Murraylink

Attachment 13: Business Cases

January 2022

Business Case

Service Provider:	APA Group	**Date:**	January 2022
Asset:	Murraylink		
Project:	**Stay In Business**		
Project Type:	*Capex*	Capex *$3.510m*	
Prepared:	*Stuart Dodds*	*Asset Manager*	
Endorsed:	*Noel Powell*	*Reliability Engineer*	
Approved:	*Mark Allen*	*Regulatory Manager*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Murraylink Regulatory Proposal for the years 2023 to 2028.

SUMMARY OF BUSINESS CASE

The following Stay In Business (SIB) projects are recommended:

- Replacement or refurbishment of aging equipment to prevent unplanned equipment failure and associated reduction in the reliability of transmission services;
- Modifying the runback schemes to meet the requirement of Project Energy Connect and the Western Victoria Transmission Network Project; and
- SCADA system upgrade, safe access improvements, reactor cooling pipework support replacement, and other low cost capex for operational improvements.

The costs of the Murraylink stay in business projects is $3.510M over the 5-year revenue period.

BACKGROUND

This program of work completes capital works to maintain the existing Murraylink functionality, and the benefits provided by the Murraylink transmission services.

The program of work is a collections of low cost capital expenditure projects to ensure Murraylink effectively meets its obligations for reliability and regulatory requirements.

IDENTIFICATION OF NEED

To meet the demand for transmission services Murraylink must maintain reliable equipment operation and respond to changes in the business operating environment. Murraylink achieves equipment reliability by replacing or refurbishing aging equipment periodically.

The significant change to the AC network around Murraylink, from Project Energy Connect, is almost certain to necessitate changes to the Murraylink NSW runback scheme to ensure continued protection to the AC networks.

A pool of low cost capital expenditure has been identified as required to ensure Murraylink efficiently responds to changing requirements for reliability and technical regulation compliance.

EVALUATION OF ALTERNATIVES

Do nothing

Individual items of equipment within Murraylink can have a useful life shorter than the overall asset life. Aging equipment must be replaced or refurbished, prior to failure, to ensure Murraylink continues to reliably provide transmission services. Not performing the planned replacement or refurbishment work leaves Murraylink operating with an increased risk of unplanned interruption to transmission services and an associated reduction in the overall reliability of the transmission services.

Murraylink interfaces with the runback schemes that protect the AC network in NSW, Victorian and South Australian. In addition, Murraylink owns all the equipment in the NSW Runback scheme. Not modifying the Murraylink control system and NSW runback scheme equipment, to meet the requirement from changes to the surrounding AC network, will result in higher constraints applied to Murraylink, and an associated reduction in the benefit of the Murraylink transmission services.

The pool of low-cost capital expenditure has the aim of ensuring Murraylink efficiently responds to changing requirements for safety, reliability and technical regulation compliance. By not undertaking this work, Murraylink is less able to mitigate risk of operating below the required standard for reliability and technical regulation compliance.

Undertake SIB Projects

Undertaking the Stay-In-Busienss work enables Murraylink to continue reliably providing its transmission services.

RECOMMENDATION

The proposed solution is to complete the proposed SIB projects to ensure continued reliable transmission services.

ESTIMATE OF COST

The costs of the Murraylink stay in business projects is $3.510m over the 5 year revenue period.

The estimated costs for the recommendations detailed have been included in the capital expenditure forecasts for the Murraylink Regulatory submissions.

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The delivery of the project will be consistent with APA's project management and procurement policies.

JUSTIFICATION

The Stay In Business projects for Murraylink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules):

(1) meet the expected demand for prescribed transmission services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under sub rule (3) on the basis that the Stay In Business projects will assist to maintain the quality, reliability and security of supply of prescribed transmission service

Business Case

Service Provider:	APA Group	**Date:**	January 2022
Asset:	Murraylink		
Project:	Enhanced Cooling Systems		
Project Type:	*Capex*	*$3.252m*	
Prepared:	*Stuart Dodds*	*Asset Manager*	
Endorsed:	*Noel Powell*	*Reliability Engineer*	
Approved:	*Mark Allen*	*Regulatory Manager*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Murraylink Regulatory Proposal for the years 2023 to 2028.

SUMMARY OF BUSINESS CASE

Murraylink's power transmission capability deteriorates when the ambient temperature exceeds 40ºC. At ambient temperatures above 45ºC the cooling systems struggle to reject heat generated by the AC-DC conversion process, ultimately leading to significantly reduced transmission capability.

