Regulatory Investment Test for Distribution

Final Project Assessment Report

Addressing Reliability Requirements in the Cannonvale Network Area

Publication Date: **13 March 2020**

Part of Energy Queensland

Executive Summary

ABOUT ERGON ENERGY

Ergon Energy Corporation Limited (Ergon Energy) is part of the Energy Queensland Group and manages an electricity distribution network which supplies electricity to more than 740,000 customers. Our vast operating area covers over one million square kilometres – around 97% of the state of Queensland – from the expanding coastal and rural population centres to the remote communities of outback Queensland and the Torres Strait.

Our electricity network consists of approximately 160,000 kilometres of powerlines and one million power poles, along with associated infrastructure such as major substations and power transformers.

We also own and operate 33 stand-alone power stations that provide supply to isolated communities across Queensland which are not connected to the main electricity grid.

IDENTIFIED NEED

Ergon Energy Corporation Limited (Ergon Energy) is responsible (under its Distribution Authority) for electricity supply to the Cannonvale / Airlie Beach area in North Queensland.

The Airlie Beach region is a nationally and internationally renowned tourism hub in North Queensland located approximately 100km north of Mackay. In addition to being a holiday destination in its own right, Airlie Beach is the major tourism gateway to the Whitsunday Islands.

The region is supplied by four key substations, with Cannonvale (CANN) and Jubilee Pocket (JUPO) being the main substations supplying the mainland, and Mount Rooper (MORO) and Shuthaven (SHUT) supplying the Whitsunday Islands. Ergon Energy's 66kV sub-transmission and distribution networks supply approximately 7,931 premises in the area, with major customers including Proserpine Sugar Mill, Hamilton Island, Hayman Island, South Molle Island, Daydream Island and numerous hotels and marinas.

The customer base of 7,931 premises including the major holiday destinations of Airlie Beach and Hamilton, Hayman and Daydream Islands are supplied from radial 66kV sub-transmission lines. The radial supply arrangement to the area and the existing manual 66kV switching arrangement at Cannonvale has resulted in less than ideal power supply reliability due to frequent outages.

From Cannonvale Substation (CANN) which is the main substation in the area, the radial 66kV network supplying the other three substations has a load of approximately 16.4MVA. A credible fault on this network would mean that load cannot be restored within the requirements of the Safety Net security criteria, with this situation worsening as load increases.

The CANN-01 66kV feeder cable entering the switchyard at CANN failed in January 2017. It is probable that other failures in cables of the same type and age will occur over the next few years as all cables in and out of CANN are of similar type and vintage as the failed CANN-01 entry cable. Any restoration of such a failure is likely to result in extended outage durations to customers and island resorts. Additionally, the transformer 66kV circuit breakers at Cannonvale are planned for condition-based replacement due to safety concerns in the event of a potential failure.

The combination of these drivers has prompted a coordinated plan to review and reinforce the 66kV supply arrangement to meet security criteria obligations, address aged asset issues, improve supply reliability to customers and provide capacity for future growth and development.

APPROACH

The National Electricity Rules (NER) require that, subject to certain exclusion criteria, network business investments for meeting service standards for a distribution business are subject to a Regulatory Investment Test for Distribution (RIT-D). Ergon Energy has determined that network investment is essential in this case for it to continue to provide electricity to the consumers in the Cannonvale and Jubilee Pocket supply areas in a reliable, safe and cost-effective manner. Accordingly, this investment is subject to a RIT-D.

Ergon Energy published a Draft Project Assessment Report for the above described network constraint on 15 November 2019. No submissions were received by the closing date of 27 December 2019.

Three potentially feasible options have been investigated:

- **Option A:** Cannonvale Substation 66kV Switchyard Upgrade & Duplication / Replacement of 66kV Cables.
- **Option B:** New Dedicated 66kV Feeder from Proserpine to Proserpine Mill & Duplication / Replacement of 66kV Cables.
- **Option C:** Construct 66kV switchyard at future Riordanvale Substation site & duplication / replacement of 66kV cables.

This Final Project Assessment Report (FPAR), where Ergon Energy provides both technical and economic information about possible solutions, has been prepared in accordance with the requirements of clause 5.17.4(o). Ergon Energy's preferred solution to address the identified need is Option A – Cannonvale Substation 66kV Switchyard Upgrade & Duplication / Replacement of 66kV Cables.

1 Introduction

This FPAR has been prepared by Ergon Energy in accordance with the requirements of clause 5.17.4(o) of the NER.

This report represents the final stage of the consultation process in relation to the application of the RIT-D on potential credible options to address the identified need for the Cannonvale and Jubilee Pocket network area.

In preparing this RIT-D, Ergon Energy is required to consider reasonable future scenarios. With respect to major customer loads and generation, Ergon Energy has, in good faith, included as much detail as possible while maintaining necessary customer confidentiality. Potential large future connections that Ergon Energy is aware of are in different stages of progress and are subject to change (including outcomes where none or all proceed). These and other customer activity can occur over the consultation period and may change the timing and/or scope of any proposed solutions.

1.1. Response to the DPAR

Ergon Energy published a Draft Project Assessment Report for the identified need in the Cannonvale and Jubilee Pocket network area on the 15 November 2019. No submissions were received by the closing date of the 27 December 2019.

1.2. Structure of this report

This report:

- Provides background information on the network capability limitations of the distribution network supplying the Cannonvale and Jubilee Pocket network area.
- Identifies the need which Ergon Energy is seeking to address, together with the assumptions used in identifying and quantifying that need.
- Describes the credible options that are considered in this RIT-D assessment.
- Quantifies costs and classes of material market benefits for each of the credible options.
- Describes the methods used in quantifying each class of market benefit.
- Provides details of classes of market benefits that are not considered material to this RIT-D assessment and provides explanations as to why these classes of market benefits are not considered material.
- Provides the results of Net Present Value (NPV) analysis of each credible option and accompanying explanatory statements regarding the results.
- Identifies the proposed preferred option, including detailed characteristics, estimated commissioning date, indicative costs, and noting that it satisfies the RIT-D.
- Provides contact details for queries on this RIT-D.

1.3. Dispute Resolution Process

In accordance with the provisions set out in clause 5.17.5(a) of the NER, Registered Participants or Interested Parties may, within 30 days after the publication of this report, dispute the conclusions made by Ergon Energy in this report with the Australian Energy Regulator. Accordingly, Registered

Participants and Interested Parties who wish to dispute the conclusions outlined in this report based on a manifest error in the calculations or application of the RIT-D must do so within 30 days of the publication date of this report. Any parties raising a dispute are also required to notify Ergon Energy. Dispute notifications should be sent to demandmanagement@ergon.com.au

If no formal dispute is raised, Ergon Energy will proceed with the preferred option to upgrade the Cannonvale Substation 66kV Switchyard and duplicate / replace 66kV Cables.

1.4. Contact Details

Inquiries about this RIT-D may be sent to:

E: demandmanagement@ergon.com.au

P: 13 74 66

2 Background

2.1. Geographic Region

The geographic region covered by this RIT-D is the Cannonvale Substation and surrounding 66kV sub-transmission network. The network in this area consists of approximately 7,931 customers, with major customers including Proserpine Sugar Mill, Hamilton Island, Hayman Island, South Molle Island and Daydream Island, and is located in the Mackay area of the Northern Region of Ergon Energy's Network.

The geographical location of Ergon Energy's 66kV sub-transmission network and substations in the Cannonvale / Airlie Beach area is illustrated in the Google Earth image below.

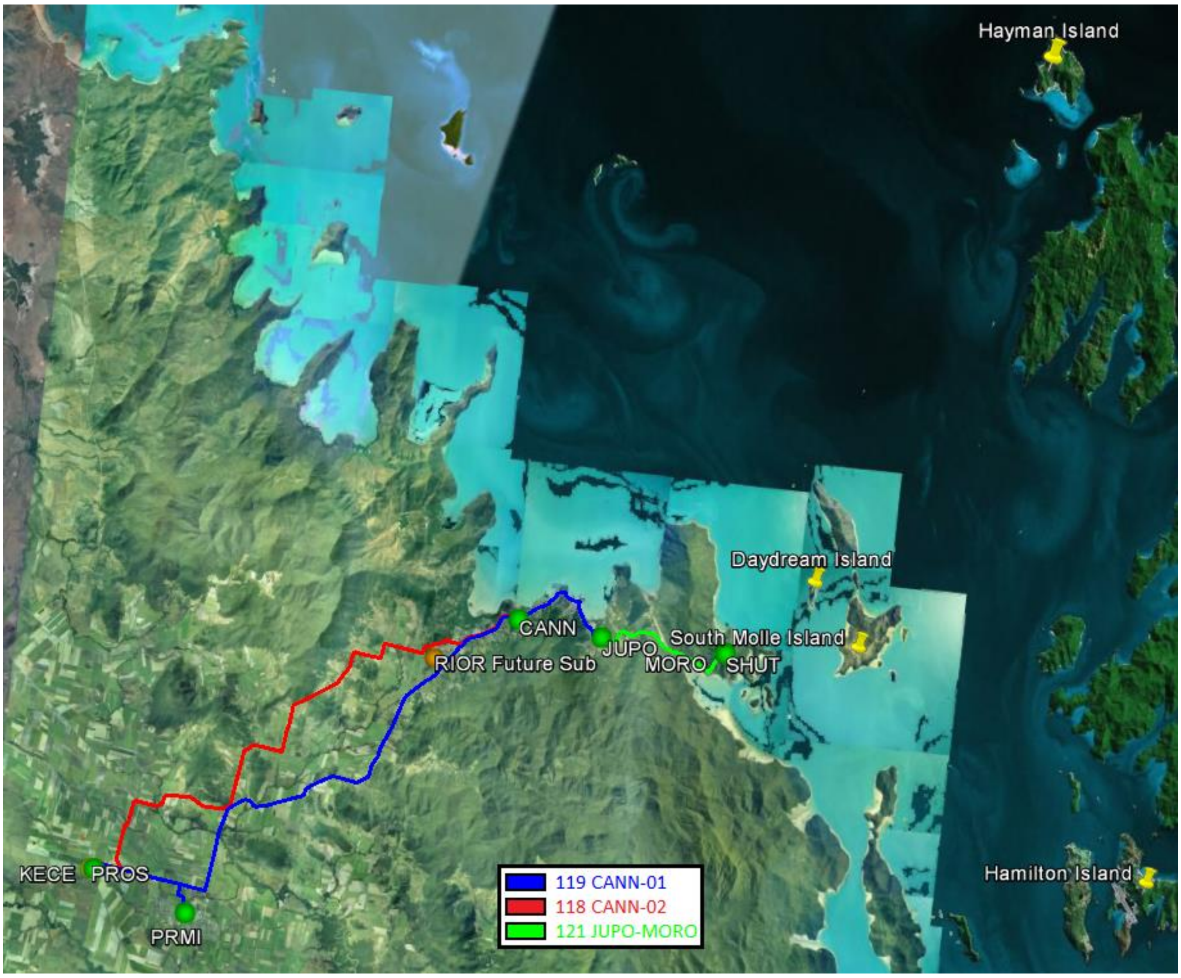

Figure 1: Cannonvale / Airlie Beach 66kV Sub-transmission Network

2.2. Existing Supply System

The Cannonvale / Airlie Beach area is supplied from Cannonvale (CANN) 66/11kV, Jubilee Pocket (JUPO) 66/11kV, Mount Rooper (MORO) 66/11kV and Shutehaven (SHUT) 66/22kV zone substations.

Cannonvale (CANN) Substation presently supplies 6,124 customers and has two 15MVA 66/11kV transformers which have an N-1 transformer cyclic and long-term emergency cyclic rating of 18.9MVA and 20.0MVA respectively. Two 4.8MVAr 11kV capacitor banks can minimise the transformer load and improve the substation power factor however their primary function is to provide voltage support during 66kV feeder outages and network re-configuration.

Jubilee Pocket (JUPO) Substation currently supplies 1,693 customers via one 32MVA 66/11kV OLTC transformer, three 11kV feeders and a 4.8MVAr 11kV capacitor bank which also provides 66kV network support under contingency conditions. JUPO was constructed with a fully switched 66kV bus and outgoing 66kV feeder to Mt Rooper. A spare 66kV feeder bay will accommodate a future second feeder from CANN. There is also a second cold standby 32MVA 66/11kV OLTC transformer on-site which has been retained as an in-situ spare.

Mount Rooper (MORO) Substation currently supplies 111 customers including the major 11kV customer Daydream Island/South Molle Island via privately owned submarine cables and an 11kV mainland connection point and recloser. The substation has a single 5MVA 66/11kV fixed tap transformer that supplies unregulated 11kV to the islands, however a set of 100A voltage regulators regulates the voltage on the 11kV Shute Harbour feeder supplying approx. 79 customers. There is a N/O 11kV feeder tie to the Mandalay feeder from JUPO.

Shutehaven (SHUT) Substation currently supplies three customers including the major 22kV customer Long Island/Hamilton Island via privately owned 22kV submarine cables and a 22kV mainland connection point and recloser. The 22kV submarine cable to Hayman Island is owned by Ergon Energy. On the island, a fixed tap 5MVA 22/11kV transformer supplies the resort via an 11kV connection point. SHUT has one 25MVA 66/22kV OLTC transformer.

