

Appendix 5.26: Supply to Whitlam PJR

**Regulatory proposal for the ACT electricity distribution network 2019-24
January 2018**

Disclaimer: On 1 January 2018, the part of ActewAGL that looks after the electricity network changed its name to Evoenergy. This change has been brought about from a decision by the Australian Energy Regulator. Unless otherwise stated, ActewAGL Distribution branded documents provided with this regulatory proposal are Evoenergy documents.

Project Justification Report

Project name	Supply to Whitlam
Expenditure type	Capital Expenditure
Business Group	Asset Strategy
Regulatory Period	1 July 2019 to 30 June 2024
Total Project Cost Estimate	\$274,500 excluding corporate overheads, excluding contingency, and excluding GST
Five year total spend 2019-24	\$274,500 excluding corporate overheads, excluding contingency, and excluding GST
CAPEX category	ENAA Distribution
Primary driver	Load growth of Whitlam Estate
Project Number	20004516

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Reference documents

Document	Version	Date
National Electricity Rules	102	
National Electricity Law		19.12.13
Utilities Act (ACT)		2000
Utilities (Management of Electricity Network Assets Code) Determination		2013
Evoenergy Maximum Demand Forecast		2017
ActewAGL Annual Planning Report		22.12.17
Distribution Network Augmentation Standard SM1197	1.1	12.5.15
Evoenergy Risk Assessment Tables PR4660.2	1.0	12.1.17
Evoenergy Quality of Supply Strategy SM11150	1.0	8.10.15
Evoenergy Asset Management Strategy SM1192	2.12	22.6.15
Evoenergy Peak Demand Reduction Strategy	2.0	22.8.17
Augmentation NPV Model Methodology	1.0	29.9.17

1. Executive Summary

Whitlam is a new suburb is to be developed by the ACT Government's Suburban Land Agency (SLA) in the Molonglo Valley, occupying the area of land between William Hovell Drive and the Molonglo River.

Whitlam suburb will eventually comprise approximately 10,500 dwellings with the first stage, comprising 500 dwellings scheduled to be constructed in 2019-20 with electrical reticulation to be installed and available by 30 June 2020.

Supply to Whitlam will eventually be provided via the proposed Molonglo Zone Substation. However, the Molonglo Zone Substation will not be available until 2022. Until this time, this project proposes to install a new underground cable 11 kV feeder extension from the existing Civic – Black Mountain feeder. This feeder has recently been upgraded to provide capacity and back-up supply security to the Molonglo Valley.

As development of Whitlam proceeds and the Molonglo Zone Substation is installed, the overhead section of the Black Mountain feeder will be removed and the underground feeder installed under this project will be extended and connected to Molonglo Zone Substation as a permanent feeder.

Other options such as the extension of the Weir feeder from Latham Zone Substation and non-network options have been considered and evaluated.

A preliminary cost estimate for the selected option is **\$274,500 excluding corporate overheads, excluding contingency, and excluding GST.**

2. Strategic Context and Expenditure Need

2.1. Strategic Context

Whitlam is a new suburb is to be developed by the ACT Government's Suburban Land Agency (SLA) in the Molonglo Valley occupying the area of land between William Hovell Drive and the Molonglo River, approximately 10 km from the Canberra Central Business District (CBD).. The development of the suburb is part of the broader development of Molonglo Valley District to eventually accommodate 55,000 people with 10,500 dwellings located in Whitlam.

The proposed new residential suburb of Whitlam is at planning stage with construction scheduled to commence in the 2019-20 financial year. Development will be carried out in stages; Stage 1 (2019-20) will comprise 500 dwellings and Stage 2 (2020-21) will comprise 600 dwellings. The first and second stages of Whitlam are located to the west of John Gorton Drive (refer Figure 1). Spare 150mm diameter conduits are to be installed across Coulter Drive and William Hovell Drive, and down John Gorton Drive as part of the ACT Government's developments in the area. These conduits will be installed during 2018-19 so will be available for use to supply Whitlam Stage 1 and 2 by 2020.

Figure 1 shows the location of the Whitlam suburb in the context of the broader development of Molonglo Valley.

2.2. Existing Infrastructure

The Whitlam suburb is not currently serviced by ActewAGL's network. The closest feeders are the 11kV Weir feeder and the 11kV Black Mountain feeder from Civic zone substation.

