PR423: MARYLANDS ZONE SUBSTATION
MAJOR PROJECT BUSINESS CASE

Project	Description
Primary Driver	Network Connection
Project Category	GREENFIELD AUGEX
Publish Date	

Approvals	Name	Designation	Date
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Revision	Amendment	Date

1.0 Background

The precincts of Marylands and Lowes Creek are part of the NSW Government's South West Priority Growth Area. A significant portion of the area (referred to in Government documents as "Lowes Creek and Maryland Part" is on a pathway for accelerated rezoning under the Precinct Acceleration Protocol (PAP). This is being led by a single developer and a voluntary planning agreement was executed in 2015. The first dwelling completions for the Lowes Creek/Maryland Part precinct is forecast to begin in 2021/22. The remainder of the Lowes Creek and Marylands precincts, while not yet released are expected to begin development in the early 2020s, and enquiries are already being received by Endeavour Energy in relation to servicing of the remainder of the area.

The Lowes Creek/Maryland Part precinct (PAP) will have an ultimate yield of 4000 residential lots. The remainder of the Marylands and Lowes Creek precincts will have 21,000 and 5,000 residential lots respectively. In addition to residential land, the area will include 0.57 and 1.22 square kilometres of employment land respectively.

Marylands ZS is a part of overall South West Section Area Plan. **Error! Reference source not found.** presents an overview of the area and highlights existing and future investments required.

Figure 2 and 3 show the Department of Planning and Environment's forecast for dwelling completions in the 3 precincts. The figures indicate that a large increase in dwelling completions is forecast for the 2024/25 financial year.

At the time of writing Federal and State governments announced a plan for a major new "north-south" rail line through the Lowes Creek/Maryland precinct (refer to https://cities.infrastructure.gov.au/western-sydney-city-deal).
This will provide a catalyst for development and is likely to result in increased densities near any proposed stations. The details of proposed density increase are not yet available and therefore not considered in this business case at this point in time. However this major infrastructure announcement will make a high growth scenario more likely in this location.

