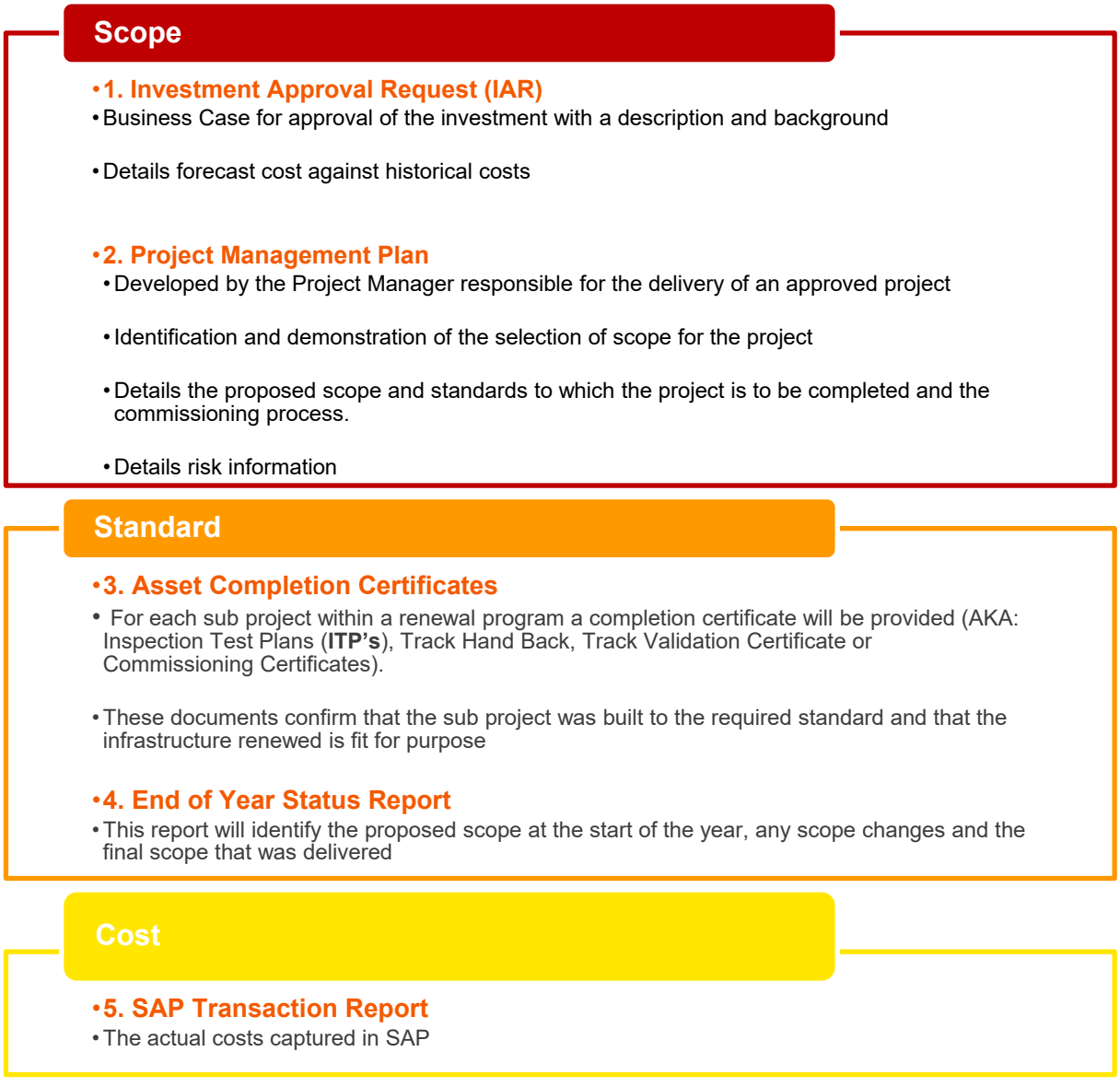
Prudency and Efficiency

This report demonstrates Aurizon Network has sought to construct new infrastructure and undertake renewal works using existing rail standards developed by Aurizon Network or applicable Australian or industry standards. Appendix A: Capital Expenditure Project List sets out the details for each of the FY19 capital expenditure projects. Supporting documentation is available for all of these projects to demonstrate that the scope, standard and cost are prudent and efficient.

For each of the Top 10 Material Projects within this submission, Aurizon Network has provided 5 Key Documents in support of the capital expenditure claimed (renewal projects only). Publication of these documents are not permitted without prior consent from Aurizon Network.

The 5 Key Documents are as follows:

Figure 2. 5 Key Documents



Further information can be provided to the QCA, if required, via a Request for Information (**RFI**).

Additional Information

Access Agreements and Contractual Obligations

The QCA is required to have regard to Aurizon Network's obligations under Access Agreements in considering the prudency and efficiency of capital expenditure in line with clause 2.2(b)(i)(B) and 2.2(b)(ii)(A) of Schedule E of UT5, along with any contractual timeframes as relevant to clause 2.2(b)(iii)(E)(8) of Schedule E. In particular, Growth projects are often linked to an Access Agreement held between Aurizon Network and another party, and there may be other contracts in place for an individual project.

Network Development Plan

The Network Development Plan is Aurizon Network's medium to long term planning document which sets out a range of options to increase the capacity of the CQCN. The QCA is required to have regard to any relevant Network Development Plan in considering the prudency and efficiency of capital expenditure in line with clauses 2.2(b)(i)(A) and 2.2(b)(iii)(A) of Schedule E of UT5. The Network Development Plan also demonstrates consideration of supply chain impacts, as required by clause 2.2(b)(iii)(E)(7) of Schedule E of UT5.