The Black Mountain feeder is an overhead line that emanates from Civic Zone Substation. The overhead section from Redfern St southwards to Denman Prospect estate has recently been upgraded and has approximately 3.6 MVA spare capacity available.

The Weir feeder is an overhead line that emanates from Latham Zone Substation. Weir feeder currently has approximately 1.75 MVA spare capacity available.

The proposed new Molonglo Zone Substation (see separate PJR) will not be available to supply the first stages of Whitlam.

2.3. Driving need for infrastructure investment

Based on an After Diversity Average Demand (ADMD) of 3 kVA per dwelling, the load to be supplied will be approximately 1.2 MVA at Stage 1 by June 2020 and 1.8 MVA at Stage 2, ie a total of 3.0 MVA by June 2021.

There is likely to be significant installation of rooftop solar PV generation on new detached dwellings at Whitlam. There could also be significant installation of home battery energy storage systems associated with this PV generation. As prices of battery storage systems are anticipated to fall over coming years, it is expected that the rate of uptake will increase and ultimately all customers who have a PV installation may opt to install a battery storage system also. Thus a penetration rate of 30% has been assumed for rooftop PV and 20% for associated residential level battery storage systems throughout the Molonglo Valley and this is incorporated in the forecasts above.

This project justification report identifies and evaluates options to provide this initial 11 kV supply to the Whitlam suburb until this load can be transferred to the future Molonglo Zone Substation.