It is recommended that additional cooling equipment be installed to ensure the cooling systems can reject the heat, generated by the AC-DC conversion process, at times of high ambient temperatures.

The cost is $3.252M over the 5-year revenue period.

BACKGROUND

This program of work seeks to ensure Murraylink maintains reliable transmission services at times when demanding climatic conditions currently limit the power transfer capability.

Murraylink is designed for full power transmission capability up to 40ºC, then to reduce capability linearly as the ambient temperature increases up to 45ºC. At ambient temperatures above 45ºC the cooling systems struggle to reject heat

generated by the AC-DC conversion process, ultimately leading to significantly reduced transmission capability.

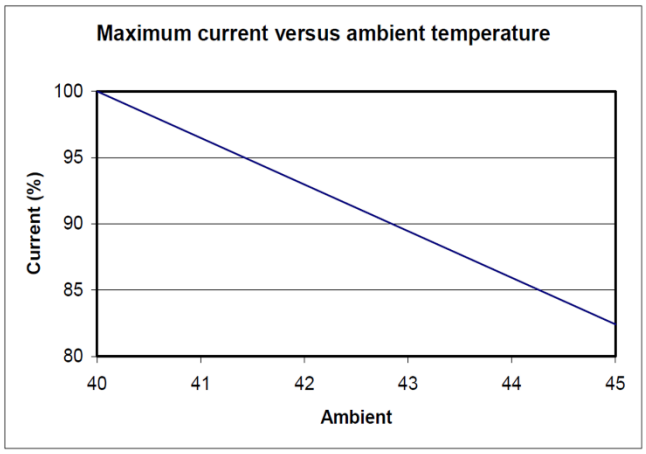
This business case covers the works to enhance the Murraylink cooling systems and improve the heat rejection capability of the Murraylink Cooling systems.

Due to worsening climatic conditions (i.e., expected increase in number of hot days), the enhanced cooling system is required to maintain the reliability of Murraylink.

IDENTIFICATION OF NEED

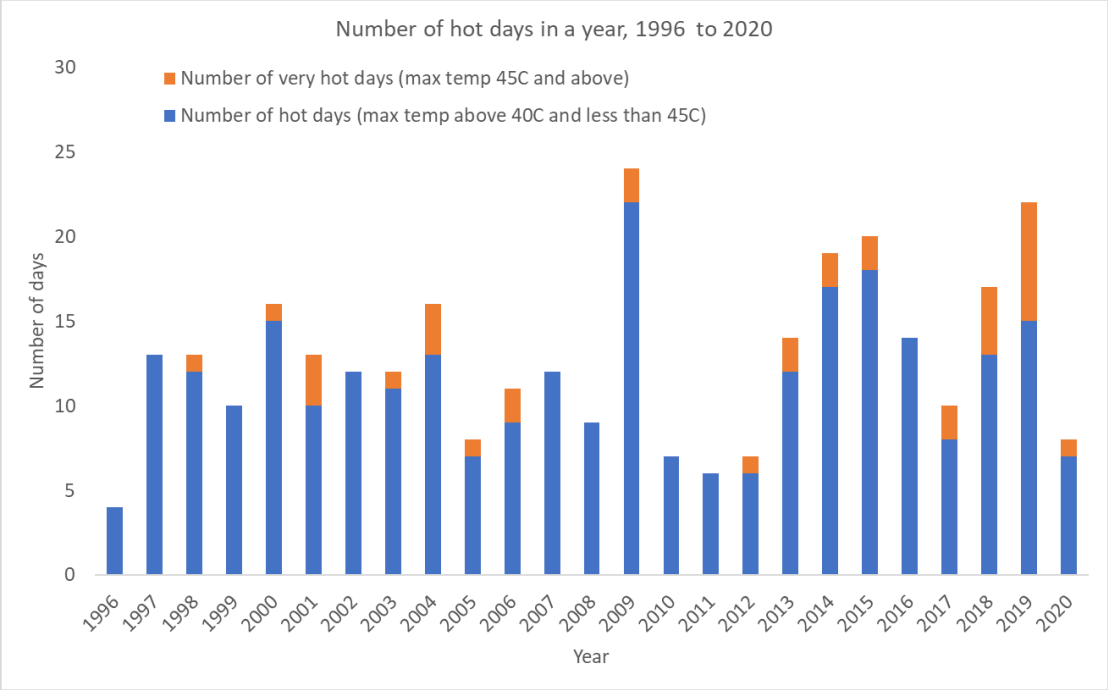
The Murraylink transmission services contribute to minimising price separation between Victoria and South Australia. This is particularly important during periods of high ambient temperatures where capability of the whole power system generation and transmission capacity is generally struggling to meet the consumer demand for power.

