Final Project Assessment Report

Providing Supply to Sovereign Hills Area

19 July 2024

Essential Energy

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Glossary

ACRONYM	FULL NAME
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BESS	Battery Energy Storage System
CAPEX	Capital Expenditure
DPAR	Draft Project Assessment Report
EE	Essential Energy
EV	Electric vehicle
FPAR	Final Project Assessment Report
NEM	National Electricity Market
NER	National Electricity Rules
NNOR	Non-Network Options Screening Report
NPB	Net Present Value (Benefit)
NPC	Net Present Value (Cost)
NPV	Net Present Value
NPVM	Net Present Value to Market
O&M	Operational and Maintenance Expenditure
RIT-D	Regulated Investment Test for Distribution
STPIS	Service Target Performance Incentive Scheme
VUE	Value of Unserved Energy
VCR	Value of Customer Reliability
ZS	Zone Substation

1. Executive Summary

This Final Project Assessment Report (FPAR) was prepared by Essential Energy (EE) in accordance with the Regulatory Investment Test for Distribution (RIT-D) requirements outlined in the National Electricity Rules (NER).

The purpose of this report is to demonstrate the basis for selection of the preferred option to provide supply to the Sovereign Hills Area.

Sovereign Hills is situated in the Mid North Coast, 8 kilometres west of the centre of Port Macquarie, approximately four hours north of Sydney. This area is slated for substantial residential and commercial development, with plans for over 4,000 new dwellings. Ultimately, it will evolve into a satellite township featuring a shopping centre, schools, and various industrial and commercial zones. The capacity of the existing distribution network is reaching limitations. Meeting the long-term electricity supply requirements of this region will necessitate significant enhancements to the electrical infrastructure.

The identified need for this investment is 'reliability corrective action' since investment is required to comply with our NER obligations to connect customers. Essential Energy (EE) considers there is a high consequence loss of supply risk and approaching inability to connect new customers which should be addressed without delay.

Two options were determined to be credible in addressing the network need;

Option 1 – Augment distribution network

Option 2 – Establish Sovereign Hills 33/11kV zone substation.

Economic assessment of the options determined the maximum present value of net economic benefit was achieved with Option 2, as such it is the preferred option. Further detail of economic assessment is below in Section 3 - Assessment Framework and Net Present Value Analysis

This FPAR follows publication of a Non-Network Options Report (NNOR) on 9th June 2023, with a twelve-week public consultation period, inviting written submissions/proposals for non-network solutions that may address the network constraints in the Sovereign Hills area. One submission for a battery energy storage system (BESS) was received. Review and analysis of this proposal concluded it could not address the high consequence loss of supply/reliability risk.

A Draft Project Assessment Report (DPAR) was published 31st May 2024, with a six-week public consultation period, inviting written submissions regards the conclusion of the NNOR. That consultation was completed 12th July 2024. No non-network submissions addressing the results of the DPAR or network need were received.

In compliance with NER clause 5.17.4(i), publication of this FPAR represents the final stage of the RIT-D process, as such EE will proceed with establishment of a new 33/11kV zone substation at Sovereign Hills.

Any enquiry regarding this FPAR should be directed to:

Email: reginvestment@essentialenergy.com.au.

2. Background

2.1 Location

Port Macquarie Hastings Council (PMHC) is a local government area in the Mid North Coast region of New South Wales, four hours north of Sydney. The area has a population of 87,000, with the major population centre at Port Macquarie and smaller centres at Wauchope, Camden Haven, Lake Cathie and Kendall.

Thrumster/Sovereign Hills (Area 13), 8kms west of the centre of Port Macquarie, is the largest of three development areas in the PMHC region as shown below in Figure 1.

Incorporating several residential/commercial developments, mostly to the east of the Pacific Highway and industrial developments in the northern pocket as shown in Figure 2, the Sovereign Hills Area is independently developed by several developers and remained relatively stagnant with small releases of residential lots in early years. In recent years, the last three years in particular, the release and uptake of residential lots has increased rapidly, and commercial/industrial releases are subsequently following.

