Greater Macarthur Land Release Investigation

High Level Services Infrastructure Strategy

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High Level Services Infrastructure Strategy

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Executive Summary

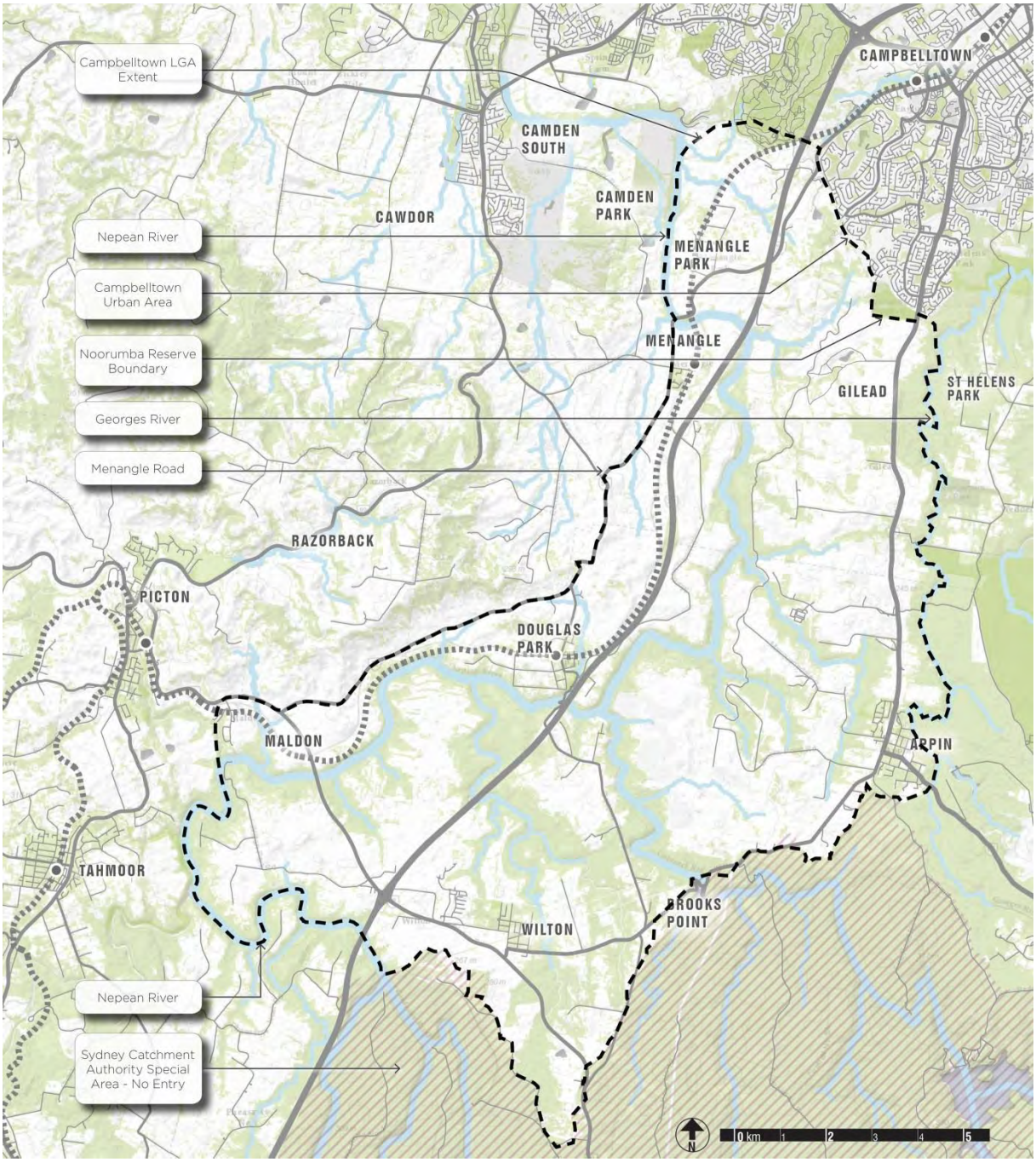
The Department of Planning and Environment (DP&E), formerly known as The Department of Planning and Infrastructure (DP&I) has engaged AECOM to undertake a High Level Services Infrastructure Assessment to support the Greater MacArthur Land Release Investigation Area ('the study area').

The High Level Service Infrastructure Assessment is one of a number of studies being undertaken concurrently to support the DP&E plans in delivering priority growth areas to establish more opportunities in Greater Sydney for housing and employment. Other studies, but not limited to, include Master Plan by Urbis, Stormwater Management and Preliminary Social Infrastructure Assessment by GHD and a Strategic Transport Plan by AECOM.

The study area comprises an area of approximately 18,000 hectares and is located approximately 70km south-west of the Sydney CBD. The area spreads across the Campbelltown and Wollondilly Local Government Areas and extends from Menangle Park in the north, Appin in the East, Wilton in the south and Maldon to the south west.

The study area (18,000 hectares) has been developed as part of 'A Plan for Growing Sydney', which has identified the area for urban investigation. The investigation area progressed into an Urban Capable Boundary (16,000 hectares) that responds to natural and geographic boundaries. Urbis undertook a land use planning exercise and segregated the study into several precincts and assessed each precinct for urban development capability areas. This resulted in approximately 9,500 hectares of Urban Capable Footprint (UCF). They assumed a 60% development of that UCF and a 15 dwellings/Ha to calculate a proposed total of residential dwellings of approximately 85,200 and approximately 570 hectares of employment lands (Urbis). It is understood that that SGS economics are undertaking an Economic Assessment to confirm the strategic employment lands. Figure 1-1 below depicts the Urban Capable Footprint boundary area.

Figure 1-1: Greater Macarthur Urban Capable Boundary (Source: Urbis)



The existing primary Services suppliers for the study area were identified as follows:

- Sydney Water - Potable Water, Sewer and Recycled Water;
- Endeavour Energy - Electricity (Distribution);
- Transgrid - Electricity (Bulk Supply)
- Jemena - Natural Gas; and
- NBN Co and Telstra - Telecommunications.

The existing service infrastructure in the study area was investigated through mean of known development studies, Dial Before You Dig and publicly available utility strategy plans.

Demand estimates for each of the primary services for each of the precincts based on the development scenario proposed by Urbis. The demand estimates were compared against the known existing service infrastructure in the study area to develop preliminary service infrastructure augmentation requirements to develop the study area.

In collaboration with DP&E an agency consultation plan was outlined and then implemented. This included feasibility applications to each of the primary utility providers and a combined agency workshop. The feasibility applications outlined the Greater MacArthur Land Release Investigation and contained the demand estimates and preliminary service augmentation proposal already developed.

A summary of the responses from each of the primary services supplies is as follows:-

- Sydney Water – A formal response has been provided on 5th June 2015 which was followed up with a meeting to discuss and key messages or concerns. The response documents hypothetical advice, if Sydney Water were to be confirmed as the Water and Sewer infrastructure service provider, on the servicing approach, associated costs and sequencing for servicing the development. It is understood this should be considered as advice only and does not constitute a commitment by Sydney Water to build any of the infrastructure documented as required to service the Study Area.
- Endeavour Energy – A formal response has been provided on 21st May 2015 and can be found in the appendices. The response documented a joint planning meeting had been held with Transgrid, where in principle an agreement was made to supply the area from the Macarthur Bulk Supply Point (BSP). Endeavour Energy provided a new network proposal (not yet consulted with Transgrid) for 66kV feeders and augmented Zone-substations. They indicated the cost of the network upgrade and zone sub-stations would be $310, which would be in addition to the developer funded 11kV feeders and low voltage reticulation works and the Transgrid augmentation of the MacArthur BSP.
- Transgrid – A formal response was received from Transgrid which confirmed they are responsible for the High Voltage electrical infrastructure in the area, which included a 330kV transmission line with associated 60 meter easement and the Macarthur Bulk Supply Point (BSP), however it did not confirm any required upgrade or scheduled upgrade works for the area. It is understood an agreement in principle to supply the study area during a joint planning meeting with Endeavour Energy would result in an upgrade to the BSP.
- Jemena – A formal response has not been received from Jemena yet, however initial consultation indicates they would look favourably on extending their Network to supply all new developments dependant on economic viability. It is understood the formal response is currently with the Network team; unfortunately an indication of when a formal response may be received is not available.
- NBN Co – A formal response has not been received from NBN Co as providing a formal letter response would require a full NBN legal engagement. An informal response received by email on 18th May 2015 indicated that the study area would qualify for NBN roll out of infrastructure based on the TIND policy set out by the federal government.

Following consultation with the utility providers the preliminary service infrastructure augmentation plans were further developed and documented on plans, these are presented in section 7.0 of the High Level Infrastructure Services Report.

As a result of the information provided by the primary utility providers and the service infrastructure augmentation plans a Service Infrastructure staging plan was developed based on existing infrastructure capacity, required infrastructure upgrades and new infrastructure. The following is a summary of the stages with a brief description of sequence reasoning:

- **Stage 1:** Menangle Park and the northern part of Gilead (including private development of Mt Gilead). This area is referenced as Stage 1 in regards to infrastructure delivery already being planned by each authority, utility demands and Development Staging Plan.
- **Stage 2:** Wilton is subject to infrastructure delivery already planned by each authority. Further drivers have influenced this staging, from the short term electrical capacity at Wilton Zone Substations and Bingara Gorge (private) Sewer Treatment Plant. The area of Wilton is reference as Stage 2 which included the area of Maldon (2B) and south-east Wilton (2A).

  It is noted that South East Wilton (2A) and Maldon (2B) could be developed before or after the main area of Wilton due to the presence of existing services infrastructure, however this would alter the infrastructure upgrade and augmentation sequencing.

Also noted an opportunity for Gilead south (3A - Campbelltown South proposal) to concurrently develop.

- **Stage 3**: Gilead North (3B) and Gilead South (3A – including Campbelltown South private proposal) build on the development of Mt. Gilead.
- **Stage 4:** Proposes West Appin as a continuation of development South from Stage 1 and Stage 3. The sewer demand load will be connected to the proposed new WTP.
- **Stage 5**: Proposes Douglas Park due to the upgraded water main connections to Douglas Park and the water connection at Menangle and the electrical infrastructure upgrades.
- **Stage 6**: The area between Appin and Wilton had been considered most constrained area in terms developable topography making utility infrastructure difficult to provide and therefore proposed as the last stage to be developed.

The sequencing of the staging influences the services infrastructure augmentations and order of roll out. Based on the above sequence and the Service Infrastructure augmentation plans the following tables itemise the infrastructure required for each stage with an associated indicative order of magnitude cost. The order of magnitude costs is for trunk infrastructure only and does not include reticulation of services downstream of the trunk supply points.

Table 1-1: Stage 1 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 1		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Gilead ZS, 2 x 35MVA Transformer	19	89
	Mac BSP - Gi ZS 66kV DC Feeder 1/2, Overhead 2500m	2	
	Establish Menangle ZS, 2 x 35MVA Transformer	19	
	Mac BSP – MP ZS 66kV DC Feeder 1/2, Overhead 5000m	4	
	Upgrade Macarthur BSP 1 x 132kV exit, 5 x 66kV exits, 330/132kV 200MVA Transformer, 132/66kV 150MVA Transformer	45	
Potable Water Infrastructure	New Water Pumping Station (Mt Gilead)	6	41.2
	10ML reservoir	5	
	1880m of DN250 pressure main	1.7	
	6625m of DN375mm diameter potable water trunk main	8.9	
	Design Costs (% of Direct & Indirect Costs) – 10%	2.2	
	Planning Costs – 10%	2.2	
	Project Management – 10%	2.2	
	Scope Contingency – 50%	10.8	
	Risk Contingency – 10%	2.2	
Sewer Infrastructure	2 New Pumping Stations (Mt Gilead and Menangle)	8	27.9
	1000m DN250mm diameter sewer gravity main	1.2	
	1000m DN300mm diameter sewer gravity main	1.2	
	4000m DN300mm diameter sewer rising main	4.2	
	Design Costs (% of Direct & Indirect Costs) – 10%	1.5	
	Planning Costs – 10%	1.5	
	Project Management – 10%	1.5	

Stage 1		Total ($M)	Sub-total ($M)
	Scope Contingency – 50%	7.3	
	Risk Contingency – 10%	1.5	
		Total	**158.1**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition, or operational costs.*

Table 1-2: Stage 2 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 2		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Bingara ZS, 3 x 35MVA Transformers	25	62
	DP Switching Station – Bi ZS 66kV Feeders, 2 x Underground Cable	18	
	Add 35MVA Transformer and Switch Board to Maldon ZS	8	
	DP Switching Station to Maldon ZS 66kV OH line	3	
	Add 35MVA Transformer and Switch Board to Maldon ZS	8	
Potable Water Infrastructure	2 new 30ML and 20ML Water Reservoirs	22	104
	1 New pumping station	6	
	WPS amplification	0.5	
	6,500m DN600mm diameter potable water trunk main (duplication WFP to Wilton)	12.7	
	10,000m DN300-DN450mm diameter potable water trunk main	13.4	
	Design Costs (% of Direct & Indirect Costs) – 10%	5.5	
	Planning Costs – 10%	5.5	
	Project Management – 10%	5.5	
	Scope Contingency – 50%	27.3	
	Risk Contingency – 10%	5.5	
Sewer Infrastructure	5 New pumping stations	20	133
	2,000m of DN450mm diameter sewer gravity main	3.4	
	3,000m of DN525mm diameter sewer gravity main	5.6	
	10,000m of DN600mm diameter sewer gravity main	23	
	15,000m of DN710mm diameter sewer rising main	18	
	Design Costs (% of Direct & Indirect Costs) – 10%	7	
	Planning Costs – 10%	7	
	Project Management – 10%	7	
	Scope Contingency – 50%	35	
	Risk Contingency – 10%	7	
		Total	**299**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition, or operational costs.*

Table 1-3: Stage 3 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 3		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish North Appin ZS, 2 x 35MVA Transformers	19	31
	Mac BSP- NA ZS 66kV Feeder 1, Overhead 12000m	7	
	Gi ZS- NA ZS 66kV Feeder 2, Overhead 8000m	5	
Potable Water Infrastructure	1 new 35ML Water Storage at Appin (ultimate storage)	15.2	60.2
	3000m DN600mm diameter potable water trunk main	5.9	
	6500m DN450mm diameter potable water trunk main	10	
	Water pumping station amplification	0.5	
	Design Costs (% of Direct & Indirect Costs) – 10%	3.2	
	Planning Costs – 10%	3.2	
	Project Management – 10%	3.2	
	Scope Contingency – 50%	15.8	
	Risk Contingency – 10%	3.2	
Sewer Infrastructure	2 New pumping stations	8	46.9
	6000m DN375-DN450 diameter sewer gravity main	10.1	
	5000m DN225-DN375 diameter sewer rising main	6.5	
	Design Costs (% of Direct & Indirect Costs) – 10%	2.5	
	Planning Costs – 10%	2.5	
	Project Management – 10%	2.5	
	Scope Contingency – 50%	12.3	
	Risk Contingency – 10%	2.5	
		Total	**138.1**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition, or operational costs.*

Table 1-4: Stage 4 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 4		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Upgrade Douglas Pk Switching Station to 132/66kV incl. 2 x 132/66kV Transformers	25	90
	Establish DP ZS to 66/11, 70MVA Transformers and 2000m of 66kV feeder	25	
	Nepean Transmission Station to DP Switching Station 132kV, Upgrade 851 66kV to 132kV	23	
	Nepean Transmission Station 132kV exit	5	
	Add 35MVA Transformer and Switch Board to Appin ZS (Modular)	12	
Potable Water Infrastructure	7000m of DN375-DN400mm potable water trunk main	9.3	17.6
	Design Costs (% of Direct & Indirect Costs) – 10%	0.9	
	Planning Costs – 10%	0.9	
	Project Management – 10%	0.9	
	Scope Contingency – 50%	4.7	
	Risk Contingency – 10%	0.9	
Sewer Infrastructure	12000m DN450diameter sewer trunk gravity main	21.1	40.1
	WWTP upgrades (refer to notes below)	-	
	Design Costs (% of Direct & Indirect Costs) – 10%	2.1	
	Planning Costs – 10%	2.1	
	Project Management – 10%	2.1	
	Scope Contingency – 50%	10.6	
	Risk Contingency – 10%	2.1	
		Total	**147.7**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition, or operational costs.*

Table 1-5: Stage 5 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 5		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Morton Pk ZS, 2 x 35MVA Transformers	19	36
	DP Switching Station – MP ZS 66kV Feeder 1, Overhead 7500m	5	
	DP Switching Station – MP ZS 66kV Feeder 2, Underground 5000m	12	
Potable Water Infrastructure	7000m DN375-DN400mm diameter potable water main	3	34.7
	3000m DN250mm diameter potable water main	9.3	
	1 new Water Pumping Station	6	
	Design Costs (% of Direct & Indirect Costs) – 10%	1.8	
	Planning Costs – 10%	1.8	
	Project Management – 10%	1.8	
	Scope Contingency – 50%	9.2	
	Risk Contingency – 10%	1.8	
Sewer Infrastructure	3 New pumping stations	12	57
	2,500m DN300-DN375 diameter sewer gravity main	3.4	
	5,500m DN450mm diameter sewer gravity main	9.3	
	5,000m DN300mm diameter sewer rising main	5.3	
	Design Costs (% of Direct & Indirect Costs) – 10%	3	
	Planning Costs – 10%	3	
	Project Management – 10%	3	
	Scope Contingency – 50%	15	
	Risk Contingency – 10%	3	
		Total	**127.7**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition, or operational costs.*

Table 1-6: Stage 6 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 6		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Wilton Junction ZS, 2 x 35MVA Transformers	19	48
	DP Switching Station- WJ ZS 66kV DC Feeders 1 & 2, Overhead	8	
	Macarthur BSP to DP Switching Station 132kV, Upgrade existing 33kV Feeder 14000m	21	
Potable Water Infrastructure	1530m of DN300 diameter potable water trunk main	1.6	3.2
	Design Costs (% of Direct & Indirect Costs) – 10%	0.2	
	Planning Costs – 10%	0.2	
	Project Management – 10%	0.2	
	Scope Contingency – 50%	0.8	
	Risk Contingency – 10%	0.2	
Sewer Infrastructure	1 New pumping station	4	17.1
	4000m DN375 diameter sewer gravity main	1.3	
	Design Costs (% of Direct & Indirect Costs) – 10%	1.3	
	Planning Costs – 10%	1.3	
	Project Management – 10%	1.3	
	Scope Contingency – 50%	6.6	
	Risk Contingency – 10%	1.3	
		Total	**68.3**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition or operational costs.*

To further understand the feasibility of developing the study area the cost per dwelling has been calculated by comparing the costs against the total dwellings. A summary of the total stage costs and the cost per dwelling for the infrastructure works is shown in Table 1-7.

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Table 1-7: Order of magnitude cost per dwelling

Service Infrastructure Stage	Approximate Dwellings	Approximate Stage Cost ($m)	Approximate Cost per Dwelling ($)
1	10,500	158.1	15,057
2	22,500	299	13,289
3	9,750	138.1	14,164
4	19,500	147.7	7,574
5	12,750	127.7	10,016
6	10,200	68.3	6,696
Pre-treatment Stage	**85,200**	**939**	**11,020**
Treatment Stage	**85,200**	**1,118**	**13,122**
Ultimate Stage (including treatment stage)	**85,200**	**2,057**	**24,143**

The allocation of cost is dependent on the specific stage sequencing adopted; lead in works may need to be transferred between stages if undertaken in a different order.

The slightly elevated per dwelling cost of stage 1 is a result of the need to upgrade the MacArthur electrical Bulk Supply Point, it is understood this will be required as the 66kV feeder supply is exhausted. The timing of this has not been confirmed by Transgrid as this will be dependent on when developments are constructed and at what rate, however it has been assumed it will occur during stage 1.

The costs do not include land acquisition requirements or operational costs.

The water and wastewater costs were developed through refinement of this service infrastructure investigation and have been further informed following discussions with Sydney Water Corporation.

1.0 Introduction

1.1 Background

In the next 20 years, the population of Sydney is expected to grow by 1.6 million to 6.2 million people, requiring the need for 664,000 new homes. While the North West and South West Growth Centres have provided the framework for approximately 180,000 new dwellings in Western Sydney, the NSW Government is investigating where the most suitable locations are to accommodate the required additional housing.