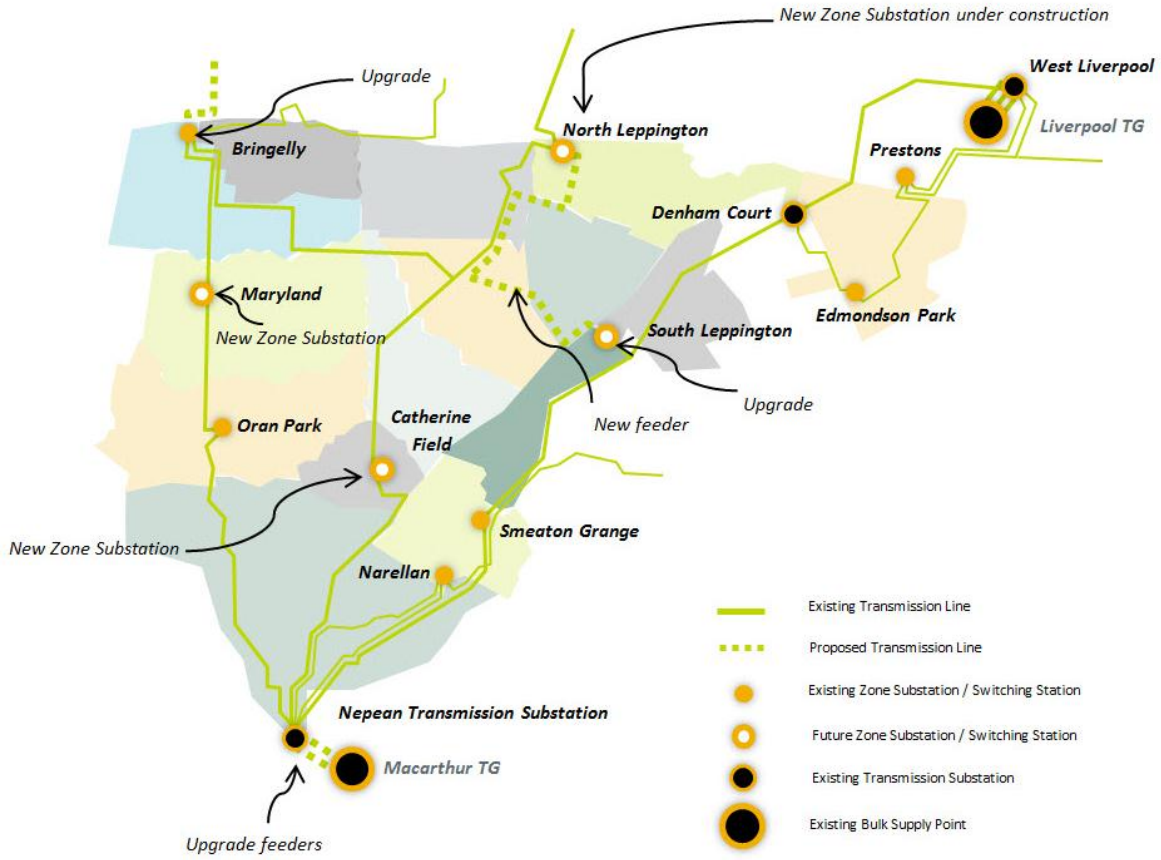

Figure 1 – Overview

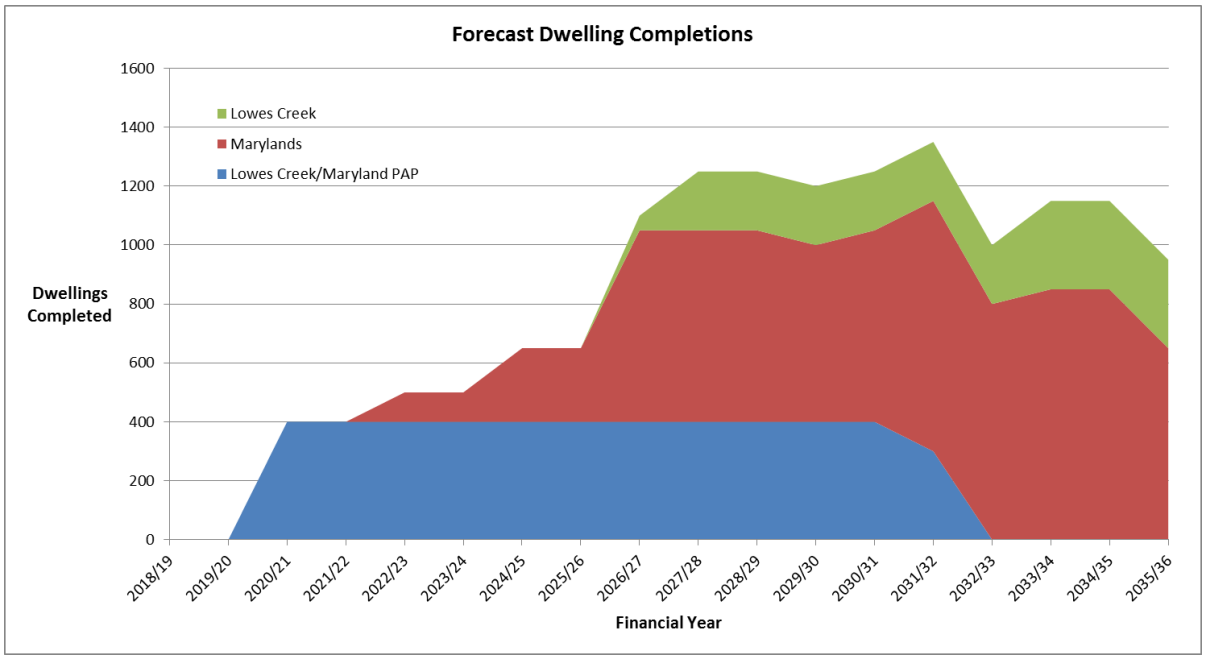

Figure 2 - Dwelling Completions Forecast (Source: NSW Government Department of Planning and Environment)