2.2 Existing Supply System

The Sovereign Hills Area is supplied by a direct 11kV feeder (CPM3B7) that emanates from Clearwater Crescent 33/11kV zone substation (ZS), some 7km's east of Sovereign Hills as shown below in Figure 2. Another 11kV feeder (CPM3B4) that provides supply to other areas (Port Macquarie base hospital, Major Innes, Ascot Park) to the east of Sovereign Hills, also emanates from Clearwater Crescent ZS. The direct 11kV feeder (CPM3B7) from Clearwater Crescent to Sovereign Hills is mostly underground construction.

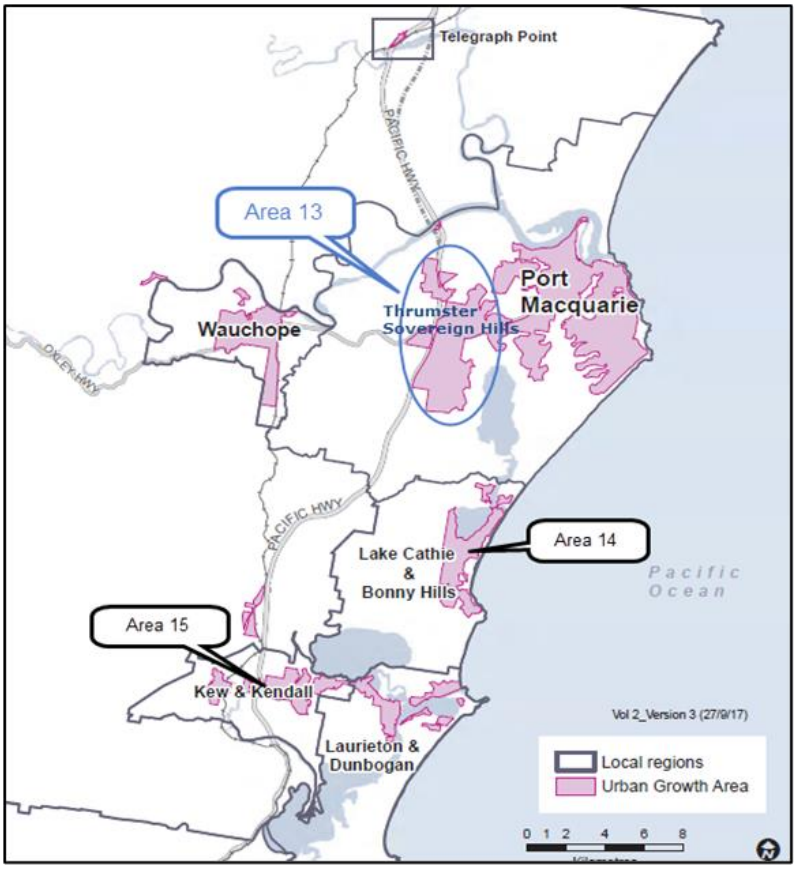

Figure 1: Port Macquarie Hastings Council Urban Growth Areas

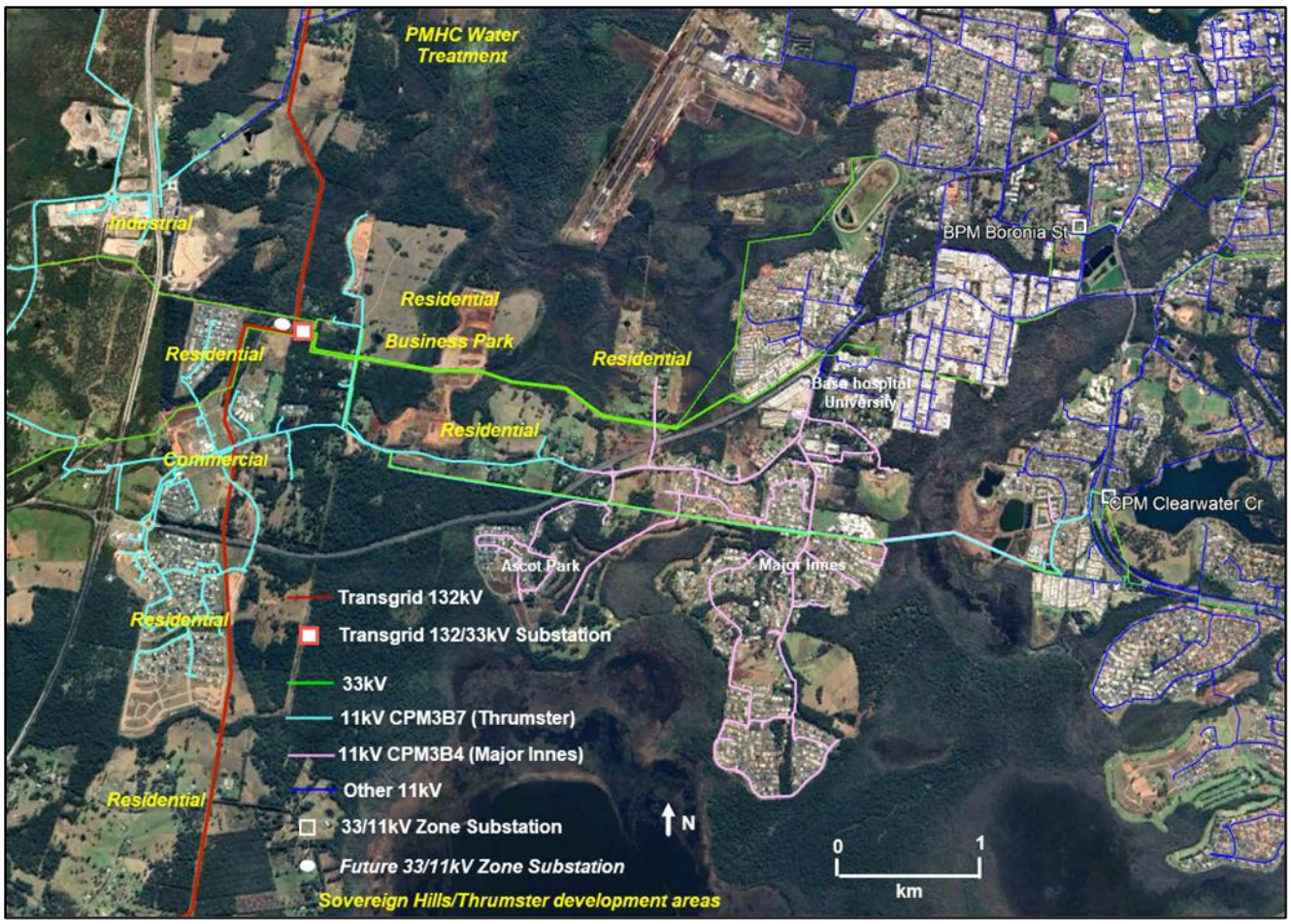

Figure 2: Subtransmission / Distribution Network

2.3 Network Need

The peak demand for the area is expected to reach 20+MVA in 2035 (high scenario). Figure 4 below is forecast peak demand (MVA) for the area up to 2035. The peak demand forecast, energy and demand profile data used in the analysis are a best estimate of use in the area, based on residential connection history, recent developers' proposals, PMHC growth strategy dwelling estimates and spot load connections.

The following spot loads, which will connect in the short-medium term are included in peak demand forecasts;

- Data centre (ramping up to peak 3MVA flat profile)
- PMHC water treatment plant (ramping up to peak 2MVA profile based on other plants in area)
- Electric vehicle chargers 20 posts (ramping up to profile based on existing chargers)

The system normal network constraint as indicated by the dashed line is a representation of the network capacity with all existing 11kV distribution elements in service. The system abnormal network constraint as indicated by the dotted line is a representation of a level where an element of the existing 11kV distribution network is out of service and the network is constrained.

The existing 11kV network for the Sovereign Hills Area supplied from Clearwater zone substation will reach system normal thermal and voltage limitations in medium demand forecast scenario by 2025.