'A Plan for Growing Sydney' (The Plan) is the NSW Government's plan to identify how Sydney can create this required additional housing stock, as well as providing the necessary employment opportunities and infrastructure delivery, while protecting the significant and iconic natural environment and improving the liveability of the city.

Within A Plan for Growing Sydney there are a number of actions identified to achieve these goals. Action 2.4.2 of the Plan identifies the need to develop a framework for the identification of new Growth Centres with the following objectives:

- To improve the management of future land release, stimulate competition to keep downward pressure on prices and help prevent speculative investment and land-banking;
- To assist the orderly release of land to allow efficient delivery of infrastructure;
- To assist in the creation of new communities that are readily able to access employment, public transport, shops and services; and
- To allow the cumulative effects of development to be carefully considered and addressed.

The Plan specifies the investigation for greenfield development south and south-west of Campbelltown-Macarthur which is referred to in this report as the Greater Macarthur Land Release Investigation Area ('the Study Area'). Refer to Figure 1-1.

Action 2.4.2 identifies the need to prepare a long-term growth framework to consider:

- the sustainability of Sydney's agricultural and resource sectors
- the cost of delivering roads, transport and services infrastructure
- the costs to communities of higher transport and infrastructure costs, reduced social outcomes and poorer access to economic opportunities and services
- the compatibility of development with adjacent land uses
- access to employment, noting that currently 69 per cent of residents in Sydney's north west and south west travel outside their Local Government Area to work, adding considerably to their weekly expenses.

In preparing a framework for the identification of new Growth Centres Action 2.4.2 indicates that the following issues should be considered:

- the value of land for drinking water supply, agriculture, environmental management, resources, tourism and other purposes
- constraints to development, including environmental constraints and natural hazards
- private sector interest in developing particular land
- proximity of land to current and planned locations of employment
- the cost of infrastructure provision including roads, water, sewerage, public transport, schools and health facilities
- the economic and social cost to communities of having relatively poor access to employment and services.

Department of Planning and Environment (DP&E) engaged AECOM to undertake a High Level Services Infrastructure assessment to support the Greater MacArthur Land Release Investigation to inform if any urban capable footprint identified can be serviced and how it may be serviced.

This High Level Services Infrastructure Assessment aims to identify where existing networks can be utilised and/or require augmentation and where new infrastructure will be necessary. A proposal for staged delivery of the services infrastructure will be developed, which will be used to indicate a magnitude of cost for each of the proposed stages, which can be broken down into an approximate cost per dwelling.

In addition to the Services Infrastructure Assessment by AECOM, DP&E have engaged Urbis to act as Master Planner for the Investigation, GHD to undertake high level assessments of Social infrastructure and Stormwater infrastructure and SGS to complete economic and employment assessment to confirm the strategic employment lands requirements to provide further understanding of the Study Area's development potential. AECOM have also been engaged by Transport for NSW to undertake a Strategic Transport Plan to support the investigation.

The Services Infrastructure Assessment will consider the supply of the following services to the study area:

- Potable Water;
- Recycled Water;
- Waste Water (sewer);
- Electricity;
- Natural Gas; and
- Telecommunications.

It is noted potable water, recycled water, waste water and electricity are more critical to the development of greenfield land than natural gas and telecommunications, therefore greater detail has been provided for those services.

The information provided in this report is intended to inform DP&E of the opportunities and constraints associated with the provision of Services Infrastructure to the study area. Specifically, the report provides the following information:

- Layout and capacity of existing service networks;
- Indicative utility demand for the current development proposals;
- A summary of the current service infrastructure delivery programs for each utility supplier;
- Opportunities for advance servicing of the area;
- Service infrastructure assets required onsite (for critical services only); and
- Indicative trunk infrastructure service layouts and typical sections (for critical services only).

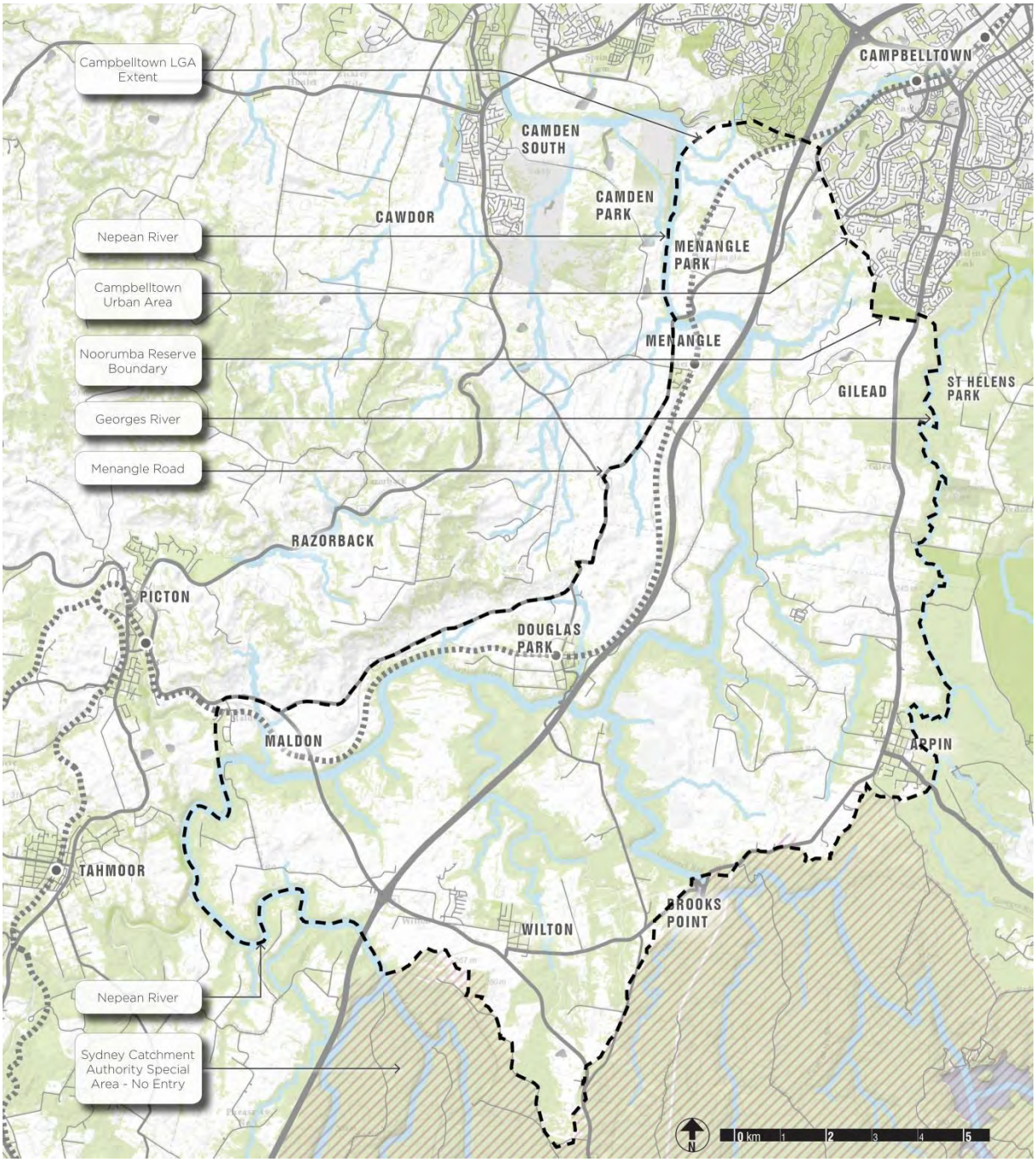
1.2 The Study Area

The study area comprises an area of approximately 17,600 hectares and is located approximately 70km south-west of the Sydney CBD. The area spreads across the Campbelltown and Wollondilly Local Government Areas and extends from Menangle Park in the north, Appin in the East, Wilton in the south and Maldon to the south west.

The terrain across the study area is relatively flat with steeper topography around river and creek lines, while the topography to the west of the site is considerably more variable associated with the Razorback Range. The study area is located within both the Nepean River and Georges River catchments and contains a number of tributaries associated with both rivers.

The southern portion of the study area and beyond is identified as a Metropolitan Special Area by the Sydney Catchment Authority (Water NSW). Access to this area is restricted to protect the water quality associated with the Nepean, Avon, Cordeaux and Cataract Dams as part of the Sydney Drinking Water catchment as well as the significant biodiversity located within.

Figure 1-1: Greater MacArthur Urban Capable Footprint Boundary (SOURCE: Urbis)



2.0 Development Yield

2.1 Introduction

Urbis as Study Master Planner have undertaken land-use planning and propose the study area is to cater for approximately 250,000 people with the provision of 85,283 new dwellings, social infrastructure, network infrastructure and conservation lands. The vision is to create more opportunities in Western Sydney. Urbis has defined this potential urban capable footprint boundary based on biodiversity layers, natural and urban constraints. The evolution of the Greater Macarthur boundary is attached in Appendix A. The boundary of the study area has been shaped by acknowledging the following constraints:

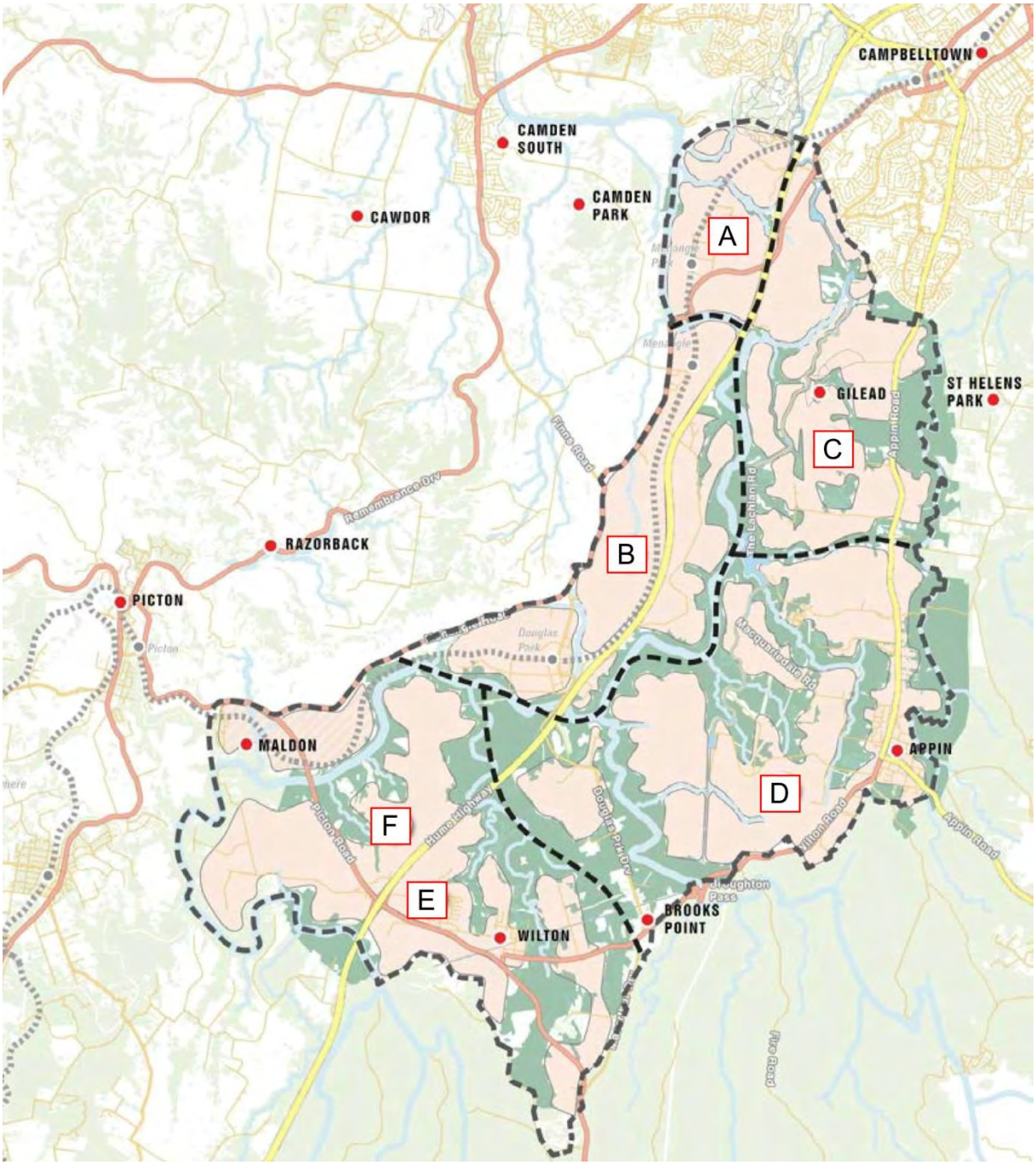
- Natural slopes greater than 18%;
- Strahler Streams 3-7;
- Biodiversity;
- Sydney Catchment Authority Special Area;
- Sydney Catchment Authority Upper Canal; and
- Network and Social Infrastructure.

It is envisaged that residents residing in the study area would have access to employment, services and amenities, and major centres at Campbelltown, Liverpool and Wollongong.

2.2 Precincts and Yield

Urbis introduced proposed precincts within the study area to establish a basis for the DP&E consultants to carry out analysis. It should be noted the proposed precincts are neither a staging plan nor a hierarchical guide. The proposed precincts are depicted in Figure 2-1.

Figure 2-1: Precinct Zone Boundaries (SOURCE – Urbis)



For each of the precincts Urbis calculated an urban capable footprint using the constraints documented in 2.1 to determine a capable footprint for each of the zones. Of the capable foot print area, it was determined by Urbis only 60% of the urban capable footprint would be developed to provide a total area of 5,686 Ha. The number of dwellings is based on the following calculation:

No. of dwellings = (60% urban capable footprint) x 15 dwellings/ha

The 60% urban capable footprint also included an assumed 10% employment zoned land and therefore the number of dwellings and commercial area would be based on the following calculations:

No. of dwellings = [(60% urban capable footprint) – (Employment Area)] x 15 dwellings/ha

Commercial (ha) = 10% x (60% urban capable footprint)

Table 2-1 summarises the dwelling and commercial development yields.

Table 2-1: Indicative Greater Macarthur Residential and Commercial Yield (SOURCE: Urbis)

Precinct	Gross Area (Ha)	Urban Capable Footprint (UCF)	60% of UCF	With Employment Zones		Without Employment Zones
				Dwellings (No.)	Commercial (ha)	Dwelling (No.)
A	1,050	800	500	6,750	50	7,500
B	2,500	1,700	1,000	13,500	100	15,000
C	2,550	1,650	1,000	13,500	100	15,000
D	4,850	2,650	1,600	21,600	160	24,000
E	2,250	1,100	650	8,800	65	9,750
F	2,750	1,600	950	12,800	95	14,250
Total	**15,950**	**9,500**	**5,700**	**76,950**	**570**	**85,500**

Note:

- *The proposed precincts are only estimates used to facilitate demand estimation and guide development staging.*
- *Precinct E was separated into two smaller precincts for practicality.*

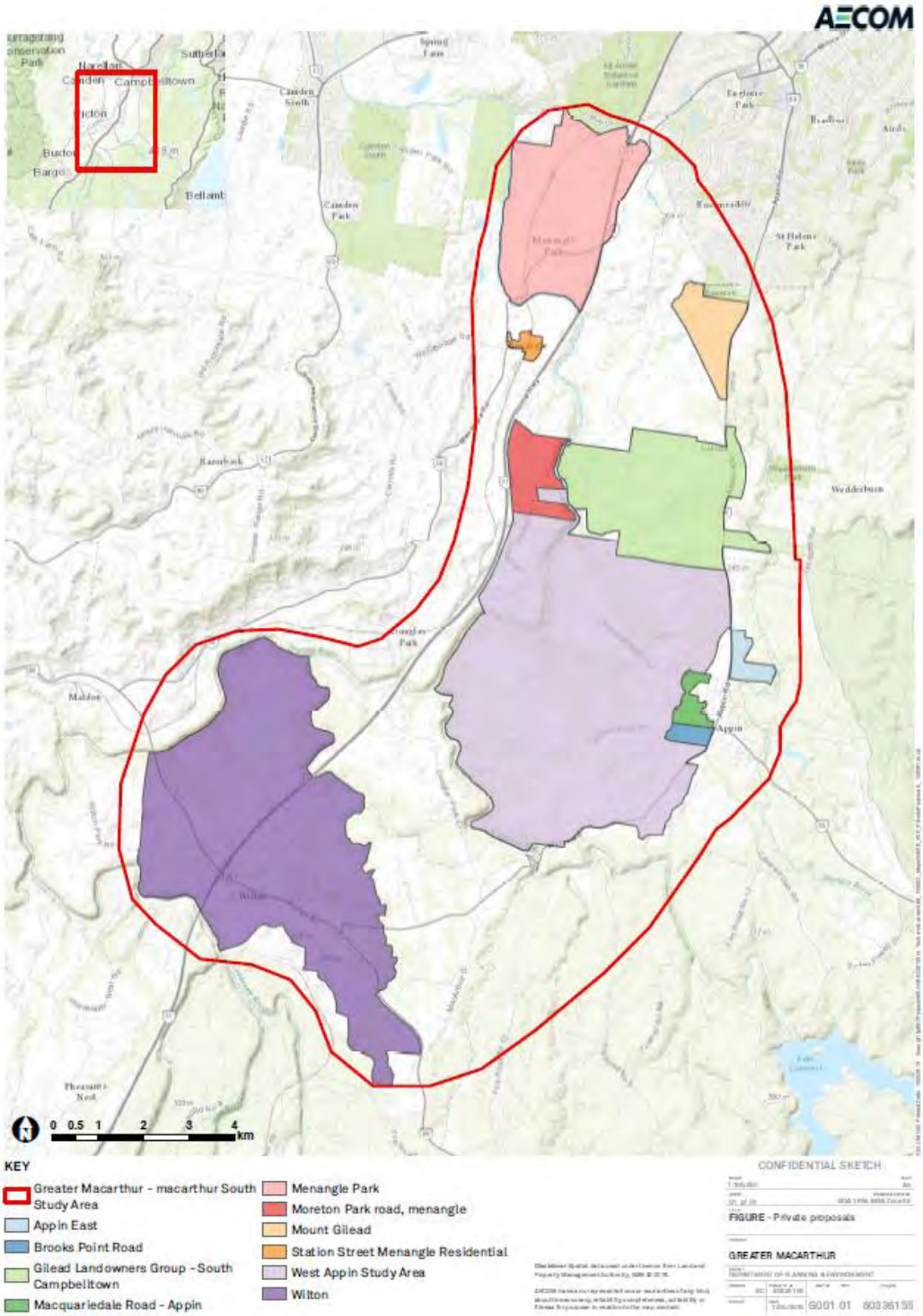
The driver of the development will be predicated on the existing and planned infrastructure networks, networks capacity and indicative future augmentation plans.

It is noted that the above yields for each precinct are an estimate and will likely vary dependent on market conditions and the outcome of the study.

2.3 Private Proposals

The precinct zones have been influenced by private developer proposals submitted the government for assessment. The proposals are identified as Appin and West Appin; Wilton Junction; South Campbelltown; Menangle Park; Appin East Precinct; Mouth Gilead and Menangle general areas, as depicted in Figure 2-2.

Figure 2-2: Private Proposals within the Greater Macarthur



3.0 Primary Utility Suppliers

The high level service infrastructure investigation identified the primary utility providers as these would be able to provide detail of the existing networks and available capacity, which are detailed in Table 3-1

Table 3-1: Primary Utility Suppliers in the Study area

Service	Primary Utility Suppliers
Potable & Recycle Water	Sydney Water
Sewer	Sydney Water
Electricity	Endeavour Energy (Distribution) Transgrid (Bulk Supply)
Gas	Jemena
Telecommunications	NBN & Telstra

Note: Telecommunications primary supplier was identified as NBN as it was determined the area qualified under their development requirements and would therefore provide a detailed response to a feasibility application.

Whilst researching the primary utility suppliers in the Study area further local authorities were noted for each of the established villages and additional proponent study areas, the details of these suppliers in these areas are noted in Table 3-2.