Proserpine Mill (PRMI) Substation has a single 10/12MVA 66/11kV OLTC transformer that currently supplies the township of Proserpine (i.e. 80 customers) and the embedded generator Proserpine Sugar Mill. The Authorised Demand of Proserpine Mill is 10MVA (10MW) export and 4MVA (3.6MW) import.

The Cannonvale / Airlie Beach area zone substations are supplied via two radial 66kV feeders (119 Cannonvale No. 1 and 118 Cannonvale No. 2 feeders) out of T39 Proserpine (PROS) 132/66kV Substation. Cannonvale No. 2 (CANN-02) supplies Cannonvale Substation while Cannonvale No. 1 (CANN-01) bypasses Cannonvale Substation to supply Jubilee Pocket, Shutehaven and Mount Rooper Substations.

The 66kV feeders between Proserpine and Cannonvale are predominantly timber pole, timber crossarm construction but with no overhead earthwire. One line is constructed in 1984 and the other in 2000. The summer day (SD) overhead line ratings of CANN-01 and CANN-02 are 43.0MVA and 45.6MVA respectively. The backbone circuit distance from Proserpine to Cannonvale is approximately 24.9km (CANN-01) and 27km (CANN-02).

CANN-01 has a hard tee (of approx. 1.0km O/H and 0.37km U/G) to Proserpine Mill (PRMI) 66/11kV Substation, 4.0km from Proserpine.

The existing 66kV network arrangement is shown schematically in the figure below.

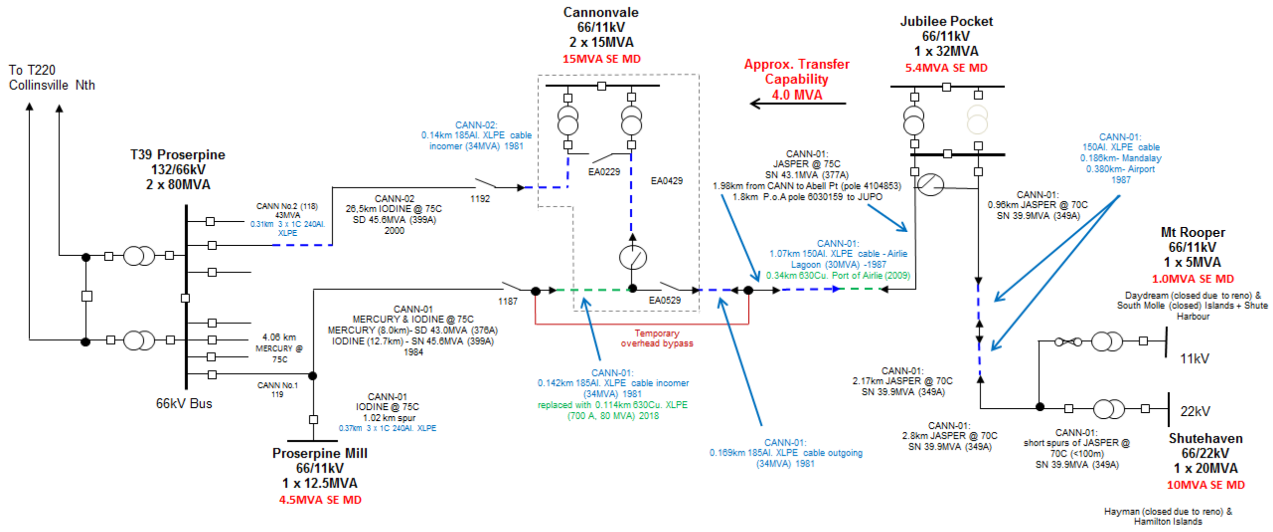

Figure 2: Existing 66kV Sub-transmission Network

There are also plans for a future 66/11kV substation at Riordanvale to in order to accommodate further load growth in the distribution network to the south-west of Cannonvale.

2.3. Load Profiles / Forecasts

The load at Cannonvale / Airlie Beach comprises a mix of residential and industrial customers. Daily peak loads generally occur in the late afternoon and evening. The load is summer peaking, and annual peak loads are predominantly driven by air-conditioning.

2.3.1. Cannonvale (CANN) 66/11kV Substation

The historical load of Cannonvale Substation for the summer day (SD), summer night (SN), winter day (WD) and winter night (WN) periods since 2004 is shown in the figure below.

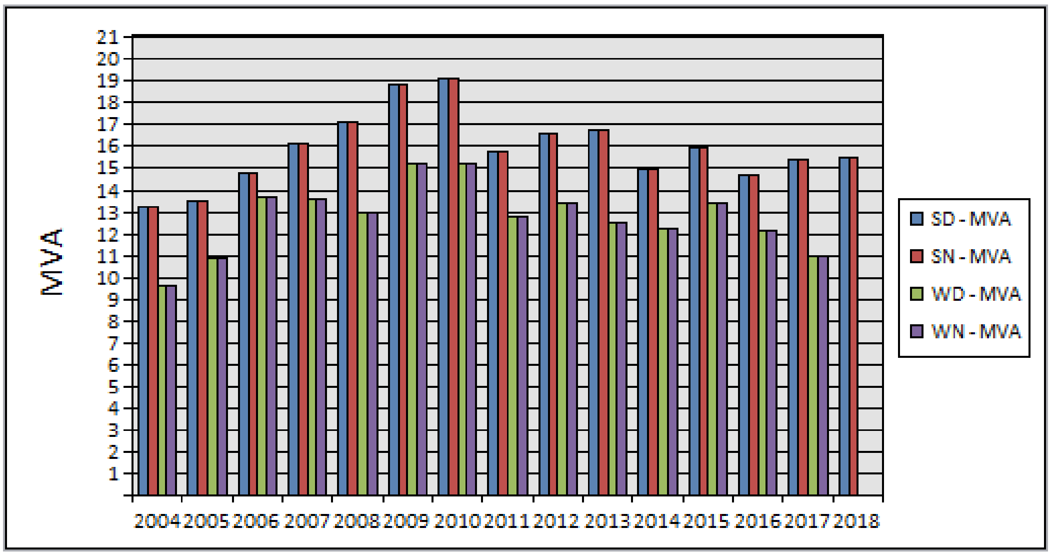

Figure 3: Historical Load of Cannonvale Substation (Since 2004)

The sudden drop in load seen between 2010 and 2011 is a result of Jubilee Pocket Substation being energised and taking some of the load from Cannonvale.

Taking into account historical feeder growth and the forecast population growth, a load growth of 2% is expected. The peak load by 2030 will then be 19.15MVA. Under a high load growth of 4%, the load would increase to 24.18MVA.

It should be noted that the Cannonvale Substation summer peaks were being experienced between 1.30 pm to 4.00 pm in the afternoon, however in recent years (2015 to 2018 inclusive), the summer peak is now being experienced from 4.30 pm to 7.30 pm due to the installation of customer-owned rooftop solar PV systems (refer to the figure below).

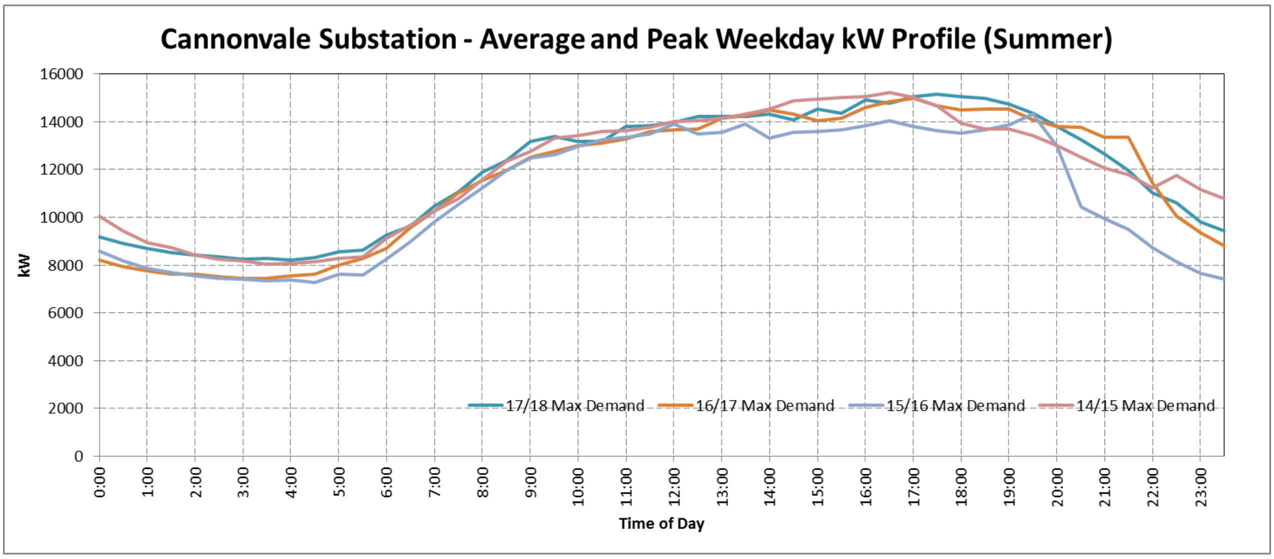

Figure 4: Cannonvale Average & Peak Weekday Load Profile (Summer)

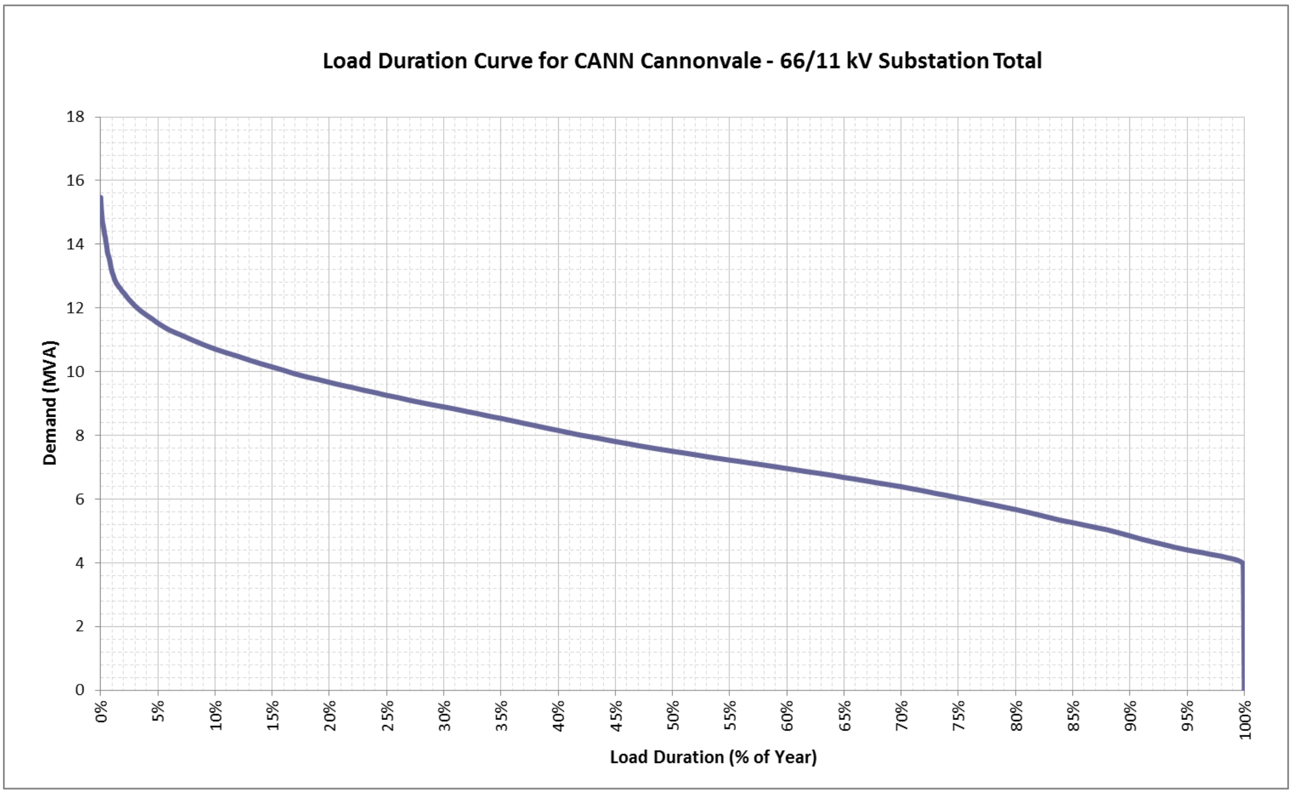

Figure 5: Cannonvale Load Duration Curve

2.3.2. Jubilee Pocket (JUPO) 66/11kV Substation

The historical load of Jubilee Pocket Substation for the summer day (SD), summer night (SN), winter day (WD) and winter night (WN) periods since its energisation in 2010 is shown in the figure below.