With an unplanned outage of the single direct 11kV feeder (CPM3B7) to Sovereign Hills, loss of supply to the area will occur during medium to peak load times as the backup 11kV feeder (CPM3B4) cannot supply the demand. Reduced customer reliability will increase significantly in the short term. If a fault occurs on any of the underground sections of CPM3B7 and depending on the type of fault, customers at Sovereign Hills could lose supply for extended periods as cable faults can take day/s to rectify.

With 7km's of the total 8km's (backbone to centre Sovereign Hills Area) of CPM3B7 being underground, EE considers this loss of supply risk to be high consequence which should be addressed without delay.

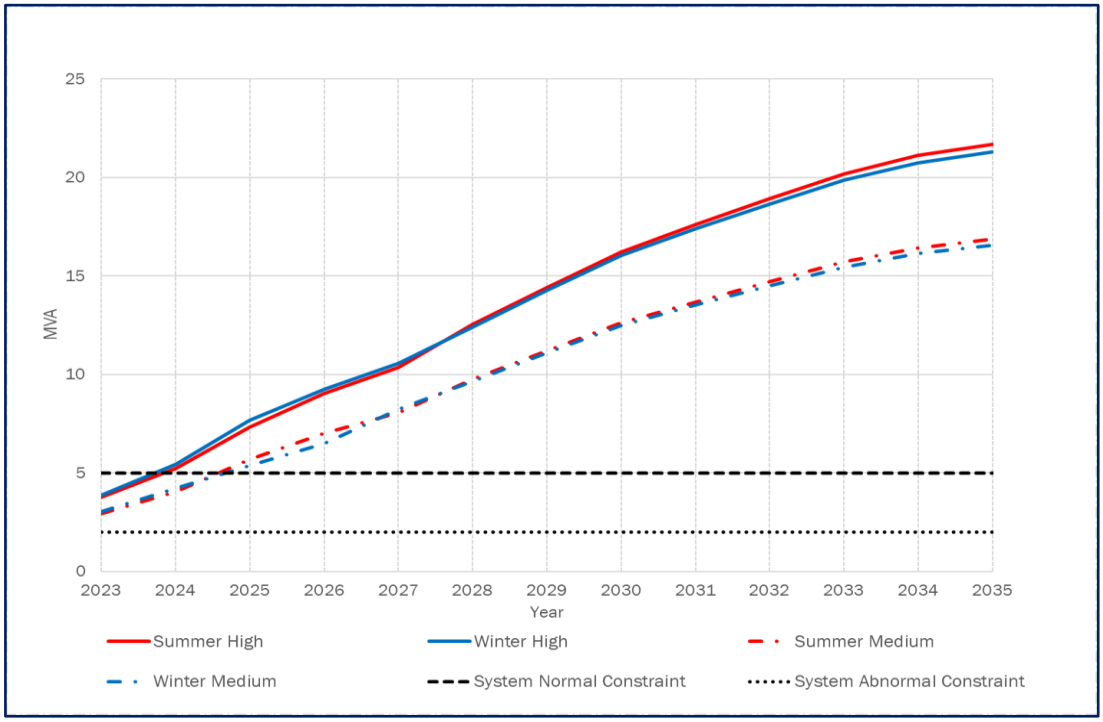

Figure 3: Sovereign Hills area maximum demand forecast

3. Proposed Network Options

The network risk as detailed above in Section 2.3 must be addressed. EE is at risk of not meeting its DNSP requirements as stipulated under section 5.2.3 and Schedule 5.1 of the NER, regards providing adequate customer supply. The following is a summary of the two credible network options that were investigated to address the risk;

3.1 Option 1 – Augment Existing Distribution Network

Option 1 involves staged augmentation of the 11kV distribution network. As demand in the area increases new underground 11kV feeders would be installed from Clearwater Crescent ZS, the timing of which would be dependent on load growth. It's probable an extra five 11kV feeders would be required over the long term. Reliability requirements would take into account, with unplanned outage of a single 11kV feeder, the remaining in-service feeders would supply all demand.