At ambient temperatures above 40 degrees Celsius, Murraylink power transfer derates linearly down to 82.5% at 45 degrees Celsius. Murraylink is not able to effectively reject the heat generated from its operating equipment at ambient temperatures beyond 45 degrees Celsius. See chart below.



Source: Murraylink Maximum current at ambient above 40 degree C., ABB design document, 2002-09-12, pages 1 and 2

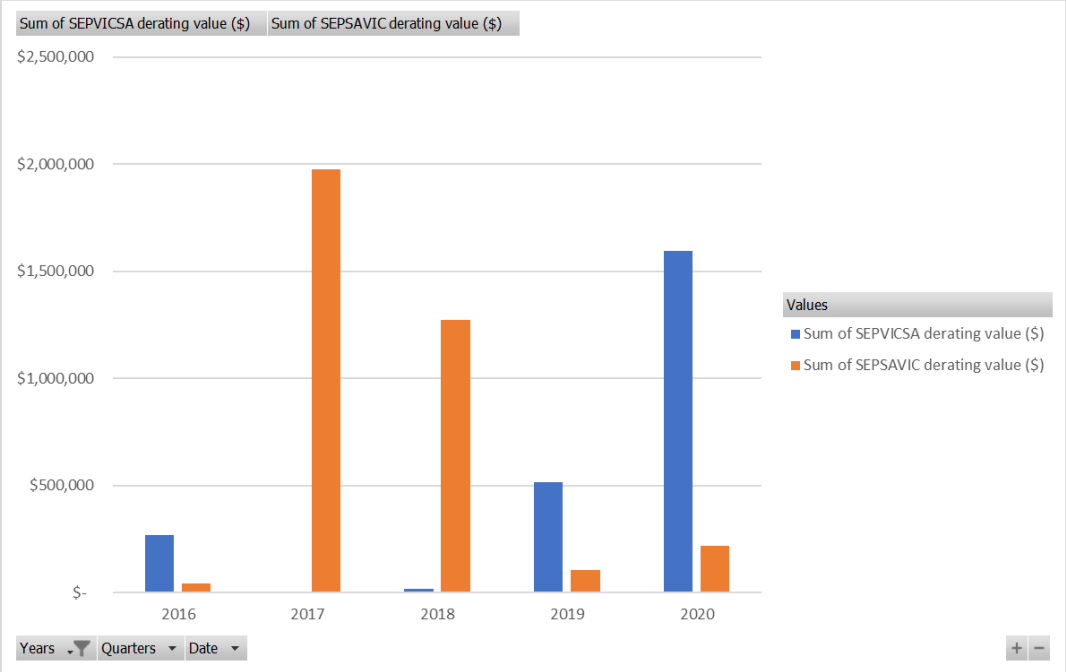
Long term climate forecasts predict a general global warming trend which creates a foreseeable increase in the number of summer days with ambient temperatures above 45 degrees Celsius in the region around Murraylink. Analysis of maximum temperature data from close to the Murraylink Berri converter station (Renmark Airport) seems to support the forecast for an increasing number of days above 45 degrees Celsius. See figure below.



A role of Murraylink is providing power transfer capacity between Victoria and South Australia to minimise price separation. By investing in an enhanced cooling system, the capacity of Murraylink can be maintained during the more numerous hot days in the future (i.e. mitigating derating).

The cost of price separations events at high ambient temperatures has been found to be approximately $6M over the 5 years ending 2021. Enabling operation at full rated power for high ambient temperatures will maximise Murraylink's contribution to minimising the price separation between Victoria and South Australia. The chart below shows cost of price separation between Victoria and South Australia from 2016 to 2020:

- SEPVICSA is the difference between the Vic half-hourly price and SA half-hourly spot price, where the Vic price is higher than the SA price.
- SEPSAVIC is the difference between the Vic half-hourly price and SA half-hourly spot price, where the SA price is higher than the Vic price.