Table 3-2: Localised Utility suppliers

Growth Area	Service	Preliminary Utility Supplier
Wilton	Potable Water	Sydney Water
	Sewer	Private Developers and Sydney Water
	Recycled Water	Not provided in the area (Bingara has a recycled network which is privately owned)
	Electricity	Endeavour Energy
	Gas	Jemena
	Telecommunication	Telstra
Appin	Potable Water	Sydney Water
	Sewer	Sydney Water and Private Septic Tanks (Council owned)
	Recycled Water	Not provided in the area
	Electricity	Endeavour Energy
	Gas	Jemena
	Telecommunication	NBN Co, Telstra, AAPT and Nextgen
Douglas Park	Potable Water	Sydney Water
	Sewer	Sydney Water and Private Septic Tanks (Council owned)
	Recycled Water	Not provided in the area
	Electricity	Endeavour Energy
	Gas	Not serviced in this area
	Telecommunication	Telstra Aerial and underground optic cable

Growth Area	Service	Preliminary Utility Supplier
Menangle Park	Potable Water	Sydney Water
	Sewer	Private Septic Tanks
	Recycled Water	Not provided in the area
	Electricity	Endeavour Energy
	Gas	Not serviced in this area
	Telecommunication	Telstra Aerial and underground optic cable, and Optus
Gilead	Potable Water	Sydney Water
	Sewer	Sydney Water
	Recycled Water	Not provided in the area
	Electricity	Endeavour Energy
	Gas	Jemena Gas Country
	Telecommunication	Telstra
Maldon	Potable Water	Sydney Water via – Nepean WFP
	Sewer	Sydney Water/ Council
	Recycled Water	Not provided in the area
	Electricity	Endeavour
	Gas	Jemena
	Telecommunication	Telstra

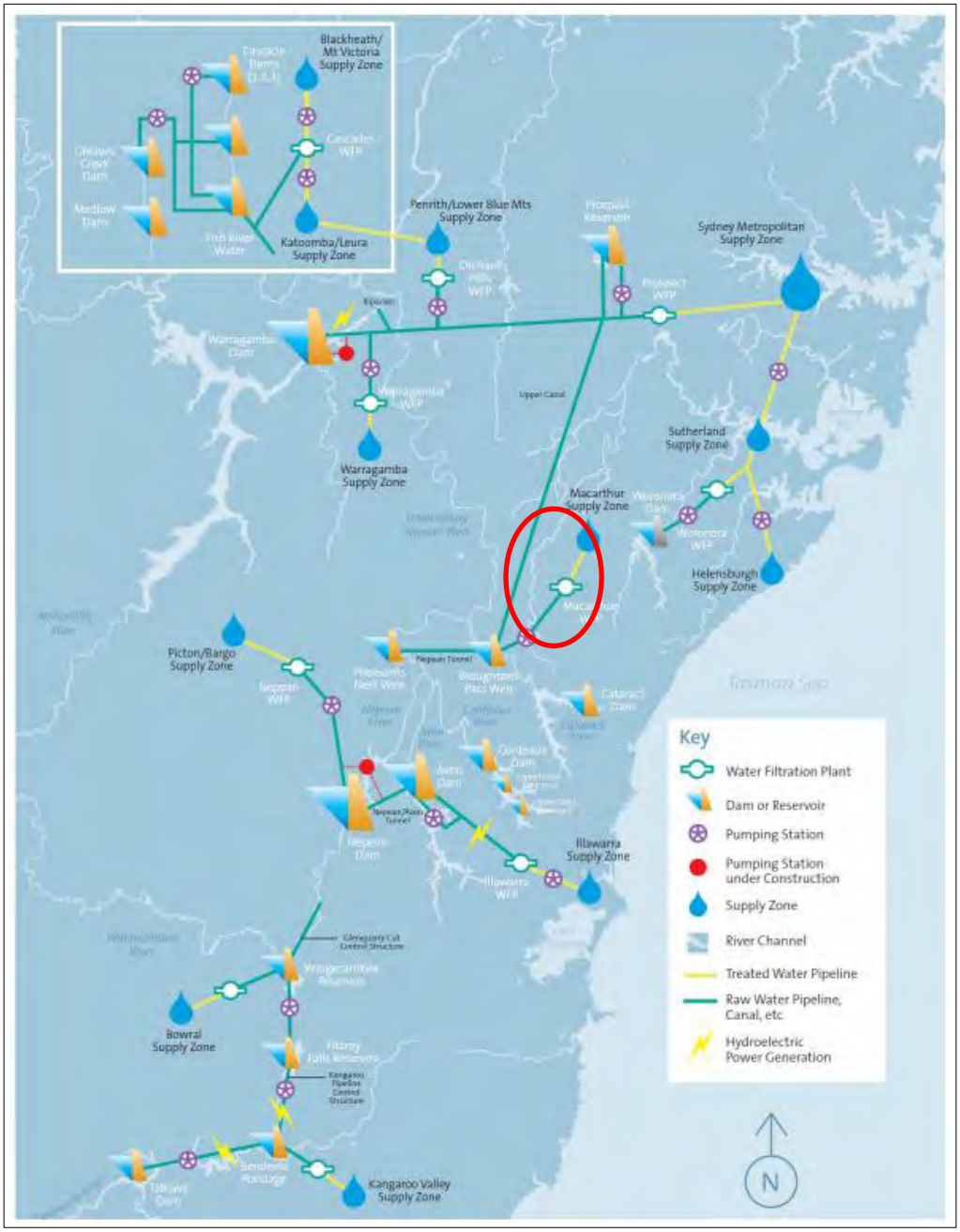
The study area is also traversed by the APA High Pressure Trunk Main. This main is not proposed to be used to supply gas to the proposed development, but will restrict the land use proposals within the associated easement. APA is a key stakeholder, since they source natural gas to Jemena at Wilton.

4.0 Existing Services Infrastructure Networks and Capacity

Existing Services Infrastructure networks in the study area are generally limited, supplying only the existing and current semi-rural development in the area. The existing networks area generally aligned with the existing roads, with the majority of existing trunk services contained within the Wilton Road, Douglas Park Road, Appin Road and between Hume Highway and Appin Road alignment.

4.1 Potable Water Network

Figure 4-1: Greater Sydney water supply system (SOURCE: Sydney Water GIS)



The review of the potable water networks indicates limited number on trunk mains and reticulation main within the study area (Refer to Figure 4-1). Currently, Macarthur Water Filtration Plants (WFP) and Appin Reservoir are located within the Study Area. The water supply system in Figure 4-1 presents the study area's water supply system, encompassing the areas of Sydney, the Illawarra and the Blue Mountains.

The Macarthur Water Filtration Plants (WFP) provides water to the Macarthur Delivery Area and supplies developments in Wilton (including Bingara Gorge), Appin and Douglas Park, as well as Appin east colliery, Appin west colliery, Ingham poultry. It is anticipated that supply of potable water to Menangle Park, Maldon and Mt Gilead is achieved through private connections to the Sydney Water network that is located outside the study area.

- The Menangle Park Detailed Planning completed by AECOM stated that the Menangle Park is currently being supplied by Campbelltown South Water Supply Zone.
- The planning proposal released recently by Campbelltown Council anticipates that Mt Gilead potable water demand will be serviced by the Rosemeadow Water Supply Zone.
- Maldon is understood to be serviced by Nepean WFP, but this will need to be confirmed with Sydney Water.

The Macarthur Water Filtration Plant WFP (WP0302) is owned by Trility and operated by Macarthur Water Pty Ltd. The Plant extract raw water from Broughton pass weir along Cataract River and has a design capacity of 265 MLD, however, due to the turbidity issue of raw water the treatment capacity was limited to 130 MLD.

Sydney Water GIS database Hydra indicates existing water filtration plant, water supply zone, water trunk mains and pumping station within the study area. Sydney Water owned assets are located in Appin: Appin Reservoir (WS412), Appin North trunk mains, Wilton and Appin & Wilton Road Boundary trunk mains and pumping stations.

The decommissioned elevated Appin reservoir, in conjunction with the upstream constrains at Macarthur WFP and the existing capacity and configuration of these networks implies no spare capacity to sustain the development demands.

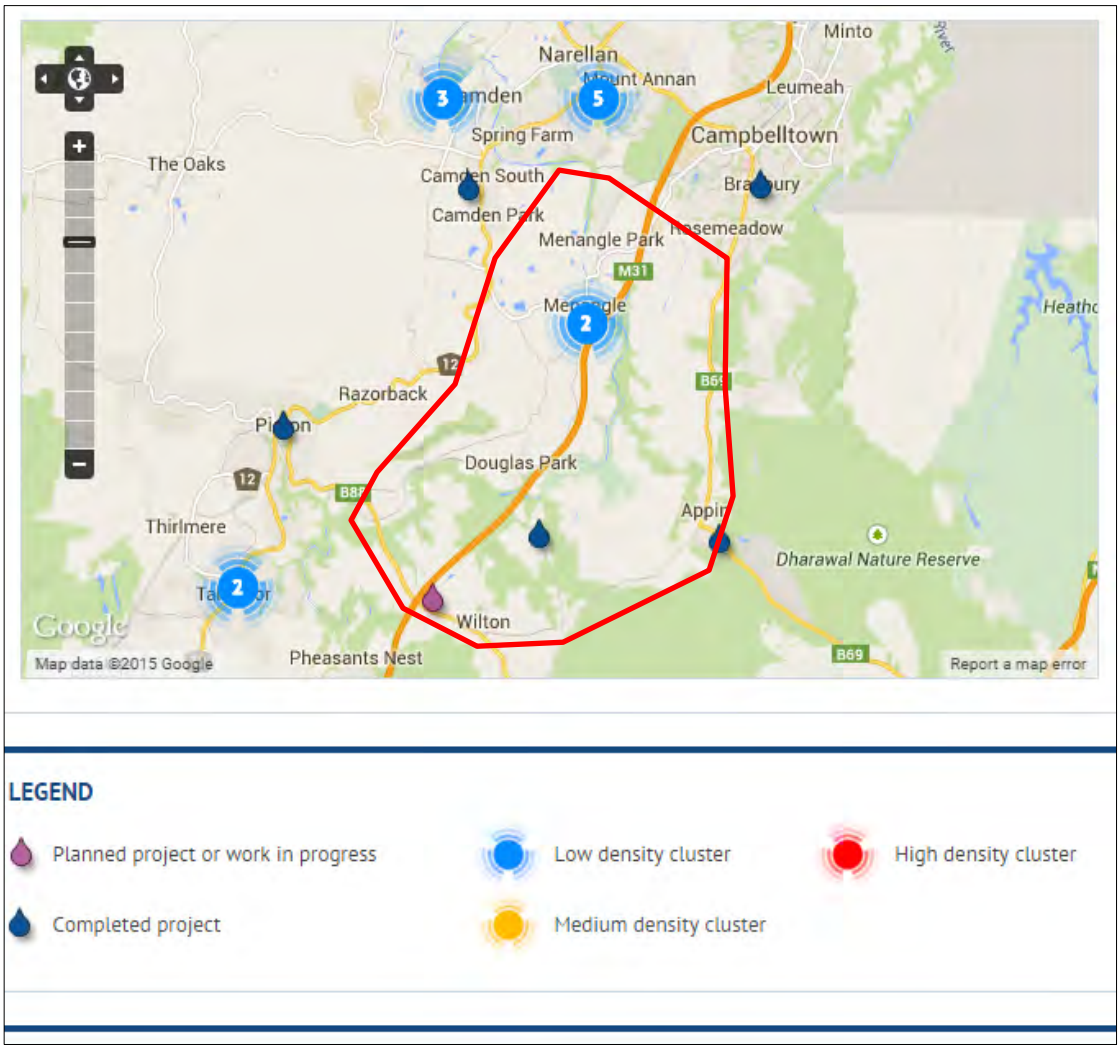
Sydney Water recently commenced an assessment on required amplification of the Macarthur Water Filtration Plant as part of the South West Growth Management Strategy.

In addition, to service the current growth in the area, Sydney Water has commenced a construction of a 2ML reservoir to service the Bingara Gorge Development. It had been recommended by Sydney Water that West Appin proposal area be serviced by the Macarthur System.

4.2 Recycle Water Network

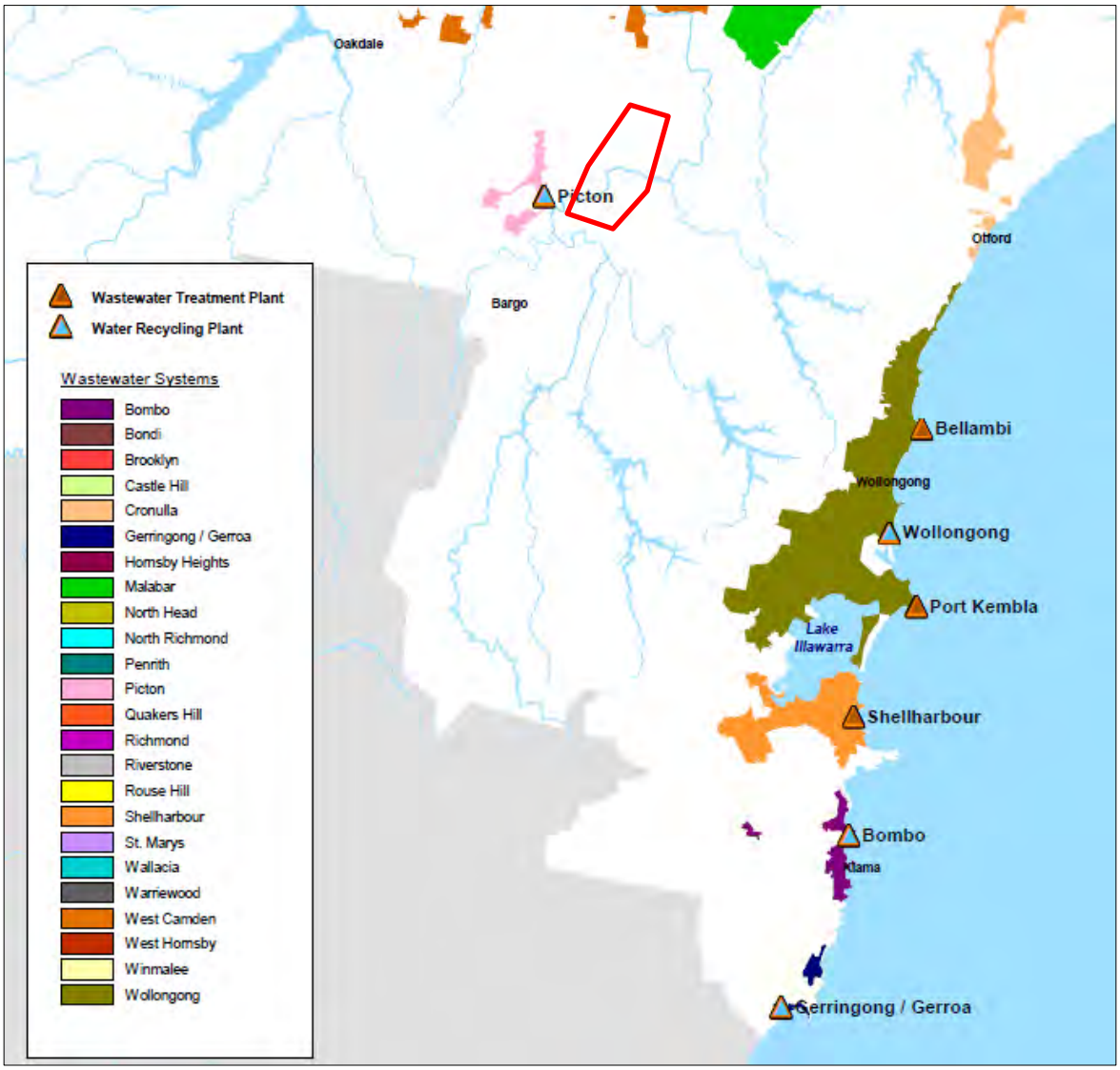
Sydney Water does not currently operate any recycle water service within the study area. The review of recycled water networks indicated recycle water network on adjacent areas such as Picton, Glenfield and West Camden. Based on the Metropolitan Water Directorate, there is water recycling systems that currently operates at Picton, Appin and Douglas Park, with one in progress at Wilton. A map showing the current rollout of the water recycling systems in the area is shown below in Figure 4-2.

Figure 4-2: Water Recycling Projects Roll Out (SOURCE: Sydney Water GIS)



It is understood that Glenfield Water Recycling Plant (WRP) ST0023 has a limited short term capacity to service growth in Appin until 2020. The recycling network adjacent to the study area is illustrated below in Figure 4-3.

Figure 4-3: Picton Recycle Water Network (SOURCE: Sydney Water)



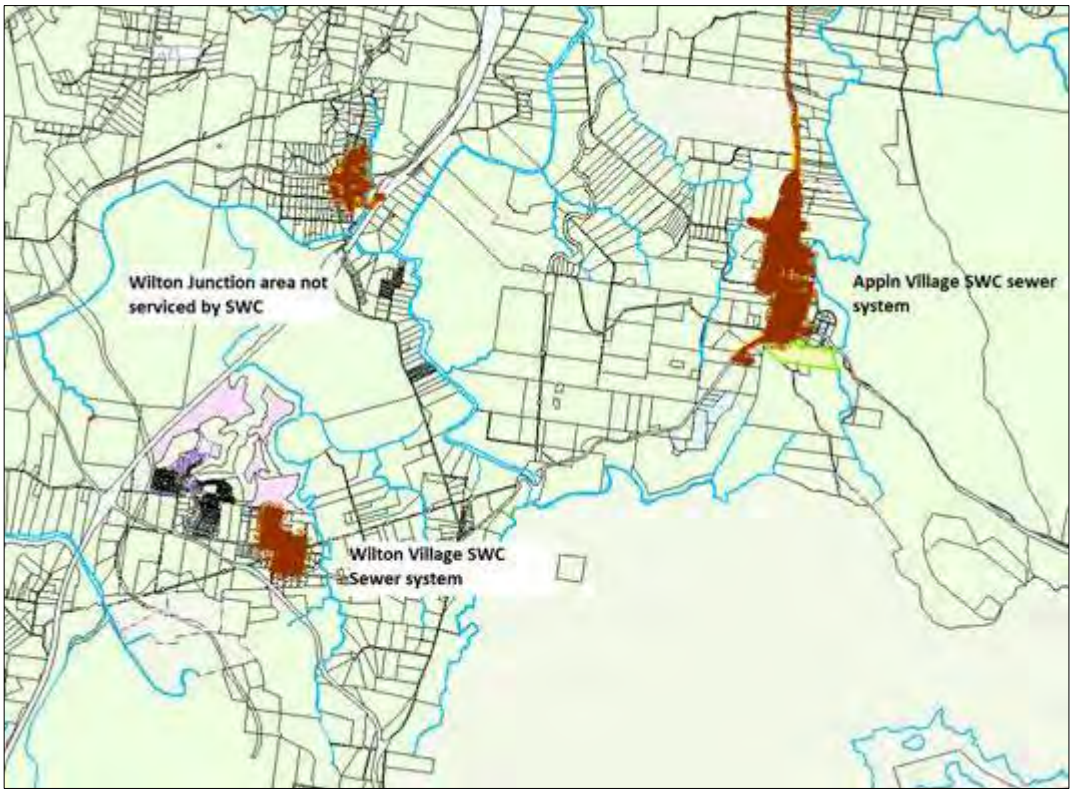
4.3 Sewer Network

Similar with potable water, the review of the existing sewer networks indicates limited sewer mains present within the study area. Sydney Water database Hydra, illustrates existing pressure sewer trunk mains within Appin Village, sewer mains within Wilton Village and reticulated network in Douglas Park as presented in Figure 4-4.

Glenfield Water Recycling Plant currently service North Appin through a pressure sewer main that traverse along Appin Road via Rosemeadow pumping station, which is then discharge to Malabar Waste Water Treatment Plant (416 ML/d) . It is anticipated that existing properties within the study area dispose of sewage using onsite disposal (septic tank) or by a privately owned treatment plant (which is the case at Wilton).

Sydney Water's Priority Sewerage Program (PSP) under the NSW Government's PSP has recently provided reticulated pressure sewerage systems to service unsewered urban communities. As part of the scheme, pressure sewerage systems, including tanks and pumps, have been delivered to service the urban villages of Appin, Douglas Park and Wilton.