Where relevant, current and likely future usage levels are considered in developing projects and these are recorded in modelling and stakeholder communications as required for the particular project. Such information supports prudency and efficiency with respect to 2.2(b)(i)(C) and 2.2(b)(ii)(B) of Schedule E of UT5.

Asset Management Plans

In determining the prudency and efficiency of Aurizon Network's capital expenditure, the QCA is required to have regard to the age and condition of existing assets and any Asset Management Plan which has been accepted by the QCA under clause 3 of Schedule E of UT5. Whilst there are not currently any QCA-approved Asset Management Plans, Aurizon Network's Asset Maintenance and Renewal Policy clearly documents defined assumptions that sit behind plans for managing assets.

Aurizon Network's asset management documentation, including Condition Assessments and Prioritisation Models, further support the prudency and efficiency of the FY19 capital expenditure under clauses 2.2(b)(i)(D), 2.2(b)(ii)(D) and 2.2(b)(ii)(D) of Schedule E of UT5, where applicable.

Standards, Specifications and Policies

The QCA is required to have regard to the standard of works for the project, where relevant to Aurizon Network's design standards and relevant Australian design and construction standards, as detailed in clauses 2.2(b)(ii)(C) and (E) of Schedule E of UT5. In support of the QCA's decision, Aurizon Network's suite of standards, specifications and policies are available. This includes Aurizon Network's design standards arising from the Safety Management System.

The requirements contained in these documents are based on the requirements of the relevant Australian Standard(s) and technical knowledge and experience. Any additional or non-standard requirements are outlined in project documentation such as Client Requirement Briefs and Project Management Plans, or similar.

Aurizon Network's project completion processes include Project Commissioning Certificates (or similar) and Project Completion Reports to record that the specified standards were implemented. Where relevant, these are further supported by As-Built Drawings and Quality Management documentation including, Inspection and Test Plans, Track Validation Certification, Practical Completion Certificates and photographs of completed works.

Further, these documents, support Aurizon Network in meeting its legislative and tenure requirements, including those relating to rail safety, workplace health, safety and environmental requirements, as required by clause 2.2(b)(i)(G) of Schedule E of UT5. In relation to this requirement, Aurizon Network has a fully-integrated Safety, Health and Environment Management (**SHEM**) system that supports the management of incidents, hazards, near misses and safety interactions. This system and related documentation also support Aurizon Network's compliance with Laws and the requirements of Authorities, as required by clauses 2.2(b)(ii)(F) and 2.2(b)(iii)(E)(3) of Schedule E of UT5.

Stakeholder Engagement

Where relevant, particularly for Growth projects, Aurizon Network consults with Access Seekers and Access Holders who may be impacted by the capital expenditure, in support of clause 2.2(b)(i)(G) of Schedule E of UT5. Matters raised by Funding Users are also considered, in line with the requirements of clauses 2.2(b)(i)(H), 2.2(b)(ii)(G) and 2.2(b)(iii)(F) of Schedule E of UT5.

Interest During Construction (IDC)

The financing charges incurred by Aurizon Network during the creation of assets are capitalised as appropriate. Refer to the IDC Calculation Method section for detail on how IDC is calculated. Generally, this interest is capitalised where: Expenditure has commenced on the capital project; the assets being delivered or renewed under the project are for Aurizon Network's use, and not for resale; there has been continuous construction or work on the project over the period (such that significant delays in construction if any are excluded); and there are actual financing costs in place with Aurizon Network's funding providers.

Funding (Gearing) Ratio

The gearing ratio for Aurizon Network to source funds is debt of 55% and equity of 45%. The QCA has noted this is efficient and that the approved weighted average cost of capital (**WACC**) utilising this gearing ratio is appropriate for the calculation of IDC. This has been the method adopted since the approval of UT1 in December 2001.

Aurizon Network has applied the QCA approved regulated WACC to calculate the relevant IDC included in this submission.

IDC Calculation Method

In calculating the IDC for this FY19 Capital Expenditure submission, Aurizon Network has applied the S-curve methodology. This is consistent with the calculation method applied by Aurizon Network, and approved by the QCA, from 2010.

To obtain the IDC amount, the S-curve approach uses monthly cash flow values, multiplied by the applicable interest rate. These cash flows are extracted from Aurizon Network's financial accounting system (**SAP**). The applicable interest rate is the WACC for the relevant regulatory period.

Aurizon Network includes approved capital expenditure into the RAB as at the 1st January in the year of commissioning of the project. To do this, the IDC calculation must be conducted to the mid-point in the year the project was commissioned. For the FY19 Capital Expenditure this mid-point is 31 December 2018. Any negative IDC is also calculated from the mid-point of the year, to the conclusion of the financial year.

Capital Project Discipline Types

Within this report Aurizon Network submits a number of projects which relate to three general project categories, and also the cost of funding such projects including IDC.

Sustaining

In prior submissions, such projects were referred to as “Capital Renewal”.

Includes projects which relate to the renewal or replacement of infrastructure assets within specified disciplines. Those disciplines include: Civil, Control Systems and Electrical.

In order to provide the safe and reliable operation of the CQCN, Aurizon Network undertakes the renewal of the assets used to deliver contractual obligations to access holders. Capital Renewal projects are capital investment works that replace or upgrade life expired infrastructure. Items are identified for renewal based on age, wear, condition and/or obsolescence.

Given the extent of these works, they are generally undertaken by, and reported by project disciplines.