Clearwater Crescent ZS would require augmentation with a third 33/11 transformer and 11kV switchboard extension. The 33kV network supplying Clearwater Crescent ZS would also require augmentation with conductor replacements.

Timing of augmentation is based on medium demand forecast. The total capital cost of this option over the long term is expected to be $45.6M and the NPV cost (base scenario) is $40.1M

Option 1 relies on an upgrading and installing an extensive long-term underground distribution feeder network. The zone substation servicing the area requires brownfield augmentation to meet the growing demand. This augmentation process presents logistical challenges and potential service disruptions during construction.

The distribution source is located away from the load centre. This design, while feasible, is inefficient with significant energy loss. As energy is distributed through the network, heat is inherently radiated from infrastructure resulting in energy loss.

With this option, Clearwater Crescent ZS is the distribution source, 8km east of Sovereign Hills load centre. Energy is delivered to this ZS via subtransmission (33kV) from Transgrid's 132/33kV substation which is adjacent to Sovereign Hills. Customer supply to Sovereign Hills is then delivered back to Sovereign Hills via the distribution network. This delivery of energy through ultimately a network of subtransmission (two x 8km) and distribution (five x 8km), results in excessive energy loss.

Augmenting brownfield sites (ZS and underground feeder) are normally more expensive and complex than greenfield sites. There are also additional safety risks related to working around live high voltage that is not present with a greenfield build.

SCOPE	DESCRIPTION	YEAR	CAPEX ($M)
Distribution	11kV distribution feeder 1 (8km)	1	$6.7
	11kV distribution feeder 2 (8km added conduits)	5	$9.5
	11kV distribution feeder 3 (8km)	9	$6.7
	11kV distribution feeder 4 (8km)	13	$6.7
	11kV distribution feeder 5 (8km)	17	$6.0
Subtransmission	Reconductor 33kV feeder to Clearwater Cres (9km/dual cct)	7	$4.1
Zone Substation	Clearwater Cres zone substation, add third transformer, extend switchboard	5	$6.0
TOTAL	**Augment existing distribution network**		**$45.6**

Table 1: Scope and Cost Estimates Option 1

3.2 Option 2 – Establish Sovereign Hills 33/11kv Zone Substation

Option 2 involves immediate construction of a 33/11kV ZS on an existing site which is adjacent Transgrid's Port Macquarie 132/33kV bulk supply point substation and 1km north of the centre of the Sovereign Hills development. The new ZS would have two 33/11kV transformers, indoor 33kV and 11kV switchboards and be supplied by two 33kV underground cable connections (each 350m) from Transgrid's 132/33kV substation. Transgrid have two spare 33kV feeder bays (33kV circuit breakers and associated equipment) available for connection.

With Sovereign Hills initial development of roads and other infrastructure several conduits have been and will be laid for 11kV connections to the new zone substation. Initially three 11kV feeders from the existing 11kV network will connect to the new ZS via new cables or new conduits and cables, with all three within 1km of the ZS site.

Into the future further 11kV connections from the existing network will be connected to the ZS, these connections will be within 1km of the ZS.

The total capital cost of this option over the long term is expected to be $15.7M and the NPV cost (base scenario) is $16.3M. With an initial capital cost of $13.9M.

Option 2 is the preferred network option. It provides a least cost, straightforward solution that will deliver appropriate levels of capacity and reliability for existing and future customers, meeting the ultimate need in the Sovereign Hills and surrounding area. Opting for a greenfield site for ZS and distribution feeder construction greatly simplifies the process. This choice not only reduces overall costs but also minimizes construction safety risks.

The ZS site is strategically situated adjacent to existing electricity infrastructure, TransGrid's 132/33kV Port Macquarie substation, minimizing visual impact This location enhances supply backup capabilities for existing customers in nearby areas, particularly to the east of Sovereign Hills. With the ZS in close proximity to the load centre, energy losses are minimised, making it an environmentally friendly choice while optimizing operational efficiency.