Figure 4-4 – Sydney Water Sewer Catchment (SOURCE: Hydra)



The design capacity of the reticulated system is limited to 450 L/household/day. Wollondilly Council encourages existing 'eligible' properties to connect to the new system. Initial enquiry with Sydney Water's priority sewerage program community indicates that future development s after the 30th of June 2015 will need to engage a Sydney Water Servicing Coordinator to determine connection. However, future connections to the network are not guaranteed as it will be dependent on the size of the development and existing capacity in the system.

The existing systems are serviced by a range of wastewater transportation and treatment schemes. These include:

- Douglas Park wastewater is collected and stored at Moreton Park and transported by tanker trucks to Sydney Water's wastewater pumping station on Camden Valley Road at Catherine Field.
- Appin wastewater is collected and transferred to Glenfield Water Recycling Plant.
- Wilton's wastewater is collected and transferred to the Bingara Gorge wastewater network for treatment.
- The villages of Menangle and Menangle Park which are currently unsewered and are serviced by on-site sewerage systems.

4.4 Electricity Network

Endeavour Energy is the main supplier of the study area. The MacArthur Bulk Supply Point (BSP) 66kV and Appin North distribution network provides all existing development within the study area, with the exclusion of Wilton which is serviced by privately owned substations.

Endeavour Energy and TransGrid has limited infrastructure adjacent and within the study area as summarised below:

- Douglas Park Switching Station (Connection point)
- Appin Zone Substations (15 MVA)
- Campbelltown Zone Substations (105 MVA)

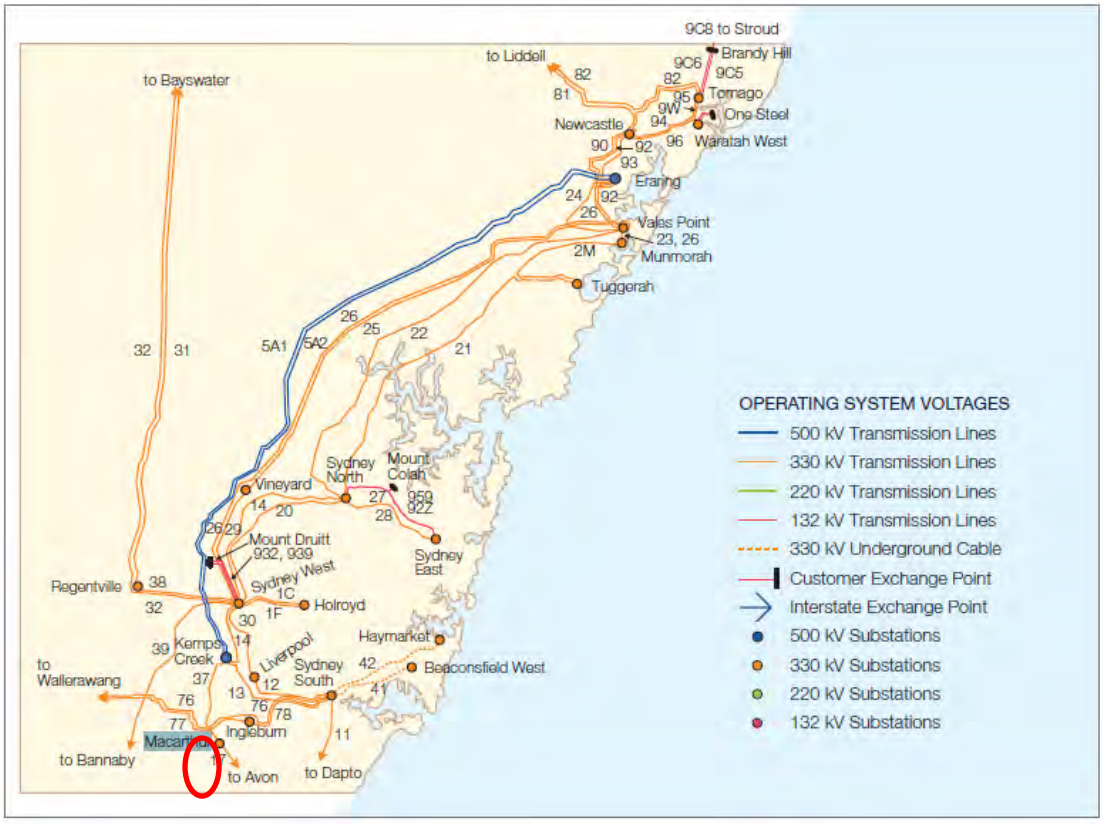
- Ambarvale Zone Substations (70 MVA)
- Maldon Zone Substation (11 kV)
- Wilton Zone Substations (11 kV)
- Bingara Gorge Substation (66kV) (privately owned)
- Macarthur BSP
- Macarthur Feeder (132 kV)

It should be noted two further power plants owned by Energy Development Limited called Appin Power Plant and Tower Power Plant are located within the Study Area and produce 55MW and 41MW. The distribution of this power is unconfirmed, however it is understood only a limited amount of it is supplied to the public network for use.

Macarthur BSP has been established to the south of the Mt Annan Botanic Garden by TransGrid to serve as a bulk supply to the South West Growth Sector.

In addition to the Endeavour network, the study area is traversed by the Sydney West to Sydney North TransGrid 330/132kV aerial transmission line. This infrastructure will not be used to supply the development; however it will need to be accommodated in the development area.

Figure 4-5: TransGrid Macarthur BSP 330/132 kV ZS (SOURCE: Transgrid)



Endeavour Energy had proposed a 33kv line to Menangle Park and a zone substation at Wilton to service Bingara Gorge. TransGrid and Endeavour Energy are undertaking collaborative project to increase transmission system supply to Sydney West.

4.5 Natural Gas Network

Jemena supplies the study area through a combination of high pressure and reticulation mains. Plans provided by Jemena through Dial Before You Dig indicate that there is a limited gas reticulation within the study area, primarily within Wilton and Appin. Jemena had recently installed a main trunk line near Appin and reticulate main to serve Bingara Gorge and Appin Township.

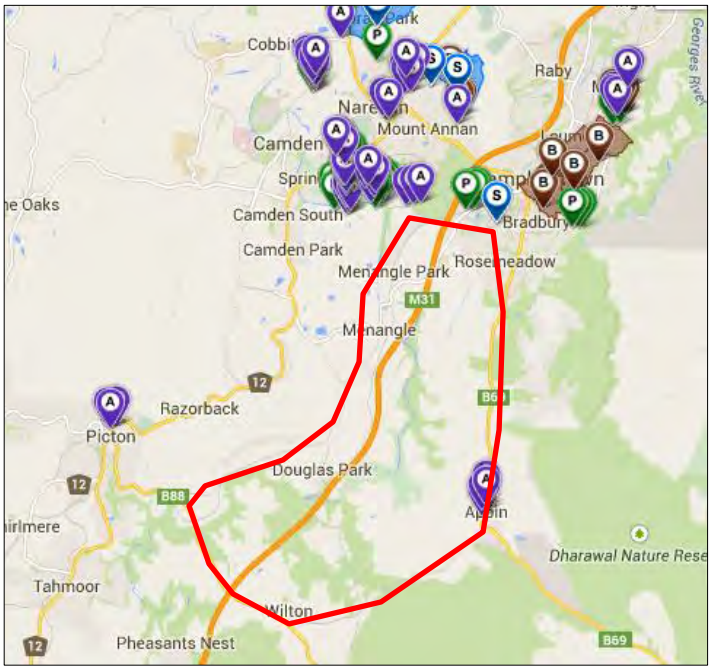
Figure 4-6: Jemena Main Trunk pipeline (SOURCE – Jemena)

4.6 Telecommunications Networks

Plans provided by Telstra through Dial Before You Dig shows an existing telecommunications network present within the study area. The existing network is a combination of aerial and buried optic cable.

The National Broadband Network (NBN) is currently operating at Appin. A map showing the current rollout of the NBN network in the area is shown below in Figure 4-7.

Figure 4-7: NBN Co. Roll Out (SOURCE Telstra)



5.0 Service Demand Estimates

Service Demand estimates have been calculated based on the proposed precincts shown in Figure 2-1 and the dwelling and commercial yields summarised in Table 2-1.

5.1 Potable Water and Recycle Water Demand

5.1.1 Demand Assessment

An assessment of estimated demand in potable water for the study area has been undertaken to assist in determining the required infrastructure upgrades associated with the proposed development.

Demand forecasting and profiles were developed for the study area. The demand assessment have been based on the average number of dwellings and proposed gross floor area (GFA) for commercial development. Demand estimates for the potable water reticulation system have been calculated using the *Design Criteria Guidelines Supplement for Single Reticulation System (Sydney Water, 2014)* and is based on maximum daily demand (MDD).

A summary of the water demand unit rates is present in Table 5-1

Table 5-1: Potable Water Demand Unit Rates

Land Use	Design Criteria	Units	Potable Water Demand	Sources
Single Dwelling Residential (14-17 dwelling/net area/ha)	Max Day Demand	EP/ dwelling	3.0	Formal Response by Sydney Water Received 5th June 205 Average Daily Demand (ADD): 190 L/person/day Maximum Daily Demand (MDD) : 440 L/person/day
Suburban Commercial	Max Day Demand	kL/Ha/day	41	Water Supply Code of Australia WSA 03-2011 - 3.1 (Sydney Water 2014 Edition)
BASIX Reduction		%	40	Not applicable to MDD

An estimate of the total potable water demand for the study area has been calculated based on the estimated average number of dwellings for residential and GFA for commercial development.

Proposed residential properties within the development have been classified as ‘single dwelling 14-17 dwelling/net area/ha development based on housing density. For the residential demand calculations in the Study Area Sydney Water guidance indicates the use of EP/dwelling of 3 people and a maximum daily demand (MDD) of 440L/person/day. The commercial density has been estimated on an equivalent potable water demand rate of 41kL/Ha/day.

Under BASIX requirements, proposed residential developments are required to comply and reduce mains-supplied potable water consumption by 40% (since the BASIX amendment was introduced in 2006) compared to the average NSW dwelling. Table 5-2 and Table 5-3 present the estimated maximum daily demand potable water for each precinct including additional scenarios allowing for a 40% BASIX reduction.

The cumulative MDD, for the ‘With Commercial Zones’ without utilising BASIX, is estimated to be 102 megalitres per day (MLD) for residential and 23.4 megalitres per day for commercial. However when utilising BASIX requirements the cumulative MDD for residential reduces to 61 MLD.

The cumulative MDD for the ‘Without Commercial Zones’ without utilising BASIX is estimated to be 113 megalitres per day (MLD) for residential. However when including BASIX requirements the ‘Without Commercial Zones’ MDD reduces to 68 MLD for residential.

Table 5-2: Cumulative Maximum Daily Potable Water Demand (kL/day)

Precinct	With Employment Zones		Without Employment Zones
	Residential Potable Water Demand (kL/day)	Commercial Potable Water Demand (kL/day)	Residential Potable Water Demand (kL/day)
A	8,900	2,050	9,900
B	17,800	4,100	19,800
C	17,800	4,100	19,800
D	28,500	6,550	31,700
E	11,600	2,650	12,900
F	16,900	3,900	18,800
Total	**101,500**	**23,350**	**112,900**

Table 5-3: Cumulative Maximum Daily Potable Water Demand (kL/day) including BASIX

Precinct	With Employment Zones	Without Employment Zones
	Residential Potable Water Demand (kL/day)	Residential Potable Water Demand (kL/day)
A	5,350	5,950
B	10,700	11,900
C	10,700	11,900
D	17,100	19,000
E	7,000	7,750
F	10,150	11,300
Total	**60,900**	**67,800**

It is anticipated that providing recycled non-potable water for domestic use within the study area, including toilet flushing and external uses, could see a potential reduction in the proposed potable water demand by up to 50% of the maximum day demand, based on the Sydney Water Codes SWC Area Planning Design Criteria Guide (Sydney Water, 2010).

The reduction in potable water demand associated with providing a dual reticulation network, has not been included in our demand estimates. Further discussion would be required with SWC on its implementation and criteria intent.

The exact reduction in potable water demand would be subject to further investigation considering the extent of the usage required and density of the development. Potential opportunities for incorporating non-potable water schemes within the study area will be further discussed with the DP&E if the land release is determined to hold urban capable footprint capabilities.

5.2 Sewer Loading

5.2.1 Demand Assessment

An assessment of sewer loading for the study area has been calculated based on the estimated average number of dwellings for residential and GFA for commercial development.

The design criteria used to forecast future sewer loading are generally taken from the Sydney Water Area *Planning Design Criteria Guide: WSA 02-2002-3.0 (Sewer Code of Australia)* and is expressed as an equivalent population (EP) for a particular land use.

A summary of the sewer load unit rates are summarised in Table 5-4.

Table 5-4: Sewer Design Loading Criteria

Land Use	Units	Potable Water Demand	Sources
Medium Density	EP/dwelling	3	SWC Area Planning Design Criteria Guide: WSA 02-2002- 3.0 (Sewer Code of Australia)
Local Commercial	EP/ha	75	SWC Area Planning Design Criteria Guide: WSA 02-2002- 3.0 (Sewer Code of Australia)
BASIX Reduction	%	40	

The residential developments within the study area have been classified as 'medium density dwelling' as agreed with the client and investigation team and 'local commercial' development.

In accordance with the Sydney Water criteria guide, the Average Dry Weather Flow (ADWF) per Equivalent Population (EP) is usually taken as 180 L/day or 0.0021L/s (ADWF(L/s) = 0.0021 * EP). Sydney Water have provided guidance for the Greater Macarthur area to use 150L/person/day for the ADWF, a peak dry weather flow (PDWF) factor 2 and a peak wet weather flow (PWWF) factor of 2.5. Estimates of the Average Dry Weather Flow (ADWF) for the study area's proposed development have been calculated using these rates.

Under BASIX requirements, proposed residential developments are required to reduce their loading by 40%. Table 5-5 and Table 5-6 present the estimated ADWF including additional estimates due to a 40% reduction in ADWF.

Table 5-5; Cumulative Average Dry Weather Flow (L/s)

Precinct	With Commercial Zones		Without Commercial Zones
	Residential Sewer Demand (L/s)	Commercial Sewer Demand (L/s)	Residential Sewer Demand (L/s)
A	35	7	40
B	70	13	78
C	70	13	78
D	113	21	125
E	46	8	51
F	67	12	74
Total	**401**	**74**	**446**

Table 5-6: Cumulative Average Dry Weather Flow (L/s) including BASIX

Precinct	With Commercial Zones	Without Commercial Zones
	Residential Sewer Demand (L/s)	Residential Sewer Demand (L/s)
A	21	24
B	42	47
C	42	47
D	68	75
E	28	31
F	40	44
Total	**241**	**268**

The cumulative total ADWF is estimated to be 401 L/s for 'With Commercial Zones' Residential; this reduces to 241L/s when BASIX is considered. Similarly, the cumulative total ADWF is estimated to be 446 L/s for 'Without Commercial Zones' Residential; this reduces to 268 L/s when BASIX is considered.

5.3 Electricity Demand

5.3.1 Demand Assessment

An assessment of electrical demand for the study area has been undertaken to assist in determining the required infrastructure upgrades.

Demand forecasting and profiles were developed for the study area based on the average number of dwellings and gross floor area (GFA) for retail and commercial development. Demand estimates for electricity at each of the precinct have been calculated by applying a peak demand rate of 5kVA per dwelling and 0.1 kVA per m² for commercial and retail buildings (Endeavour Energy: Distribution and Transmission Annual Planning Report, 2013) as typically adopted by Endeavour for planning purposes. These rates are generally considered to be conservative but are appropriate for preliminary estimation purposes and these rates are applied to proposed dwellings, commercial and retail spaces to provide an indication of the magnitude of the demand increase.

An energy efficiency scenario is also considered, where the electricity use rate is reduced by 25%. This is required by BASIX for residential development, with a diversity factor of 0.8 applied to the resultant sum (after the BASIX reduction). The BASIX reduction has only been applied to the residential dwellings, while the diversity factor has been applied to both commercial and residential areas.

The diversity factor is applied to give a reasonable estimate of the cumulative demand for large sites such as the study area. It is applied to make allowance for the variation in timing of usage across the development. This is particularly important where the load is being reviewed against the capacity of the trunk infrastructure, which may also serve other developments.

Table 5-7 shows the electricity demand unit rates while Table 5-8 and Table 5-9 show the estimated peak electrical loads.

Table 5-7: Electricity Demand Unit Rates

Building Type	Peak Demand Rate	Unit
Residential BASIX compliant dwellings (incl. Single Detached; Townhouse; Apartment)	4	kVA/dwelling
Residential non-BASIX compliant dwellings (incl. Single Detached; Townhouse; Apartment)	5	kVA/dwelling
Commercial	0.1	kVA/m ²
BASIX Reduction	25	%
Diversity Factor	0.8	

Table 5-8: Cumulative Peak Electrical Load (kVA)

Precinct	With Commercial Zones		Without Commercial Zones
	Residential Electricity Demand (kVA)	Commercial (ha) Electricity Demand (kVA)	Residential Electricity Demand (kVA)
A	33,750	50,000	37,500
B	67,500	100,000	75,000
C	67,500	100,000	75,000
D	108,000	160,000	120,000
E	44,000	65,000	48,750
F	64,000	95,000	71,250
Total	**384,750**	**520,000**	**427,500**

Note: Endeavour Energy reported the commercial demand estimate in table 5-8 is significantly greater than their calculations, which indicate a total load of 27MVA. A breakdown of their estimate has not been provided.

Table 5-9: Cumulative Peak Electrical Load (kVA) including BASIX + Diversification

Precinct	With Commercial Zones	Without Commercial Zones
	Residential Electricity Demand (kVA)	Residential Electricity Demand (kVA)
A	20,250	22,500
B	40,500	45,000
C	40,500	45,000
D	64,800	72,000
E	26,400	29,250
F	38,400	42,750
Total	**230,850**	**256,500**

The 'With Commercial Zones' total cumulative peak electricity load increase has been assessed as 385 MVA for residential and 520 MVA for commercial; residential has reduces to 231 MVA when including BASIX and diversity requirements. 'Without Commercial Zones' cumulative peak electricity load increase has been assessed as 428 MVA for residential; this reduces to 257 MVA when including BASIX and diversity requirements.

5.4 Natural Gas Demand

5.4.1 Demand Assessment

An assessment of the gas demand for the study area has been undertaken to assist in determining the required infrastructure upgrades.

Jemena use an energy demand of 20 gigajoules (GJ) per year to estimate the average annual domestic usage of natural gas for residential dwellings and commercial buildings. This usage rate typically equates to a natural gas hot water tank, cook top and heating point. Note peak demand and annual gas demand are also dependent on the plant supplying the project area. These will be confirmed with Jemena during subsequent stages of work.

Table 5-10 presents the estimated natural gas usage for the proposed conditions for the study area, assuming supply to residential and commercial properties only. This estimate uses a conversion factor of 39.6 m³ / GJ to covert the estimated usage into a volume of gas (Parliament of Australia: Natural Gas: Energy for the New Millennium, 2015). This equates to 2.169 m³ / day.

Under the BASIX requirements, the proposed residential developments are required to reduce gas consumption by up to 25% compared to the average NSW dwelling.

Table 5-10: Cumulative Gas Demand (m3/day)

Precinct	With Commercial Zones	Without Commercial Zones
	Residential Gas Demand (m^3/day)	Residential Gas Demand (m^3/day)
A	14,640	16,270
B	29,280	32,535
C	29,280	32,535
D	46,850	52,060
E	19,090	21,150
F	27,760	30,900
Total	**166,900**	**185,450**

Table 5-11: Cumulative Gas Demand (m3/day) including BASIX

Precinct	With Commercial Zones	Without Commercial Zones
	Residential Gas Demand (m^3/day)	Residential Gas Demand (m^3/day)
A	10,980	12,200
B	21,960	24,400
C	21,960	24,400
D	35,140	39,045
E	14,320	15,860
F	20,820	23,175
Total	**125,180**	**139,080**

The cumulative gas demand is estimated to be 166,900m^3/day for the 'With Commercial Zones' development. BASIX compliant buildings would reduce this to an estimated 125,180m^3/day. As oppose to the cumulative gas demand of the 'Without Commercial Zones' which is estimated to be 185,450m^3/day with no BASIX compliance and 139,080m^3/day with BASIX.