Figure 1: Stages of development of Molonglo Valley

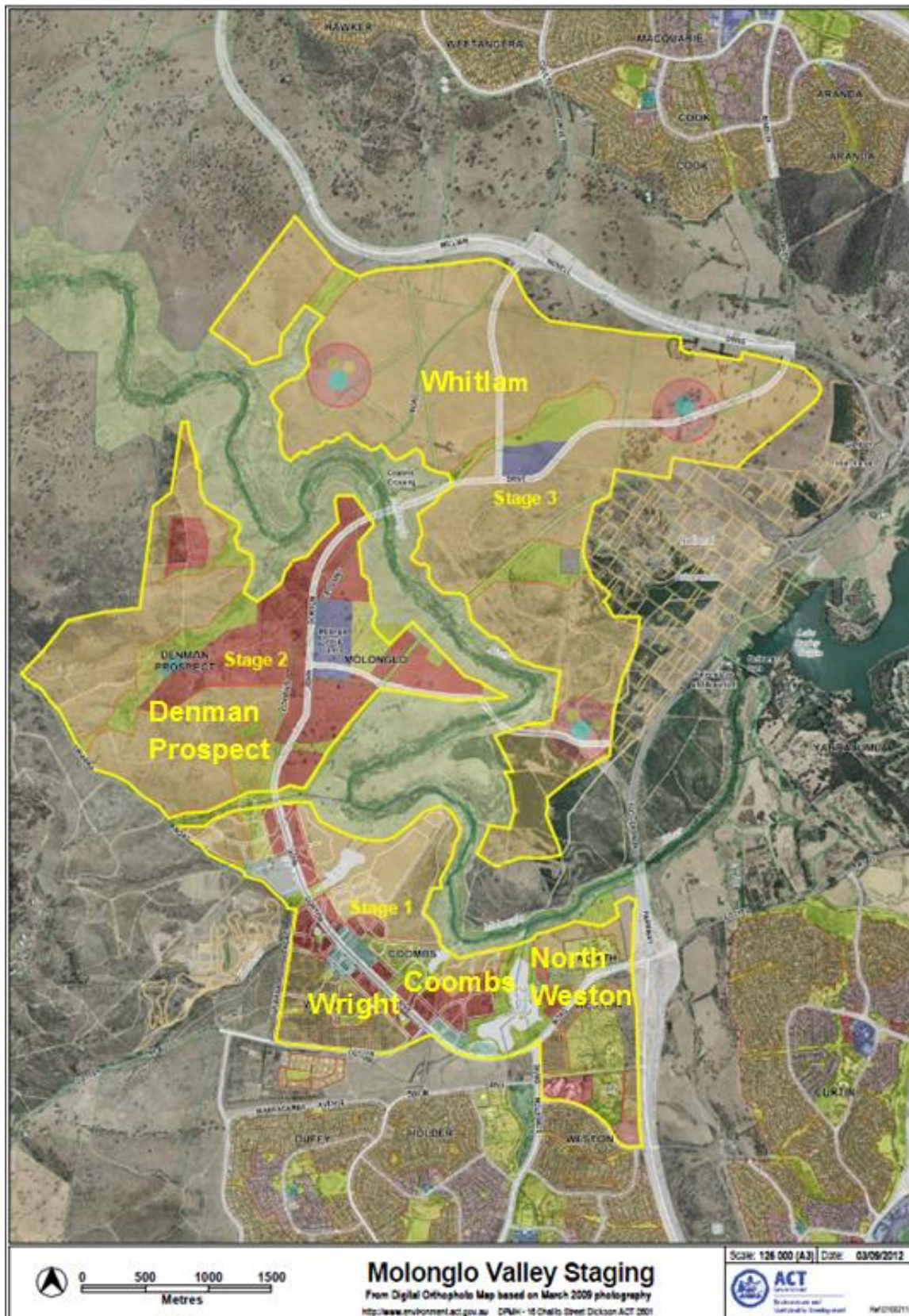


Figure 2 shows a conceptual 11 kV reticulation design for Whitlam Stages 1 and 2, and the eventual supply from the Molonglo Zone Substation.

Figure 2: Conceptual 11 kV Design Whitlam Stages 1 and 2



3. Objectives

3.1. Corporate, asset management and key project objectives

The corporate, asset management and related key project objectives are shown in Table 1 below. These objectives are used to assess the relative risk of options.

Table 1: Corporate, asset management and key project objectives

Corporate objectives	Asset management objectives	Key project objectives
Responsible	<ul style="list-style-type: none"> Achieve zero deaths or injuries to employees or the public. Maintain a good reputation within the community. Minimise environmental impacts, for example bushfire mitigation. Meet all requirements of regulatory authorities, such as the AER as outlined in the NER, and the ACT Utilities (Technical Regulations) Act 2014. 	The selected option must ensure environment and safety standards will be met.
Reliable	<ul style="list-style-type: none"> Tailor maintenance and renewal programs for each asset class based on real time modelling of asset health and risk. Meet network SAIDI and SAIFI KPIs. Record failure modes of the most common asset failures in the network. Successfully deliver the asset class Program of Work (PoW) to ensure that the protection operates correctly to disconnect faulty sections in accordance with the NER. 	<p>Options evaluations to consider the value of customer reliability (VCR).</p> <p>In accordance with regulated requirements, the selected option must ensure access to an electricity supply.</p>
Sustainable	<ul style="list-style-type: none"> Enhance asset condition and risk modelling to optimise and implement maintenance and renewal programs tailored to the assets' needs. Make prudent commercial investment decisions to manage assets at the lowest lifecycle cost. Integrate primary assets with protection and automation systems in accordance with current and future best practice industry standards Deliver the asset class PoW within budget. 	<p>Options evaluations to consider the cost effectiveness of the solution.</p> <p>In accordance with regulated requirements, the selected option must be the most prudent and efficient.</p> <p>Non-network options will be evaluated on equal merit with network solutions.</p>
People	<ul style="list-style-type: none"> Proactively seek continual improvement in asset management capability and competencies of maintenance personnel. 	A post implementation review to incorporate learnings through the asset management system.

The project objectives are consistent with Evoenergy's regulatory requirements described below.

3.2. Regulatory Compliance

3.2.1. National Electricity Law and National Electricity Rules

Evoenergy is subject to the National Electricity Law (NEL) and the National Electricity Regulations (NER) which regulate the National Electricity Market (NEM). Evoenergy operates in the NEM as both a Transmission Network Service Provider (TNSP) and a Distribution Network Service Provider (DNSP).

The National Electricity Objective (NEO), as stated in the NEL is to:

“...promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

- a) price, quality, safety, reliability and security of supply of electricity; and*
- b) the reliability, safety and security of the national electricity system.”*

This objective requires Registered NEM participants to balance the costs and risks associated with electricity supply.

The planning and development process for distribution and transmission networks is carried out in accordance with the National Electricity Rules (NER) Chapter 5 Part B Network Planning and Expansion.