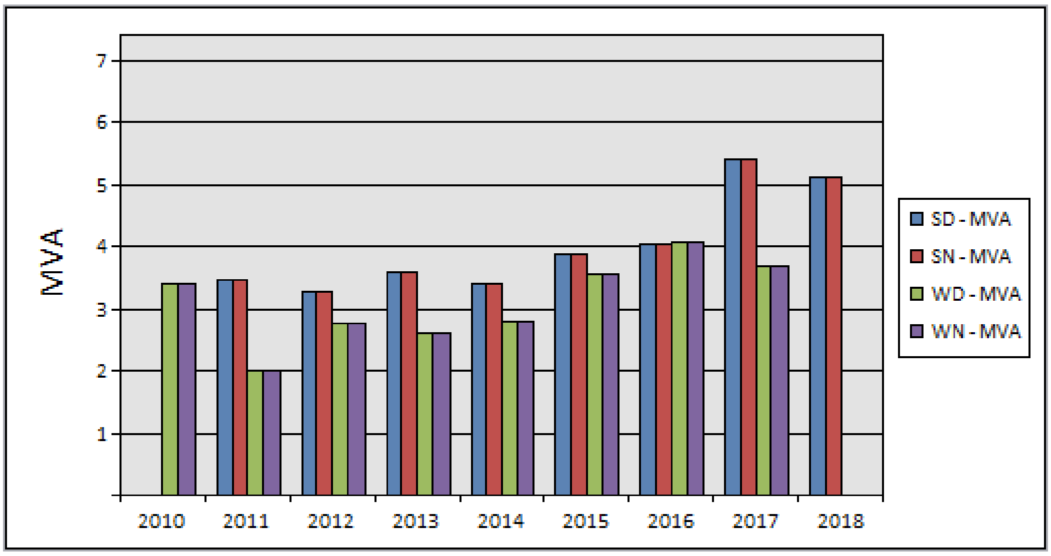

Figure 6: Historical Load of Jubilee Pocket Substation (Since 2010)

With a 2% load growth, the load will peak at 6.62MVA in 2030 which is well below the Jubilee Pocket transformer nameplate rating of 32MVA. However as upstream supply reliability improves it will allow more 11kV feeder load to be transferred from Cannonvale to Jubilee Pocket. Point loads like Port of Airlie will likely proceed and be supported by the adjacent residential locality of Jubilee Pocket. The substation load will increase accordingly.

The daily load profile is also shown in the figure below.

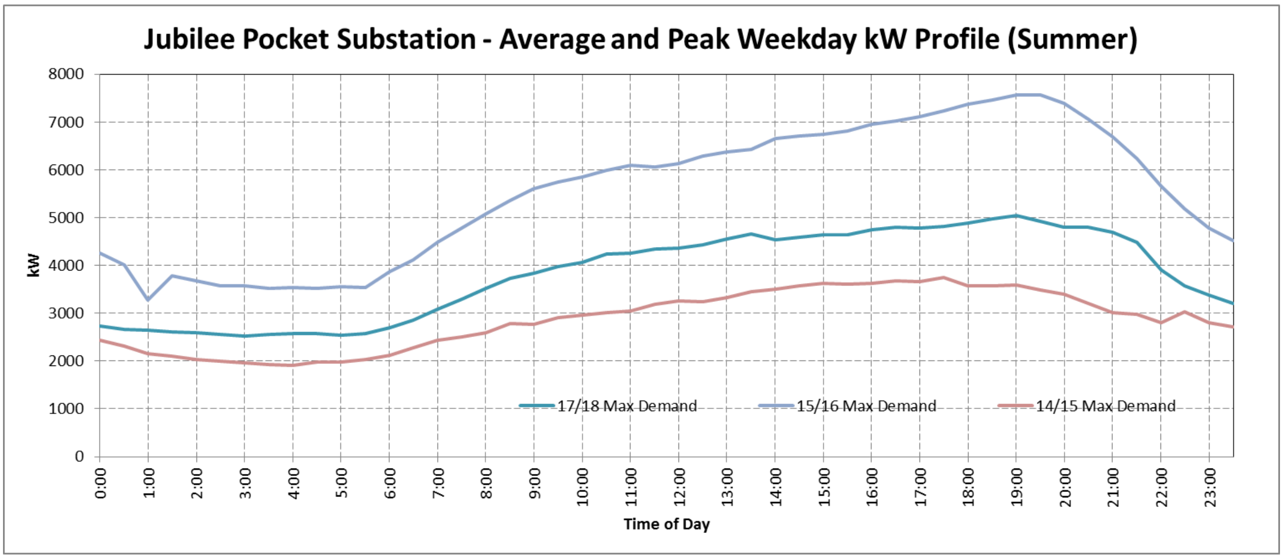

Figure 7: Jubilee Pocket Average & Peak Weekday Load Profile (Summer)

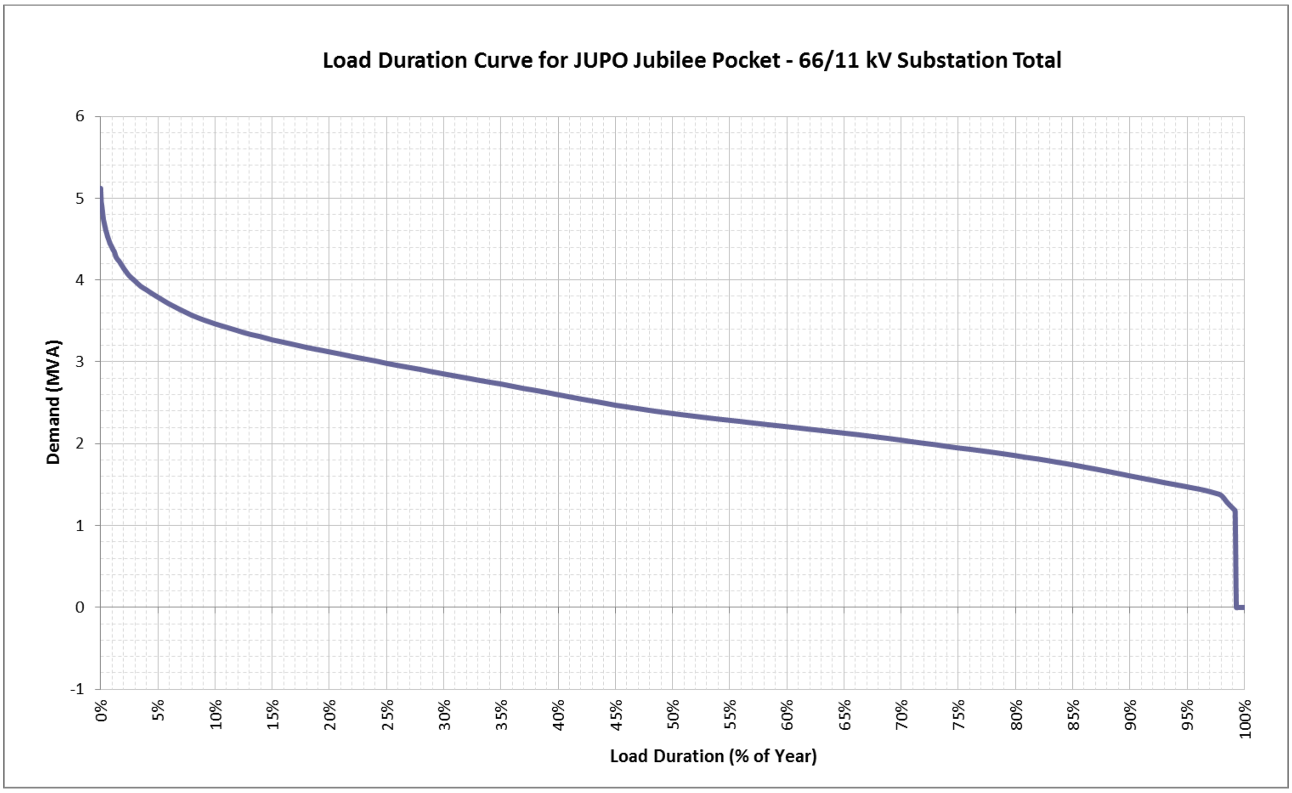

Figure 8: Jubilee Pocket Load Duration Curve

2.3.3. Mount Rooper (MORO) 66/11kV Substation

The historical load of Mount Rooper Substation for the summer day (SD), summer night (SN), winter day (WD) and winter night (WN) periods since 2002 is shown in the figure below.

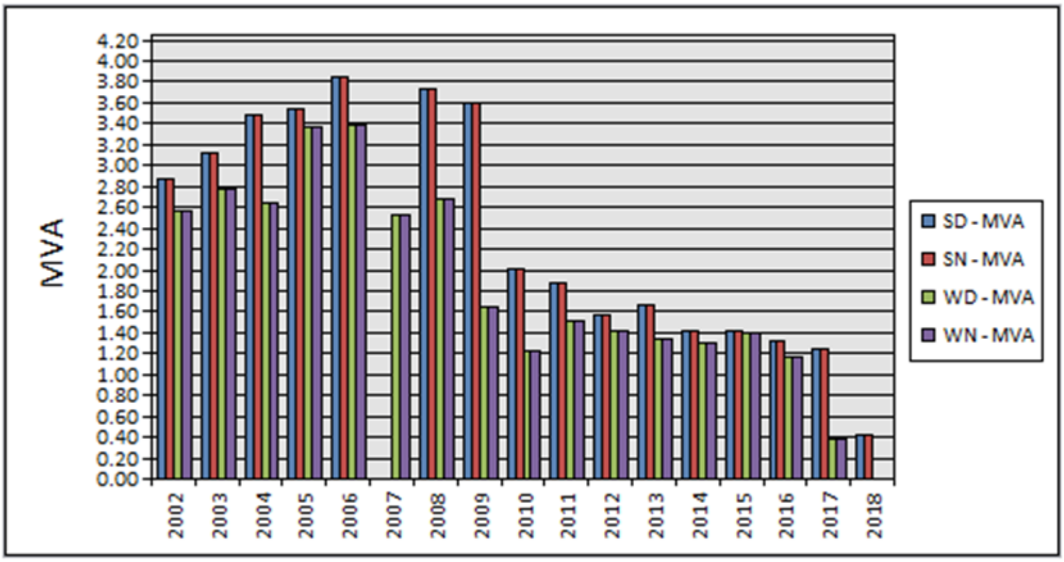

Figure 9: Historical Load of Mount Rooper Substation (Since 2002)

As the majority of load on this substation is from the Daydream/South Molle feeder, the forecast growth of this substation will be heavily dependent on the resorts on these islands.

Daydream Island has recently undergone refurbishment and therefore the load is expected to increase as the resort begins taking more tourists. Daydream Island bore the brunt of Category 4 Cyclone Debbie in March 2017 with 260km/hr wind gusts and a tidal surge that caused significant damage to the iconic island 4.5 star resort. Cyclone Debbie is responsible for the drop in demand experienced in 2017.

Repair and development works are currently being undertaken, and the luxury island 277 room resort and associated facilities are expected to re-open at the end of the first quarter 2019.

The yearly daily load profile of Mount Rooper Substation since 2014/15 is also shown in the figure below.

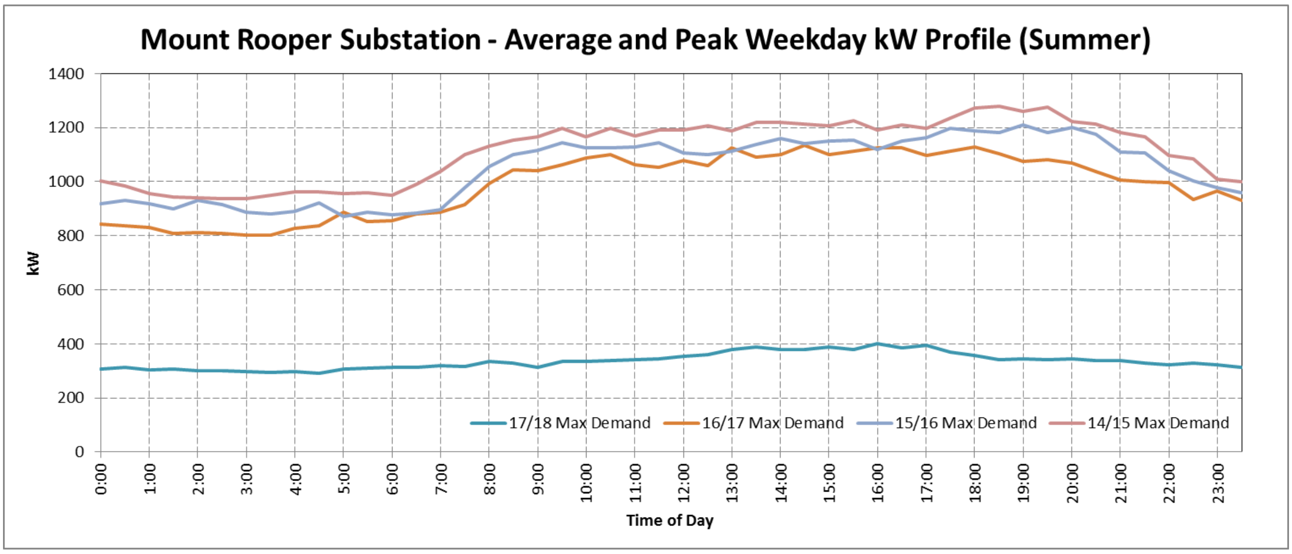

Figure 10: Mount Rooper Average & Peak Weekday Load Profile (Summer)