SCOPE	DESCRIPTION	YEAR	CAPEX ($M)
Distribution	11kV distribution feeder connections (three initial)	1	$2.2
	11kV distribution feeder 4 (500m cable)	9	$0.5
Subtransmission	11kV distribution feeder 5 (1km)	13	$1.1
	Two 33kV UG connections to Transgrid (each 350m)	1	$1.5
Zone Substation	Establish Sovereign Hills zone substation, two 33/11kV transformers, (one new, one system spare), 11kV switchboard	1	$10.4
TOTAL	**Establish Sovereign Hills zone substation**		**$15.7**

Table 2: Scope and Cost Estimates Option 2

Below table is summary of key points for each option.

OPTION	DESCRIPTION	COMMENT	CAPEX ($M)
1	Augment existing distribution network	• Extensive long term underground distribution feeder network (construction risk, easement acquisition risk, reliability risk) • Significant zone substation brownfield augmentation • Distribution source away from load centre • Lesser long term supply reliability • Inefficient/greater energy losses	$45.6
2	Establish Sovereign Hills 33/11kV zone substation	• Lower overall cost, highest net market benefit, higher upfront cost • Greenfield site, ease of zone substation and distribution feeder construction (reduced construction safety risk) • Zone substation site adjacent existing electricity infrastructure, suitable public visual impact • Long term supply reliability (less infrastructure, less failures) • Distribution source close proximity to load centre (minimal energy loss)	$15.7

Table 3: Options Summary

4. Assessment Framework and NPV

This section outlines the methodology applied in assessing the market benefits and costs associated with each option.

4.1 Overview

The costs and benefits with each option have been assessed against a do-nothing scenario. In a do-nothing scenario, the capacity of the distribution network in system normal configuration will be exceeded in the short term. It is likely EE would not be capable of connecting new customers in the short term, particularly spot loads (small-medium commercial and industrial customers). With existing customers, in system abnormal configuration (loss of 11kV feeder 3B7) EE would have to shed load, customers would be without supply for extended periods, depending on type and location of fault.

The NPV analysis have been taken over a 20-year period as it is considered a reasonable representation of market benefits and costs for each of the options. Although the asset life for these options are well beyond 20 years, the main market benefit of improved customer reliability cannot be realistically represented over 40 years.

4.2 Market Benefit

A number of market benefits were considered when undertaking initial option analysis. Only one, the annual unserved energy (VUE) estimated via value of customer reliability (VCR) was considered as a material market benefit and taken into account in the NPV analysis.

The key value (annual $/MWH) in the VUE analysis utilised a weighting of AER published (Dec 2021) VCR for NSW residential and commercial (<10MVA) customers with added CPI to 2024.

DESCRIPTION	RESIDENTIAL	COMMERCIAL
Composition of Sovereign Hills customers	56%	44%
AER VCR $/MWH (AER published Dec 2021)	$26.51	$46.18
Weighted $/MWH VCR + CPI		**$37.87**

Table 4: VCR used in NPV analysis

The VUE analysis takes into account historical unplanned annual outage rates and durations on the direct 11kV feeder (CPM3B7 from Clearwater Crescent ZS) to the Sovereign Hills Area. The backup supply on loss of CPM3B7 is the CPM3B4 Major Innes feeder, which also emanates from Clearwater Cresent ZS. CPM3B4 is approaching its system normal capacity and as such provides limited backup supply to CPM3B7, particularly in times of peak demand. This limited backup will deteriorate each year as demand on CPM3B7 increases.

The main backbone of the CPM3B7 feeder is 8kms with 7kms of underground. There are several areas of concern with this underground, in particular, a 1km run that transverse under a major four lane roadway in a congested area with four other 11kV feeders. Rectification of a cable fault in this area could be well beyond 24 hours.

EE considers the VCR market benefit used in NPV cost benefit analysis of unplanned outages on CPM3B7 to be conservative with the possible high consequence loss of supply and high reputational impact of an extended outages. Also, another possible loss of supply scenario, catastrophic failure of the Clearwater Crescent 3B7 11kV indoor circuit breaker, with minimal means of bypass, has not been taken into account.