The primary objective of planning is to ensure that customers are able to receive a sufficient and reliable supply of electricity now and into the future.

3.2.2. Capital Expenditure Objectives and Criteria

The NER provides further guidance in terms of allowable capital expenditure via the capital expenditure objectives and criteria for standard control services. These capital expenditure objectives, specified in clause 6.5.6(a) and 6.5.7(a) of the NER describe the outcomes or outputs to be achieved by the expenditure. The objectives include:

- 1) Meet or manage the expected demand for standard control services*
- 2) Comply with all applicable regulatory obligations or requirements associated with the provision of standard control services*
- 3) To the extent that there is no applicable regulatory obligation or requirement in relation to the quality, reliability or security of supply of standard control services; or the reliability or security of the distribution system through the supply of standard control services, to the relevant extent:*
 - a) Maintain the quality, reliability and security of supply of standard control services*
 - b) Maintain the reliability and security of the distribution system through the supply of standard control services*
- 4) Maintain the safety of the distribution system through the supply of standard control services.*

The expenditure criteria, set out in Section 6.5.6(c) and Section 6.5.7(c) of the NER, further outline requirements for the way in which expenditure must be set to achieve the objectives above. These include:

- 1) The efficient costs of achieving the expenditure objectives*
- 2) The costs that a prudent operator would require to achieve the expenditure objectives; and*
- 3) A realistic expectation of the demand forecast and cost inputs required to achieve the expenditure objectives.*

The above criteria therefore imply that the capital expenditure, determined in line with the expenditure objectives, must be met via prudent and efficient expenditure, is to be achieved at least cost.

3.2.3. Regulatory Investment Test

Section 5.16 of the NER describes the Regulatory Investment Test for Transmission (RIT-T) and Section 5.17 describes the Regulatory Investment Test for Distribution (RIT-D). These tests must be carried out for any proposed investment where the augmentation or replacement cost of the most expensive credible option exceeds \$5 million.

The regulatory investment tests provide the opportunity for external parties to submit alternative proposals to the Network Service Provider, who is obliged to consider any credible proposal objectively.

Since the required investment is greater than \$5million the project is subject to the RIT-D. Evoenergy commenced RIT-D process in 2014 with publication of a Project Specification Consultation Report, but has yet to complete the RIT-D process (ie publication of Draft Project Assessment Report and Final Project Assessment Report). These reports will need to be prepared as part of the development of this project. The initial RIT-D consultation paper published in 2014 recommended establishing a new zone substation at the Arboretum site (comprising two transformers and two switchboards) by 2017-18, but lower load growth rate has enabled this to be deferred to 2021-22.

3.2.4. Utilities Act 2000 (ACT)

Evoenergy has an obligation to comply with the Utilities Act 2000 (ACT) which imposes specific technical, safety and reliability obligations via the Management of Electricity Network Assets Code and the Electricity Distribution Supply Standards Code.

The Electricity Distribution Supply Standards Code (August 2013) sets out performance standards for Evoenergy's distribution network. Evoenergy is required to take all reasonable steps to ensure that its Electricity Network will have sufficient capacity to make an agreed level of supply available.

This local jurisdictional code specifies reliability standards that Evoenergy must endeavour to meet when planning, operating and maintaining the distribution network. It also specifies power quality parameters that must be met including limits on voltage flicker, voltage dips, switching transients, earth potential rise voltage unbalance, harmonics and direct current content.

The Management of Electricity Network Assets Code requires electricity distributors to protect integrity and reliability of the electricity network and to ensure the safe management of the electricity network without injury to any person or damage to property and the environment.

3.2.5. Evoenergy's Distribution Network Augmentation Standards

Evoenergy's distribution network augmentation standards are set to ensure compliance with the relevant regulatory instruments as described above.

Evoenergy's planning standards are determined on an economic basis but expressed deterministically so that peak demand can be met with an appropriate level of backup should a credible contingency event occur. A credible contingency event is the loss of a single network element, which occurs sufficiently frequently, and has such consequences, as to justify Evoenergy to take prudent precautions to mitigate. This is commonly referred to as an N-1 event.

Zone substation capacity must be augmented if the forecast zone substation maximum demand based on 50% PoE under N-1 conditions exceeds the two-hour emergency rating.