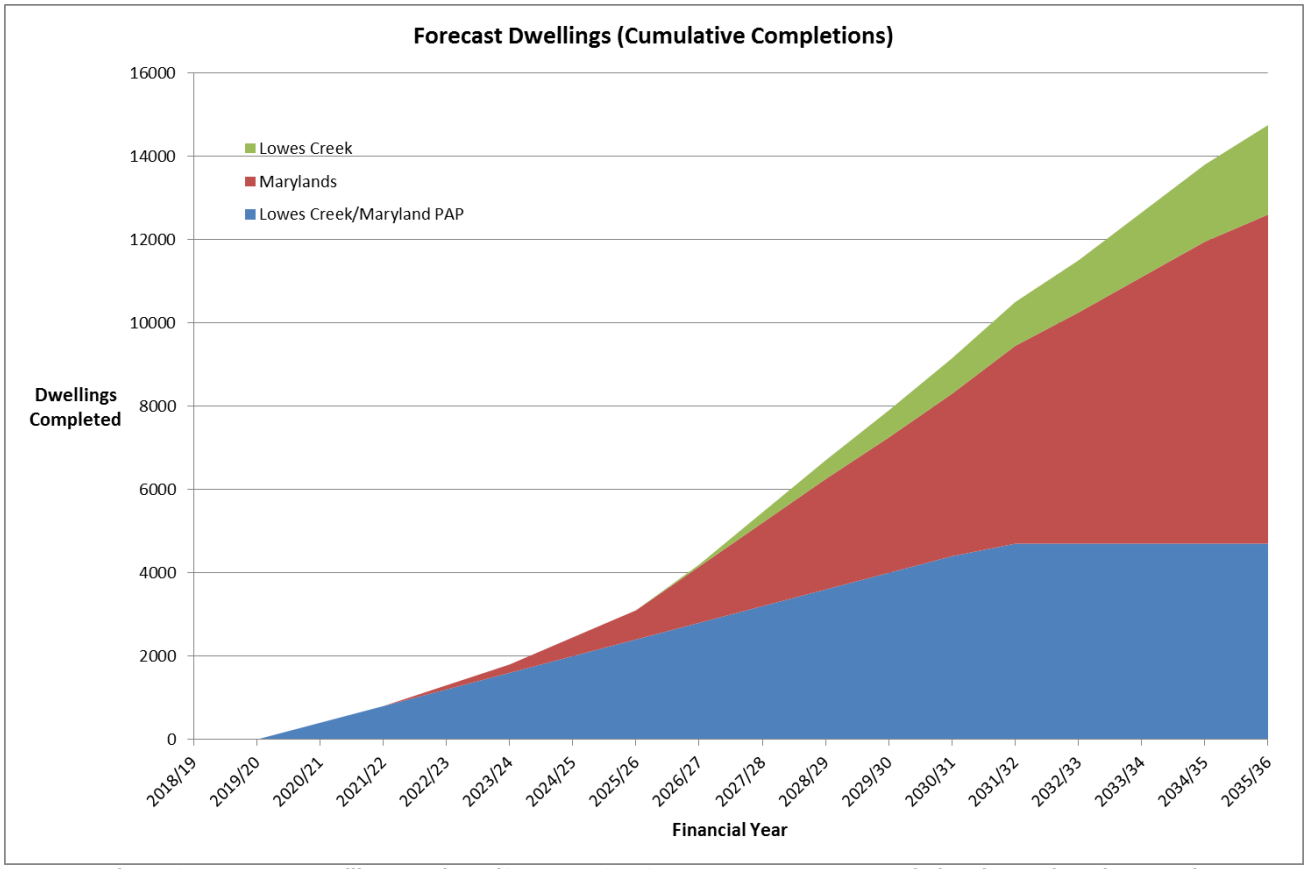

Figure 3 - Forecast Dwelling Numbers (Source: NSW Government Department of Planning and Environment)

2.0 Need/Opportunity

The Lowes Creek/Maryland (Part) PAP precinct is expected to be rezoned by the 2020/21 financial year and the remaining parts of Lowes Creek/Maryland will be rezoned soon after. The precincts lie between Bringelly ZS and Oran Park ZS and there are existing feeders supplying the area. These feeders will be able to supply some initial developments in the part precinct (PAP area).