Other market benefits considered but not included were;

- Changes in electrical losses and distribution loss factor:- It is recognised that each option will have different changes to the loss profile for customers in the network. This will not have a detrimental effect on distribution loss factors. The demand from Transgrid's Port Macquarie 132/33kV substation would differ with each option. There would be minimal change in Transgrid's transmission charges ($kW/month).

- Improved reliability to other existing customers outside of Sovereign Hills Area. Option 2 will inherently provide improved reliability to customers supplied by CPM3B4, providing slightly better backup capabilities than Option 1.

4.3 NPV Cost Benefit Assessment

The NPV cost benefit analysis includes three scenarios, which are designed to test alternative assumptions and whether they significantly affect the identification of the preferred option.

Three alternative scenarios were assumed;

Base – assumptions that reflect a central set of variable estimates, which provide the most likely scenario.

Low benefit – assumptions that give rise to a lower bound on reasonably expected market benefits and costs.

High benefit – assumptions that give rise to a upper bound on reasonably expected market benefits and costs.

The scenarios were developed to test a range of net benefits that can be expected from credible options. We consider that this approach allows for a robust test of the preferred option compared with adopting individual sensitivity tests because multiple inputs are changed together. EE considers that the base scenario is most likely because it is based primarily on expected assumptions/outcomes.

PARAMETER	BASE	LOW BENEFIT	HIGH BENEFIT
CAPEX	100%	125%	75%
Discount rate	3.14%	4.14%	2.14%
O&M	0.5%	0.63%	0.38%
VCR	100%	70%	130%

Table 5: Scenarios in NPV analysis

4.4 NPV Cost Benefit Outcomes

The following table is a summary of the NPV cost benefit analysis. As noted above the NPV analysis has been taken over a 20-year period as it is considered a reasonable representation of market benefits and costs for each of the options. The two credible options have been assessed against a business-as-usual base case.

In a project where the identified need is for reliability corrective action, such as in this situation, the net economic benefit can be negative, and the preferred option can be identified as the one that maximises net present economic value to market.

Defined in NER clause 5.17.1(b), that states that the purpose of the RIT–D is to:

...identify the credible option that maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the National Electricity Market (the preferred option). For the avoidance of doubt, a preferred option may, in the relevant circumstances, have a negative net economic benefit (that is, a net economic cost) where the identified need is for reliability corrective action.

OPTION	SCENARIO	CAPEX	NPC	NPB	NPVM
1 - Augment Distribution	Base	($45.6)	($39.8)	$9.3	**($28.7)**
2 - Establish Sovereign Hills ZS		($15.7)	($16.4)	$9.3	**($6.5)**
1 - Augment Distribution	Low	($57.1)	($46.9)	$5.8	**($38.9)**
2 - Establish Sovereign Hills ZS		($19.7)	($20.3)	$5.8	**($13.8)**
1 - Augment Distribution	High	($34.2)	($31.6)	$13.5	**($16.8)**
2 - Establish Sovereign Hills ZS		($11.8)	($12.4)	$13.5	**$1.5**

Table 6: Summary NPV analysis

NPC: Net Present Cost NPB: Net Present Benefit NPVM: Net Present Value to Market ( ): NPV negative

NPC represents both capital and operating and maintenance expenditures over the 20-year analysis. Option 1 NPC's are lower than the estimated CAPEX, primarily due to staged timing of augmentations. Option 2 NPC's are slightly higher than CAPEX due to higher upfront capital and O&M costs.

NPB represents the benefit of alleviating the unserved energy that Sovereign Hills customers would experience due to unplanned outages on CPM3B7, limited backup capabilities and ongoing growth in demand. It is assumed both Option 1 and Option 2 will provide similar benefit, although Option 2 will ultimately provide more immediate benefit to other customers outside of the Sovereign Hills Area, during unplanned outages on other distribution feeders than CPM3B&, that additional benefit has not be taken into account.

The above table shows that although negative in all scenarios, Option 2 presents better value to market with a lower NPVM's when compared to Option 1, and as such is the preferred option.