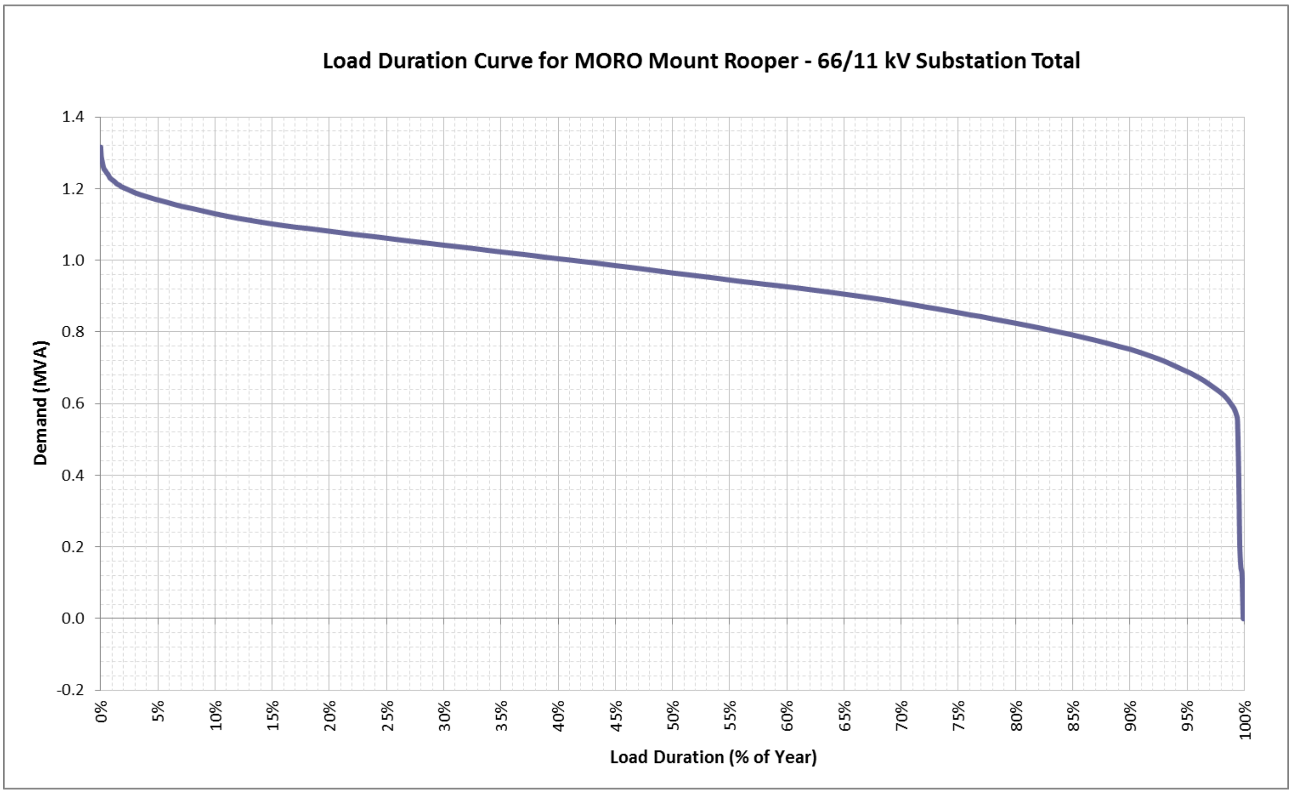

Figure 11: Mount Rooper Load Duration Curve

2.3.4. Shutehaven (SHUT) 66/11kV Substation

The historical load of Shutehaven Substation for the summer day (SD), summer night (SN), winter day (WD) and winter night (WN) periods since 2000 is shown in the figure below.

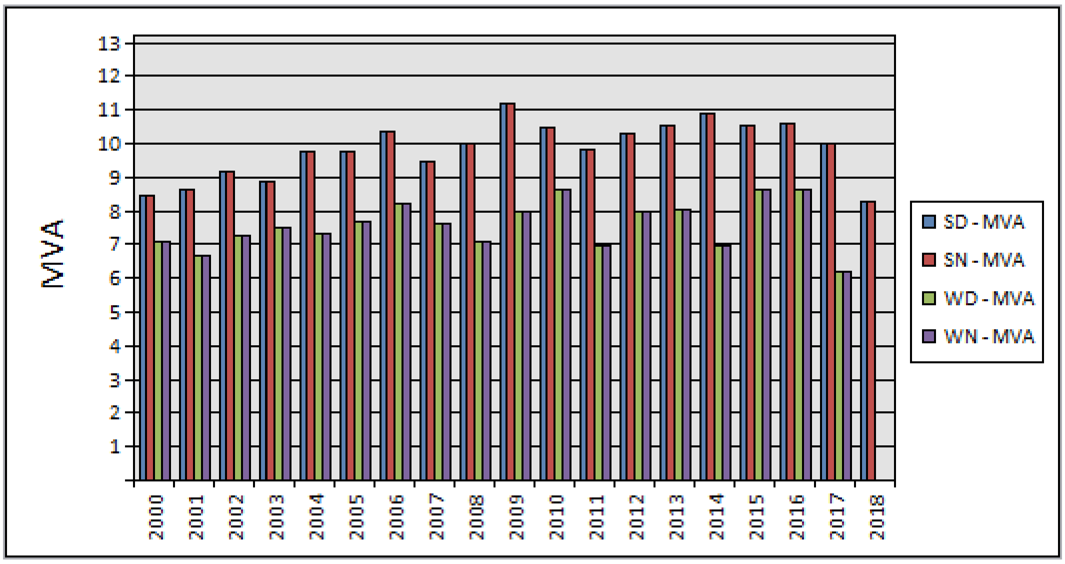

Figure 12: Historical Load of Shutehaven Substation (Since 2000)

Similarly to Mount Rooper, the load on Shutehaven Substation is dependent on the load of the two connected islands, Hayman Island and Hamilton Island.

Before damage from cyclone Debbie forced the resorts on the Hayman and Hamilton islands to partly close, the authorised demands were 3.3MVA and 11.0MVA respectively. Consequently, it can be expected that the peak load on Shutehaven Substation can return to previous peak demands of 11.0MVA and potentially increase to 13.3MVA (being the combined island authorised demand).

The recent daily summer load profiles for Shutehaven Substation can be seen in the figure below.

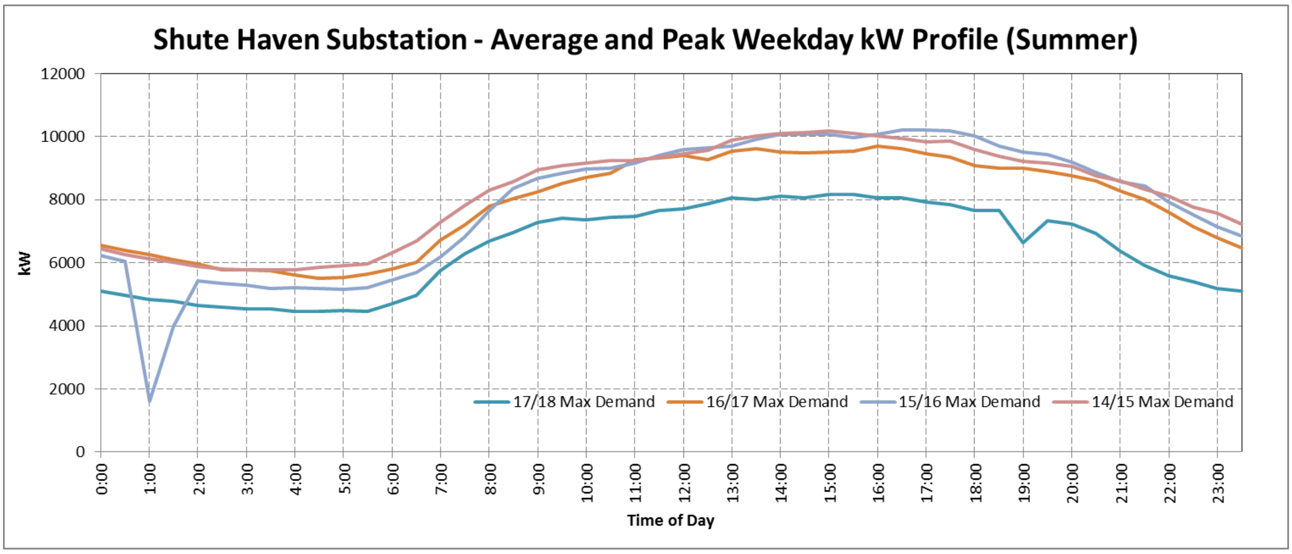

Figure 13: Shutehaven Average & Peak Weekday Load Profile (Summer)

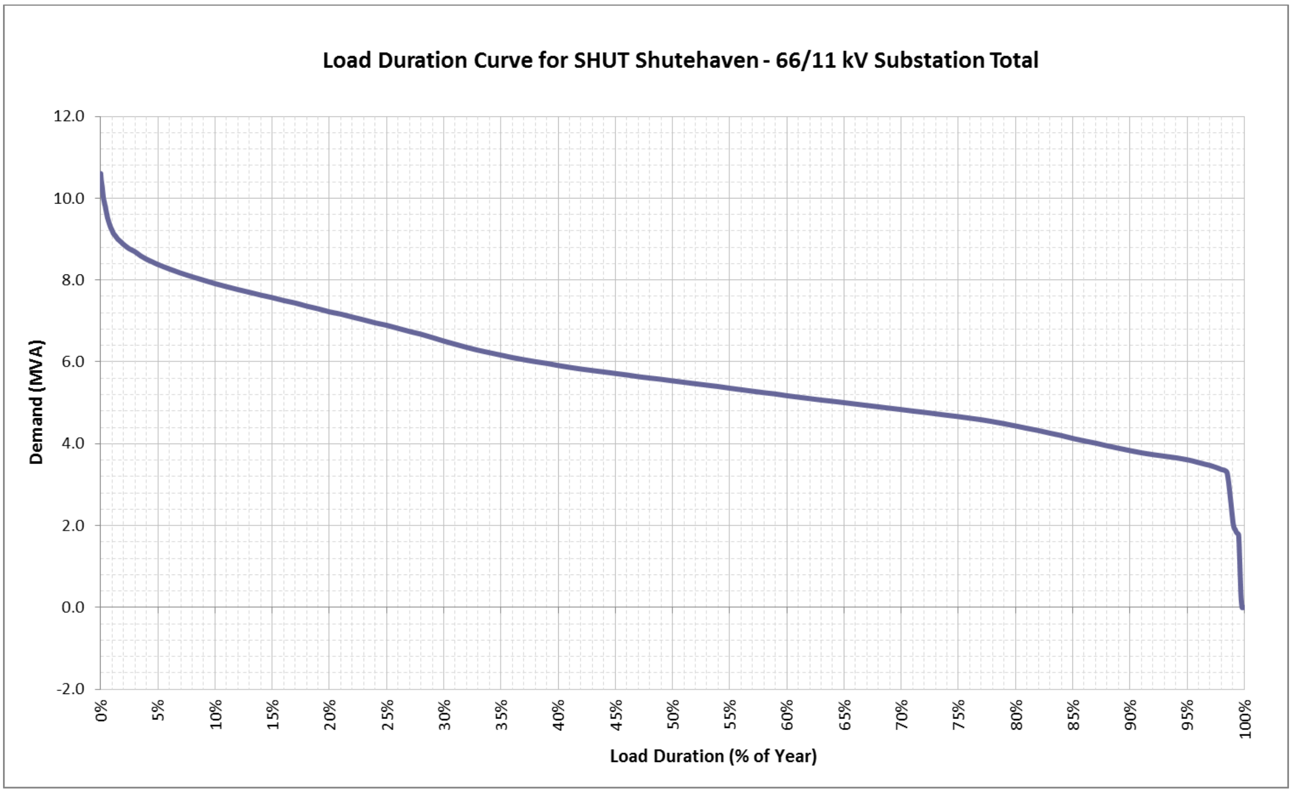

Figure 14: Shutehaven Load Duration Curve

3 Identified Need

3.1. Description of the Identified Need

The identified need can be broken down into four major components as detailed below.

3.1.1. Low Reliability due to Reliance on Manual Switching at Cannonvale

Cannonvale does not have a fully switched 66kV bus; as such there is a reliance on manual switching at Cannonvale to restore supply to customers downstream of the CANN-JUPO 66kV feeder for a fault on the CANN-01 feeder between Proserpine and Cannonvale. The CANN-01 feeder also has a hard tee off to Cannonvale Substation via a normally open 66kV isolator which is manually closed following a contingency failure of CANN-02 feeder.

Time consuming manually operated 66kV switches at Cannonvale Substation are operated to rearrange the 66kV network and restore supply via CANN-01 or CANN-02 under forced or planned outage conditions.