EVALUATION OF ALTERNATIVES

Do nothing

Murraylink can continue to provide transmission service with the same cooling systems as has been the case since commissioning. However, during time of high ambient temperatures, Murraylink will derate its transmission capability to ensure equipment is not damaged.

Refrigeration Chiller Cooling

This option involves annual hiring of refrigeration chillers and diesel generators then using the chillers to cool the air that is drawn in by the existing cooling systems. The estimated cost of this options is $450k per annum for 12 weeks of hire over the summer period. This is not the preferred option as relies on being able to hire equipment at a predictable cost for the remaining life of Murraylink.

Evaporative Cooling

This option involves installing evaporative coolers to cool the air that is drawn in by the existing cooling systems. The estimated cost of the evaporative cooling installation is $3.252m and the on-going running cost is negligible. This option is the preferred due to its controllable project cost and negligible lifetime running cost.

Enhancing the Murraylink cooling systems will ensure Murraylink is able to provide its full transmission capability at ambient temperatures above 40ºC. The project aims to

install additional cooling equipment to ensure the cooling systems are able to reject the heat generated by the AC-DC conversion process.

This will maintain reliability of Murraylink.

RECOMMENDATION

The proposed solution is to implement measures that ensure the Murraylink cooling systems enable full transmission services at ambient temperatures above 40ºC.

ESTIMATE OF COST

The costs to enhance the Murraylink cooling systems is $3.252m over the 5-year revenue period.

The estimated costs for the recommendations detailed have been included in the capital expenditure forecasts for the Murraylink Regulatory submissions.

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The delivery of the project will be consistent with APA's project management and procurement policies.

JUSTIFICATION

The enhanced cooling systems for Murraylink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules):

(1) meet the expected demand for prescribed transmission services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under sub rule (3) on the basis that the enhanced cooling systems will assist to maintain the quality, reliability and security of supply of prescribed transmission service

Business Case

Service Provider:	APA Group	**Date:**	January 2022
Asset:	Murraylink		
Project:	**Cable Modification**		
Project Type:	*Capex/Opex :*	Capex *$2.484m*	
Prepared:	*Stuart Dodds*	*Asset Manager*	
Endorsed:	*Noel Powell*	*Reliability Engineer*	
Approved:	*Mark Allen*	*Regulatory Manager*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Murraylink Regulatory Proposal for the years 2023 to 2028.

SUMMARY OF BUSINESS CASE

In order to prevent or mitigate unintended third-party interference of the Murraylink cables, Murraylink recommends the following:

- Replacing the DC cables marker signage where the cables pass through public land; and
- Relocating DC cables from the South Australian government inspection station near the South Australia – Victoria border. This is because the level of development activities in the surrounding this area is high. Such high activity level would potentially increase the frequency and complexity associated with cable fault repair.

The cost of the project is $2.484M over the five-year revenue period.

BACKGROUND

Murraylink invests in protecting the underground high voltage DC cables from unintended third-party interference. This is achieved through a range of measures including:

- clear cable route signage for the public when they are near the cables; and

- coordinating with surrounding development activities (e.g., roadworks) to prevent such unintended interference.

Cable route signage

To prevent or minimise unintended interference by the public, cable route signage is important to inform the location of underground DC cables. The existing signage has been in place since the original cable installation. With age the signs fade, particularly the high visibility red, red “Danger” part of the sign. The signs have been rejuvenated several times to maintain their visibility, but the rejuvenation process becomes less effective as the signs age. In addition, the signs should be increased in size to improve their visibility and deterrent effect.