Growth

There has been no change to this category name from prior years submissions.

Includes projects that add capacity to the existing network through expansion or augmentation.

Transformation

In prior submissions, such projects were referred to as “Other”.

Includes projects which do not fall within the Sustaining or Growth categories, and which often involve information technology (**IT**) and operating technology (**OT**) programs, projects to improve operational efficiency and environmental or sustainability programs.

A summary of each of these categories, relevant to the FY19 Capital Expenditure, is set out in Table 1.

Table 1. Summary of Capital Expenditure by Project Type

Discipline Type	Capital Expenditure (excluding IDC)	IDC	Capital Expenditure (including IDC)
Growth	238,068	3,492	241,560
Sustaining *(Capital Renewal)*	121,271,876	418,577	121,690,454
Transformation *(Other)*	8,596,304	-73,271	8,523,033
Total	**$130,106,248**	**$348,799**	**$130,455,047**

Capital Project Asset Types

Civil

Civil, referred to as TACA in SAP, projects include those relating to rail formation and ballast, sleepers, rail, turnouts and structures. The details of these asset types are set out in Table 5 below.

Table 2. Civil Projects by Asset Type

Asset Type	Description	Capital Expenditure (excluding IDC)
Rail	Renewal of end of life rail	26,666,099
Track	A combination of assets types in works, including ballast, sleepers and rail replacement	14,799,271
Sleepers	Renewal of end of life sleepers, upgrade of timber to concrete sleepers, and upgrade of sleeper fasteners	6,654,840
Structures	Replacement of culverts and concrete drains	16,374,974
Formation / Ballast	Sub-formation, capping layer, ballast renewal and ballast cleaning	19,243,671
Various	Civil works conducted as part of a response to events such as cyclones or flooding	1,156,299
Turnouts	Turnouts and turnout components	14,749,888
Corridor Access	Projects within the Corridor discipline include those which impact on assets within the rail corridor, such as access points, access roads and corridor security including fencing	2,984,207
Total		**$102,629,249**

Control Systems

Control Systems projects include those relating to the assets that communicate with the Universal Traffic Control (**UTC**) system which allows train movements, identifies train locations, operates rail points, and activates level crossing protections. These systems are also required to monitor and protect below-rail assets from risk of derailment or infrastructure damage, from rolling stock defects. Control Systems projects also includes telecommunications projects, relating to assets providing the data linkages between field equipment and network control, enabling Aurion Network to manage safe train operations.

The details of the FY19 Projects involving Control Systems are set out in Table 6**.**

Table 3. Control Systems Projects by Asset Type

Asset Type	Description	Capital Expenditure (excluding IDC)
Network Controls	Provides Network Control systems, digital and microwave radio systems and information technology system	12,968,299
Operational Systems *(Systems)*	Provides axle counters, monitoring systems	353,868
Telecommunication	Provides data, optic and radio linkages	7,105
Level Crossings	Road and rail interfaces and protection systems	4,359,809
Total		**$17,689,082**

Electrical

Electrical projects cover works associated with all elements of the supply and distribution of electricity for the utilisation of electric traction in the Blackwater and Goonyella Systems. The details of these projects by asset type are set out in Table 7 below.

Table 4. Electrical Projects by Asset Type

Asset Type	Description	Capital Expenditure (excluding IDC)
Power Systems	Provides feeder stations, track section cabins and supply transformers	185,545
Electrical	Provides masts and wires of the distribution system	768,001
Total		**$953,546**

FY19 Top 10 Projects by value

Given the nature of the expenditure included in this submission, Aurizon Network has elected to provide detailed discussion in this report of the top 10 projects, listed below in Table 9.

Table 5. Summary of Material Projects

Project Number	Project Name	Project Type	Capital Expenditure (excluding IDC)
IV.00425	Rail Renewal Program Package 1	Sustaining	26,572,373
IV.00446	Structures Renewal Package 1	Sustaining	15,465,451
IV.00476	Track Renewal Package 1	Sustaining	15,193,594
IV.00461	Turnout Renewal Package 1	Sustaining	14,053,345
IV.00452	Formation Renewal Package 1	Sustaining	9,851,560
IV.00449	Bridge Ballast Renewal Package 1	Sustaining	8,567,512
IV.00455	Control Systems Renewal Package 1	Sustaining	6,875,112
IV.00473	Sleeper Renewal Package 1	Sustaining	6,317,874
IV.00577	East End Fishermans Landing Infra Upgrade	Transformation	4,858,621
IV.00458	Level Crossing Renewal Package 1	Sustaining	4,048,374
Total			$111,803,815

IV.00425 Rail Renewal Program Package 1

Aurizon Network has 2,760KMs of track in the CQCN, the majority of which was installed in the 1980s and 1990s. The main reason for the rail renewal program, a Capital Renewal project, is due to rail wear as a result of friction between wagon wheels and the rail. Lubrication of curved rail and appropriate rail grinding is necessary to ensure rail reaches its maximum rail life. The greater the train weight the higher the friction and the greater the wear, meaning tracks carrying loaded trains will wear at a faster rate than tracks carrying empty trains.

The Rail Renewal Program for the CQCN aims to renew damaged or worn rail assets to ensure compliance with the mandatory Civil Engineering Track Standard (**CETS**) Network Safety Management System. CETS Module 2 prescribes the standards for the design, construction, monitoring, maintenance and modification of rail used in the CQCN and outlines specific thresholds for rail wear.