5.5 Telecommunication Demand

There is limited data on the existing communications infrastructure present throughout the study area. No demand calculations have been completed for the telecommunications requirements.

6.0 Consultation and Feasibility Applications

As part of the Services Infrastructure assessment contact with the primary utility providers, as reported in section 3.0, has been undertaken to confirm the assumptions, demand calculations and future proposed works are feasible. For the Greater MacArthur study this has been carried through formal liaison in the form of feasibility applications and Agency and Council workshops. Additional information has been sourced from available responses as part of the individual proponent studies within the study area.

6.1 Feasibility Applications

Each of these primary utility suppliers has been contacted during the preparation of this Report to confirm the extent of their existing service networks and proposals for supplying the demands of the proposed development.

A formal feasibility application was sent to the primary utility providers via email with an attached formal letter, subsequent phone calls were made to gain initial feedback prior to receiving formal responses. All formal correspondence sent and received from the above utility suppliers is documented in the appendices.

6.1.1 Potable Water and Recycle Water

Sydney Water has confirmed that they are the servicing authority for potable water supply to the study area.

A formal feasibility application response was received from Sydney Water on 5th June by email and letter, which was supported by a response workshop to clarify items. Sydney Water highlighted that the formal response is hypothetical advice only and not a commitment to providing the infrastructure that they suggest would be required to service the Study area.

Sydney Water have assumed an average household of 3 equivalent persons (EP) and calculated an Average Daily Demand (ADD) of 52ML/day. They indicated the Macarthur water filtration plant (WFP) would sufficient capacity for this increase in ADD flows for the study area. However the Macarthur WFP would require amplification to accommodate the Maximum Day Demands (MDD) calculated in section 5.1.1 and this could be augmented when required.

Refer to Appendix D for Potable water related correspondence with Sydney Water.

6.1.2 Sewer

Sydney Water has confirmed that they are the servicing authority for sewage disposal to the study area, through Glenfield WRP and localised reticulation networks. However, it had also been noted that a private reticulated water treatment plant currently operates at Bingara Gorge, Wilton.

A formal feasibility application response was received from Sydney Water on 5th June by email and letter, which was supported by a response workshop to clarify items. Sydney Water highlighted that the formal response is hypothetical advice only and not a commitment to providing the infrastructure that they suggest would be required to service the Study area.

Sydney Water as part of their response has made the assumption that the North West Growth Centre (NWGC) and the South West Growth Centre (SWGC) will be fully developed by the time the Study area is being developed. They have advised as a result of full development of NWGC and SWGC there will be limited capacity in the Malabar system to accommodate growth in Greater Macarthur and therefore it is likely to be discharged into the Hawkesbury-Nepean system. This would be subject to the Hawkesbury-Nepean Wastewater strategy and would require tertiary treatment (TN of 5mg/L) as a result. Treatment would be sized and matched to the development sequencing to mitigate risk of overspend if the ultimate development was not realised.

The preliminary proposal of 7,000 dwellings in Menangle Park and Mt Gilead, as part of Stage 1, is reasonable (note SW are already committed to delivery of infrastructure for 3,600 dwellings in 2016). Proposal of 16,000 dwellings in Wilton for stage 2 would require significant investment in water and wastewater treatment and trunk system. However beyond those stages SW have no preferred approach to staging for the remainder of the Study Area.

Refer to Appendix D for Sewer related correspondence with Sydney Water.

6.1.3 Electricity

TransGrid and Endeavour Energy has confirmed existing assets within and adjacent to the study area. TransGrid current assets comprise of MacArthur Bulk Supply Point and a 330 kV transmission line easement that traverse through the area. Endeavour Energy's assets includes Wilton ZS; Appin ZS; Maldon ZS and Ambarvale ZS. A formal response has been received from Endeavour Energy on 21st May and from TransGrid on 13th May 2015.

Endeavour Energy reported the proposed 85, 500 residential lots and 570Ha of employment lands represent a load of 341MVA and 27MVA respectively, giving an ultimate load of 368MVA. Current supply from existing zone substation is limited and ultimately the study area will require additional electrical infrastructure requirements. Preliminary analyses undertaken by Endeavour Energy indicate that supply to the study area, in the ultimate case, would require the following new electrical infrastructure and augmentation of the existing electrical infrastructure:

- Conversion of Douglas Park SS to a 132/66kV Transmission Substation, incorporating Douglas Park Zone Substation
- Augmentation of Maldon and Wilton ZSs to a firm capacity of 70 MVA.
- Augmentation of Appin ZS to a firm capacity of 35 MVA.
- Establish Bingara ZS with a firm capacity of 70 MVA.
- Establish Wilton Junction, Morton Park, North Appin, Gilead and Menangle Park zone substations each with a firm capacity of 35 MVA.
- Augment 66kV feeder 852 and out of service feeder 308 for 132kV operation.
- Augment 66kV feeder 851 from Nepean TS to Finns Rd to 132kV and establish a new 132kV line to Douglas Park TS.
- Build a new 66kV line from Douglas Park TS to Menangle Rd to join to 66kV feeder 851 to Maldon ZS.
- Establish additional 66kV feeders from Douglas Park TS to the various zone substations.
- Establish 66kV feeders from Macarthur BSP to Menangle Park, Gilead ZSs and North Appin Zone Substations.

Engagement between Endeavour Energy and TransGrid has resulted predominantly in the Macarthur Bulk Supply Point (BSP) potential augmentation. It had been noted that Macarthur BSP is a hybrid site with both 66kV and 132kV. Electricity will be distributed from MacArthur BSP through the study area via Endeavour Energy Zone Substations at 11kV.

As an initial view of staging, Endeavour has indicated that it is ideal to start from where infrastructure was either existing or planned to be established in the next 3 years. This includes Wilton Zone Substation (existing infrastructure) and Menangle Park Zone Substation (2018) (planned infrastructure).

Refer to Appendix E for Electrical Distribution related correspondence with Endeavour Energy and Appendix F for Electrical Bulk Supply related correspondence with Transgrid.

6.1.4 Natural Gas

A formal feasibility application response was received from Jemena on 11th June.

Jemena report precincts A, B, C & E have very low prospects of gas being available as there are significant costs in order to service these areas which would render the project commercially unviable. Precincts D & F have small Gas networks around Appin and Wilton town centre respectively which would be able to accommodate a small amount of growth. However any major growth would require significant investment as there are large areas within the precincts that have no gas coverage.

Refer to Appendix G for Gas related correspondence with Jemena.

6.1.5 Telecommunications

NBN had advised that the study area can be serviced. NBN networks will be supplied as part of the Telecommunication Infrastructure in New Development (TIND) Policy. The NBN is a Federal Government initiative which will deliver high speed broadband through an open access network that will require laying of fibre optic cabling.

Refer to Appendix H for Telecommunications Gas related correspondence with NBN Co.

6.2 Agencies and Councils Workshop Outcomes

DP&E held a technical workshop regarding the study area on the 27th of April 2015 at the Campbelltown Catholic Club, in accordance with *A Plan for Growing Sydney.* Agencies, Councils and Consultants were divided into groups based on the topics of, Agriculture; Mining; Environment; Infrastructure Capacity and Economic drivers and Employment. Representatives from Wollondilly Council, Campbelltown Council, DP&E, Urbis, AECOM, GHD, TransGrid, Endeavour Energy, Sydney Water, Department of Health, Department of Education, SGS, TfNSW and AgEconPlus were present at the workshop.

The primary objective of the workshop was to address the following

1. *What is important about the topic in the context of the Greater Macarthur?*
2. *How should the planning of Greater Macarthur deal with the issues?*
3. *How should staging occur in relationship to the study area?*

In addition, the workshop also provided;

- Opportunity for consultants to engage with the DP& E, and Wollondilly and Campbelltown Council and discuss their consolidated findings. The groups will cluster the identified issues and constrained the DP&E are evaluating as part of the investigation.
- The consultants and DP&E to collate views and options on the topics, implications for the study area and staging;
- Envisage the current issues of the study area, and utilise this to underpin requirements for the study area

As a result of the workshop, it is our understanding that the staging of the growth within the land release area, and the subsequent infrastructure delivery strategy, will be influenced by:

- The capacity the existing infrastructures
- Currently planned augmentation/upgrade works
- Led in cost of bulk infrastructure to supply each land release package.

The current infrastructures spare capacity and future servicing strategies discussed in section 7.0 is fundamental to the proposed development. These are significant factors that feed into the staging and consideration of layout of the development to facilitate infrastructure delivery.

Underpinning the spare capacity allowances for each major infrastructure network is essential to identify the issues between the networks and the development delivery. This will form the basis for the staging development strategy for the study area and inform utility providers of network gaps and further infrastructure delivery for consideration.

While there is generally limited existing infrastructure within the study area there is some opportunity to service proposed development from the existing networks.

The constraints associated with the delivery of services infrastructure are identified where known.

6.2.1 Potable and Recycled Water

Sydney Water's existing assets that could service the study area are only limited to Appin Reservoir and Rosemeadow Reservoir. The water stored in these reservoirs is sourced from the Macarthur Water Filtration Plant (WFP), which is owned and operated privately by Trility.

It is our understanding that assets within the study area are exhausted, with no reserved capacity at Appin Reservoir or Picton Water Recycling Plant. This indicates the need to consider major network upgrades or potential alternative sources to service the study area.

As part of the Mt Gilead development public exhibition Sydney Water has indicated that water will be provided to the development from Rosemeadow water system and the Glenfield Water recycling plant will serve the development. The existing reservoir at Wilton only has the capacity to provide to Bingara Gorge Development which could be optimised. This reservoir however, is owned and operated by a private developer. It is understood

Sydney Water has commenced the construction of a 2ML reservoir to facilitate servicing of the Bingara Gorge Development.

Key Points

Limited numbers of trunk and reticulation mains are present within the area; these vary on type and age. The key points sourced from the workshop for potable water servicing in Greater Macarthur are as follows:

- There is no spare capacity to service additional growth from the Macarthur Water Filtration Plant (WFP) system. West Appin servicing strategy indicated that Sydney Water is currently investigating options to increase the plant capacity to service existing and forecast growth.
- The Broughton Pass Weir where water is extracted and pumped to Macarthur WFP has been recognised to be a high risk for Sydney Water.
- Funding for additional infrastructure capacity or network augmentation is not currently budgeted, with most funding allocated to South West Growth Centres.

6.2.2 Sewer

It is our understanding that Menangle Park can be serviced by Glenfield Water Recycling Plant (WRP), whereas Appin only has as short term capacity as a result of commitment to other developments. With the scarcity of sewerage networks available within the area to address the increased demand major works to the reticulation network and delivery of trunk mains will be required across the study area. With the size of the study area, localised solutions appear to be potential feasible options in treating sewerage in the study area.

Key Points

Limited numbers of trunk mains are present within the area; these vary on type and age. The key points sourced from the workshop for sewer servicing in Greater Macarthur are as follows:

- Sydney Water currently has no plan to increase the capacity of the DN300 pressure sewer main that traverse from Appin to Glenfield WRP.
- Douglas Park is serviced via a local reticulation Network
- Effluent Management: Discharge of effluent is currently extracted by trucks, stored and treated.
- Funding for additional infrastructure capacity or network augmentation within the study area is not currently budgeted, with most funding allocated to South Growth Centres.

6.2.3 Electricity

Endeavour Energy in conjunction with TransGrid services the existing development at Greater Macarthur. TransGrid's Macarthur Bulk Supply Point supplies, through 66 KV feeders, Endeavour Energy's distribution zone substations within the study area. It is understood that Endeavour Energy Networks and TransGrid's Bulk Supply Point is limited in its capacity to supply the proposed residential and commercial developments unless major system augmentations are implemented.

There are current opportunities to partially service development at Wilton and Menangle Park through existing service infrastructure. The new Wilton Zone Substation at Bingara Gorge has the capacity to service up to 4,000 – 5,000 dwellings. The proposed Menangle Park Zone Substation could potentially service the proposed number of dwellings and commercial spaces documented in the Menangle Park proponent study.

Key Points

The key points sourced from the workshop for Electricity servicing in Greater Macarthur are as follows:

- TransGrid's existing Servicing Strategy does not include plans to upgrade the Macarthur Bulk Supply Point
- The Electricity feeder supply does not have capacity within the existing 66kV easements which is insufficient to traverse Electricity to supply the study area. Therefore, trunk main upgrades will be required for development of the study area;

- Government energy funding cuts and development uncertainty will influence Endeavour Energy and TransGrid's network delivery capability;
- Electricity supply in the study area is supplemented by electricity generated as a result of the mining powers stations within the study area. The extent of the supplementation has not been provided by the parties involved and therefore the implications of a future shut down of the mining power stations is not possible to quantify. Further investigation of this should be undertaken and considered further during the next steps of the study area investigation;
- Step change potential for Endeavour Energy's Networks will require trigger points considerations; and
- The current policy of "no build 60 meter corridor", this 60 meter corridor does not accommodate other utilities and would need to be wider to accommodate for other utilities to use the corridor.

6.2.4 Natural Gas

A representative of Jemena did not attend the agency workshop. This high level service infrastructure investigation was not reliant on information from the workshop as other contact with the provider was undertaken, refer section 6.1.4.

6.2.5 Telecommunications

A representative of NBN did not attend the agency workshop. This high level service infrastructure investigation was not reliant on information from the workshop as other contact with the provider was undertaken, refer section 6.1.5.

7.0 Proposed Servicing Strategy

The following proposed strategies are by AECOM and based on input and advice provided by the authorities. The strategies have not to adopted or approved by the relevant authorities and do not reflect a commitment for the proposed works to be constructed. The strategies have been prepared to inform the scope of services infrastructure required a potential staging and an order of magnitude cost of the works.

7.1 Potable Water

7.1.1 Preliminary Capacity Assessment

The Macarthur Water Filtration Plant (WFP) and Appin Reservoir services the existing urban and rural areas within the study area.

Sydney Water recently carried out a high level infrastructure investigation on the number of systems surrounding the proposed West Appin development. The objective of the servicing assessment was to advise the Department of Planning and Environment on the capacity of existing water and wastewater systems. The assessment identified the Macarthur WFP and Appin Water Supply Zone to be the primary sources of potable water for West Appin and to an extent for the Greater Macarthur Area.

Sydney Water servicing assessment for West Appin identified limitations of existing networks surrounding Appin, and in context the study area. The investigation concluded that the Macarthur WFP and Appin Reservoir are exhausted and substantial amplifications would be required to service the potential dwelling yield of 18,000 at West Appin. The yield forecast has been based on the DP&E dwelling occupancy rate of 3 EP/dwelling.

Table 7-1 present Sydney Water's drinking water system capacity as reported in the West Appin proponent study.

Table 7-1: Sydney Water's drinking water system capacity (West Appin Proponent Study Servicing Assessment)

Drinking water system	2015-2020	2020-2025	2025-2036	Notes
Trunk system capacity				
Macarthur Water Delivery System	✘	✘	✘	There is no existing spare capacity to service West Appin This system is the preferred bulk water supply due to its close proximity to the study area Sydney Water recently commenced studies on required amplification to Macarthur Water Filtration Plant (WFP) to service existing customer and forecast growth
Reticulation system capacity				
Appin Water Supply Zone	✘	✘	✘	There is no existing spare capacity to service West Appin There is upstream constraint at Macarthur WFP (treatment capacity and pumping capacity to Appin Reservoir) DN1200 trunk main from Macarthur WFP to Sugarloaf (not yet assessed) is located within the study area. Further planning studies may include capacity assessment of this main, however it is still constrained by Macarthur WFP capacity

A servicing capacity assessment has been undertaken for the study area based on the number of system elements, these include:

- Water Filtration Plants
- Customer Supply Systems

7.1.1.1 Trunk System

There are four potential bulk supply point for the study area, MacArthur, Nepean, Prospect South and Illawarra Water Delivery Systems.

Macarthur Water Delivery System

Raw water from Nepean, Avon, Cordeaux and Cataract Dams flows into the Broughtons Pass Weir then pumped to the Macarthur Water Filtration Plant (WFP).

Macarthur WFP service the Local Government Areas (LGA) of Wollondilly, Campbelltown, Liverpool and Camden. A capacity assessment for West Appin has been performed which underpinned the design capacity of Macarthur WFP to be 265MLD. However, due to the quality of raw water, the treatment capacity is limited to 130MLD. The existing land use imposes 70ML/d demand on average, with a maximum daily demand of 128 ML/d.

Sydney Water has indicated the Macarthur WFP has capacity for the increase in average day demands (ADD) flows for the study area (52ML/day), however it will need to be amplified to accommodate MDD for the development.

It is understood Sydney Water is currently investigating options to increase the plant capacity to service existing and forecast growth, however the findings are not yet available for reporting.

Nepean Water Delivery System

Raw material from the Nepean Dam is supplied to Nepean WFP. Nepean WFP services the areas of Buxton, Picton, Bargo and the Oaks. The WFP has a design capacity of 36ML/d, but with Sydney Water significant growth forecast the max daily demand is projected to increase to 45ML/s by 2036.

If the Nepean WFP is to be used as a bulk supply point for the study area, substantial network augmentations are essential. New trunk infrastructure would be required along Hume Highway toward the study area, in addition to significant amplification works at the plant and intake infrastructure. The cost associated with this infrastructure impacts on the feasibility of the Nepean WFP being used as a bulk supply for the Area.

Sydney Water has confirmed new demand cannot be supplied from the Nepean Delivery system, due to existing capacity constraints.

Prospect South Water Delivery System

Prospect South Water Delivery System supplies to suburbs of Minchinbury, Eastern Creek, Liverpool, Badgerys Creek, Hoxton Park and Cecil Park, with Prospect WFP supplying to Prospect South, Prospect North, Prospect East, Ryde and Pott Hill Systems. Sydney Water has proposed Prospect South to service the western portion of North West Growth Centre and north portion of South West Growth Centre.

It is not feasible to recommend Prospect South WFP as a bulk supply point to Greater Macarthur due to the distance between the study area and the system.

Illawarra South Water Delivery System

Illawarra South WFP is not recommended as a bulk supply provider due to the distance from the study area, lack of available trunk infrastructure and the terrain between the Illawarra system and the study area.

7.1.1.2 Reticulation Network

Treated water is pumped to Appin Reservoir from Macarthur WFP and distributed to townships of Appin, Douglas Park and Wilton. The reservoir has a capacity of 10ML/d and acts as a backup source for Macarthur WFP. The servicing assessment delivered by Sydney Water underpinned Appin Reservoir in having no spare capacity, but has the potential to be amplified if need be by employing new trunk infrastructure, however the extent of amplification has not been confirmed.

7.1.2 Primary Water Utility Provider Upgrades

Sydney Water's Growth Servicing Strategy (2014 -2019) identifies the potable water planned improvement works, refer to Appendix C. The report identifies the following areas as requiring future works:

- Menangle Park: *Package1 - Existing drinking water system can service 600 lots. Sydney Water will stage the delivery of major water infrastructure to service the Menangle Park Release Area. Anticipated*

delivery date has been pushed back from 2012 GSP due to delays in rezoning of the Menangle Park release area.