Coordinating with surrounding development activities

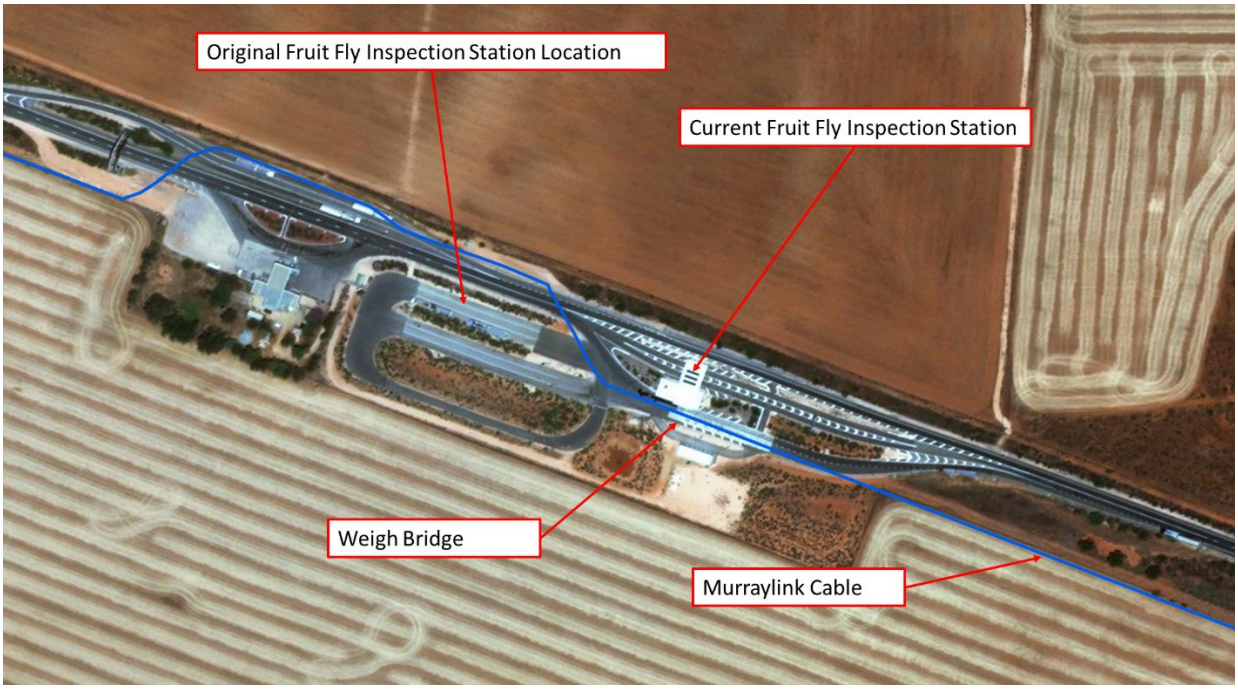
Development activities surrounding the cables can unintendedly interfere with Murraylinks cables. Murrarylinks constantly monitors such developments and take the necessary measures to prevent the interference.

There are considerable development activities on the southern side of the Sturt Highway, around the South Australian government inspection station near the South Australia – Victoria border. This includes the following:

- A new, larger inspection station has been built to the east of its original location, with a new weigh bridge, roads, buildings and car parks.

- Major road works are planned for an existing intersection on the Sturt Highway, near Berri and Monash in South Australia.

These activities are in close proximity to the current location of the Murraylink DC cables as illustrated in the image below.

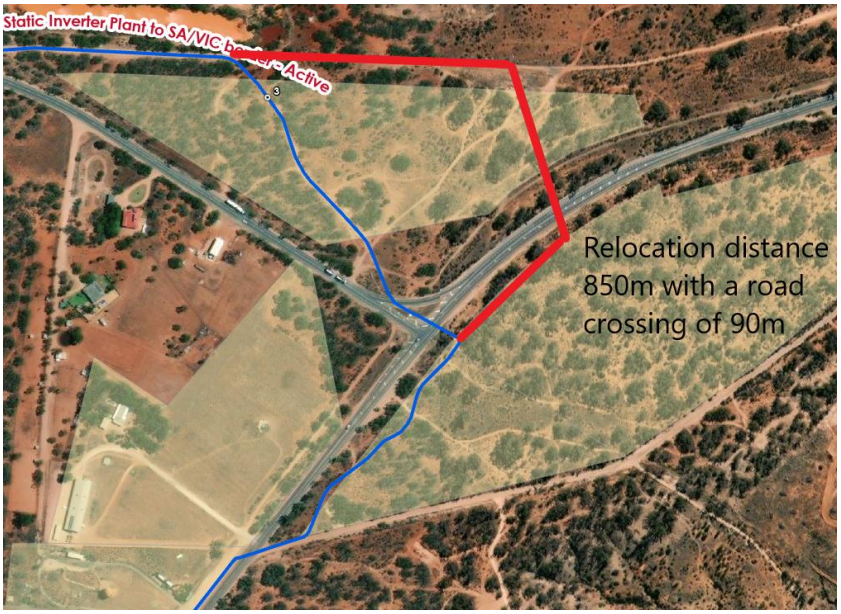


Murraylink cable (blue line) passing between building and weigh bridge at the SA Fruit Fly Inspection station.