Rail wear limits are determined by a number of factors including; curve radius, axle load, rail type, rail size and curve leg. Rail wear is captured by manual measurements from Track Inspections and data from the Rail Inspection Vehicle (**RIV**) which measures the head loss of the rail at set intervals along the track. Wear measurements over the history of the curve can be used to determine the wear rate and the date in which replacement is required. Wear rates are directly associated with the level of traffic which passes over any respective track segment.

At high annual gross tonnages, the rate of growth of rail defects may become the limiting rail life factor. Rail wear reduces the rail cross section and does not transfer loads over the required number of sleepers and consequently internal rail stress becomes excessive, increasing the likelihood of rail bending.

Aurizon Network's rail renewal strategy supports the proactive replacement of life expired rail or defective rail before it can adversely impact safety and operational performance. The Rail Renewal Program is a long-term Asset Renewal Program with a prioritised program of works developed and funded yearly.

IV.00446 Structures Renewal Package 1

This upgrade is a Capital Renewal project which will facilitate the current and future traffic and provide an asset suitable to the corrosive environments within the CQCN. Culverts and structures on the CQCN were predominantly installed during the initial track construction in the 1960's. These structures were designed for lower axle load and traffic tonnages than current operational requirements. The impact of running larger and heavier trains across these culverts since being installed have led to their accelerated degradation.

Due to overstress or condition deterioration culverts may collapse, leading to loss of top and line of the overlying track. Failure mechanisms will depend on the shape and dimension of the cross-section, maintenance undertaken to date as well as the culvert material. Culvert outlets and inlets which exhibit signs of scour are also a concern as the scour may advance towards the track and if unchecked may undermine the culvert and track itself. At best, speed restrictions would then be required to be imposed until repair/renewal of culverts is carried out while the worst case could see train derailment and track closures enforced until such time as the culverts are replaced and track reinstated.

The renewal or upgrade of the culverts increases the strength of the culverts to align with Civil Engineering Structures Standards (**CESS**), providing increased confidence in the asset and progressively improving the track infrastructure to enable future growth. The upgrading of the culverts is in line with Australian Standards and Aurizon's Code of Practice.

The Structural Renewal Program involves significant upfront site inspection, survey, design and approval activities. Currently there are 3,809 culverts and 339 bridges across the CQCN. Routine inspections, in accordance with CESS, identify structures approaching the end of their life which are then prioritised for completion under the project, using a priority rating model. Benefits of the project include less maintenance works, reduced inspection requirements, removal of speed restrictions and reduction of risk of derailments.

The Structures Renewals Program aims to replace life-expired or near life-expired structures throughout the CQCN with new structures compliant to a 300LA design loading configuration (Australian Standard) and design flood immunity of Q100 (to top of rail) and Q50 (to top of formation).

IV.00476 Track Renewal Package 1

The Track Upgrade Program, a Capital Renewal project, is a coordinated program renewing the track structure (sleepers, rail, fastenings and in some locations ballast), maximising the efficiency of construction. The renewal of track assets at the scoped locations ensures the ongoing integrity and reliability of the network, facilitating the current and future traffic task in a reliable manner.

The project involves upgrading the track structure to 60kg rail, 28tal concrete sleepers with galvanized Pandrol E clips and new ballast in select locations. Sites that have been identified for Track Upgrade in FY18 were spread across the CQCN; Goonyella, Newlands, Moura and Blackwater systems. A track upgrade site is determined by combining a site that has worn rail in need of replacement, and an area of

Fist or timber sleepers that require replacement. In some cases (depending on the condition of the ballast), the scope may also request that the ballast be replaced at the same time. Upgrading the track structure at the same time minimises the amount of time that the track is disrupted in that location and the need to incur multiple site mobilisation costs.

The minimum scope to be completed at a location is driven by the amount of worn rail needing to be replaced, however consideration is also given to maximising the productivity of mobilising resources to that location. As labour and machinery are charged on a daily basis, the preference is to maximise the productivity from the costs being incurred by undertaking additional Fist or timber sleeper replacements in that location. As a result, in those locations where the Track Laying Machine (**TLM**) was utilised, the amount of sleeper replacement being undertaken may be increased to fully utilise the already paid for plant and labour, with the only additional cost being the sleepers and associated clips and pads.

In the early 1980's mainline track was constructed with 22.5tal concrete sleepers with 'fist clips'. mainline track was constructed with 22.5tal concrete sleepers with 'fist clips'. These fist clips fasten the rail to the sleeper by leveraging via a pin and clip arrangement through the body of the sleeper. With constant exposure to the coal and coastal environments, the pins and clips of these sleepers are becoming severely corroded. The clips and pins are losing tension which can result in wide gauge and eventual failure of sleeper. Furthermore, these sleepers are rated at 22.5tal while the current track standard calls for 28tal sleepers.

The pins corrode within the sleeper, so the extent of corrosion is not fully evident on visual inspection. Given the increasing wide gauge issues, maintenance inspection of the affected areas has been increased to reduce the risk of gauge issues and likelihood of derailment. To manage this sleeper failure, a rolling sleeper replacement program has been implemented over the last couple of years. The replacement of the fist sleepers are on a priority basis determined by the condition of the sleeper. This is in addition to manual replacement during routine maintenance. Where rail is approaching the end of its life and is supported by timber sleepers which have a poor condition or fist sleepers, it is replaced with a concrete pandrol sleeper to meet current axle loads.