Major zone substation augmentation such as the installation of an additional transformer will not be considered until all other options such as load transfer to adjacent zone substations and non-network options have been fully explored and implemented.

For high voltage (11kV) distribution feeders in urban areas Evoenergy specifies that there should be a minimum of two effective feeder ties to meet two-for-three arrangement where it is economically viable, i.e. two feeders able to supply the load normally supplied by three feeders. A firm rating is assigned to each feeder based on its thermal rating and the number of feeder ties available.

Distribution high voltage feeder capacity must be augmented or demand management solutions provided if the forecast 50% PoE feeder maximum demand exceeds the firm ratings as given in Table 2.

Table 2: Feeder Firm Rating standard

Feeder configuration	Firm rating as percentage of thermal capacity
Two or more feeder ties	75%
One feeder tie	50%
Feeders operating in parallel	$\{(N-1)/N\}\%^1$
Partial feeder tie	100% or less ²
No feeder tie	100%

3.2.6. Cost compliance

Cost compliance is achieved by proactively pursuing the philosophy of compliance with the national electricity objective by fully exploring and evaluating all options technically and commercially so as to seek approval for a solution that provides sound grounds for an efficient investment while meeting the long term interests of the consumers.

The investment value has been determined using 2016-17 market prices. The methodology and estimated costs used for this project are developed through the application of industry knowledge and Good Engineering Operating Practices based on historical similar projects. This approach complies with paragraphs 6 & 7 of the National Electricity Law (NEL).

¹ “N” represents the number of feeders operating in parallel.

² A partial feeder tie refers to a tie with limited back feeding capacity. The firm capacity of a feeder with a partial feeder tie may be set below 100% its thermal capacity.

4. Options Assessment

Evoenergy has considered four options to provide initial 11 kV supply to Whitlam Stage 1 and 2, as listed in Table 3.

Table 3: Options considered for 11 kV supply to Whitlam

Option	Option type	Description	Evaluation
0	Network	Do nothing	Not selected as does not meet minimum requirements
1	Network	Construct 11 kV cable feeder spur from existing Civic–Black Mountain feeder	Selected as higher NPC
2	Network	Construct 11 kV cable feeder extension from existing Latham–Weir feeder	Not selected due to lower NPC
3	Network	Demand side management and embedded generation	Not selected as does not meet minimum requirements and lower NPC
4	Non-network	Delayed preferred network option using non-network options	Not selected as cost of delay exceeded benefits

4.1. Options analysis

4.1.1. Do Nothing Option

The ‘Do Nothing’ option would result in no supply to the Whitlam suburb.

The value of energy at risk is estimated to be approximately \$142m over a five year period.

The Do Nothing option would result in Evoenergy breaching its obligations under the National Electricity Law, and the Utilities Act as well as not meeting the capital expenditure objectives under the National Electricity Rules.

4.1.2. Option 1: Construct 11 kV cable feeder spur from existing Black Mountain feeder

Option 1 considers the connection of a new underground 11 kV cable extension from the existing Black Mountain feeder. The Black Mountain feeder is an overhead line that emanates from Civic Zone Substation. The overhead section from Redfern St southwards to Denman Prospect estate has recently been upgraded and has approximately 3.6 MVA spare capacity available.

This option proposes to connect an 11 kV cable type 3c/400mm² AL XLPE via a gas switch to be mounted on pole number POL 15056 on the western side of Coulter Drive. This cable would be installed southwards down Coulter Drive, across William Hovell Drive (via existing spare conduit) and down the western side of John Gorton Drive to Whitlam. Connection at Whitlam would be to the first distribution substation to be installed as part of the estate reticulation network (proposed location on the corner of John Gorton Drive and new road to Whitlam Stage 1). Total cable length approximately 1100m.

There is sufficient capacity available at Civic Zone Substation to supply this additional demand.

Following commissioning of the Molonglo Zone Substation (at proposed site on the eastern side of Coulter Drive), this feeder cable would be disconnected from pole POL 15056 and extended to one of the proposed new feeder circuit breaker at the zone substation. This would provide a permanent supply of approximately 6.0 MVA capacity to Whitlam.

A preliminary cost estimate for Option 1 is **\$274,500 excluding corporate overheads, contingency and GST**. Refer to cost estimates, cash flows and NPC comparison in Appendices A and B.