The reliance on manual switching at Cannonvale to restore supply to customers downstream of the CANN-JUPO 66kV feeder for a fault on CANN-01 between Proserpine and Cannonvale results in a one to four hour outage. This section of CANN-01 has experienced 20 outages (three underground and 17 overhead) over eight years with an average overhead outage restoration period of 2.8 hours (358 minutes/year), and over an 8 year long-term average assessment the Value of Customer Reliability resulting from poor reliability is approximated as $1.765m annually.

As the 66kV transfer between CANN-01 to CANN-02 occurs in the Cannonvale Substation on the quasi 66kV bus and involves staff standing under the 66kV isolator and in close proximity to the porcelain cable termination, field crews recommend load transfers via the 11kV or from a de-energised 66kV due to safety concerns.

A temporary overhead bypass has been constructed after the CANN-01 66kV XLPE cable (circa 1981) to the 66kV bus failed in March 2017. The bypass arrangement is temporary and has not undergone the relevant planning applications with Main Roads and Council to remain an approved and permanent installation.

Ergon Energy owns an additional parcel of land behind the Cannonvale Substation that could be used to enable redevelopment of the site into a fully switched 66kV bus.

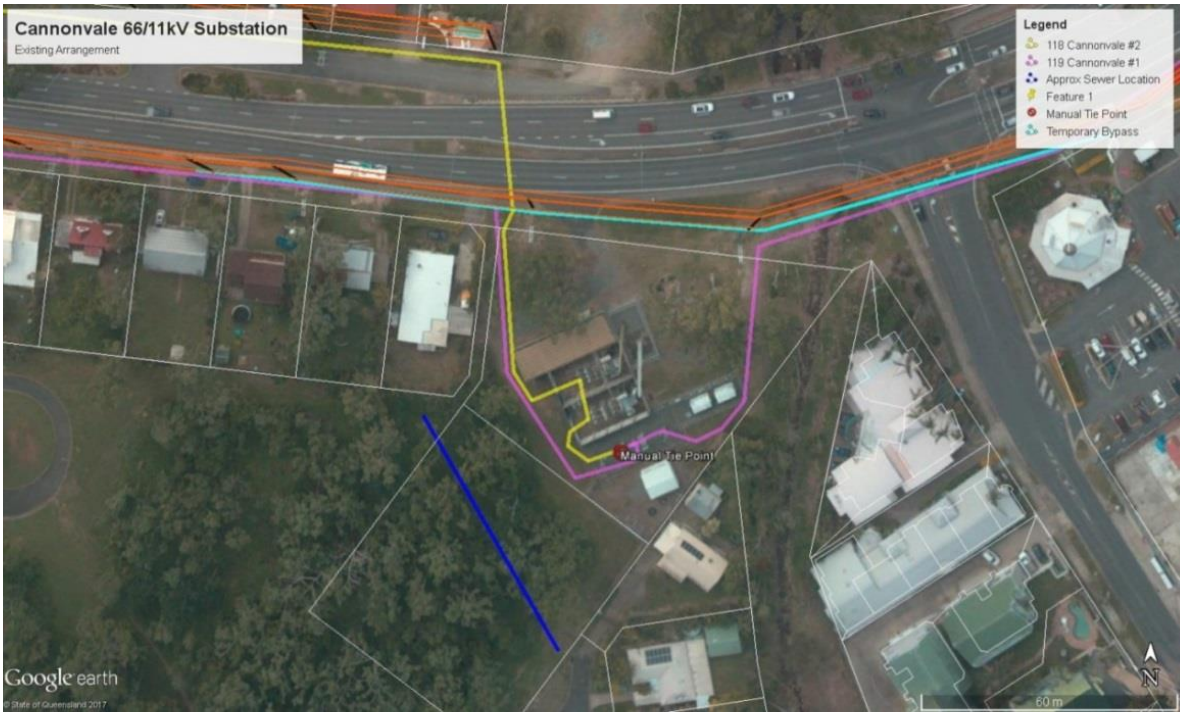

Figure 15: Cannonvale (CANN) 66/11kV Substation Existing Arrangement

3.1.2. Cable Constraints

With the exception of the CANN-01 entry cable, the remaining 66kV entry and exit cables at Cannonvale Substation are rated at 34MVA. The system peak currently exceeds 34MVA (4.5MVA from PRMI, 15MVA from CANN, 5.4MVA from JUPO, 1MVA from MORO and 10MVA from SHUT) when operating under a contingency scenario where CANN-02 has failed. The overhead sections of the 66kV feeders from Proserpine are rated above 40MVA, therefore the underground cables at Cannonvale are the constraining conductors. Increasing the rating of these cables would alleviate the risk of load exceeding rating during a contingency scenario and thus reduce outage time and improve reliability.

3.1.3. Aged and Poor Condition Assets

The existing Cannonvale Substation is of early 1980s vintage and is in reasonable condition. However, the transformer CTs are due for replacement within the next 10 years and the two transformer 66kV circuit breakers are of ABB HLC type and are planned for replacement due to a known potentially explosive failure mode.

The CANN-01 feeder cable entering the switchyard at CANN recently failed in January 2017 due to the flashover of the phase conductor to the screen as a result of the development of water trees. It is probable that other failures in cables of this same type and age will occur over the next few years as all cables in and out of CANN are of similar type and vintage as the failed entry cable.

The cable construction is single core XLPE insulated aluminium conductor with a light duty copper screen and no insect protection. Analysis of the XLPE insulation by The University of Queensland (UQ) on both the faulted phase and a healthy phase cable was conducted. The conclusions from this testing are summarised below:

"It was postulated that the failure resulted from the flashover of the phase conductor to the screen due to the progressive development into electrical trees of vented trees and/or the cumulative effects of multiple bow-tie trees over time. The true root cause could not be determined without doubt, however given the age of this cable and the fact significant numbers of water trees were discovered in un-faulted phases, this is the most likely cause in this instance. It is probable that other failures in cables of this same type and age will occur over the next few years."

Additionally, testing of the CANN-02 exit cable was performed. On-line Partial Discharge (PD) testing confirmed the presence of PD on this section of cable using two different test sets.

There are three radial cable sections between Cannonvale and Shutehaven/Mt Rooper that are first generation XLPE cables (circa 1980) of similar type and vintage as the failed 66kV CANN-01 entry cable:

- CANN to JUPO 1.41km Abell Point to Port of Airlie 66kV cable (circa 1987);
- JUPO to SHUT/MORO 0.186km Mandalay hill slope 66kV cable (circa 1987); and
- JUPO to SHUT/MORO 0.38km airport crossing 66kV cable (circa 1987).

The radial nature of these three 66kV underground circuits combined with significant sections of direct buried trench sections, the constrained geographic location to install an emergency 66kV overhead bypass (i.e. Airlie Lagoon route, airport flight path restrictions and to a lesser degree the Mandalay Hill slope), and cable replacement logistics including cable manufacture lead times, cost, installation approvals and construction timelines escalate this risk.

These cable sections represent a Safety Net risk, high probability unserved energy cost and reputational risk exposure to both Ergon Energy and the Whitsunday tourism industry.

3.1.4. Safety Net Non-Compliance

The existing sub-transmission network configuration has all customers downstream of Jubilee Pocket Substation reliant on the CANN-01 66kV line between Cannonvale and Jubilee Pocket. Currently, a fault on this section of line will result in an outage for all Jubilee Pocket, Mount Rooper and Shutehaven customers which combine for a peak load at risk of approximately 16.4MVA. The section at the highest risk of causing an extended outage is the 1.41km underground cable passing through the main tourist centre of Airlie Beach.

3.2. Quantification of the Identified Need

3.2.1. Reliability Impacts

High cost of annual unserved energy associated with the distribution network is a reflection of the poor performance of the 66kV sub-transmission network. The table below shows that in the last 8 years, 76% of the known sub-transmission fault locations were identified on the 66kV supply side of Cannonvale.

Table 1: Sub-transmission Fault Locations (Since 2010)

Fault Location	Fault Location	66kV Feeder	% of Known Fault Locations
Beyond CANN	CANN-JUPO	CANN-01	14.29%
	JUPO-SHUT	CANN-01	9.52%
Beyond CANN Total			**23.81%**
Before CANN	PROS BUS 2	CANN-02	4.76%
	PROS-CANN	CANN-02	14.29%
		CANN-01	57.14%
Before CANN Total			**76.19%**
Grand Total			**100.00%**

Applicable outage events, unserved energy and VCR were analysed over 8 years of outage data which showed an average annual unserved energy cost of $1.765m. The worst 12 months was in the year 2017/18 which saw unserved energy of 200MWh valued at $5.6m (not including Cyclone Debbie). This was largely due to the CANN-01 66kV cable fault on one of the incoming feeders into Cannonvale which took 9 hours to locate and isolate while Jubilee Pocket, Mount Rooper and Shutehaven remained offline.

The figure below indicates that a large percentage of outages have occurred during the evening peak period, meaning maximum disruption to the hospitality industry and the general population.

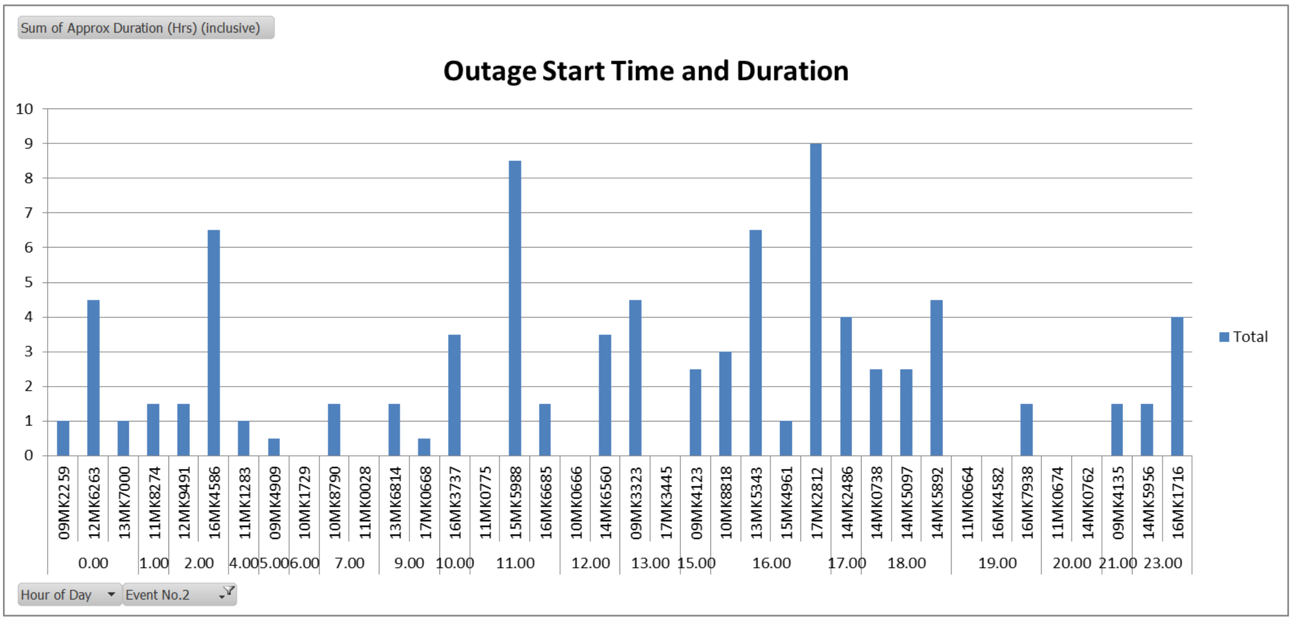

Figure 16: Outage Duration & Time of Occurrence of Sub-transmission Faults

3.2.2. Sub-transmission Network Limitations

The incoming cable from CANN-02 is 185 mm^2 aluminium with a confirmed rating of 34MVA. This is a constraint at present when CANN-01 is out of service between Proserpine and Proserpine Mill such that Proserpine Mill is back-fed from Cannonvale. In the next 5-6 years, assuming around 2% growth as justified by the forecast load and population growth, the constraint will exist for a single feeder outage without back-feeding Proserpine Mill.

The incoming cable from CANN-01 was replaced in November 2018 and now has a rating of 80MVA. As such, this is no longer a constraint however the remaining 66kV entry/exit cables at Cannonvale still remain.

The table below shows a forecast of substation loads and subsequent 66kV feeder loadings in system normal and contingency arrangements. The existing and emerging cable capacity constraints are visible in red.