Aurizon manages its below rail renewal and replacement project using the project management function within the Engineering and Project Development area, with all asset renewal activity managed by the Asset Renewal Program Manager. One of the key benefits of this approach is that the Program Manager, along with the relevant Asset Manager, has a complete view of proposed works and can program numerous projects to occur concurrently by deferring or bringing forward works in a like location. For example, if a section of sleepers in a location are programmed for replacement and on review the sleepers are expected to require replacement in 2 years and the ballast renewed in 3 years, as it is more efficient both in resource use and track possession to complete all three activities at the one time. This completion of multiple works at a single location is classed as Track Upgrade works.

IV.00461 Turnout Renewal Package 1

The Turnout Renewal Program, a Capital Renewal project, is a rolling Asset Renewal Program with a prioritised program of works developed and funded yearly. The program objectives encompass the replacement of whole turnouts, upgrading of existing components and removal of turnouts that are no longer required to maintain the system capacity.

By delivering this renewal program Aurizon Network will increase the reliability of the entire network's supply chain, while minimising the cost of the maintenance task.

Other benefits Include:

- Reduced risk of adverse network performance arising from rail defects.
- Improved supply chain benefit through decreased transit time and increased reliability
- Improves operational safety of the network.

IV.00452 Formation Renewal Package 1

The Formation Renewal Program, Capital Renewal, is a rolling Asset Renewal Program with a prioritised program of works developed and funded yearly. Scope is determined using track geometry (carried out by the Track Recording Car) which covers the entire CQCN and highlights areas of concern. Once a location has a geometry defect identified and it is determined to be due to formation failure it is then condition and risk assessed and prioritised.

The criteria used to determine scope can been identified as follows:

- The current condition of the formation;
- The impact of traffic and frequency of tonnages on that track section;
- The probability of negative impact to the Network; and
- The availability of access to the track location if failure did occur.

IV.00449 Bridge Ballast Renewal Package 1

The Bridge Ballast Renewal Program seeks to renew and replace ballast depth and profile in line with the Civil Engineering Track Standard (**CETS**) limit at priority sites across CQCN. Bridge Ballast Renewals are not included as part of Aurizon Network's maintenance allowance budget under Ballast Undercutting and as such is dealt with as a renewal activity. Aurizon Network has approximately 19.0km of ballast on 258 ballast-deck bridges across the CQCN.

The replacement of fouled ballast on bridges ensures that the track is able to drain freely, and the ballast is able to absorb and transfer the weight of trains evenly. This prevents the development of 'mud holes' and prevents the track from 'pumping', issues that can lead to a rail break which could lead to a derailment.

Ballast is typically made from crushed stone and forms the bed upon which sleepers are laid. Its primary functions are to:

- "lock" track in place
- enable even load distribution to the underlying formation/bridge structure, and;
- facilitate the drainage of water, and;
- enable mechanised reinstatement of top & line

Coal fouling and other contaminants impede the ballast's drainage functionality. As the ballast becomes increasingly fouled normal track maintenance techniques (i.e. resurfacing) are no longer effective and result in the increasing occurrence of track geometry anomalies and rail faults. These defects cause the track to settle unevenly resulting in a weakened track structure that requires regular and often reactive maintenance. It also increases the risk of derailment, train partings and broken rails. Typically, these risks are managed using speed and load restrictions.

In comparison to ballast undercutting practises, ballast renewal on bridge decks pose a unique problem due to their narrow design and the fact that there are often significant safety concerns (working at height) as well as environmental concerns of fouled ballast spilling into creeks and rivers below. The narrow design ensures that ballast undercutting techniques through mechanised, efficient bespoke machinery cannot be utilised. As a result, manual techniques of track de-construction and re-construction are required.

The scope for this rolling program is based on the following analysis:

- Civil Asset Management System (**CAMS**): based on ballast depth, extent and depth of fouling, RIMS defects, track geometry;
- Defects: feedback from Network Asset Maintenance based primarily on track geometry and defects data;
- Speed Restrictions: Bridges with speed restrictions impacting revenue traffic throughput.;
- New technologies: utilisation of ballast matting and membranes in order to reduce the changes in track stiffness between splay set to splay set;
- Track Criticality Rating: location of the bridge has been assessed in accordance with the Criticality Asset Strategy and Policy.

IV.00455 Control Systems Renewal Package 1

Control Systems Assets include Aurizon Network's train control system, asset protection and signalling control assets as well as managing Australia's largest non-commercial telecommunications data network. This program of works seeks to maximise the performance and reliability of network assets whilst maintaining safety. The program consists of a total ten projects separated into Package 1 (IV.00346) and Package 2 (IV.00347). Each project has a prioritised scope identified within the Network Assets Scope Priority Model.

There are four projects in **Package 1 (IV.00346)** discussed in further detail below:

1. Train Detection:

This project is the renewal of train detection assets in order to replace end of life track circuit related equipment and reduce fault impacts experienced by the network operators and reduce maintenance effort on the track circuit equipment.

2. Interlocking Assets:

Interlocking assets are the signalling components which control local signalling equipment e.g. signals and track circuits according to predetermined functional and safety rules. Interlocking assets allow Network Control to operate Remote Control signalling equipment which displays to the train controller via UTC status of signals and points and shows the passage of train through the CQCN Rail Network.

3. Power Resilience:

Trains have been delayed due to instability of the older signalling power systems, particularly during strm activity. The solution to this problem has been achieved by the rollout of a new Power Equipment Rooms (**PER**) that house uninterruptable power supplies that reduce significantly power instability caused by storms. This project delivered a reduction in signals being restored to stop during power changeover. This had a flow on effect of reducing train delays.