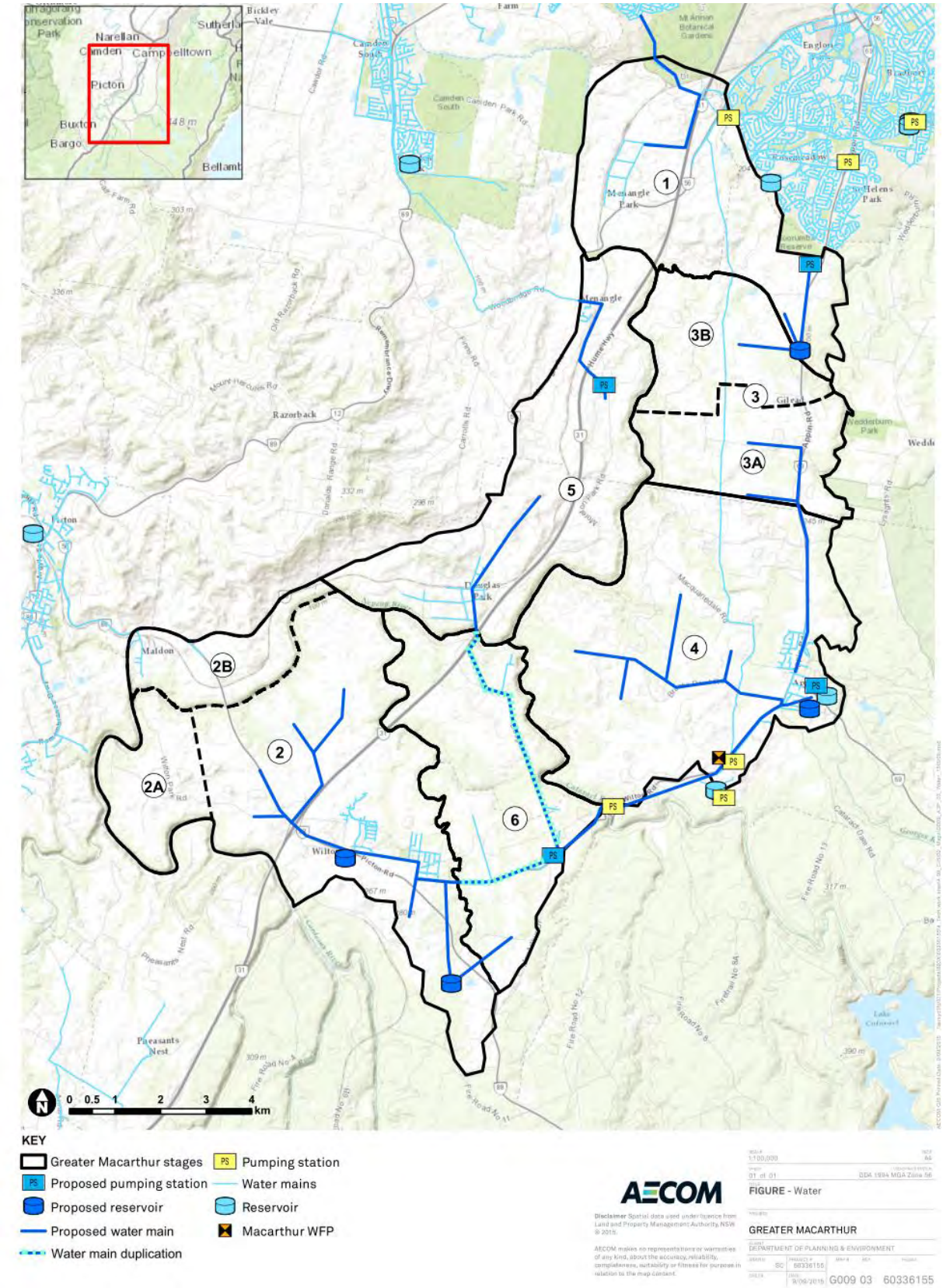
- Mount Gilead: *The development can be serviced by connection to existing wastewater infrastructure. The developer will deliver water and wastewater service to the development under a commercial agreement.*
- Appin North: *Sydney Water has delivered trunk water to the development. The developers will need to deliver some lead-in mains.*
- Rosemeadow Elevated Water Supply Zone: *The full volume of the Rosemeadow Reservoir would not be fully utilised due to pressure limitation, resulting in 7.5ML considered as non-usable storage.*
- Camden Park Reservoir: *It is understood that Sydney Water is currently undertaking a growth servicing strategy, initial findings are not yet available.*
- Mt Gilead: *For the greenfield development (forecast 1700 dwellings for 2016) it had been proposed to augment service including a new pumping station 3MLD, rising mains (combined inlet/outlet) and a 1MLD elevated reservoir.*

It is our understanding that the trunk mains will not have sufficient capacity however the reticulation network may need localised upgrades.

7.1.3 Indicative Water Infrastructure Augmentation and Upgrade Plan

Following the preliminary capacity assessment against the demand estimate calculations in section 5.1 and review of the known primary Water utility providers upgrades an indicative Water Infrastructure Augmentation and Upgrade plan was developed, which is shown in Figure 7-1.

Figure 7-1: Indicative Water Infrastructure Augmentation and Upgrade Plan



7.2 Wastewater (Sewer)

7.2.1 Preliminary Capacity Assessment

Sydney Water owns and operates 16 wastewater treatment plants and collects more than 1.3 billion litres of wastewater from over 1.7 million homes and businesses in Sydney, the Illawarra and the Blue Mountains every day. Sydney Water currently services parts of the study area through Glenfield-Malabar Sewerage Treatment Plants and localised septic tank pump outs (under the NSW Government Priority Sewerage Program).

There are three potential wastewater systems for the study area: Glenfield-Malabar system, West Camden system and Picton system.

Initial correspondence with Sydney Water has indicated that Glenfield Water Recycling Plant and its trunk mains have short term capacity (until 2020) to service West Appin, Appin Road, Appin Vale and Brooks Point developments. Due to the capacity limitation of the existing infrastructure, alternative wastewater networks and treatment solutions will need to be considered to service the proposed development of the study area.

7.2.1.1 Wastewater Treatment Plants

Glenfield – Malabar System

Sydney Water has reported the Malabar Wastewater Treatment Plant has limited capacity to accommodate growth in the study area following full development of the NWGC and SWGC.

Glenfield WTP has a nominal ADWF secondary treatment with a capacity of 46 ML/d. The plant was designed to have primary treatment capacity of 120 ML/d and a total peak wet weather capacity of 303 ML/d. There is a potential short-term spare capacity until 2020 to service approximately 8,000 EP, which is equivalent to approximately 2,667 dwellings. It is understood from Sydney Water this will accommodate the initial development at Menangle Park and potentially Mt Gilead with some augmentation.

The capacity of Malabar WWTP is 1000 ML/day with the design capacity to increase to 1300 ML/day once planned augmentation work is completed in late 2015; it currently discharges 416 ML/day of municipal wastewater. It is assumed this spare capacity will be allocated to the developed NWGC and SWGC.

West Camden System

Based on the servicing assessment carried out by Sydney Water there is a spare short term capacity at West Camden system. However, this is reserved to service Oran Park and Catherine Fields (within the South West Growth Centre). Therefore West Camden system is unable to service the study area.

Picton System

Currently, Picton Water Recycling Plant (WRP) is not performing within the limits in the current environment protection licence for the Picton sewage treatment system (EPL no.10555). It exceeded the limit of total suspended solids and BOD loads being released to Stone Quarry Creek by 286% and 310% respectively in 2011-12 with loads of 2,818 kg and 2,994 kg. There is also limitation in effluent management. Therefore Picton WRP is not an option to service the study area, without significant augmentation and upgrading.

7.2.2 Primary Sewer Utility Provider Upgrades

Sydney Water's Growth Servicing Strategy (2014 -2019) identifies the Waste Water planned improvement works, refer to Appendix C.

The report identifies the following areas as requiring future works:

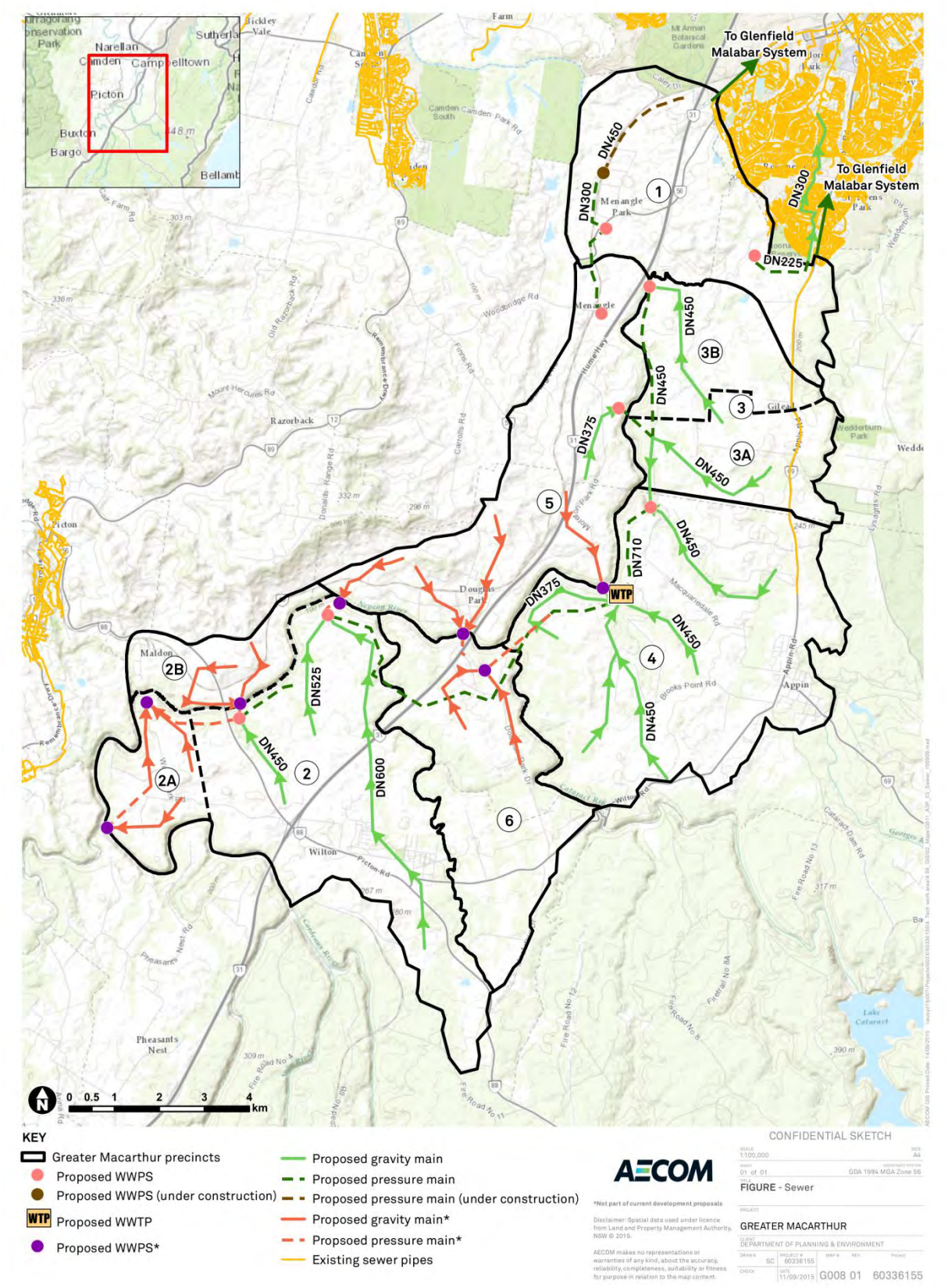
- Menangle Park: Package 1 - *Sydney Water will stage the delivery of major wastewater infrastructure to service the Menangle Park Release Area. The first stage of the wastewater infrastructure will service 700 new dwellings*
- Menangle Park*: Package 2 – Menangle Park Package 2 works will deliver trunk wastewater to service the remainder of the Menangle Park Release Area and Amplifications to the existing water system. Sydney Water anticipates beginning detailed planning for this work in 2015. The detailed planning work will determine the number of dwellings to be serviced by the future infrastructure.in the northern catchment of the catchment area. s*

- Appin North: *Sydney Water has delivered wastewater infrastructure to the development. The developers will need to deliver some lead-in mains.*
- Mount Gilead: *The development can be serviced by connection to existing wastewater infrastructure. The developer will deliver water and wastewater service to the development under a commercial agreement.*
- Bingara Gorge: *Short term development has connected to the existing water system. Sydney Water has commenced detailed planning for the staged delivery of future water infrastructure. Wastewater services being provided by private suppliers under a Water Industry Competition Act (WICA) licence.*

7.2.3 Indicative Sewer Infrastructure Augmentation and Upgrade Plan

Following the preliminary capacity assessment against the demand estimate calculations in section 5.2 and review of the known primary Sewer utility providers upgrades an indicative sewer Infrastructure Augmentation and Upgrade plan was developed, which is shown in Figure 7-2.

Figure 7-2: Indicative Sewer Infrastructure Augmentation and Upgrade Plan



7.3 Electricity

7.3.1 Preliminary Capacity Assessment

The preliminary capacity assessment has been based on a number of system elements, these include:

- Bulk Supply Point;
- 66kV and 33kV Sub Transmission Substations;
- 66kv Feeders;
- 11kV and 33kV Feeder Networks;
- Switching Station
- Tower Power Station & Colliery

7.3.1.1 Bulk Supply Point

Electricity from the power station switchyards is transmitted to Bulk Supply Points where the voltage is dropped prior to being fed to zone substations.

In NSW these Bulk Supply Points are operated and managed by TransGrid. Supply to the zone substations within the Greater Macarthur area primarily comes from the Macarthur Bulk Supply Points.

It is our understating that there is insufficient capacity within the existing Bulk Supply Points to service any new developments, on zone substations. This needs to be confirmed with Endeavour Energy during stakeholder engagement. Based on these factors it is likely that Bulk Supply upgrade would be required to service the proposed developments.

7.3.1.2 Zone Substations

Zone substations take the high-voltage electricity and convert it, via step down transformers, into lower voltage electricity for further distribution via Endeavours' poles, wires and underground networks.

The Greater Macarthur Land Release Investigation is situated within the Macarthur Bulk Supply Point (BSP) Network Area (Endeavour Planning Strategy, 2014). Substations within the Load Areas are localised with short term capacity and do not have the capacity to service the proposed immediate and long-term growth in this area.

Endeavour Energy has advised that the North Appin Zone Substations has short term capacity to supply an additional 300 lots in the northern part of Appin Township. In addition, TransGrid's Macarthur Bulk Supply Point can sustain 200 lots at its current condition. Proposed development will be supplied by the MacArthur Bulk Supply Point and will be predicated on the remaining capacity of the 66 kV Supply Point.

7.3.1.3 High Voltage Feeders

Underground and overhead high voltage feeders pass the electricity from zone substations through to distribution substations. Distribution substations include pole transformer and kiosk substations.

Endeavour's cables and trunk mains within the study area are only limited to 66 kV which act as a constraint to the study area. Where new zone substations are required then the augmentation of the existing feeder network and provision of new feeders interconnecting zone substations will likely be required.

7.3.2 Primary Electricity Utility Provider Upgrades

The current system constraints and planned utility electrical works are shown below:

1. Macarthur BSP - outage of the single 330/66kV
    - *Outage will cause load risk on feeders 9L1*
    - *Require the transfer of Kently ZS and half of Ambarvale ZS to the Ingeleburn System via Minto if required. Area diversity levels will likely defer this constraint*.
2. Menangle Park ZS (2018) - proposed 33kV
    - *The Menangle Park urban release area was rezoned by the Minister for Planning and Infrastructure as part of the Gateway determination and allows for 3,400 lots. The existing*

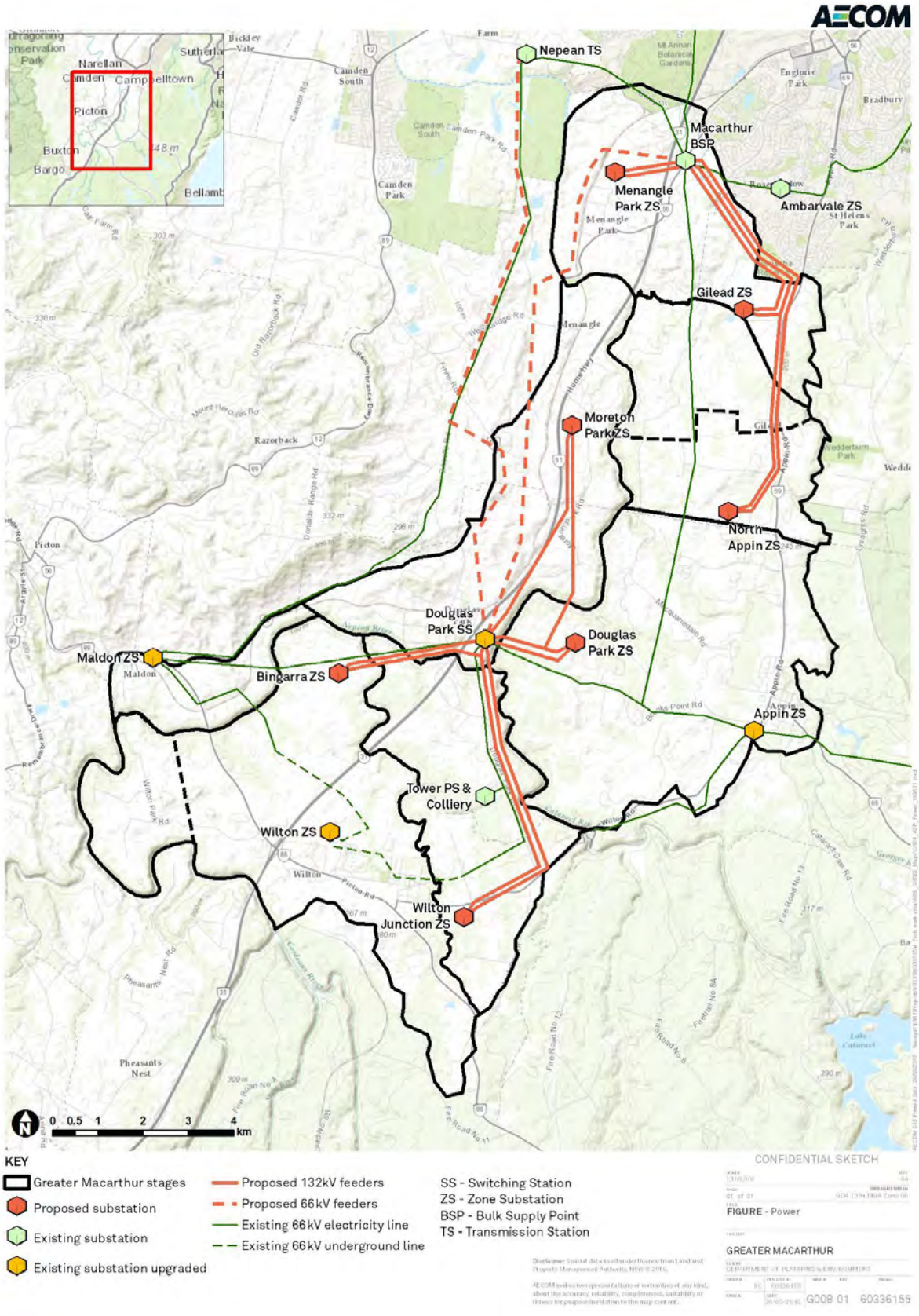
infrastructure in the area caters for the existing rural uses. To date, approximately 200 lots are able to be supplied from the existing distribution network and any further growth in demand will require a new zone substation to be established.

3. Appin North: *Endeavour has estimated Appin North to have a short term capacity to service the Appin North development.*
4. Bingara Gorge: *The Binagara Gorge development will be serviced by Maldon Zone Substation, with the ultimate servicing strategy of establishing a new zone substation at Wilton which is currently under construction.*
5. Menangle Park: *Endeavour had proposed a new Menangle Park zone substation with anticipated delivery date yet to be determined. To date, approximately 200 lots are able to be supplied from the existing distribution network and any further growth in demand will require a new zone substation to be established.*

7.3.3 Indicative Electrical Infrastructure Augmentation and Upgrade Plan

Following the preliminary capacity assessment against the demand estimate calculations in section 5.3 and review of the known primary Electricity utility providers upgrades a Water Infrastructure Augmentation and Upgrade plan was developed, which is shown in Figure 7-3.

Figure 7-3: Indicative Electrical Infrastructure Augmentation and Upgrade Plan



7.4 Natural Gas

Limited information was available outlining the capacity of the Jemena network. Representatives from Jemena verbally stated that they would assess the capacity requirements when the formal development applications are received.

The formal response received from Jemena indicated there is very little existing gas network infrastructure within the study and therefore very limited capacity to service new development without significant contributions towards infrastructure.

7.5 Telecommunications

The Federal Government has determined that from January 2011 that under The *Fibre in New Development* NBN Co will provide telecommunication infrastructure to new developments (NBN Co., 2015). NBN Co will be responsible for installation of the fibre network in the new development and covers the cost of installation to a point. Developers are required to install and fund fibre-ready pit and duct infrastructure to NBN Co's specifications. Once the developer has demonstrated to have met the specifications, the ownership of this infrastructure will be required to be transferred to NBN Co as a condition of servicing the development.

7.6 Next Steps

The next steps for the development process would be to try and determine a program of development. This would allow calculation of the service load trigger points for when augmentations may be required. The following steps are recommended to facilitate determining the service load trigger points: -.