However, analysis for the South West Priority Growth Area plan has identified significant growth in the adjacent areas concurrent to the development in the Lowes Creek and Marylands precincts. The combined load from the ultimate dwelling yields in these precincts and the precincts serviced by the adjacent zones substations will exceed the combined capacity of Oran Park and Bringelly ZS. The projected growth in the precincts currently supplied by the adjacent zone substations alone will result in their firm capacities being exceeded.

2.1 Forecast Demand

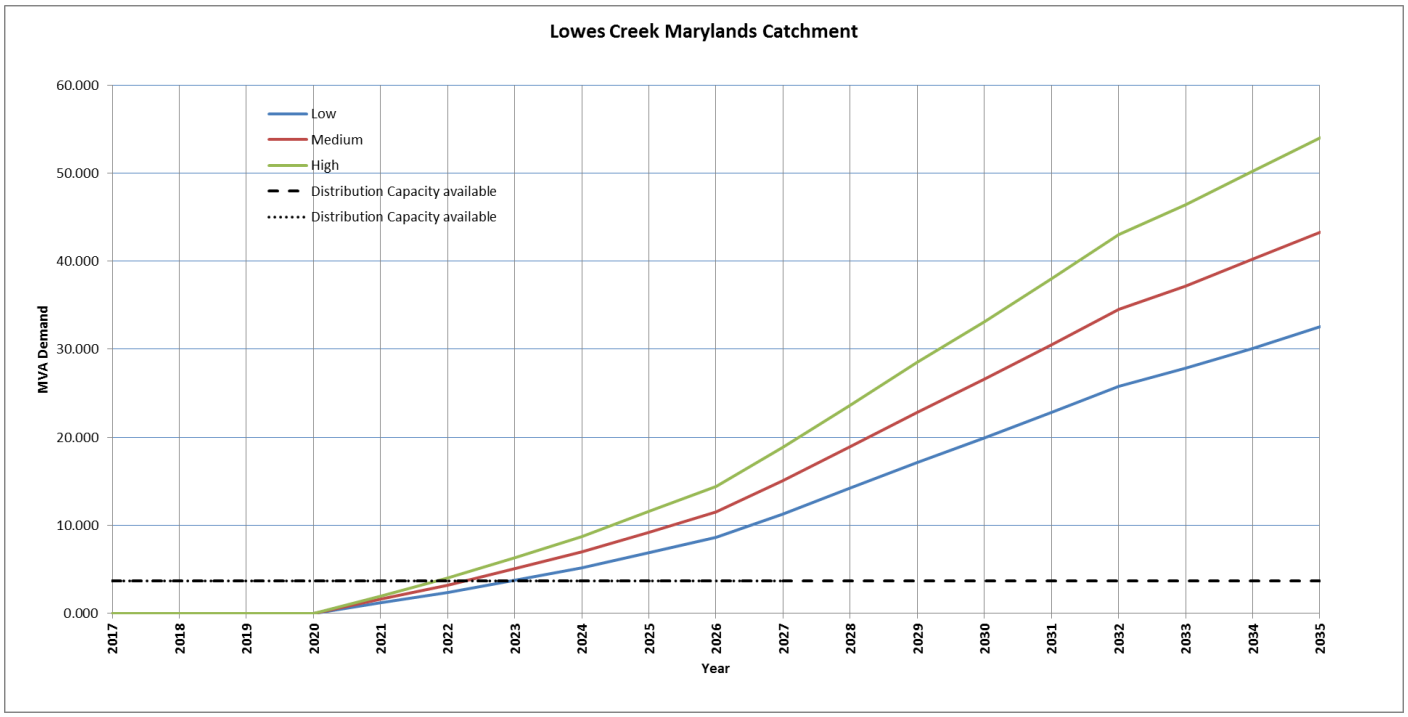

Figure 4 – Lowes Creek Marylands - Forecast residential load

Due to the high demand of these precincts and the relative proximity to both Bringelly ZS and Oran Park ZS, it is likely the load of these new precincts will be shared with these adjacent zone substations and a new zone substation at the centre of these precincts. Preliminary analysis for the South West Priority Growth Area Plan had 100% of the residential load at Lowes Creek/Maryland PAP precinct, 70% of the residential load at Marylands precinct and 55% of the residential load at the Lowes Creek precinct assigned to the new zone substation. The remaining 30% of the residential load at Marylands precinct was assigned to Oran Park ZS and the remaining 45% of the residential load at the Lowes Creek precinct was assigned to Bringelly. The resultant final load for the new substation is approximately 88MVA.