4. UTC/DTC Upgrade

The UTC/DTC upgrade project provided software and hardware updates to the key train control systems Universal Train Control (**UTC**) & Direct Train Control (**DTC**) which operate throughout the CQCN. The upgrades included software changes to the UTC system to improve safety & reliability and hardware changes to improve telemetry systems and Networking equipment that enables communications with field signalling equipment and the UTC and DTC system elements. These updates maintain and extend the life of the existing train control systems.

The project scope was determined through joint communication of the working group that meets quarterly to reprioritise the updates and proposed scope.

- A safety enhancement, providing an additional screen icon for items that currently only have text prompts
- An enhancement to upscale the UTC into the internet age, replacing aging modem infrastructure and bearers with IP based modern equivalents. This improves system reliability, allows self-healing networks, cheaper telemetry carriers and greatly simplifies disaster recovery.
- A safety enhancement, this improvement prevents accidental release of blocking placed on the UTC in support of isolations or electrical incidents.
- A safety enhancement, building the functionality of the Track Access System (**TAS**) system, providing additional location identifying features and enhanced electronic forms.
- An obsolescence replacement. The Train Overview System (**TOS**) System provides train information to external systems, primarily the widely used Realtime Train Overview (**RTOA**). TOS itself is Windows NT based and was moved to a virtual environment in FY17, however the system requires upgrade to ensure its future viability. Any changes to TOS will also obviously require changes to RTOA.

IV.00473 Sleeper Renewal Package 1

This project is to replace priority life expired and ineffective timber sleepers and corroded fist fastened sleepers designed for 22.5tal and selected timber sleepers 'on a face' (i.e replace everything between the start and finish points) with 28tal Pandrol e-clip concrete sleepers at numerous identified sites within the Goonyella, Moura, Newlands and Blackwater systems.

The sleeper is a fundamental component of the track structure and performs four critical functions to ensure the reliable passage of trains:

- Holds the track in alignment both vertically and horizontally;
- Holds the rails on which trains are conveyed and guided to "Gauge";
- Spreads the load of the trains from the wheels to the underlying soil and formation in a controlled and designed manner;
- Provides mass and resistance to lateral forces from trains and thermal effects.

As detailed in the IV.00476 Track Renewal Package 1 section, an ongoing sleeper program has been implemented to carry out sleeper replacement on a priority basis determined by the inspection regime of the track assets.

In addition to the renewal of fist concrete sleepers due to fastenings at end of life, sleeper upgrade and renewal requirements also include:

- Replacement of derailment damaged sleepers previously left in track, but at end of service life under current increased traffic operations;
- Upgrade of timber sleeper track with high sleeper replacement and maintenance requirements;

Derailment damaged sleepers suffer various damages which affect the sleeper performance and hence reliability and transit times of train services traversing them.

Timber sleepers have similar and more dramatic degradation effects. Timber sleepers still constitute a significant portion of the network. Timber, because of its organic nature, degrades and loses life not only by train traffic but also through climate and exposure to the weather environment independently of train traffic.

IV.00577 East End Fishermans Landing Infra Upgrade

This project is to renewal worn or life expired assets to enable continued railings from East End mine to facilitate access agreement. The works include; bridge rollouts, ballast lift and undercutting, level crossing undercutting and signage upgrades, re-railing, turnout undercutting and fencing in line with the Civil Engineering Track Standard (**CETS**) at priority sites on the East End Spur and Balloon Loop (**East End Branch**) and Comalco Junction to Fisherman's Landing (**Fisherman's Landing Branch**).

The upgrade works on the East End Branch and Fisherman's Landing Branch have been scoped over the 5-year period through a process of identifying critical infrastructure assets at a risk of not complying with CETS or are approaching noncompliance.

Figure 3. Map representing the East End and Fisherman's Landing Branches

IV.00458 Level Crossing Renewal Package 1

The purpose of the FY19 Level Crossing Renewals Project is to renew/upgrade through the CQCN as identified within the FY19 Scope Priority Model to ensure the safe passage of trains.

Rail Level Crossings are the locations where road and railway lines intersect allowing road users (including pedestrians and cyclist) to travel over the railway tracks. Aurizon Network is the Rail Infrastructure Manager (**RIM**) of over seven hundred and sixty-three (763) level crossings in its 2,700 kilometres of heavy haul railways throughout the Central Queensland Region.

This project is a continuing rolling program each year to identify, renew and upgrade the level crossing through the four major coal systems in CQCN. These include the Goonyella, Moura, Newlands and Blackwater systems.

FY19 Other Projects

The remaining projects, outside of the top 10, appear across various categories and in some instances include post-commissioning expenditure. These projects are considered other projects for the purpose of this report, and hence are dealt with by way of summary. Table 10 summarises the value of non-material projects across each of the categories of Sustaining, Growth and Transformation.

Table 6. Summary of Other Projects

Project Type	Number of Other Projects	Capital Expenditure (excluding IDC)
Sustaining	31	15,785,935
Growth	4	-6,079,806
Transformation	4	8,596,304
Total	**39**	**$18,302,433**

The expenditure within the Growth and Transformation projects categories are primarily related to projects which have been approved by the QCA in previous years. Expenditure related to post-commissioning costs which form part of these categories as discussed in the Post Commissioning Expenditure section.

The projects within the Sustaining category (excluding the material projects detailed above), comprise the largest portion of this submission. These projects have been further segregated by the discipline of the tasks undertaken in those projects. As discussed in the section entitled Sustaining (Capital Renewal) Projects.

Post Commissioning Expenditure

A number of projects included in this FY19 Capital Expenditure submission have been commissioned in previous financial years. The substantive expenditure for these projects has been submitted to and approved by the QCA in prior year's submissions.