Option 1 is selected due to its higher (ie least negative) net present cost (NPC).

4.1.3. Option 2: Construct 11 kV cable feeder extension from existing Weir feeder

Option 2 considers the connection of a new underground 11 kV cable extension from the existing Weir feeder. The Weir feeder is an overhead line that emanates from Latham Zone Substation. The overhead section from pole 21289 southwards to pole 34313 would require reconductoring to either Neptune 19/3.25 AAC or Krypton 19/3.25 AAAC conductor. From pole 34313 the line would be extended overhead approximately 350m (3 spans) to the northern side of William Hovell Drive. At the last pole an 11 kV cable type 3c/400mm² AL XLPE would be connected via a gas switch and run across William Hovell Drive (via 100m directional drilled 150mm diameter conduit) to connect to a distribution substation at Whitlam Stage 1. Cable run would be approximately 1.5 km.

Weir feeder currently has approximately 1.75 MVA spare capacity available so it would be necessary to transfer 1.25 MVA from it to other feeders, eg O'Loughlen and Bowley feeders, to provide the 3.0 MVA capacity required by Whitlam Stages 1 and 2. There is sufficient capacity available at Latham Zone Substation to supply this additional demand.

Following commissioning of the Molonglo Zone Substation, this feeder cable would remain to provide an inter-tie between Molonglo and Latham zone substations.

A preliminary cost estimate for Option 2 is \$417,045 excluding corporate overheads, contingency and GST. Refer to cost estimates, cash flows and NPC comparison in Appendices A and B.

Option 2 is not selected due to its lower NPC, and constructability issues (ie directional drilling across William Hovell Drive).

4.1.4. Option 3: Non-network solution

Option 3 considers non-network initiatives including:

- Incentives to realise the potential of latent demand management within the customer base
- Incentives to encourage the uptake of additional demand management within the customer base

These options are further discussed within the Demand Management Paper.

To defer all investment would require the entire load to be offset by demand management. Thus there is no viable non-network alternative to providing an 11 kV supply to Whitlam Stages 1 and 2.

Notwithstanding, latent demand management likely to be available within the Stage 1 and 2 customer base was investigated, with a maximum estimated capacity of 0.09 MVA. These are shown in Table 4 below.

Table 4: Summary of non-network options

Non-network Option	Capacity available in Whitlam area
Controllable load	0.03 MVA
Customer – owned energy storage	0.03 MVA
Load curtailment	0.03 MVA
Totals	0.09 MVA

Where there is insufficient latent demand management within the customer base, there is further opportunity to incentivise customers to adopt additional technologies to reduce demand. This includes opportunities to permanently reduce demand (such as energy efficiency technology or power factor correction) as well as opportunities to adopt

technology to enable participation in demand response markets (such as embedded generation, battery storage, building management systems). However, even where additional opportunities are identified this will not be sufficient to avoid the investment in the 11 kV supply.

4.1.5. Summary of Options Analysis

Table 5: Summary of Options

Option	Description	Total Capital Cost 2019-2039	Capital Cost 2019-24	20 year Net Present Cost	Outcome
0	Do nothing	\$0	\$0	\$0	Not selected as does not meet need
1	Construct 11 kV cable feeder spur from existing Civic–Black Mountain feeder	\$274,500	\$274,500	-\$278,092	Selected due to higher NPC
2	Construct 11 kV cable feeder extension from existing Latham–Weir feeder	\$417,045	\$417,045	-\$422,502	Not selected due to lower NPC
3	Demand side management	N/A	N/A	N/A	Not selected as does not meet need

4.2. Recommendation

The selected option is Option 1, the construction of an 11 kV underground feeder extension from the Black Mountain feeder, to the first distribution substation to be installed at Whitlam Estate Stage 1. Cable is to be installed by 30 June 2020.

Financial analysis (refer Appendix B) shows Option 1 to be the best option due to its higher (ie least negative) NPC. It also has the lowest capital cost. Refer to cost estimates, cash flows and NPC comparison in Appendices A and B. It can be implemented in time to meet the project needs as identified and will add to Evoenergy's regulated asset base. The major assets will have an economic life of 50 years.