2.2 Existing Supply

The two closest supply points to Lowes Creek and Marylands precincts are Oran Park Zone Substation and Bringelly Zone Substation. Bringelly ZS is approximately 3 km to the north and Oran Park ZS is approximately 3.5km to the south. A single feeder from Bringelly (X883) and a single feeder from Oran Park (OP1112) which run along The Northern Road are the only feeders within the Lowes Creek and Marylands precincts. Feeder X883 has 1.7 MVA of spare capacity and Feeder 2 MVA of spare capacity. The total spare distribution capacity of 3.7 MVA will allow for approximately 900 initial dwellings.

It should be noted that these new precincts will be at the extents of the ideal catchment areas of Bringelly ZS and Oran Park ZS. A majority of the area will be more than 3km from either zone substation. Supplying the Lowes Creek and Marylands precincts from the existing adjacent zone substations would require a large investment in additional distribution feeder capacity. The high final dwelling yield and subsequent high load density will further compound the issues related to supplying the areas with the existing substations. Furthermore, a significant amount of growth is forecast for the areas supplied by Oran Park and Bringelly ZS. There will be difficulty in meeting the demands of these current areas as well as the new Lowes Creek and Marylands precincts with the existing zone substations without significant investments in substation capacity.

2.3 Load at Risk

The maximum available distribution capacity in the area is 3.7MVA. Continued connection of new dwellings beyond 2023 will lead to load at risk on the distribution network, leading quickly to an inability to supply the new dwellings.

Table 1 - Load at risk (MW)

Network	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Distribution Capacity LAR (Bringelly and Oran Park ZS)	-	1.6	3.5	5.4	7.7	10.0	13.5	17.4	21.2	25.0

2.4 Energy at Risk

On the basis of supply to initial developments within the new precincts, energy at risk over the forecast period is estimated as follows:

Table 2 - Energy at Risk (MWh)

Network	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy at Risk	0	0	4	94	3042	10123	15042	17075	17513	17609
Energy unable to be supplied (no capacity)	0	0	0	0	126	1698	6687	15694	26449	36879
Sum				93.6	3168.2	11821.4	21729.1	32768.6	43961.9	54487.8

3.0 Project Value

Continued connection of new customers to the limited capacity available within the local distribution network will result in unacceptably high values for expected unserved energy and consequently VCR risk costs.

The precincts require connections for 34,500 new customers who will be entering the electricity market and generating business for market participants. In greenfield projects the VCR costs are strictly only applicable if supply is available. In this instance, capacity for new connections is only available for the first 900 of these customers, resulting in 33,600 new customers remaining unconnected unless further investment in the network is made. Application of the full VCR to these unconnected customers provides an extremely high value. Hence for the purpose of economic evaluation, an indicative retail value for the cost of energy that is less than the VCR cost has been applied to the energy that is not able to be served. This represents the value that market participants will be deprived of if these unconnected customers remained unconnected. This is considered extremely conservative as the economic costs of

customers remaining unconnected are great, but arguably not as high as the connected cost customers would be willing to pay in the event of an outage.

Hence, by establishing additional zone substation or distribution capacity to facilitate these connections, the following risk of non-supply costs would be addressed and available as benefits to the project proposal.

3.1 Modelled Project Benefits (VCR Risk Costs + Risk of Non-Supply)

Table 3 - VCR Risk Costs

Network	PV of VCR Risk + Non supply Risk Costs
Distribution Capacity from Bringelly and Oran Park ZS	$287m

The risk costs are high for this project as connection capacity will be exceeded in 2024 and if no action is taken development will not be able to proceed.