Accordingly, where expenditure has been captured against those projects post-commissioning, those amounts are being tendered in this submission for inclusion in the RAB as part of the efficient and prudent value of the assets.

Generally, costs relating to specific projects incurred in subsequent years are claimed annually until the project reaches financial close. These expenses are categorised as post-commissioning costs. Aurizon Network defines an asset commissioning as occurring when that asset has been certified as being available for the operation of revenue train services.

Demand for capacity is persistent in the CQCN, and as such to enable access to the rail networks as soon as possible, commissioning of a project – either growth or renewals – many take place prior to the completion of every aspect of work scheduled to be undertaken on a particular project. For example, diesel

traction trains can traverse a section of infrastructure before any electrical infrastructure necessary to facilitate electric traction trains is completed. Similarly, trains can traverse new infrastructure under direct train control (**DTC**) whilst signalling works are being completed. Accordingly, these types of work activities are scheduled to be completed towards the end of the project, such that the infrastructure may become operational as soon as safe.

Post commissioning cost may also be incurred on a project when there is a delay in processing invoices for externally contracted works. Costs may also be incurred during any defects or liabilities period prior to 'practical completion' and project handover to Aurizon Network's asset maintenance divisions for ongoing operation and maintenance.

The details of the projects on which Aurizon Network is submitting post commissioning expenditure for approval are set out in Table 11.

Table 7. Post-Commissioning Expenditure

Project Number	Project Name	Prior QCA Approved Expenditure	Capital Expenditure (excluding IDC)
	GROWTH		
A.01731	WIRP1: DINGO TO BLUFF DUPLICATION	208,465,446	108,391
A.04599	Havilah Culverts Upgrade	12,877,344	73,476
A.02976	WIRP1: North Coast Line	165,344,621	47,818
A.03686	WIRP1: MOURA SYSTEM UPGRADE	25,446,078	7,189
A.03735	WIRP1: Bauhinia NORTH Upgrade	15,054,934	1,194
A.01731	WIRP1: DINGO TO BLUFF DUPLICATION	208,465,446	108,391
A.04599	Havilah Culverts Upgrade	12,877,344	73,476
	SUSTAINING		
IV.00049	Radio System Replacement	23,351,894	3,609,098
IV.00399	2017 Cyclone Debbie Rectification	12,633,191	1,156,299
IV.00329	Structures Renewal FY18	15,054,900	926,232
IV.00004	Traction Fault Locator Renewal	1,985,507	881,498
IV.00346	Package 1 FY18 Control Systems Renewal	8,223,807	815,826
IV.00364	Turnout Renewal FY18	11,500,392	615,037
IV.00283	Traction SCADA System	2,078,916	811,715
IV.00364	Turnout Renewal FY18	11,500,392	696,543
A.04313	Gauge Face Lubrication Asset Renewal	6,513,572	564,946
IV.00334	Bridge Ballast Renewal Program FY18	7,272,262	493,610
IV.00321	Sleeper Renewal Program FY18	6,747,175	336,966
IV.00344	Formation Renewal FY18	12,236,291	330,989
IV.00360	Network Asset Mgt System Tranche 2	5,311,528	323,399
IV.00343	Level Crossings Renewal Program FY18	5,244,232	311,435
IV.00322	Rail Renewal FY18	21,468,545	210,734
IV.00154	FY17 Autotransformer Renewal Project	3,243,138	185,545
IV.00145	Track Upgrade FY17	26,736,855	154,769
IV.00184	Network Capacity Model	521,256	30,469
IV.00040	Train Detection Renewal Program	8,719,883	14,961
IV.00261	Telecommunications Infrastructure Renewal	1,875,684	7,105
IV.00266	Transmission Renewal FY17	1,926,012	6,281
IV.00177	Structures Renewal FY17	15,188,516	-16,709

SUSTAINING continued			
IV.00316	Access Points Renewal Program	308,344	-56,746
IV.00384	OH Equipment Renewal FY18	3,461,614	-113,497
IV.00144	Rail Renewal FY17	33,559,944	-117,009
IV.00323	Track Upgrade FY18	23,389,982	-1,114,038
TRANSFORMATION			
IV.00437	Callide Infrastructure Upgrade	5,151,241	2,298,631
TOTAL		**$690,893,105**	**$130,106,248**

Other Supporting Information

Additional information for individual projects listed in Appendix A: Capital Expenditure Project List is available on request during the review of this submission.

Conclusion

Aurizon Network is seeking the QCA's approval to include FY19 Capital Expenditure in the RAB, in accordance with clause 2 of Schedule E of UT5. This report provides the QCA with details of that capital expenditure which amounts to **$130,106,248** excluding IDC **$348,799**, for a total of **$130,455,047** including IDC.

Appendix A: Capital Expenditure Project List

Project Number	Project Name	Project Type	Project Discipline	Asset Type	System	Claimable Expenditure (pre-escalation)
			MATERIAL PROJECTS			
IV.00425	Rail Renewal Program Package 1	Capital Renewal	Civil	Rail	System Wide	26,572,373
IV.00446	Structures Renewal Package 1	Capital Renewal	Civil	Structures	System Wide	15,465,451
IV.00476	Track Renewal Package 1	Capital Renewal	Civil	Track	System Wide	15,193,594
IV.00461	Turnout Renewal Package 1	Capital Renewal	Civil	Turnouts	System Wide	14,053,345
IV.00452	Formation Renewal Package 1	Capital Renewal	Civil	Formation / Ballast	System Wide	9,851,560
IV.00449	Bridge Ballast Renewal Package 1	Capital Renewal	Civil	Formation / Ballast	System Wide	8,567,512
IV.00455	Control Systems Renewal Package 1	Capital Renewal	Systems	Network Controls	System Wide	6,875,112
IV.00473	Sleeper Renewal Package 1	Capital Renewal	Civil	Sleepers	System Wide	6,317,874
IV.00577	East End Fishermans Landing Infra Upgrade	Other	Civil	Track	Blackwater	4,858,621
IV.00458	Level Crossing Renewal Package 1	Capital Renewal	Systems	Level Crossings	System Wide	4,048,374
					Sub total	**$111,803,815**