4.5 Selection of Preferred Option

Essential Energy's preferred option is Option 2 to establish a Sovereign Hill 33/11kV zone substation with 33kV connections to Transgrid's Port Macquarie 132/33kV substation and 11kV connections to existing Sovereign Hills 11kV network. The scope of work and estimated capital costs (initial establishment only, proposed 5yr+ not included) and operating costs of this option are as below:

- Construct a 33/11kV zone substation on an existing site, with indoor 33kV and 11kV switchboards, a new 33/11kV 30MVA transformer and a refurbished 33/11kV 20MVA transformer.
- Construct two 33kV underground feeders (each 350m) from new zone substation to Transgrid's Port Macquarie 132/33kV substation onto two existing 33kV feeder bays.
- Construct three 11kV distribution feeders from zone substation to existing 11kV network (each less than 1km).

Estimated capital cost: $14.1 million (base scenario, initial year).

Estimated average operating cost per annum: $70,500 (base scenario over ten year).

Expected construction completion Apr 2027.

5. Summary of Submissions Received

On 9 June 2023, Essential Energy published the Non-Network Options Report (NNOR) providing details on the identified need for the Sovereign Hills Supply Area. 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.

Essential Energy received one submission in response to the NNOR for the Sovereign Hills Supply Area.

The response involved establishment of a BESS connected to the 11kV distribution network in the Sovereign Hills vicinity. The BESS would reduce the peak demand on the direct 11kV feeder to Sovereign Hills (CPM3B7) when it approached the system normal capacity (5MVA) by exporting back into the network, with an intention to defer the capital expenditure establishment of the zone substation.

Considering the size of the proposed BESS and the forecast demand growth, EE considered a deferral period of two-three years could possibly be achievable with the proposed BESS and undertook NPV analysis on that deferral. Although the proposed BESS solution shows slightly better NPVM in one of the three analysis scenarios in each deferral period, EE considered this not to be significant enough to indicate the non-network option as the preferred option. Also, more importantly EE considered the non-network would not provide the same reliability benefits when compared to the preferred network option. There is a high consequence loss of supply risk and approaching inability to connect new customers which should be addressed without delay. That being the case, EE will not go forward with the non-network option. A Draft Project Assessment Report (DPAR) was published 31st May 2024, with a six-week public consultation period, inviting written submissions regards the conclusion of the NNOR.

That consultation was completed 12th July 2024. No non-network submissions addressing the results of the DPAR or network need were received.

6. Satisfaction of RIT-D

Below table summarises Essential Energy's timeline in this RIT-D process. Essential Energy has concluded the proposed preferred option to establish a 33/11kV zone substation at Sovereign Hills satisfies the RIT-D process.

This statement is made based on the detailed analysis set out in this report and the DPAR. The proposed preferred option is the credible acceptable option that has the highest net economic benefit under NPV cost benefit analysis scenarios and addresses the reliability corrective action.

Any enquiries regarding this report can be directed to: Email: reginvestment@essentialenergy.com.au

STEPS	DESCRIPTION	RELEASED, DUE OR COMPLETED	DATE
Step 1	Publish Non-Network Options Report (NNOR) inviting non-network options from interested participants (twelve-week public consultation)	Completed	Friday, 9th June 2023
Step 2	Submissions in response to the Non-Network Options Report.	Completed	Friday, 8th Sept 2023
Step 3	Review and analysis of proposals by Essential Energy This is likely to involve further consultation with proponents and additional data may be requested.	Completed	Friday, 3rd May 2024
Step 4	Release of Draft Project Assessment Report (DPAR) (six-week public consultation)	Completed	Friday, 31st May 2024
Step 5	Submissions in response to the Draft Project Assessment Report.	Completed	Friday, 12th July 2024
Step 6	Review and analysis of submissions to DPAR	Completed	Friday, 19th July 2024
Step 7	Publish Final Project Assessment Report (FPAR) including summary of submissions received	Completed	Friday, 19th July 2024

Table 7: RIT-D Process Timeline

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