The close proximity of buildings to the cables, and high level of activities around the area (including further development works, routine building maintenance activities, car and pedestrian traffic) can significantly increase the likelihood of cable faults and the time required to repair such faults.

There are complex technical challenges associated with repairing a cable fault, making it infeasible under some circumstances. Repairing such fault would requires excavation of the cables, cutting out the failed section of cable, and splicing in a new section. The excavation also needs to be large enough to allow cable jointers to work inside the excavation to splice in the new section of cable. In addition, the repaired cable cannot be laid in the same narrow alignment achieved by the original installation methodology, and the spliced in section of cable needs to "snake" sideways resulting in a wider alignment.

In order to avoid or mitigate the complexity of having to deal with cable repairs, it is proposed that the relevant section of the Murraylink cable be relocated away from the proposed roadworks – as shown in the image below. In this image, the current location is shown in blue, and the proposed new location in red.



Murraylink cable (blue line) and proposed relocation (red line) to avoid future Sturt Highway intersection upgrade.

IDENTIFICATION OF NEED

The Murraylink operations team have identified the likelihood and time to repair a cable fault, in and around the fruit fly inspection station and the Monash-Berri intersection, as presenting an unacceptable risk to the provision of the transmission services provided by Murraylink.

EVALUATION OF ALTERNATIVES

Do nothing

The cable route signage will continue to deteriorate, resulting in reduced visibility of the signage. This is likely to reduce the effectiveness in preventing public interference on the cables.

Should a cable fault occur, it is very likely transmission services could not resume until the cables were relocated to enable safe and effective repair.

Pre-Planning for Cable Relocation

Undertaking the planning and approvals required for the cable relocation would reduce the overall time required for the cable fault repair. However significant disruption the transmission services would still result from the work to relocate the Murraylink cables in the event of an unplanned fault.

Pre-emptive Cable Relocation

Murraylink can also pre-emptively plan for relocating the cables in such a way that minimises the risk of significant disruption of the Murraylink transmission services.

RECOMMENDATION

Warning Sign Replacement

The proposed solution is to replace the DC cables marker signs where the cables pass through public land.

Pre-emptive Cable Relocation

The proposed solution is to relocate the DC cables to the northern of the Sturt Highway, clear of the entire South Australian government inspection station.

ESTIMATE OF COST

The total estimate for the project is $2.484m.

The pre-emptive cable relocation is forecast to be executed in FY26.

The warning sign replacement is forecast to be executed in FY24 to FY28.

The estimated costs for the recommendations detailed have been included in the capital expenditure forecasts for the Murraylink Regulatory submissions.

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) and 6A.6.6(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The delivery of the project will be consistent with APA's project management and procurement policies.

JUSTIFICATION

The Cable Modification Program for Murraylink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules):

(1) meet the expected demand for prescribed transmission services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under sub rule (3) on the basis that the cable modification and signage works will assist to maintain the quality, reliability and security of supply of prescribed transmission service

Business Case

Service Provider:	APA Group		**Date:**	January 2022
Asset:	Murraylink			
Project:	Reliability			
Project Type:	*Capex*	*$1.751m*		
Prepared:	*Stuart Dodds*	*Asset Manager*		
Endorsed:	*Noel Powell*	*Reliability Engineer*		
Approved:	*Mark Allen*	*Regulatory Manager*		

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Murraylink Regulatory Proposal for the years 2023 to 2028.

SUMMARY OF BUSINESS CASE

This program of work seeks to mitigate the risks that threaten the reliable operation of Murraylink. The recommended measures include:

- Uninterruptable Power Supply upgrade;
- Flood mitigation measures; and
- Red Cliffs AC protection relay replacement

These measures are expected to improve resilience of the asset.

The project cost is $1.751M over the 5 year revenue period.

IDENTIFICATION OF NEED

To maintain the reliability of the prescribed transmission services, Murraylink must implement controls to mitigate the known causes of unreliable operation.

This requires Murraylink to:

- **Maintain the reliability of the control system**: UPS systems are essential to maintaining the reliability of the control system. The UPS maintains power supply to the control and protection equipment in the event of an auxiliary power outage. A UPS outage impacts the operation of Murraylink for many hours after the power is restored. The control and protection system must be checked for correct operation before allowing Murraylink to resume transmission services.