3.2 Project Costs

Distribution feeders from existing zone substations will have to traverse distances of 4 km in order to service the precincts. In order to service 88MVA of load, more than 20 fully loaded distribution feeders would be required. Assuming feeder routes are available, this is likely to cost more than $32 million, not including upstream augmentation works required at zone substations and sub-transmisison feeders. Conversely, establishing a zone substation in the area will cost approximately $21 million in real terms.

4.0 Indicative Options

4.1 Option 1 – Establishment of Distribution Feeders

After exhausting existing distribution capacity, the establishment of initial distribution feeders from adjacent substations in such greenfield areas may be considered as credible options subject to a number of factors including:

- Available transformer capacity at adjacent zone substations
- Available circuit-breakers and switchboard capacity at zone substations
- the availability of suitable routes and established road layouts to establish feeders.

In this case, the establishment of additional distribution feeders from Bringelly Zone Substation is not feasible due to lack of available circuit-breakers at Bringelly ZS. It is feasible to consider two additional feeders from Oran Park ZS to cater for initial development at Maryland/Lowes Creek. Further feeders will impose constraints on Oran Park ZS in terms of its ability to supply load within its own catchment area and are at high risk of becoming redundant when the Maryland Zone Substation is established.

Extension of two 11kV distribution feeders from Oran Park Zone Substation to the Maryland precinct is expected to cost approximately $6 Million.

Given the projected dwelling numbers in the Maryland and Lowes Creeks precincts, the investment in additional distribution feeder capacity and additional substation capacity at the adjacent zones will be more than the investment required to establish a new zone substation closer to the load within these precincts. Therefore, the timely construction of an appropriately situated zone substation will be the more efficient solution for supplying the Lowes Creek and Maryland precincts.

4.2 Option 2 – Establishment of a 132/11kV Zone Substation

The establishment of a 132/11kV Zone substation is the preferred option based on greater net market benefits over option 1 and the ultimate size and extent of the development precinct. This option also removes potential load at risk at Oran Park Zone Substation.

The estimated net market benefits from this option has been evaluated to be $229 million.

A PV cost analysis of Option 1 which allows a 4 year deferral of the zone substation compared to Option 2 shows that Option 2 has the lower PV of cost by a margin of $2 million.

4.3 Option 3 – Non-Network Options

The principal contributors to the peak demand in this area are the existing rural area along with growth in demand from the new residential development. For demand management to be successful, peak demand on the existing feeders will need to be reduced as well as managing the demand growth in the development areas. However, given that surrounding areas are also developing and connections to these feeders are likely to increase, the available capacity to supply the developing areas reduces and obtaining sufficient demand reduction becomes more challenging. A demand reduction or energy efficiency program is unlikely to achieve the required levels of demand reduction from an existing customer base for this greenfield development area.

Non-network solutions may be feasible for the new planned developments in conjunction with the developer where sufficient demand reduction exists within the existing customer base in conjunction with the initiatives within the development areas such as distributed energy resources. Newly constructed dwellings within the development areas are built to high energy efficiency standards. The associated demand reduction has been built into the demand forecast for these areas. Non-network solutions may also be feasible in managing the risks of unserviced load thus allowing further connections to be made. These opportunities will be further assessed during the RIT-D phase of the project.

5.0 Conclusion

Based on the rates of growth and limited existing capacity, investment in network capacity will be required during the 2018/19-2023/24 regulatory period. The establishment of a new zone substation within the Lowes Creek/Marylands precincts is the preferred solution as this option offers higher market benefits, mainly because the three year deferral value of the zone substation does not sufficiently offset the costs of the extention of two distribution feeders into the area. In particular given recent government announcements in March 2018 regarding a new railway line, we consider that this will increase the probability of a higher growth scenario which will favour the establishment of a zone substation as the next stage of investment.

6.0 Appendix

Probabilistic VCR Template v3 - Marylands ZS Option 2 ZS Up front.xlsm			
	PV investments ($m)	PV Market Benefits ($m)	NPV ($m)
Deterministic Assessment	$ 15.8	$ 287.5	$ 271.6
Proabablistic Assessment	**$ 16.8**	**$ 285.8**	**$ 269.8**
PV of Risk Costs (Potential Market Benefits)		**$ 286.1**	
	% Risk		
Risk of Negative Market Benefits	**0%**