	Rating (MVA)	Constraint	Forecast	2016/17 (Actuals)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
Substation Load Forecasts - Peak Loads (Summer)(MVA)																
CANN Substation				14.1	14.4	14.6	14.9	15.1	15.4	15.7	16.0	16.3	16.6	16.9	17.2	17.5
			Growth %	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
			Block Increase (MVA)													
JUPO Substation				5.4	5.5	5.7	5.8	6.0	6.1	6.3	6.4	6.6	6.7	6.9	7.1	7.3
			Growth %	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
			Block Increase (MVA)													
MORO Substation				1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6
			Growth %	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
			Block Increase (MVA)													
SHUT Substation				10.5	10.7	10.9	11.1	11.4	11.6	11.8	12.1	12.3	12.5	12.8	13.1	13.3
			Growth %	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
			Block Increase (MVA)													
PRMI Substation				4.5	4.5	4.6	4.6	4.7	4.7	4.8	4.8	4.9	4.9	5.0	5.0	5.1
			Growth %	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
			Block Increase (MVA)													
Coincidence Factor																
119 Cannonvale No1 (JUPO + MORO + SHUT Coincident Peak Load)				15.6	16.0	16.3	16.6	17.0	17.3	17.7	18.1	18.4	18.8	19.2	19.6	20.0
			Coincidence Factor (Calculated)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Feeder Load Forecasts - Coincident Peak Loads (Summer)(MVA)																
118 Cannonvale No2 (PROS - CANN)																
Normal	34	Cable into CANN		14.1	14.4	14.6	14.9	15.1	15.4	15.7	16.0	16.3	16.6	16.9	17.2	17.5
119 (PRMI-CANN) OOS	34	Cable into CANN		29.7	30.3	30.9	31.5	32.1	32.7	33.4	34.0	34.7	35.4	36.1	36.8	37.5
119 (PROS-PRMI) OOS	34	Cable into CANN		34.2	34.9	35.5	36.1	36.8	37.5	38.2	38.9	39.6	40.3	41.0	41.8	42.6
119 Cannonvale No1 (PROS - PRMI Tee)																
Normal	50	OH Line		15.6	16.0	16.3	16.6	17.0	17.3	17.7	18.1	18.4	18.8	19.2	19.6	20.0
118 (PROS-CANN) OOS	50	OH Line		29.7	30.3	30.9	31.5	32.1	32.7	33.4	34.0	34.7	35.4	36.1	36.8	37.5
119 Cannonvale No1 (PRMI Tee - CANN)																
Normal	34	Cable into CANN (FAILED 2017)		15.6	16.0	16.3	16.6	17.0	17.3	17.7	18.1	18.4	18.8	19.2	19.6	20.0
118 (PROS-CANN) OOS	34	Cable into CANN (FAILED 2017)		29.7	30.3	30.9	31.5	32.1	32.7	33.4	34.0	34.7	35.4	36.1	36.8	37.5
119 Cannonvale No1 (CANN - JUPO)																
Normal	30	Cable from CANN		15.6	16.0	16.3	16.6	17.0	17.3	17.7	18.1	18.4	18.8	19.2	19.6	20.0
426 Mt Rooper (JUPO - MORO)																
Normal	47	OH Line		10.7	10.9	11.1	11.3	11.5	11.8	12.0	12.2	12.4	12.7	12.9	13.2	13.4
426 Mt Rooper (MORO - SHUT)																
Normal	47	OH Line		10.5	10.7	10.9	11.1	11.4	11.6	11.8	12.1	12.3	12.5	12.8	13.1	13.3

Figure 17: Forecast Substation & Feeder Loads (Including Contingency Arrangements)

3.2.3. Long Term Cable Failure Outage Cost

The long-term cost due to a sustained cable failure (e.g. 1.41km Airlie Lagoon cable) from water treeing has been considered in the context of a similar submarine cable failure.

Considering manufacturing and sea freight lead times for 66kV cables of 16 weeks, this would be considered a catastrophic outage scenario. The islands are presently exposed to similar risks during a privately owned submarine cable failure and should have standby operating protocols to manage fuel supply and storage for a similar long duration outage.

If the estimated cost of a four to six month outage (i.e. $8m-$12m) is borne entirely by the island resort operators, Ergon Energy will bear significant political pressure and brand damage.

3.2.4. Safety Net Non-Compliance

Cannonvale Substation has two 66kV incoming feeders (CANN-01 and CANN-02) and two 15MVA transformers that ensure supply can be fully restored to Cannonvale customers within Safety Net requirements. On the other hand, Jubilee Pocket, Mount Rooper and Shutehaven do not have N-1 security and are reliant on the 66kV radial feeder between Cannonvale and Jubilee Pocket. Currently, a fault on this section of line will result in an outage for all Jubilee Pocket, Mount Rooper and Shutehaven customers which combine for a peak load at risk of approximately 16.4MVA.

There is load transfer capacity of 4MVA to transfer Jubilee Pocket customers to Cannonvale via 11kV switching. This 11kV switching combined with mobile generation is sufficient to restore supply to all LV Customers within the Safety Net requirement. The major customers of Hayman, Hamilton, Daydream and South Molle islands would experience an outage for the full duration of the time it takes to locate and rectify the fault before restoring the power supply.

As these are major resorts that play an integral role in the success of the tourism industry in the Airlie Beach region, an extended outage for these customers is undesirable and will likely have a significant business impact.

The section at highest risk of causing an extended outage is the 1.41km underground cable passing through the main tourist centre of Airlie Beach (highlighted in Figure 3 as Section A). Fault finding and repair of this cable would be very time consuming and likely to result in an outage that spans days or even weeks instead of hours for the island customers. This section of cable is also the same XLPE type and of similar age to the recently failed 66kV CANN-01 entry cable and tested CANN-02 entry cable at Cannonvale and has been identified as having a high risk of failure within the next few years.

Figure 18: Overview of the 66kV Sub-transmission Network Downstream of CANN

3.3. Assumptions in Relation to Identified Need

Below is a summary of key assumptions that have been made when the Identified need has been analysed and quantified.

It is recognised that the below assumptions may prove to have various levels of correctness, and they merely represent a ‘best endeavours’ approach to predict the future identified need.

3.3.1. Forecast Maximum Demand

It has been assumed that peak demand at Cannonvale and Jubilee Pocket Substations will grow as forecasted.

Factors that have been taken into account when the load forecast has been developed include the following:

- load history
- known future developments (new major customers, network augmentation, etc.)
- temperature corrected start values (historical peak demands)
- forecast growth rates for organic growth

3.3.2. Load Profile

Characteristic peak day load profiles shown in Section 2.3 are unlikely to change significantly from year to year, i.e. the shape of the load profile will remain virtually the same with increasing maximum demand.

3.3.3. System Capability – Line Ratings

The thermal ratings of the 66kV sub-transmission lines that supply Cannonvale, Jubilee Pocket, Mount Rooper and Shutehaven have been calculated based on the main parameters listed in the table below.

Table 2: Line Rating Parameters

Parameter	Summer Day (9am – 5pm)	Summer Evening (5pm – 10pm)
Ambient Temperature	35°C	31°C
Wind Velocity	1.3 m/s	0.8 m/s
Wind Angle to Conductor Axis	45°	45°
Direct Solar Radiation	910 W/m^2	200 W/m^2
Diffuse Solar Radiation	210 W/m^2	20 W/m^2

4 Credible Options Assessed

4.1. Assessment of Network Solutions

Ergon Energy investigated a number of network options to address the identified need at Cannonvale. Details of the three credible options are presented in the following sections.

4.1.1. Option A: Cannonvale Substation 66kV Switchyard Upgrade & Duplication / Replacement of 66kV Cables

Option A involves the installation of a fully-switched 7-breaker 66kV switchyard at Cannonvale, replacement of the 66kV cables at Cannonvale, duplication of radial 66kV sections at Airlie Lagoon, Mandalay and the airport, and staged development of a second 66kV feeder from Cannonvale to Jubilee Pocket.

This option includes the installation of a seven breaker 66kV switchyard at Cannonvale Substation, comprised of two feeder breakers in, two feeder breakers out (one spare initially), two transformer breakers and a bus tie breaker. Both an outdoor Air Insulated Switchgear (AIS) and an indoor Gas Insulated Switchgear (GIS) solution are technically viable implementations of the proposed 66kV switchyard.

The fully switched 66kV bus arrangement at Cannonvale will sectionalise the network and eliminate outages to Cannonvale, Jubilee Pocket, Shuthaven and Mount Rooper for faults on the upstream sections of CANN-01 and CANN-02 between Proserpine and Cannonvale.

The remaining incoming and outgoing 66kV aged feeder cables at Cannonvale Substation will be removed as part of the switchyard rebuild and at risk radial cable sections downstream of CANN (i.e. Airlie Lagoon, Mandalay and airport) are recommended for duplication.

The Department of Transport and Main Roads (TMR) are planning to upgrade the section of Shute Harbour road between Island Drive and Waterson Way, and it is recommended that 66kV conduits be installed and at risk cable sections (Airlie Lagoon, Mandalay and Airport) are duplicated during the proposed TMR roadworks. The second feeder between Cannonvale and Jubilee Pocket is a long-term network development strategy but not required immediately.

Upon completion of these works, the sub-transmission network in the Cannonvale / Airlie Beach area would be Safety Net compliant. The subsequent reliability improvement to Cannonvale, Jubilee Pocket and Mount Rooper will allow commissioning of new ‘Urban’ category MSS 11kV feeders without becoming a ‘RED’ feeder immediately upon commissioning (i.e. as is currently the case with the Port of Airlie 11kV feeder). Additionally, it will also resolve the MORO Shute Harbour (108) 11kV ‘RED’ SR feeder status; and will also provide a strategic network development benefit by allowing the future Riordanvale (RIOR) 66/11kV Substation to be developed as a single T3-10 tee substation.

The network configuration proposed by Option A is illustrated below:

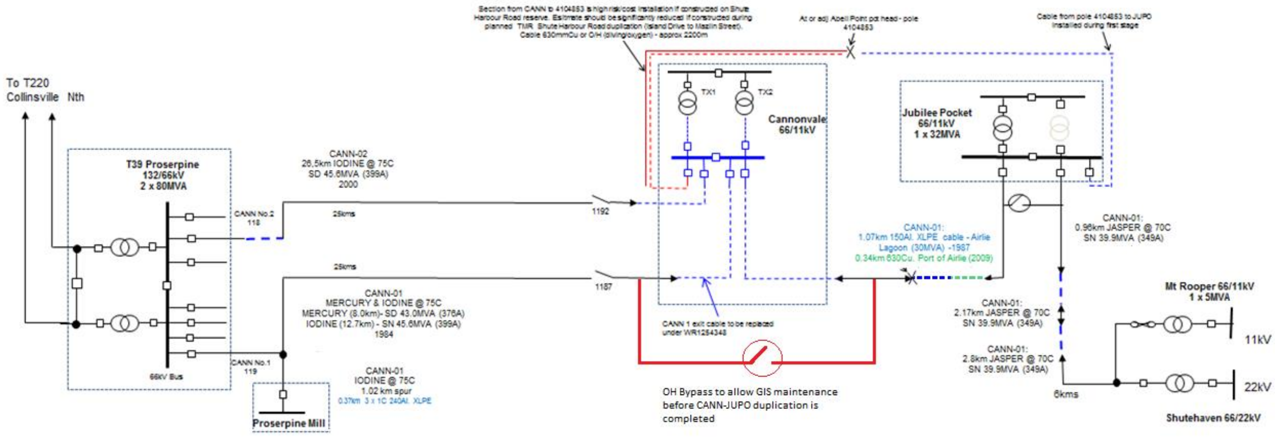

Figure 19: 66kV Network Diagram for Option A

The full scope of works to be covered by Option A is as followed:

<u>Sub-transmission Line Works</u>

- Duplication of three radial 66kV cables sections between Cannonvale and Shutehaven (Airlie Lagoon, Mandalay and Airport)
- Construct additional 66kV feeder from Cannonvale to Jubilee Pocket (not required initially but included in the NPV analysis)

<u>Substation Works</u>

- Installation of a seven breaker 66kV switchyard at Cannonvale Substation
- Installation of a control building at Cannonvale Substation
- Installation of new DC systems at Cannonvale Substation
- Installation of new 66kV secondary protection systems at Cannonvale Substation
- Installation of new 66kV feeder exit and transformer cables at Cannonvale Substation
- Removal and recovery of old 66kV cables at Cannonvale Substation
- Decommission and removal of redundant transformer 66kV switchgear at Cannonvale Substation
- Decommission and removal of redundant 66kV bus structure, isolators and terminations at Cannonvale Substation

The estimated capital cost of this option excluding overheads is $16.68m, and inclusive of interest, risk, contingencies and overheads is $23.59m. Annual operating and maintenance costs are anticipated to be 0.5% of the capital cost. The estimated project delivery timeframe has design commencing in late 2020 and construction completed by late 2023.

4.1.2. Option B: New Dedicated 66kV Feeder from Proserpine to Proserpine Mill & Duplication / Replacement of 66kV Cables

Option B involves the construction of a dedicated 66kV feeder from Proserpine to Proserpine Mill, replacement of the 66kV cables at Cannonvale, and staged development of a second 66kV feeder from Cannonvale to Jubilee Pocket.

This option comprises removing Proserpine Mill Substation (PRMI) off the CANN-01 66kV feeder and supplying this substation via a new dedicated 66kV overhead feeder from a new feeder bay at Proserpine 132/66kV Substation (PROS).

The option assumes reuse of an existing part of the CANN-01 66kV feeder between the tee-off and PRMI. A second 66kV feeder from CANN to JUPO would also be added. The final configuration would have two 66kV feeders from PROS to JUPO each teed to a transformer at CANN with the 11kV bus section circuit breaker closed. The existing outdoor switchgear would be retained to allow a safe isolation and access to the teed Transformer 2 bay (CANN-01 feeder). To allow for safe isolation and access to Transformer 1 bay either additional outdoor switchgear is required, or a combination of earth switch/isolator/earth switch which replaces the existing cable termination structure inside the bay. The installation of replacement 66kV cables (i.e. from existing outdoor switchyard to Transformer 2) introduces challenges with respect to adequate clearance for terminations.