- Develop a build out program in terms of dwelling numbers and commercial land area.
- Calculate detailed spare capacity with dates and allowance of other proposed developments in conjunction with the utility providers. This normally requires formal legal engagement of the utility providers.
- Revise the demand calculations for the updated development program.
- Undertake a detailed comparison of demand calculations and the spare capacity to determine service load trigger points.
- Develop a detailed service infrastructure augmentation program based on the trigger points

It is noted that service authorities generally only plan infrastructure works to a 5 year extent, as such this process may only be able to provide trigger points for the initial part of the overall build out. Services infrastructure capacity will also be influenced by development outside the study area, which relies on the same infrastructure, as such trigger points will need to be continually reviewed throughout the life of the planning process.

8.0 Staging and Cost

8.1 Staging

A potential staging plan of development within the study area has been established based on the services infrastructure requirements through assessment of existing and proposed capacity, and discussion with DP&E and utility providers. The staging was established as a baseline to provide DP&E transparency of the growth servicing requirement for the Greater Macarthur. This is to optimise the use of existing infrastructure, streamline infrastructure augmentation and facilitate the delivery of housing and employment opportunities.

The development staging was solely based on utility infrastructure requirement, however other drivers including transportation; social infrastructure and stormwater possess capability to alter the staging sequence. For the purpose of delivering a high level utility infrastructure strategy, the implications of these drivers were not used to inform the staging presented here. These drivers were examined separately in a Stormwater Management Plan, a Preliminary Social Infrastructure assessment carried out by GHD and a Transportation study by AECOM on behalf of Transport NSW as part of separate studies. As part of coordination comments have been provided from Stormwater Management Planning, Social Infrastructure and Transport Planning standpoints by GHD and AECOM respectively. These comments have been documented in Appendix I.

A preliminary assessment of the study area initially proposed a north to south development staging, as it would enable the study area to grow organically proportionate to infrastructure delivery. However, a further assessment of the study area and existing infrastructure was undertaken after consultation with DP&E and the primary utility providers, which resulted in a more optimal approach. In this approach, short term development has been identified and segregated where infrastructure was either existing or planned to be established in the next 5 years (as part of growth servicing strategies of each primary utility provider). To this effect, the development staging sequence was established.

8.2 Staging Objectives

The following factors have underpinned the preparation of a staging plan for development of the study area.

- **Existing capacity and layout of infrastructures.** The report documents the existing Services Infrastructure and condition. The development staging is predicated in the existing and proposed capacity of utilities (potable water, sewer treatment and effluent disposal, recycle water reuse, Electricity and gas).
- **Infrastructure Requirements.** Infrastructure requirements are subjected on the utility demands and the population distribution across the study area. The staging will contain the required infrastructure networks and the development stage that will be serviced by infrastructure.
- **Planned infrastructure works and augmentation.** Establishment and augmentation of infrastructure networks within the study area is objective on the proposed development staging. In the aim to optimise infrastructure planning and to inform utility provider underpinning the total demands on infrastructure per staging is critical. AECOM has provided indicative options on the key infrastructure and servicing requirements to service each development staging, which includes details on high level cost estimates for each infrastructure item.

8.3 Proposed Service Infrastructure based Staging Plan

Liaison with the Department of Planning and Environment and Urbis, AECOM established a staging plan. The staging development has considered the potential implications of known private proposals and assumed for several areas to concurrently develop at the same time. The proposed sequence of development is listed in Table 8-1 and shown in Figure 8-1.

Figure 8-1: Indicative Service Infrastructure based Staging Plan

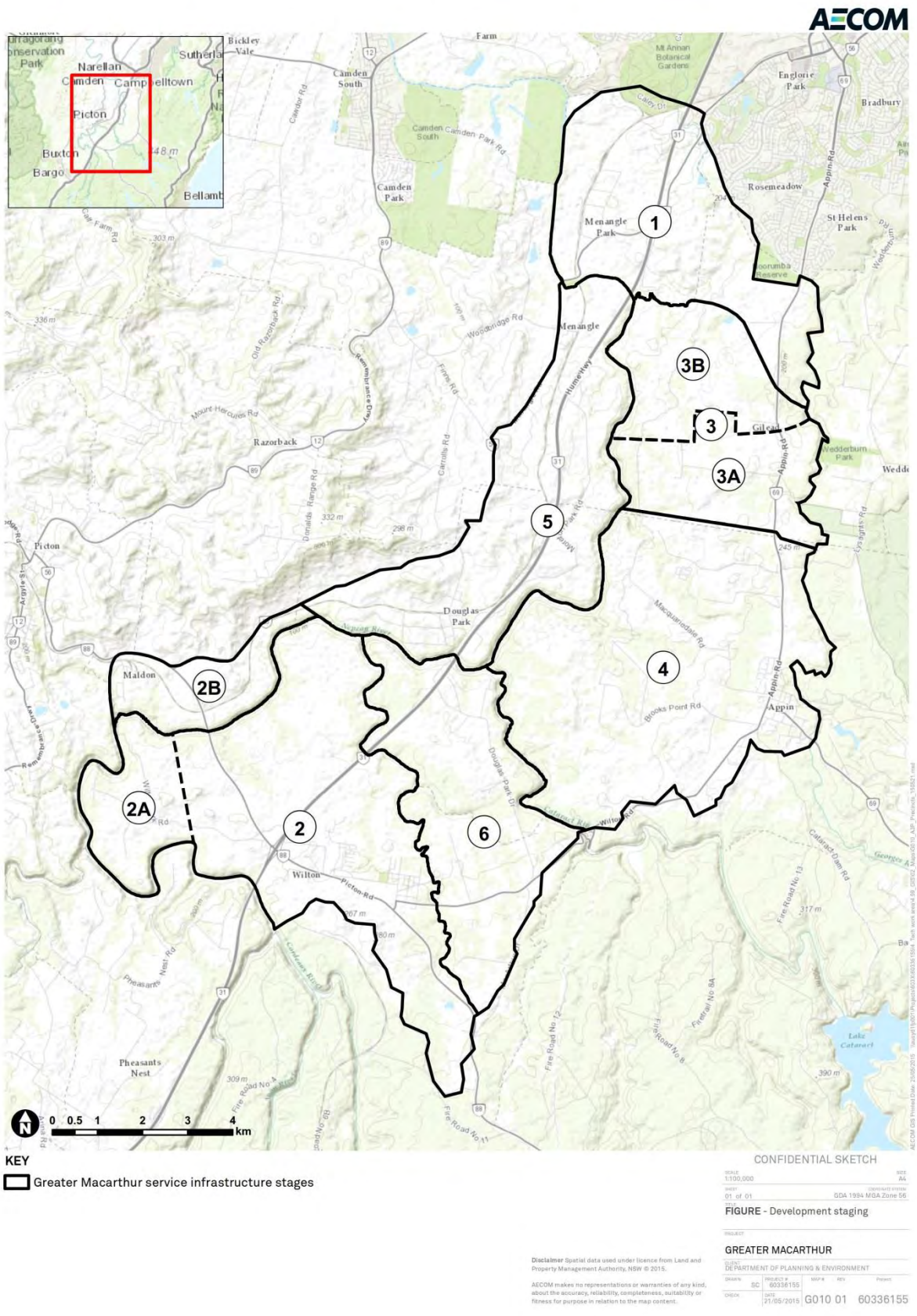


Table 8-1: Precinct Names

Stage Number /Precinct	Stage Precinct Name
1	Menangle & Mt Gilead
2	Wilton
3	Gilead
4	West Appin
5	Menangle & Douglas Park
6	Cataract

- **Stage 1:** Menangle Park and the northern part of Gilead (including private development of Mt Gilead). This area is referenced as Stage 1 in regards to infrastructure delivery already being planned by each authority, utility demands and Development Staging Plan.
- **Stage 2:** Wilton is subject to infrastructure delivery already planned by each authority. Further drivers have influenced this staging, from the short term electrical capacity at Wilton Zone Substations and Bingara Gorge (private) Sewer Treatment Plant. The area of Wilton is referenced as Stage 2 which included the area of Maldon (2B) and south-east Wilton (2A).

  It is noted that South East Wilton (2A) and Maldon (2B) could be developed before or after the main area of Wilton due to the presence of existing services infrastructure, however this would alter the infrastructure upgrade and augmentation sequencing.

  Also noted an opportunity for Gilead south (3A - Campbelltown South proposal) to concurrently develop.
- **Stage 3**: Gilead North (3B) and Gilead South (3A – including Campbelltown South private proposal) builds on the development of Mt. Gilead.
- **Stage 4:** Proposes West Appin as a continuation of development south from Stage 1 and Stage 3. The sewer demand load will be connected to the proposed new WWTP.
- **Stage 5**: Proposes Douglas Park due to the upgraded water main connections to Douglas Park and the water connection at Menangle and the electrical infrastructure upgrades.
- **Stage 6**: The area between Appin and Wilton had been considered most constrained area in terms developable topography making utility infrastructure difficult to provide and therefore proposed as the last stage to be developed.

Further detailed analysis of trigger points and planned development dates may alter the sequence of staging. In addition there may be an alternative servicing solution such as decentralised systems, which may also influence the sequencing.

Based on the above stages the urban capable footprint was determined and used to calculate a breakdown of the estimated number of residential dwellings and population for each development stage. This is presented in Table 8-2. It should be noted that the Net Development Area excludes the areas of roads and footpaths within the residential land use areas.

Table 8-2: Development Staging Areas, populations and dwellings

Stage Name	Gross Area (Ha)	Calculated Net Development Area (Ha)	Urban Capable Footprint (Ha)	Calculated Dwellings (15/Ha)	Calculated Population (2.6 person/dwelling)
1. Menangle & Mt Gilead	2,000	1,200	700	10,500	27,300
2. Wilton	4,200	2,500	1,500	22,500	58,500
3. Gilead	1,800	1,100	650	9,750	25,350
4. West Appin	3,650	2,200	1,300	19,500	50,700
5. Menangle & Douglas Park	2,400	1,400	850	12,750	33,150
6. Cataract	1,900	1,100	680	10,200	26,520
TOTAL	**15,950**	**9,500**	**5,680**	**85,200**	**221,520**

Note:

- *For the purpose of determining the demand for the proposed composition of residential and employment yield, a rate of 15 dwelling/hectares was used across the urban capable footprint which is 60% of the gross area (Department of Planning and Environment excluding the land use zoning/types). In estimating the population distribution across the study area, a rate of 2.6 person per dwelling was utilised as per Australian Bureau of Statistics.*
- *The numbers in table 8-1 are based on the complete stage boundaries depicted in figure 8-2 and do not account for the potential of sub-stages or simultaneous development of the sub-stages.*

Using the population and dwelling figures in Table 8-2, utility demand estimates have been calculated per stage as shown in Table 8-3. Estimation of the potable water demand, sewer demand and electricity demand provides DP&E an indication of the urban capability of each stage and stakeholders the opportunity to prioritise and assess areas against current infrastructure proposals and effectively deliver infrastructure networks.

Table 8-3: Development Staging Utility Demands

Stage Name	No. of Dwellings	Potable Water Demand (kL/d)	Sewer ADWF Demand (L/s)	Electricity Demand (kVA)
1. Menangle & Mt Gilead	10,500	13,860	55	52,500
2. Wilton	22,500	29,700	117	112,500
3. Gilead	9,750	12,870	51	48,750
4. West Appin	19,500	25,740	102	97,500
5. Menangle & Douglas Park	12,750	16,830	66	63,750
6. Cataract	10,200	13,464	53	51,000
TOTAL	**85,200**	**112,500**	**444**	**426,000**

Note:

- *Based on advice from Sydney Water the Potable Water Demand and Sewer ADWF are calculated using 3 Equivalent persons per dwelling.*

8.3.1 Stage 1 – Menangle & Mt. Gilead

Stage 1 encapsulates areas of Menangle Park and the northern part of Gilead. The main driver for this is electricity, due to the proximity of the area to Macarthur Bulk Supply Point (BSP) and the planned Menangle Zone Substations to service 5000 lots. Endeavour Energy has indicated that Ambarvale ZS currently supplies Menangle Park, and has the capacity to supply the preliminary stage development of 200 lots as well as the Mt Gilead private development, with several network augmentations required.

The Menangle Park Detailed Planning executed by AECOM as part of Sydney Water's growth servicing strategy had underpinned future network augmentation within the area. In addition, review of existing infrastructures has highlighted existing potable water mains within Menangle Park that anchor to Campbelltown South water Supply Zone, with a possibility of connecting to Rosemeadow Water Supply Zone to provide additional source to service Stage 1. Rosemeadow Elevated Water Supply Zone has a total design capacity of 17.5 MLD, however due to pressure limitations 7.5MLD is considered non-utilised storage.

Stage 1 comprise of approximately 10,500 dwelling to accommodate 27,300 people. This results in a total potable water demand of 13.8MLD, a sewer loading of 55 L/s and electrical network loading of 52.5 MVA. AECOM has provided indicative options based on the key infrastructure and servicing requirements to service Stage 1 of the ultimate development at Greater Macarthur. An itemised summary of the infrastructure upgrades required for stage 1 and the associated order of magnitude costs are documented in Table 8-4.

Table 8-4: Stage 1 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 1		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Gilead ZS, 2 x 35MVA Transformer	19	89
	Mac BSP - Gi ZS 66kV DC Feeder 1/2, Overhead 2500m	2	
	Establish Menangle ZS, 2 x 35MVA Transformer	19	
	Mac BSP – MP ZS 66kV DC Feeder 1/2, Overhead 5000m	4	
	Upgrade Macarthur BSP 1 x 132kV exit, 5 x 66kV exits, 330/132kV 200MVA Transformer, 132/66kV 150MVA Transformer	45	
Potable Water Infrastructure	New Water Pumping Station (Mt Gilead)	6	41.2
	10ML reservoir	5	
	1880m of DN250 pressure main	1.7	
	6625m of DN375mm diameter potable water trunk main	8.9	
	Design Costs (% of Direct & Indirect Costs) – 10%	2.2	
	Planning Costs – 10%	2.2	
	Project Management – 10%	2.2	
	Scope Contingency – 50%	10.8	
	Risk Contingency – 10%	2.2	
Sewer Infrastructure	2 New Pumping Stations (Mt Gilead and Menangle)	8	27.9
	1000m DN250mm diameter sewer gravity main	1.2	
	1000m DN300mm diameter sewer gravity main	1.2	
	4000m DN300mm diameter sewer rising main	4.2	
	Design Costs (% of Direct & Indirect Costs) – 10%	1.5	

Stage 1		Total ($M)	Sub-total ($M)
	Planning Costs – 10%	1.5	
	Project Management – 10%	1.5	
	Scope Contingency – 50%	7.3	
	Risk Contingency – 10%	1.5	
		Total	**158.1**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition, or operational costs*

8.3.2 Stage 2 – Wilton

Stage 2 proposes Wilton. The area has been broken down in three sub-areas as follows stage 2; stage 2A and stage 2B to differentiate Maldon and the known Wilton Junction private proposal. The short term electrical capacity at Wilton Zone Substations and Bingara Gorge (private) Sewer Treatment Plant have lead the Wilton area to be stage 2. Endeavour has indicated that Wilton ZS currently supplies Wilton Township and Bingara Gorge, with the potential to service other development within Wilton.

The Wilton Water Detailed Planning Study executed by AECOM as part of Sydney Water's growth servicing strategy had indicated possible future network augmentation within the area. In addition, review of existing infrastructures has highlighted existing potable water mains within Wilton that anchors to Macarthur Water Filtration Plant.

The advice from Sydney Water indicates there is a requirement for a new Sewer Treatment Plant as part of a method of servicing the study area. A significant element of the Stage 2 development would be serviced by the STP and therefore it is likely that the STP will be constructed during this stage. Advice was not provided on whether it would be a partial or full build out, however Sydney Water indicated infrastructure would be built as and when it is needed to reduce the risk of unnecessary capital cost outlays. The advice indicated a potential connection to the Nepean-Hawkesbury system would require a tertiary treatment level, which would increase the cost. The advice provided did not detail the cost of the STP as it has several variable factors which are difficult to quantify and are likely to be spread over several stages. Therefore the cost is not included within associated costs of each stage.

Stage 2 comprise of approximately 22,500 dwelling to accommodate 58,500 people. This results in a total potable water demand of 29.7MLD, a sewer loading of 117 L/s and electrical network loading of 112.5 MVA. AECOM has provided indicative options based on the key infrastructure and servicing requirements to service Stage 2 of the ultimate development at Greater Macarthur. An itemised summary of the infrastructure upgrades required for stage 2 and the associated order of magnitude costs are documented in Table 8-5.

Table 8-5: Stage 2 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 2		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Bingara ZS, 3 x 35MVA Transformers	25	62
	DP Switching Station – Bi ZS 66kV Feeders, 2 x Underground Cable	18	
	Add 35MVA Transformer and Switch Board to Maldon ZS	8	
	DP Switching Station to Maldon ZS 66kV OH line	3	
	Add 35MVA Transformer and Switch Board to Maldon ZS	8	
Potable Water Infrastructure	2 new 30ML and 20ML Water Reservoirs	22	104
	1 New pumping station	6	
	WPS amplification	0.5	
	6,500m DN600mm diameter potable water trunk main (duplication WFP to Wilton)	12.7	
	10,000m DN300-DN450mm diameter potable water trunk main	13.4	
	Design Costs (% of Direct & Indirect Costs) – 10%	5.5	
	Planning Costs – 10%	5.5	
	Project Management – 10%	5.5	
	Scope Contingency – 50%	27.3	
	Risk Contingency – 10%	5.5	
Sewer Infrastructure	5 New pumping stations	20	133
	2,000m of DN450mm diameter sewer gravity main	3.4	
	3,000m of DN525mm diameter sewer gravity main	5.6	
	10,000m of DN600mm diameter sewer gravity main	23	
	15,000m of DN710mm diameter sewer rising main	18	
	Design Costs (% of Direct & Indirect Costs) – 10%	7	
	Planning Costs – 10%	7	
	Project Management – 10%	7	
	Scope Contingency – 50%	35	
	Risk Contingency – 10%	7	
		Total	**299**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition or operational costs*

8.3.3 Stage 3 – Gilead

Stage 3 proposes Gilead. The area was sub-divided to 3A and 3B to isolate locations with private proposals. Drivers that developed this stage included known private proposals and the continuation development from Mt. Gilead.

Stage 3 comprise of approximately 9,750 dwelling to accommodate 25,350 people. This results in a total potable water demand of 12.9MLD, a sewer loading of 51L/s and electrical network loading of 49MVA. AECOM has provided indicative options based on the key infrastructure and servicing requirements to service Stage 3 of the ultimate development at Greater Macarthur. An itemised summary of the infrastructure upgrades required for stage 3 and the associated order of magnitude costs are documented in Table 8-6.

Table 8-6: Stage 3 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 3		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish North Appin ZS, 2 x 35MVA Transformers	19	31
	Mac BSP- NA ZS 66kV Feeder 1, Overhead 12000m	7	
	Gi ZS- NA ZS 66kV Feeder 2, Overhead 8000m	5	
Potable Water Infrastructure	1 new 35ML Water Storage at Appin (ultimate storage)	15.2	60.2
	3000m DN600mm diameter potable water trunk main	5.9	
	6500m DN450mm diameter potable water trunk main	10	
	Water pumping station amplification	0.5	
	Design Costs (% of Direct & Indirect Costs) – 10%	3.2	
	Planning Costs – 10%	3.2	
	Project Management – 10%	3.2	
	Scope Contingency – 50%	15.8	
	Risk Contingency – 10%	3.2	
Sewer Infrastructure	2 New pumping stations	8	46.9
	6000m DN375-DN450 diameter sewer gravity main	10.1	
	5000m DN225-DN375 diameter sewer rising main	6.5	
	Design Costs (% of Direct & Indirect Costs) – 10%	2.5	
	Planning Costs – 10%	2.5	
	Project Management – 10%	2.5	
	Scope Contingency – 50%	12.3	
	Risk Contingency – 10%	2.5	
		Total	**138.1**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition or operational costs.*

8.3.4 Stage 4 – West Appin

Stage 4 encompasses the area of Appin. The main driver is the location short term capacity of Appin ZS, and the location of the Macarthur Water Filtration Plant. Endeavour Energy indicated that Appin ZS would supply the northern part of the Appin Township.