- **Manage flood risk**: the Red Cliffs converter station is located less than 50 metres the Murray River and protected only by a levy bank on an adjoining property. Should the levy fail, and flood waters enter the converter building, transmission services are expected to be disrupted for several weeks. Hence, appropriate measures need to be in place to manage such risk.

- **Red Cliffs AC Protection Relay Replacement**: The AC cable, between Murraylink and the Red Cliffs Terminal Station, is protected by two protection relays that have reached the end of their useful life. An unexpected failure of a protection relay will disrupt Murraylink transmission services for a significant period of time and increase the risk of material damage to the AC cable.

EVALUATION OF ALTERNATIVES

Do nothing

Not completing the proposed measures fails to meet the expectation of regulators, industry, and consumers for Murraylink reliable transmission. The upgrade and replacement works are required to efficiently restore the equipment to as new condition so it can be relied upon to operate in a predictable manner under foreseeable operating conditions. The flood risk mitigation work is required to ensure the Murraylink transmission services are protected from risks that can disrupt operations for a significant time.

Undertake Reliability Measures

Implementing the upgrade and replacement works ensures the equipment continues to perform its function and contributes to the overall reliability of Murraylink.

Implementing risk mitigation measures meet the expectation of regulators, the industry, and consumers for Murraylink and protects the Murraylink transmission services from significant potential disruption.

RECOMMENDATION

The proposed solution is to complete the refurbishment and risk mitigation measures.

ESTIMATE OF COST

The costs to complete the refurbishment and risk mitigation measures is $1.751m over the 5 year revenue period.

The estimated costs for the recommendations detailed have been included in the capital expenditure forecasts for the Murraylink Regulatory submissions.

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The delivery of the project will be consistent with APA's project management and procurement policies.

JUSTIFICATION

The refurbishment and risk mitigation measures for Murraylink are required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules):

(1) meet the expected demand for prescribed transmission services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under sub rule (3) on the basis that the refurbishment and risk mitigation measures will assist to maintain the quality, reliability and security of supply of prescribed transmission service

Business Case

Service Provider:	APA Group	**Date:**	January 2022
Asset:	Murraylink		
Project:	Essential Spares		
Project Type:	*Capex*	*$1.232m*	
Prepared:	*Stuart Dodds*	*Asset Manager*	
Endorsed:	*Noel Powell*	*Reliability Engineer*	
Approved:	*Mark Allen*	*Regulatory Manager*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Murraylink Regulatory Proposal for the years 2023 to 2028.

SUMMARY OF BUSINESS CASE

The program of essential spares purchasing seeks to maintain Murraylink's availability by ensuring spare parts are available to replace failed equipment as required. Replacing spare parts as they are consumed ensures the inventory of spares is readily available to maintain reliability of the Murraylink transmission services.

The spare parts inventory covers all Murraylink sub-systems including low voltage auxiliary power, cooling, air conditioning, control systems, and high voltage components.

This business case includes the purchasing for all spare parts, however it excludes purchasing of spare IGBTs, which are no longer available to Murraylink in the forthcoming regulatory period.

The costs to maintain the Murraylink inventory is $1.232M over the 5-year revenue period.

IDENTIFICATION OF NEED

To meet the demand for transmission services Murraylink must maintain a high level of availability. Many items of equipment, that are essential to the operation of Murraylink, have long lead times for procurement. Maintaining the inventory of spare parts is necessary to enable timely restoration of transmission services.

EVALUATION OF ALTERNATIVES

Do nothing

Not maintaining the inventory of spare parts would result in a degradation in the availability of Murraylink. Should a fault occur, and spare parts not be available, Murraylink could not resume transmission services until the requires spare part were delivered.

Maintain Inventory

Maintaining the inventory of spare equipment enables prompt repair of equipment faults and ensures the Murraylink transmission services continue to meet the standard and quality required by the National Electricity Rules.

RECOMMENDATION

The proposed solution is to maintain the inventory of spare equipment.

ESTIMATE OF COST

The costs to maintain the Murraylink inventory is $1.232M over the 5-year revenue period.

The estimated costs for the recommendations detailed have been included in the capital expenditure forecasts for the Murraylink Regulatory submissions.

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The delivery of the project will be consistent with APA's project management and procurement policies.

JUSTIFICATION

The essential spares purchasing program for Murraylink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules):

(1) meet the expected demand for prescribed transmission services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under sub rule (3) on the basis that the essential spares purchasing will assist to maintain the quality, reliability and security of supply of prescribed transmission service