The network configuration proposed by Option B is illustrated below:

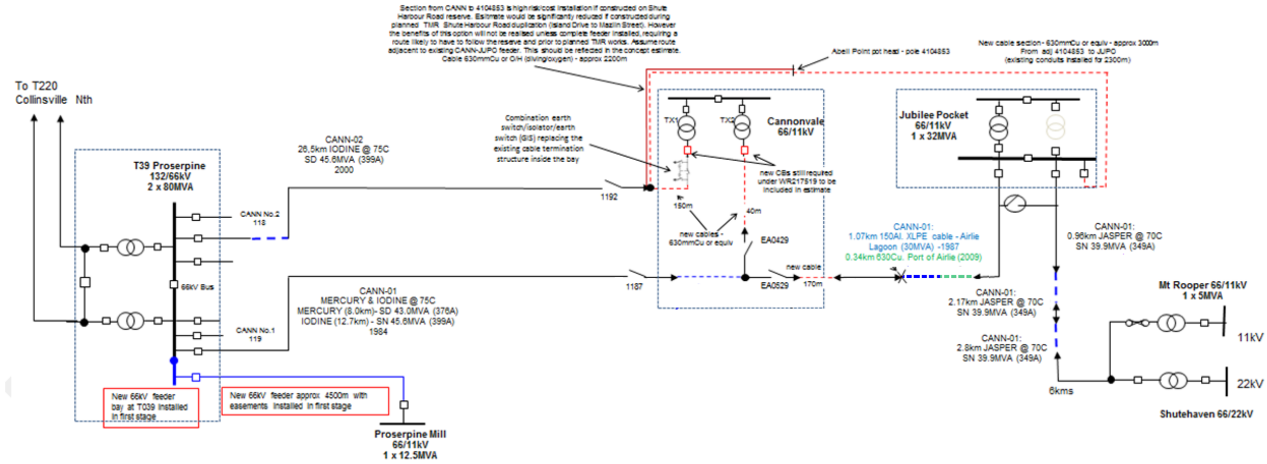

Figure 20: 66kV Network Diagram for Option B

The full scope of works to be covered by Option B is as followed:

<u>Sub-transmission Line Works</u>

- Acquire line easements where required for sections of new feeders
- Construct a new 66kV feeder from Proserpine to existing CANN-01 feeder tee-off to Proserpine Mill Substation (reuse existing overhead line from CANN-01 feeder to PRMI)
- Install new protection signalling schemes between Proserpine and Proserpine Mill Substations (including duplicate communications paths)
- Construct an additional 66kV feeder from Cannnonvale to Jubilee Pocket Substation

Substation Works

- Construct a new 66kV feeder bay at Proserpine Substation with primary plant and secondary systems (including control panels, etc.)
- Upgrade 66kV protection schemes at Proserpine Mill Substation
- Install a remote control 11kV gas switch at Proserpine Mill Substation
- Replace cable support structures and cable terminations in Transformer 1 bay with GIS (containing earth switch / isolator / earth switch) to facilitate a transformer ended feeder arrangement at Cannonvale Substation
- Installation of new 66kV feeder exit and transformer cables at Cannonvale Substation
- Removal and recovery of old 66kV cables at Cannonvale Substation
- Decommission and remove redundant transformer HV switchgear at Cannonvale Substation (66kV bus tie in transformer compounds)
- Replace two 66kV circuit breakers at Cannonvale Substation

The estimated capital cost of Option B excluding risk, contingency and overheads is $17.61m. Annual operating and maintenance costs are anticipated to be 0.5% of the capital cost. The estimated project delivery timeframe has design commencing in late 2020 and construction completed by late 2023.

4.1.3. Option C: Construct 66kV Switchyard at Future Riordanvale Substation Site & Duplication / Replacement of 66kV Cables

Option C involves the construction of a 66kV switching station at Riordanvale, replacement of the 66kV cables at Cannonvale, duplication of radial 66kV sections at Airlie Lagoon, Mandalay and the airport, and staged development of a second 66kV feeder from Cannonvale to Jubilee Pocket.

Option C considers a new switching station at Ergon Energy’s existing Riordanvale (RIOR) site. Cable replacement replacement work at CANN and the duplication of the 66kV at risk cables between CANN and JUPO will still be undertaken. The existing CANN-01 and CANN-02 feeders are assumed to be split adjacent to the Riordanvale site with exit cables in to and out of the new switching station. The location of the future RIOR Substation is shown in the figure below.

Figure 21: Geographic Overview of Future Riordanvale Substation

Indicated feeder locations are a guide only and would be dependent on easements being obtained.

This option still proceeds with the installation of conduits along parts of the Shute Harbour Road reserve (in conjunction with TMR and their timing) between CANN and Abell Point for the future CANN – JUPO second 66kV feeder.

The final configuration (RIOR to JUPO) is of two feeders from RIOR, each teed to a transformer at Cannonvale Substation. The existing outdoor switchgear at CANN is retained to allow a safe isolation and access to the teed Transformer 2 bay (CANN-01 feeder).

To allow for safe isolation and access to Transformer 1 bay either additional outdoor switchgear is required, or a combination of earth switch/isolator/earth switch which replaces the existing cable termination structure inside the bay. The installation of replacement 66kV cables (i.e. from existing outdoor switchyard to Transformer 2) introduces challenges with respect to adequate clearance for terminations. The requirement for manual switching at CANN is still required to restore supply to CANN if a fault occurs on the section of CANN-02 between RIOR and CANN which will result in a longer outage for CANN customers. This will reduce the VCR benefits achieved by this solution, however, this will be resolved as part of the cable replacements.

The requirement for manual switching at CANN is still required to restore supply to the CANN 66/11kV transformer if a fault occurs on the cable section from CANN-01 to the transformer which will result in a longer outage restoration for JUPO to Shute Harbour customers. Given this 66kV cable will be a new 66kV XLPE cable section, the probability of failure will be low from a VCR perspective and manageable if the external bypass is retained.

The network configuration proposed by Option C is illustrated below:

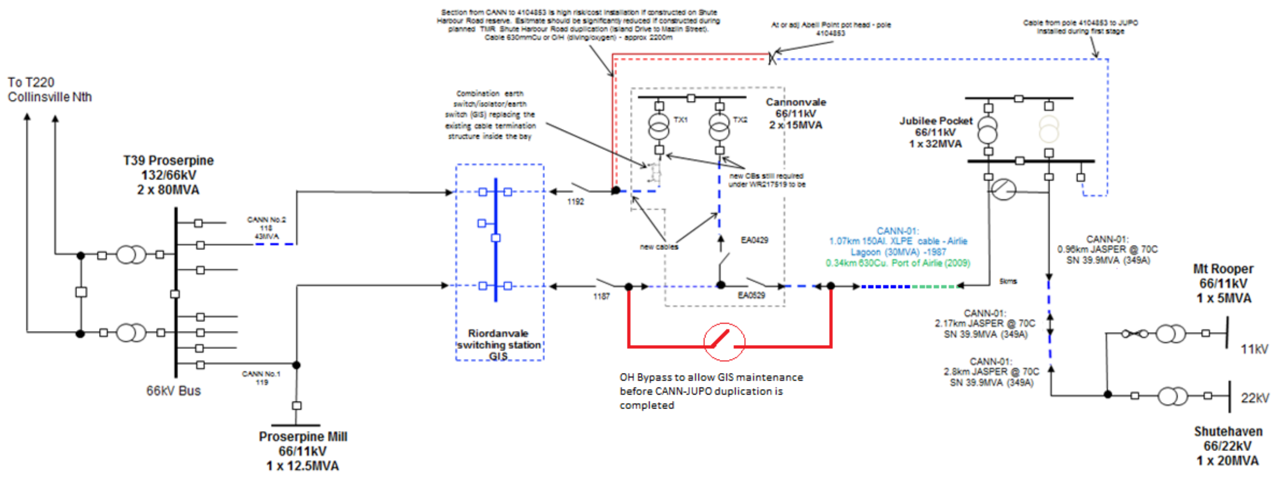

Figure 22: 66kV Network Diagram for Option C

The full scope of works to be covered by Option C is as followed:

<u>Sub-transmission Line Works</u>

- Acquire line easements where required for sections of new feeders
- Cut-in to the existing 66kV CANN-01 and CANN-02 feeders in order to construct new 66kV lines to Riordanvale Substation
- Duplication of three radial 66kV cables sections between Cannonvale and Shutehaven (Airlie Lagoon, Mandalay and Airport)
- Construct additional 66kV feeder from Cannonvale to Jubilee Pocket (not required initially but included in the NPV analysis)

Substation Works

- Construct a new 66kV switching station at the Riordanvale Substation site with in-feeds from CANN-01 and CANN-02 and two out-feeds to Cannonvale Substation
    - 6 bay switchgear (1 spare bay for future RIOR 66/11kV transformer)
    - Separate control room containing protection panels, DC & AC supplies, and comms
    - Two station services transformers
    - Four 66kV feeder landing spans and associated structures
- Replace cable support structures and cable terminations in Transformer 1 bay with GIS (containing earth switch / isolator / earth switch) to facilitate a transformer ended feeder arrangement at Cannonvale Substation
- Installation of new 66kV feeder exit and transformer cables at Cannonvale Substation
- Removal and recovery of old 66kV cables at Cannonvale Substation
- Decommission and remove redundant transformer HV switchgear at Cannonvale Substation (66kV bus tie in transformer compounds)
- Replace two 66kV circuit breakers at Cannonvale Substation

The estimated capital cost of Option C excluding risk, contingency and overheads is $22.11m. Annual operating and maintenance costs are anticipated to be 0.5% of the capital cost. The estimated project delivery timeframe has design commencing in late 2020 and construction completed by late 2023.

4.2. Assessment of Non-Network Solutions

Ergon Energy's Demand & Energy Management (DEM) team has assessed the potential non-network alternative (NNA) options required to defer the Network option and determine if there is a viable demand management (DM) option to replace or reduce the need for the network options proposed.

4.2.1. Demand Management (Demand Reduction)

The customer base is largely residential and small business. Demand savings in these customer market segments are characterised by very small demand saving increments with a slow rate of uptake. The most cost effective demand reduction measure for this market in a short timeframe could be increased utilisation of the existing LC by Ergon Energy.

Energy efficiency and other demand reduction measures such as power factor correction, lighting etc. have been assessed as not technically viable in this instance. Therefore, reductions in demand will not help to improve restoration times for the number of unmet load hours.

4.2.2. Demand Response

Four methods utilising demand response technology for deferring network investment are: call off load (COL), customer embedded generation (CEG), large scale customer generation (LSG) and customer solar power systems

4.2.2.1. Customer Call off Load (COL)

COL is an effective technique for deferring network investment where the need is for a short time period. This is however not the case this instance. There are a small number of Large Customers in the catchment area but the businesses are not suited to call off. This option is therefore assessed as technically not viable as it does not address the risk of possible failures to major sections of the HV network.

4.2.2.2. Customer Embedded Generation (CEG)

CEG is an effective technique for deferring network investment where the need is for a short time period. The primary driver for investment in this instance is the requirement for a contingency for Safety Net. A short-term deferral of network investment by using CEG may not be a technical or financially feasible option (due to the number of contracts required to be negotiated and managed).

This option has been assessed as technically not viable as it will not address the identified network requirement.

4.2.2.3. Large Scale Customer Generation (LSG)

LSG sites such as renewable energy generation, solar or wind farms of multiple MW's capacity constitute an opportunity to support ZS investment by reducing demand on, and potentially providing reactive power support for substation assets.

In the Whitsunday region, LSG demand response may be valued up to $40/kVA P.A plus fuel costs. This area has a combined maximum generation demand capacity of approximately 18.75MVA. The cost to contract this generation is contingent upon negotiation with each customer and would have additional costs for fuel, customer recruitment and establishment costs.

4.2.2.4. Customer Solar Power Systems

Business customers with large solar arrays are deemed to present a significant opportunity for targeted load control or load curtailment if coupled with a Battery Energy Storage System (BESS). Contracting such customers is attractive as they represent a larger load across a fewer customers and therefore are cheaper and easier to engage and contract.

Only a small percentage of customers in this supply area have solar PV systems and possibly none have a BESS. PV systems with BESS present a future portfolio opportunity for potential demand response but currently this supply area has a very limited solar/BESS. Solar customers without a BESS will not meet the technical needs of the demand reduction as their solar contribution may not be available when the network un-met need is required.

4.2.3. Demand Management Summary

Based on the demand management options considered above, it is considered possible that sufficient demand management measures may be feasibly implemented to technically and economically defer the network investment required as a contingency for Safety Net issues for supply to the Whitsunday Islands, however there are no credible NNA's that will address the identified need at Cannonvale.

4.3. Preferred Network Option

Ergon Energy's preferred internal network option is to install a 7-breaker 66kV switchyard at Cannonvale, replace Cannonvale 66kV cables, duplicate radial 66kV sections at Airlie Lagoon, Mandalay and the airport, and staged development of a second 66kV feeder from Cannonvale to Jubilee Pocket.