The new feeder extension will provide 3.0 MVA capacity to Stages 1 and 2 of the Whitlam suburb development, until the future Molonglo Zone Substation is completed. The Black Mountain feeder will then be re-connected to the 11 kV switchboard at Molonglo Zone Substation.

Preliminary cost estimate is **\$274,500 excluding overheads, contingency and GST**.

The proposed 11 kV feeder extension will in future be inter-tied to other feeders from Molonglo and Woden zone substations, and thus provide some backup supply capability in the future.

The augmentation cost of the most expensive option does not exceed \$5 million so this project will not be subject to the Regulatory Investment Test for Distribution (RIT-D).

Appendix A – Preliminary Cost Estimates

A.1 Cost Estimate – Option 1: 11 kV feeder spur from existing Black Mountain feeder

11 kV initial supply to Whitlam from Black Mountain Feeder. Assume 150mm conduit available across William Hovell Drive and down John Gorton Drive. Total route length approx 1.1 km.					
Preliminary Estimate ± 30% Accuracy					
Description	Notes	Unit	\$/Unit	Quantity	Cost
Trenching and drilling					\$75,500
Clearing of route where required	Allowance	m2	\$10	200	\$2,000
Directional drilling	Assume drilling with no rock.	m	\$600	0	\$0
Open trenching and backfilling	Assume excavation with no rock. Backfill with bedding sand and native soil. Assume three conduits per trench.	m	\$300	180	\$54,000
Cable jointing and haulage pits	Assume every 500m	ea	\$3,000	2	\$6,000
Traffic management		m	\$5	1100	\$5,500
Reinstatement incl revegetation as required	Allowance	m3	\$40	200	\$8,000
Cabling works					\$95,000
11 kV 3c/400mm2 XLPE cable		m	\$56	1100	\$61,600
Throughjoints	Assume every 500m	ea	\$1,000	1	\$1,000
Terminations	Terminations at gas switch and distribution substation	ea	\$1,500	2	\$3,000
Conduit and marker tape	3x150mm from POL 15056 to William Hovell Drive	m	\$10	540	\$5,400
HV Cables Test & Commissioning	Allowance	ea	\$2,000	1	\$2,000
Cable installation labour and plant		m	\$20	1100	\$22,000
11 kV Switchgear					\$24,000
11 kV pole-mounted gas switch	Mount on pole 15056	ea	\$15,000	1	\$15,000
11 kV surge arrestors	Cable UGOH	set	\$1,500	1	\$1,500
Overhead line labour and plant	Allowance	lot	\$7,500	1	\$7,500
Indirect Costs					\$80,000
Development Application	Allowance	ea	\$15,000	1	\$15,000
Contractor's Preliminaries, site establishment and disestablishment	Allowance	ea	\$15,000	1	\$15,000
Project management and administration	Allowance	ea	\$50,000	1	\$50,000
Sub Total without overheads					\$274,500
Overheads					
Overall average overhead rate	Allowance	27%		1	\$74,115
Sub Total with overheads					\$348,615
Contingency					
All project works	Preliminary allowance	15%		1	\$52,292
Project total with all overheads and contingency					\$400,907