Project Number	Project Name	Project Type	Project Discipline	Asset Type	System	Claimable Expenditure (pre-escalation)
			OTHER PROJECTS			
IV.00049	Radio System Replacement	Capital Renewal	Systems	Network Controls	System Wide	3,609,098
IV.00437	Callide Infrastructure Upgrade	Other	Civil	Track	Moura	2,298,631
IV.00555	FY19 Minerva Infrastructure Upgrade	Other	Civil	Track	Blackwater	1,379,635
IV.00470	Corridor Security Package 1	Capital Renewal	Corridor	Corridor Access	System Wide	1,381,137
IV.00399	2017 Cyclone Debbie Rectification	Capital Renewal	Civil	Various	System Wide	1,156,299
IV.00329	Structures Renewal FY18	Capital Renewal	Civil	Structures	System Wide	926,232
IV.00004	Traction Fault Locator Renewal	Capital Renewal	Electrical	Electrical	System Wide	881,498
IV.00376	FY18 Access Points	Capital Renewal	Corridor	Corridor Access	System Wide	843,497
IV.00346	Package 1 FY18 Control Systems Renewal	Capital Renewal	Systems	Network Controls	System Wide	815,826
IV.00503	Power Systems Renewal Package 1	Capital Renewal	Systems	Network Controls	System Wide	835,307
IV.00283	Traction SCADA System	Capital Renewal	Systems	Network Controls	System Wide	811,715
IV.00364	Turnout Renewal FY18	Capital Renewal	Civil	Turnouts	System Wide	696,543
A.04313	Gauge Face Lubrication Asset Renewal	Capital Renewal	Civil	Track	System Wide	564,946
IV.00334	Bridge Ballast Renewal Program FY18	Capital Renewal	Civil	Formation / Ballast	System Wide	493,610
IV.00467	Access Roads Package 1	Capital Renewal	Corridor	Corridor Access	System Wide	478,621
IV.00321	Sleeper Renewal Program FY18	Capital Renewal	Civil	Sleepers	System Wide	336,966
IV.00344	Formation Renewal FY18	Capital Renewal	Civil	Formation / Ballast	System Wide	330,989
IV.00374	CQ Access Roads FY18	Capital Renewal	Corridor	Corridor Access	System Wide	337,699
IV.00360	Network Asset Mgt System Tranche 2	Capital Renewal	Systems	Systems	System Wide	323,399
IV.00343	Level Crossings Renewal Program FY18	Capital Renewal	Systems	Level Crossings	System Wide	311,435
IV.00322	Rail Renewal FY18	Capital Renewal	Civil	Rail	System Wide	210,734
IV.00154	FY17 Autotransformer Renewal Project	Capital Renewal	Electrical	Power Systems	System Wide	185,545
IV.00145	Track Upgrade FY17	Capital Renewal	Civil	Track	System Wide	154,769
A.01731	WIRP1: DINGO TO BLUFF DUPLICATION	Growth	Civil	Track	Blackwater	108,391
A.04599	Havilah Culverts Upgrade	Growth	Expansion	Structures	Newlands	73,476
IV.00495	Coppabella Walkways Relocation	Other	Corridor	Corridor Access	Goonyella	59,417

Project Number	Project Name	Project Type	Project Discipline	Asset Type	System	Claimable Expenditure (pre-escalation)
			OTHER PROJECTS continued			
A.02976	WIRP1: North Coast Line	Growth	Civil	Track	Blackwater	47,818
IV.00184	Network Capacity Model	Capital Renewal	Systems	Systems	System Wide	30,469
IV.00040	Train Detection Renewal Program	Capital Renewal	Systems	Network Controls	Goonyella	14,961
IV.00261	Telecommunications Infrastructure Renewal	Capital Renewal	Systems	Telecommunication	System Wide	7,105
A.03686	WIRP1: MOURA SYSTEM UPGRADE	Growth	Civil	Track	Moura	7,189
IV.00266	Transmission Renewal FY17	Capital Renewal	Systems	Network Controls	System Wide	6,281
A.03735	WIRP1: Bauhinia NORTH Upgrade	Growth	Civil	Track	Blackwater	1,194
IV.00465	Access Points Package 1	Capital Renewal	Corridor	Corridor Access	System Wide	0
IV.00506	Electrical Overhead Renewal Package 1	Capital Renewal	Electrical	Electrical	System Wide	0
IV.00177	Structures Renewal FY17	Capital Renewal	Civil	Structures	System Wide	-16,709
IV.00316	Access Points Renewal Program	Capital Renewal	Corridor	Corridor Access	System Wide	-56,746
IV.00384	OH Equipment Renewal FY18	Capital Renewal	Electrical	Electrical	System Wide	-113,497
IV.00144	Rail Renewal FY17	Capital Renewal	Civil	Rail	System Wide	-117,009
IV.00323	Track Upgrade FY18	Capital Renewal	Civil	Track	System Wide	-1,114,038
					Sub total	$18,302,433
					TOTAL	$130,106,248