Upon completion of these works, the sub-transmission network in the Cannonvale / Airlie Beach area would be Safety Net compliant. This option will minimise capital expenditure to cover reliability and Safety Net requirements, and will also provide a strategic network development benefit by allowing the future Riordanvale (RIOR) 66/11kV Substation to be developed as a single T3-10 tee substation.

The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is $23.59m. Annual operating and maintenance costs are anticipated to be 0.5% of the capital cost. The estimated project delivery timeframe has design commencing in late 2020 and construction completed by late 2023.

5 Summary of Submissions Received in Response to Draft Project Assessment Report

On 15 November 2019, Ergon Energy published the Draft Project Assessment Report providing details on the identified need on the sub-transmission network that supplies Cannonvale and Jubilee Pocket. This report provided both technical and economic information about possible solutions and sought information from interested parties about possible alternate solutions to address the need for investment.

In response to the Draft Project Assessment Report, Ergon Energy received no submissions by 27 December 2019, which was the closing date for submissions to the Draft Project Assessment Report.

6 Market Benefit Assessment Methodology

The purpose of the RIT-D is to identify the option that maximises the present value of net market benefits to all those who produce, consume and transport electricity in the National Electricity Market (NEM).

In order to measure the increase in net market benefit, Ergon Energy has analysed the classes of market benefits required to be considered by the RIT-D.

6.1. Classes of Market Benefits Considered and Quantified

The following classes of market benefits are considered material, and have been included in this RIT-D assessment:

- Changes in involuntary load shedding

6.1.1. Changes in Involuntary Load Shedding

Involuntary load shedding is where a customer's load is interrupted from the network without their agreement or prior warning. Ergon Energy has forecast load over the assessment period and has quantified the expected unserved energy by comparing forecast load to network capabilities under system normal and network outage conditions. A reduction in involuntary load shedding expected from an option, relative to the base case, results in a positive contribution to the market benefits of the credible option being assessed.

Involuntary load shedding of a credible option is derived by the quantity in MWh of involuntary load shedding required assuming the credible option is completed multiplied by the Value of Customer Reliability (VCR). The VCR is measured in dollars per MWh and is used as a proxy to evaluate the economic impact of unserved energy on customers under the RIT-D.

Ergon Energy has applied a VCR estimate of $28/kWh, which has been derived from the AEMO 2014 Value of Customer Reliability (VCR) values. In particular, Ergon Energy has weighted the AEMO estimates according to the make-up of the specific load considered.

In addition, Ergon Energy has investigated how a reduced VCR forecast going forward changes the expected net market benefits under the options. In particular, we have undertaken a reduced VCR customer economic sensitivity cost analysis to review the impact upon the credible options. The results of this sensitivity analysis are illustrated in Section 7.

6.2. Classes of Market Benefits not Expected to be Material

The following classes of market benefits are not considered to be material for this RIT-D, and have not been included in this RIT-D assessment:

- Changes in voluntary load curtailment
- Changes in costs to other parties
- Changes in timing of expenditure
- Changes in load transfer capability
- Changes in network losses
- Option value

6.2.1. Changes in Voluntary Load Curtailment

Because none of the credible options include any voluntary load curtailment, and because there are no customers on voluntary load curtailment agreements in the Cannonvale / Airlie Beach area at present, any market benefits associated with changes in voluntary load curtailment have not been considered.

6.2.2. Changes in Costs to Other Parties

Ergon Energy does not anticipate that any of the credible options included in this RIT-D assessment will affect costs incurred by other parties.

6.2.3. Changes in Timing of Expenditure

None of the credible options included in this RIT-D assessment is expected to affect the timing of other distribution investments for unrelated identified needs.

6.2.4. Changes in Load Transfer Capability

None of the credible options included in this RIT-D assessment are expected to have an impact on the load transfer capability between the zone substations in the Cannonvale / Airlie Beach area.

6.2.5. Changes in Network Losses

Ergon Energy does not anticipate that any of the credible options included in the RIT-D assessment will lead to any significant change in network losses.

6.2.6. Option Value

The AER's view is that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available in the future is likely to change, and the credible options considered by the RIT-D proponent are sufficiently flexible to respond to that change[1].

Ergon Energy does not consider that the identified need for the options included in this RIT-D would be affected by uncertain factors about which there may be more clarity in future.

7 Detailed Economic Assessment

7.1. Net Present Value (NPV)

Net Present Values of the three credible options are presented in Table 3 and Table 4 below. The NPV analysis demonstrates that Option A has the lowest Net Present Cost.

Note that the figures in the table below are the discounted present values evaluated over a 20 year period. These direct costs are preliminary estimates which are subject to change as costs are refined, and do not include any interest, risk, contingencies or overheads, but does include residual life values at the end of the 20 year period. Operating and maintenance costs and market benefits are assumed to be similar for the three options.

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[1] AER "Regulatory Investment Test for Distribution Application Guidelines", Section A6.
Available at: http://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/regulatory-investment-test-for-distribution-rit-d-and-application-guidelines

Table 3 illustrates the results of the NPV analysis with the forecast VCR.

Table 3: Net Present Value Analysis with Forecast VCR

$ Millions	Option A	Option B	Option C
Capex	(13.45)	(14.18)	(15.34)
Opex	0.00	0.00	0.00
Direct Benefits	0.00	0.00	0.00
Commercial NPV	**(13.45)**	**(14.18)**	**(15.34)**
Ranking	*1*	*2*	*3*
Indirect/Risk	14.35	14.35	14.35
Commercial + Risk	**0.91**	**0.17**	**(0.98)**
Ranking	*1*	*2*	*3*

Table 4 illustrates the results of the NPV analysis with the reduced VCR. Whilst it is anticipated that the credible options will improve reliability and VCR, the sensitivity analysis does not change the recommendation and Option A has the lowest Net Present Cost.

Table 4: Net Present Value Analysis with Forecast Low VCR

$ Millions	Option A	Option B	Option C
Capex	(13.45)	(14.18)	(15.34)
Opex	0.00	0.00	0.00
Direct Benefits	0.00	0.00	0.00
Commercial NPV	**(13.45)**	**(14.18)**	**(15.34)**
Ranking	*1*	*2*	*3*
Indirect/Risk	9.09	9.09	9.09
Commercial + Risk	**(4.36)**	**(5.09)**	**(6.25)**
Ranking	*1*	*2*	*3*

8 Conclusion

The Final Project Assessment Report (FPAR) represents the final stage of the consultation process in relation to the application of the RIT-D.

Ergon Energy intends to take steps to progress the proposed preferred option to ensure any statutory non-compliance is addressed and undertake appropriately justified network reliability improvements, as necessary.

8.1. Preferred Option

Ergon Energy's preferred internal network option is to install a 7-breaker 66kV switchyard at Cannonvale, replace Cannonvale 66kV cables, duplicate radial 66kV sections at Airlie Lagoon, Mandalay and the airport, and staged development of a second 66kV feeder from Cannonvale to Jubilee Pocket.

Upon completion of these works, the sub-transmission network in the Cannonvale / Airlie Beach area would be Safety Net compliant. This option will minimise capital expenditure to cover reliability and Safety Net requirements, and will also provide a strategic network development benefit by allowing the future Riordanvale (RIOR) 66/11kV Substation to be developed as a single T3-10 tee substation.

The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is $23.59m. Annual operating and maintenance costs are anticipated to be 0.5% of the capital cost. The estimated project delivery timeframe has design commencing in late 2020 and construction completed by late 2023.

8.2. Satisfaction of RIT-D

The proposed preferred option satisfies the RIT-D.

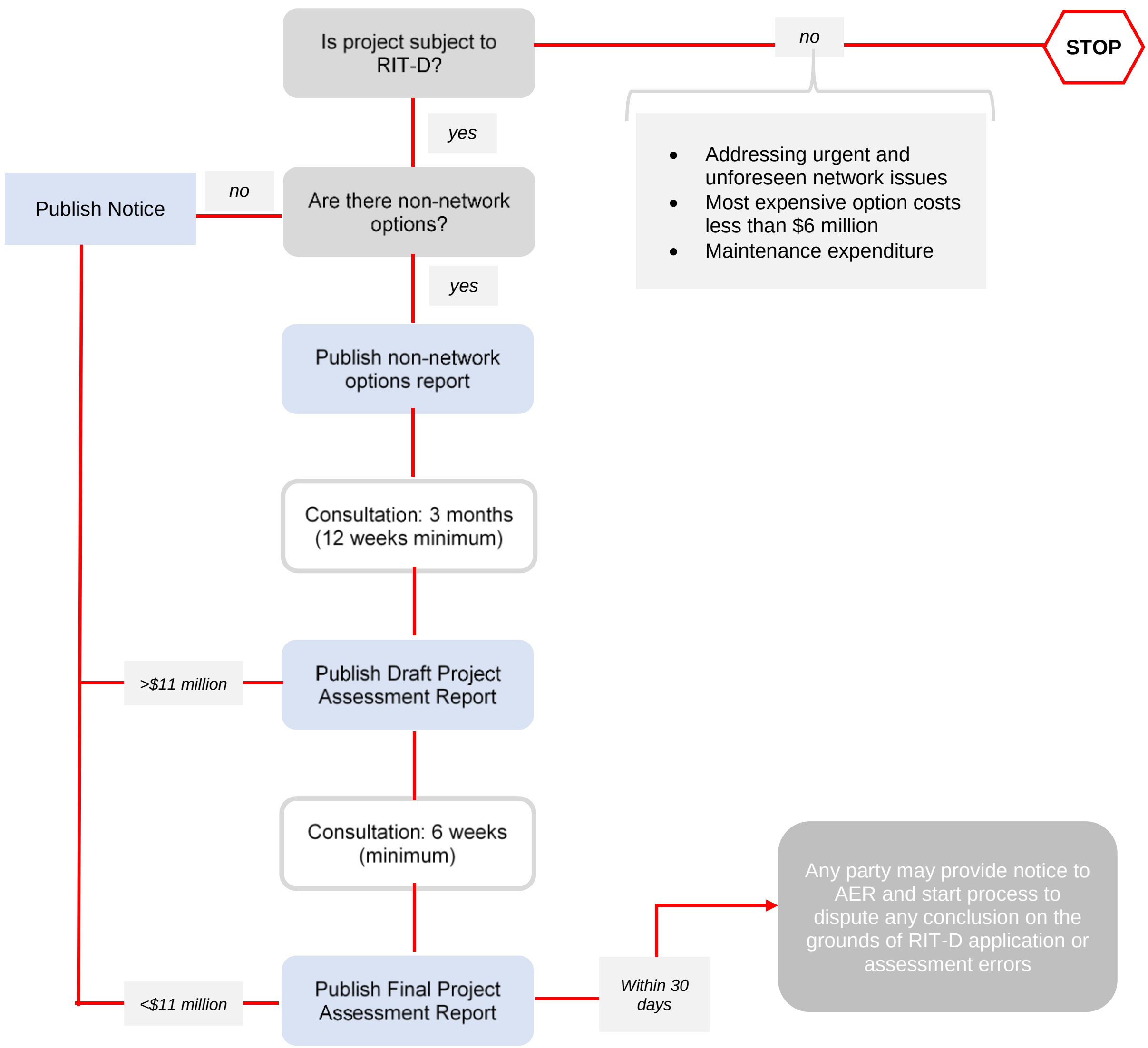
This statement is made on the basis of the detailed analysis set out in this report. The proposed preferred option is the credible option that has the highest net economic benefit under the most likely reasonable scenarios.

9 Compliance Statement

This Final Project Assessment Report complies with the requirements of NER section 5.17.4(j) as demonstrated below:

Requirement	Report Section
(1) a description of the identified need for investment;	3
(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-D proponent considers reliability corrective action is necessary);	3.3
(3) if applicable, a summary of, and commentary on, the submissions received on the DPAR;	5
(4) a description of each credible option assessed	4 & 5
(5) where a *Distribution Network Service Provider* has quantified market benefits in accordance with clause 5.17.1(d), a quantification of each applicable market benefit of each credible option	6
(6) a quantification of each applicable cost for each credible option, including a breakdown of operating and capital expenditure	4 & 5
(7) a detailed description of the methodologies used in quantifying each class of costs or market benefit	6
(8) where relevant, the reasons why the RIT-D proponent has determined that a class or classes of market benefits or costs do not apply to a credible option	6.2
(9) the results of a NPV analysis of each credible option and accompanying explanatory statements regarding the results	7.1
(10) the identification of the proposed preferred option	8.1
(11) for the proposed preferred option, the RIT-D proponent must provide: (i) details of the technical characteristics; (ii) the estimated construction timetable and commissioning date (where relevant); (ii) the indicative capital and operating costs (where relevant); (iv) a statement and accompanying analysis that the proposed preferred option satisfied the RIT-D; and (v) if the proposed preferred option is for reliability corrective action and that option has a proponent, the name of the proponent	8.1
(12) contact details for a suitably qualified staff member of the RIT-D proponent to whom queries on the final report may be directed.	1.4

Appendix A – The RIT-D Process



Source: AEMC, *Rule determination: National Electricity Amendment (Replacement expenditure planning arrangements) Rule 2017*, July 2017, p. 64.