A.2 Cost Estimate – Option 2: 11 kV feeder extension from Weir Feeder

11 kV initial supply to Whitlam from Weir Feeder. Assume 3 spans (350m) overhead to be reconducted to Neptune. Assume 150mm conduit to be drilled across William Hovell Drive (100m) with remainder of cable route to be trenched (400m). Total cable route length approx 500 m.					
Preliminary Estimate ± 30% Accuracy					
Description	Notes	Unit	\$/Unit	Quantity	Cost
Trenching and drilling					\$218,500
Clearing of route where required	Allowance	m2	\$10	1000	\$10,000
Directional drilling	Assume drilling with no rock. 3 x 150mm conduits across William Hovell Drive.	m	\$600	100	\$60,000
Open trenching and backfilling	Assume excavation with no rock. Backfill with bedding sand and native soil. Assume three conduits per trench.	m	\$300	400	\$120,000
Cable jointing and haulage pits	Assume every 500m	ea	\$3,000	2	\$6,000
Traffic management		m	\$5	500	\$2,500
Reinstatement incl revegetation as required	Allowance	m3	\$40	500	\$20,000
Cabling works					\$48,000
11 kV 3c/400mm2 XLPE cable		m	\$56	500	\$28,000
Throughjoints	Assume every 500m	ea	\$1,000	0	\$0
Terminations	Terminations at gas switch and distribution substation	ea	\$1,500	2	\$3,000
Conduit and marker tape	3x150mm from POL 15056 to William Hovell Drive	m	\$10	500	\$5,000
HV Cables Test & Commissioning	Allowance	ea	\$2,000	1	\$2,000
Cable installation labour and plant		m	\$20	500	\$10,000
11 kV Overhead Line works					\$40,545
158mm2 AAC Neptune conductor - 400m x 3-phase	Stringing from ground using truck-mounted winches etc	m	\$5	1200	\$6,000
12.5m concrete pole	8/16kN Type 3	ea	\$2,100	3	\$6,300
11 kV pin insulator		ea	\$30	9	\$270
11 kV strain insulator		ea	\$50	6	\$300
Crossarm	100mm x 100mm x 2000mm composite fibre	ea	\$225	3	\$675
Misc line hardware, stays, earths etc	Allowance	lot	\$1,000	3	\$3,000
11 kV pole-mounted gas switch	Mount on new pole	ea	\$15,000	1	\$15,000
11 kV surge arrestors	Cable UGOH	set	\$1,500	1	\$1,500
Overhead line labour and plant	Allowance	lot	\$7,500	1	\$7,500
Indirect Costs					\$110,000
Development Application	Allowance	ea	\$30,000	1	\$30,000
Contractor's Preliminaries, site establishment and disestablishment	Allowance	ea	\$30,000	1	\$30,000
Project management and administration	Allowance	ea	\$50,000	1	\$50,000
Sub Total without overheads					\$417,045
Overheads					
Overall average overhead rate	Allowance	27%		1	\$112,602
Sub Total with overheads					\$529,647
Contingency					
All project works	Preliminary allowance	15%		1	\$79,447
Project total with all overheads and contingency					\$609,094

Appendix B – Financial Analysis

B.1 Capital Expenditure Cash Flow for Each Option

Financial Year	Option 1	Option 2
2019/20	\$274,000	\$417,045
2020/21		
2021/22		
2022/23		
2023/24		
2024/25		
2025/26		
2026/27		
2027/28		
2028/29		
2029/30		
2030/31		
2031/32		
2032/33		
2033/34		
2034/35		
2035/36		
2036/37		
2037/38		
2038/39		
Total Cost (20 yr)	\$274,000	\$417,045
2019-24 Regulatory Control Period Cost	\$274,500	\$417,045

* Option 3 utilises a network owned battery which is modular and redeployable and has a 10 year lifetime. The battery is costed on a lease-like basis.

** Deferral in Option 4 is not exercised as it is not economic.

B.2 NPC Analysis

The Net Present Cost (NPC) was calculated using a Monte-Carlo simulation model. The simulation randomly selects a peak demand growth rate for each year that is within $\pm 10\%$ of the forecasted load expected in Whitlam. The use of a Monte-Carlo simulation results in selection of the best option that is robust to uncertain peak demand growth forecasts.

Investment within the simulation is dynamic – investment decisions change based on the randomly selected growth rates from previous years. Investment occurs automatically when the firm rating is breached so the value of energy at risk is always zero. In options where multiple investments are available the cheapest is selected.

Summary Financial Analysis Results for Supply to Whitlam

The summary below shows the average values for the selected characteristics after 50 simulations.

Options:

One – new 11 kV feeder extension from Black Mountain feeder

Two – new 11 kV feeder extension from Weir feeder

Three – best non-network option (network battery)

Four – best mixed network and non-network combination (option one plus network battery)

RESULTS (Average over 50 simulations):

Option:	One	Two	Three	Four
NPC (2019-2024)	-\$254,415	-\$386,530	-\$1,991,965	-\$999,202
NPC (2019-2039)	-\$278,092	-\$422,502	-\$1,991,965	-\$1,022,878
Network Option total Capital Cost	\$274,500	\$417,045	-	\$274,500
Option Capital Cost (2019-2024)	\$274,500	\$417,045	\$2,286,532	\$1,136,729
Option Capital Cost (2019-2039)	\$274,500	\$417,045	\$2,286,532	\$1,136,729