Stage 4 comprise of approximately 19, 500 dwelling to accommodate 50,700 people. This results in a total potable water demand of 25.7MLD, a sewer loading of 102L/s and electrical network loading of 97.5MVA. AECOM has provided indicative options based on the key infrastructure and servicing requirements to service Stage 4 of the ultimate development at Greater Macarthur. An itemised summary of the infrastructure upgrades required for stage 4 and the associated order of magnitude costs are documented in Table 8-7.

Table 8-7: Stage 4 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 4		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Upgrade Douglas Pk Switching Station to 132/66kV incl. 2 x 132/66kV Transformers	25	90
	Establish DP ZS to 66/11, 70MVA Transformers and 2000m of 66kV feeder	25	
	Nepean Transmission Station to DP Switching Station 132kV, Upgrade 851 66kV to 132kV	23	
	Nepean Transmission Station 132kV exit	5	
	Add 35MVA Transformer and Switch Board to Appin ZS (Modular)	12	
Potable Water Infrastructure	7000m of DN375-DN400mm potable water trunk main	9.3	17.6
	Design Costs (% of Direct & Indirect Costs) – 10%	0.9	
	Planning Costs – 10%	0.9	
	Project Management – 10%	0.9	
	Scope Contingency – 50%	4.7	
	Risk Contingency – 10%	0.9	
Sewer Infrastructure	12000m DN450diameter sewer trunk gravity main	21.1	40.1
	Design Costs (% of Direct & Indirect Costs) – 10%	2.1	
	Planning Costs – 10%	2.1	
	Project Management – 10%	2.1	
	Scope Contingency – 50%	10.6	
	Risk Contingency – 10%	2.1	
		Total	**147.7**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition or operational costs.*

8.3.5 Stage 5 – Menangle & Douglas Park

Stage 5 proposes Douglas Park due to the upgraded potable trunk main connections and the electrical infrastructure upgrades. The stage comprise of approximately 12,750 dwelling to accommodate 33,150 people. This results in a total potable water demand of 16.8MLD, a sewer loading of 66L/s and electrical network loading of 63.8MVA. AECOM has provided indicative options based on the key infrastructure and servicing requirements to service Stage 5 of the ultimate development at Greater Macarthur. An itemised summary of the infrastructure upgrades required for stage 5 and the associated order of magnitude costs are documented in Table 8-8.

Table 8-8: Stage 5 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 5		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Morton Pk ZS, 2 x 35MVA Transformers	19	36
	DP Switching Station – MP ZS 66kV Feeder 1, Overhead 7500m	5	
	DP Switching Station – MP ZS 66kV Feeder 2, Underground 5000m	12	
Potable Water Infrastructure	7000m DN375-DN400mm diameter potable water main	3	34.7
	3000m DN250mm diameter potable water main	9.3	
	1 new Water Pumping Station	6	
	Design Costs (% of Direct & Indirect Costs) – 10%	1.8	
	Planning Costs – 10%	1.8	
	Project Management – 10%	1.8	
	Scope Contingency – 50%	9.2	
	Risk Contingency – 10%	1.8	
Sewer Infrastructure	3 New pumping stations	12	57
	2,500m DN300-DN375 diameter sewer gravity main	3.4	
	5,500m DN450mm diameter sewer gravity main	9.3	
	5,000m DN300mm diameter sewer rising main	5.3	
	Design Costs (% of Direct & Indirect Costs) – 10%	3	
	Planning Costs – 10%	3	
	Project Management – 10%	3	
	Scope Contingency – 50%	15	
	Risk Contingency – 10%	3	
		Total	**127.7**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition or operational costs.*

8.3.6 Stage 6 – Cataract

Stage 6 encapsulates the area between Wilton and Appin had been considered most constrained area in terms of developable topography and difficulties in providing utility infrastructure. The stage comprise of approximately 10,200 dwelling to accommodate 26,520 people. This results in a total potable water demand of 13.4MLD, a sewer loading of 53L/s and electrical network loading of 51MVA. AECOM has provided indicative options based on the key infrastructure and servicing requirements to service Stage 6 of the ultimate development at Greater Macarthur. An itemised summary of the infrastructure upgrades required for stage 6 and the associated order of magnitude costs are documented in Table 8-9.

Table 8-9: Stage 6 itemised infrastructure summary and associated indicative order of magnitude costs

Stage 6		Total ($M)	Sub-total ($M)
Electrical Infrastructure	Establish Wilton Junction ZS, 2 x 35MVA Transformers	19	48
	DP Switching Station- WJ ZS 66kV DC Feeders 1 & 2, Overhead	8	
	Macarthur BSP to DP Switching Station 132kV, Upgrade existing 33kV Feeder 14000m	21	
Potable Water Infrastructure	1530m of DN300 diameter potable water trunk main	1.6	3.2
	Design Costs (% of Direct & Indirect Costs) – 10%	0.2	
	Planning Costs – 10%	0.2	
	Project Management – 10%	0.2	
	Scope Contingency – 50%	0.8	
	Risk Contingency – 10%	0.2	
Sewer Infrastructure	1 New pumping station	4	17.1
	4000m DN375 diameter sewer gravity main	1.3	
	Design Costs (% of Direct & Indirect Costs) – 10%	1.3	
	Planning Costs – 10%	1.3	
	Project Management – 10%	1.3	
	Scope Contingency – 50%	6.6	
	Risk Contingency – 10%	1.3	
		Total	**68.3**

Note:

- *The contractor's preliminaries and Margin, Design costs and Risk Contingency are included within the Electricity Infrastructure Costs.*
- *The potable water and Sewer infrastructure does not include land acquisition or operational costs.*

8.3.7 Treatment Stage

The wastewater treatment and water treatment infrastructure requirements are difficult to split by stage requirements as it is dependent on the development rate of the North West and South West Growth Centres.

The order of magnitude cost for wastewater treatment infrastructure is approximately $410 Million. An allowance 10 % for planning, 10% project management and 10% for risk contingency, insurance, financing and tendering costs increases the order of magnitude cost to $533 Million.

The order of magnitude cost for water treatment infrastructure is approximately $450 Million. An allowance 10 % for planning, 10% project management and 10% for risk contingency, insurance, financing and tendering costs increases the order of magnitude cost to $585 Million.

These costs would be distributed across the stages; however it would not be evenly distributed as it will be dependent on existing capacities and the rate of construction of surrounding developments. These costs have been informed through discussions with Sydney Water Corporation.

8.4 Order of Magnitude Cost per Dwelling

To further understand the feasibility of developing the study area the cost per dwelling has been calculated by comparing the costs against the total dwellings. A summary of the total stage costs and the cost per dwelling for the infrastructure works is shown in Table 8-10.

Table 8-10: Order of Magnitude cost per dwelling

Service Infrastructure Stage	Approximate Dwellings	Approximate Stage Cost ($m)	Approximate Cost per Dwelling ($)
1	10,500	158.1	15,057
2	22,500	299	13,289
3	9,750	138.1	14,164
4	19,500	147.7	7,574
5	12,750	127.7	10,016
6	10,200	68.3	6,696
Pre-treatment Stage	**85,200**	**939**	**11,020**
Treatment Stage	**85,200**	**1,118**	**13,122**
Ultimate Stage (including treatment stage)	**85,200**	**2,057**	**24,143**

The allocation of cost is dependent on the specific stage sequencing adopted; lead in works may need to be transferred between stages if undertaken in a different order.

The slightly elevated per dwelling cost of stage 1 is a result of the need to upgrade the MacArthur electrical Bulk Supply Point, it is understood this will be required as the 66kV feeder supply is exhausted. The timing of this has not been confirmed by Transgrid as this will be dependent on when developments are constructed and at what rate, however it has been assumed it will occur during stage 1.

The costs do not include land acquisition requirements or operational costs.

The water and wastewater costs were developed through refinement of this service infrastructure investigation and have been further informed following discussions with Sydney Water Corporation.

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Appendix A

Greater Macarthur Boundary (Urbis)

Appendix A Greater Macarthur Boundary (Urbis)

Campbelltown LGA Extent

Nepean River

Campbelltown Urban Area

Noorumba Reserve Boundary

Georges River

Menangle Road

Nepean River

Sydney Catchment Authority Special Area - No Entry

CAMPBELLTOWN

CAMDEN SOUTH

CAMDEN PARK

CAWDOR

MENANGLE PARK

MENANGLE

GILEAD

ST HELENS PARK

RAZORBACK

PICTON

DOUGLAS PARK

MALDON

ARPIN

TAHMOOR

WILTON

BROOKS POINT

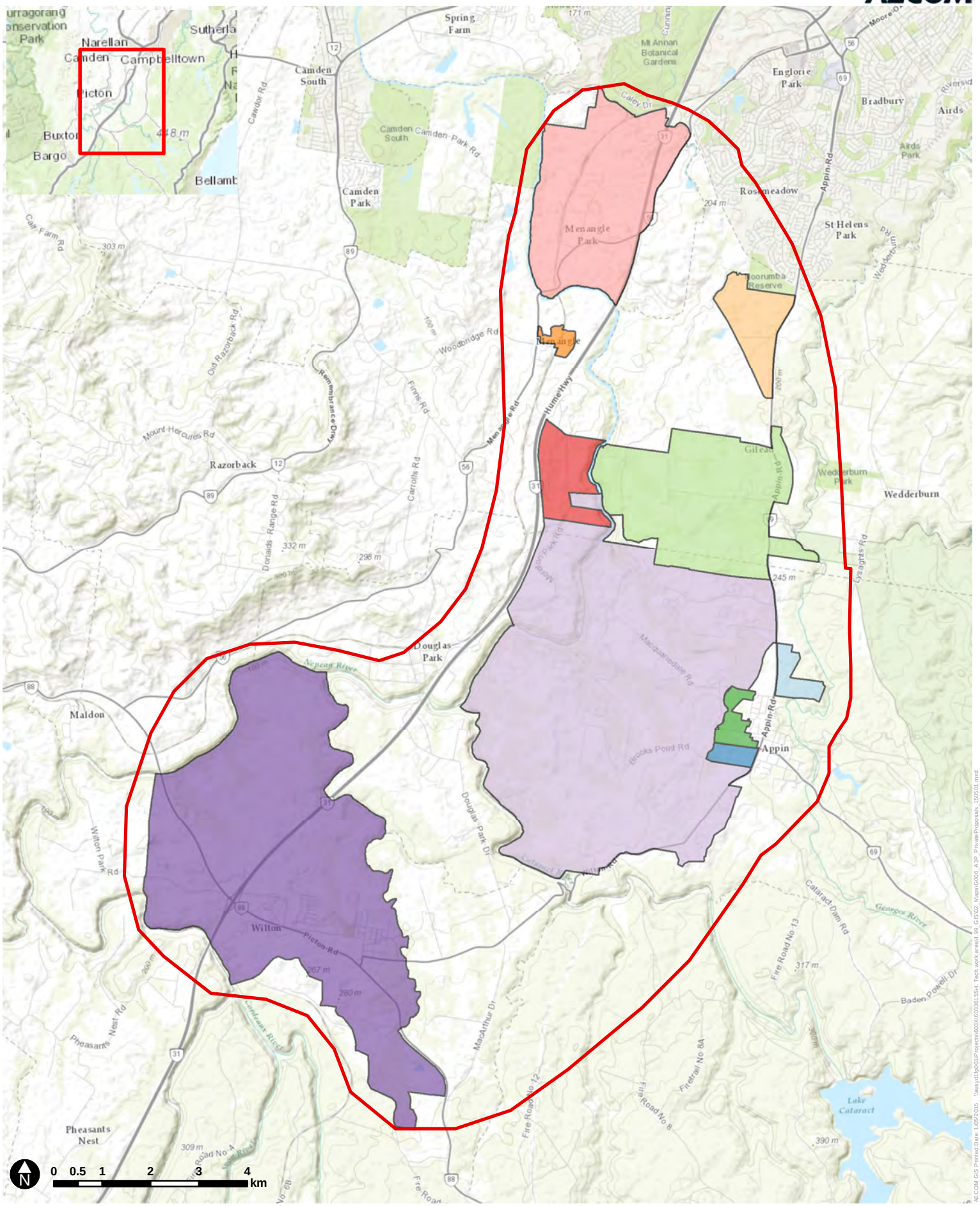
N

0 km 1 2 3 4 5

Appendix B

Private Proposals

Appendix B Private Proposals



KEY

- Greater Macarthur - macarthur South Study Area
- Appin East
- Brooks Point Road
- Gilead Landowners Group - South Campbelltown
- Macquariedale Road - Appin
- Menangle Park
- Moreton Park road, menangle
- Mount Gilead
- Station Street Menangle Residential
- West Appin Study Area
- Wilton

CONFIDENTIAL SKETCH

SCALE 1:100,000 | SIZE A4

SHEET 01 of 01 | COORDINATE SYSTEM GDA 1994 MGA Zone 56

TITLE **FIGURE** - Private proposals

PROJECT

GREATER MACARTHUR

CLIENT DEPARTMENT OF PLANNING & ENVIRONMENT

DRAWN	PROJECT #	MAP #	REV	Project
SC	60336155			
CHECK	DATE			
	1/05/2015	G001	01	60336155

Appendix C

Sydney Water Growth Servicing Strategy

Appendix C Sydney Water Growth Servicing Strategy

South West Subregion - Greenfield Development		Metropolitan Development Program 2010/11			Sydney Water anticipated works (if any) - prior to June 2019							
Local Government Area	Release Area / Precinct	Total Potential Dwellings*	Short term 10/11-14/15	Medium term 15/16-19/20	Package of work	Commence Detailed Planning	Anticipated Planning Approval	Anticipated Delivery Date	Committed Delivery Date (Business Case Approved)	Last Year's Anticipated Delivery Date	Service Availability	Servicing Comments
Wollondilly	Camden Park	230	230	0		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.
	Picton Tahmoor Thirlmere* Urban Lands	2,423	809	239		Jun-12	Dec-13	Dec-15	To be approved	Jun-15	△	Sydney Water will be amplifying the Picton sewerage system to cater for this development.
Campbelltown	Blairmount	0	0	0		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.
	Edmondson Park Composite	1,687	729	750		Timeframe to be determined by developer				No work specified	⬡	The developer will deliver wastewater infrastructure to facilitate development in Edmondson Park South. There is capacity in the existing trunk water system.
	Glenfield Road	638	348	290		No works required				Works complete	●	The developer has delivered services under a Commercial Agreement.
	Macquarie Links	120	92	28		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.
	Menangle Park	3,600	185	675	*Menangle Park Package 1*	Jun-11	Feb-14	Nov-15	Nov-15	Yet to be determined	△	Existing drinking water system can service 600 lots. Sydney Water will stage the delivery of major water and wastewater infrastructure to service the Menangle Park Release Area. The first stage of wastewater infrastructure will service 700 new dwellings in the northern catchment of the release area. Anticipated delivery date has been pushed back from the 2012 GSP due to delays in rezoning of the Menangle Park release area.
					Menangle Park Package 2	Jul-15	Dec-16	Jun-19	To be approved	New work	△	Menangle Park Package 2 works will deliver trunk wastewater works to service the remainder of the Menangle Park Release Area and amplifications to the existing water system. Sydney Water anticipates beginning detailed planning for this work in 2015. The detailed planning work will determine the number of dwellings to be serviced by the future infrastructure.
	Mount Gilead	1,700	0	0		To be determined by developer.				No work required	⬡	The developer will deliver water and wastewater services to the development under a commercial agreement.
	St Helen's Park	138	98	40		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.

* Total potential dwellings of greenfield developments are based on MDP 2010-11, latest information from Planning and Infrastructure, Council and/or developer. Infrastructure delivery may be broken into packages of work. Number of dwellings serviced by the infrastructure is identified under Servicing Comments.

● The development can be serviced by connection to existing infrastructure. The developer may need to deliver some lead in infrastructure and reticulation works.

■ Capacity is available for initial development to connect to existing infrastructure - Sydney Water may need to deliver some local trunk amplification works and major downstream augmentation to cater for future development

△ Sydney Water is completing planning work for servicing the precinct. Sydney Water will only commit to delivering the infrastructure if there is approved funding for the work. Once funding is approved a committed delivery date is shown.

⬡ Major works to be delivered by developer

New site announced by Government since MDP 2010-11. Forecast is for total development and is based on latest information from Planning and Infrastructure, Council or developer (short and medium term forecasts not identified)

New package of works

Anticipated delivery date brought forward from previous year

Anticipated delivery date pushed back from previous year

South West Subregion - Greenfield Development		Metropolitan Development Program			Sydney Water anticipated works (if any) - prior to June 2017							
Local Government Area	Precincts	Total Additional Dwellings (including long term to 2025)	Short term 10/11-14/15	Medium term 15/16-19/20	Staging	Commence Detailed Planning	Anticipated Planning Approval	Anticipated Delivery Date	Committed Delivery Date (Business Case Approved)	Last Year's Anticipated Delivery Date	Service Availability	Servicing Comments
Wollondilly	Picton Tahmoor Thirlmere*	2,423	809	239		Jun-12	Sydney Water has not yet determined planning and delivery dates			New Site	▲	Sydney Water will be amplifying the Picton sewerage system to cater for future development.
	Camden Park	30	30	0		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.
Campbelltown	Blairmount	0	0	0		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.
	Edmondson Park Composite	1,687	729	750		Jun-09	No work anticipated to be delivered by Sydney Water during this period. Timeframe to be determined by developer			No work specified	⬡	The developer will deliver wastewater infrastructure to facilitate development in South Edmondson Park. There is capacity in the existing water system.
	Glenfield Road	638	348	290		Works have been delivered				Determined by developer	●	The developer has delivered services under a Commercial Agreement.
	Macquarie Links	120	92	28		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.
	St Helen's Park	138	98	40		No work required				No work required	●	The development can be serviced by connection to existing infrastructure.
	Menangle Park	1,610	185	675		Jun-11	Sydney Water will confirm these dates following detailed planning. Business case to be approved. Delivery date to be confirmed.			No work required	▲	Existing drinking water system can service 600 lots. Initial development will require a temporary wastewater pump out. Following this, Sydney Water will stage the delivery of major water and wastewater infrastructure to service the Menangle Park Release Area in line with development timeframes.
	Mount Gilead	0	0	0		No work anticipated to be delivered by Sydney Water during this period.				No work required	⬡	No works anticipated in Mount Gilead as no lots are planned in the Metropolitan Development Program.

*Dwelling projection information provided by council

● The development can be serviced by connection to existing infrastructure

■ Capacity available to connect to existing system for short term development - some local trunk amplification works and major downstream augmentation to be delivered by Sydney Water in the medium term

▲ Sydney Water to construct works to service precinct

⬡ Major works to be delivered by developer

New major site added to the GSP 2012 based on latest DP&I forecasts

Anticipated delivery date brought forward from previous year

Anticipated delivery date pushed back from previous year

Appendix D

Sydney Water Correspondence

Appendix D Sydney Water Correspondence

Sydney WATER

5 June 2015

Mr Paul Robilliard
Director, Release Area Delivery
Department of Planning and Environment
PO Box 1457
PARRAMATTA NSW 2124

Greater Macarthur Investigation Area

Dear Mr Robilliard

Sydney Water welcomes the opportunity to assist the Department of Planning and Environment (DP&E) with its strategic investigation into the possibility of developing the Greater Macarthur area. We are able to provide high level commercial in confidence advice regarding a servicing approach, associated costs and sequencing utilising existing capacity where available.

Attached is a response to the series of requests received in recent months from the Department and its consultants AECOM to inform the investigation. It includes advice on the West Appin Private Proposal which is best considered in the context of the Greater Macarthur Investigation Area rather than in isolation.

Given this is a strategic investigation by DP&E to inform decisions around where best to accommodate Sydney's growing population it is worth acknowledging the relative costs of servicing greenfield development compared to infill development in terms of water and wastewater servicing.

Sydney Water's experience is that the cost of servicing new greenfield development remote from existing infrastructure and systems is much higher (up to ten times) than the cost of servicing infill growth in Sydney. This is due mainly to:

1. The need for substantive new infrastructure in greenfield areas, the relatively high cost of water treatment if not supplied by the Prospect system, and the high treatment standard needed to discharge effluent to the inland Hawkesbury Nepean River system compared to ocean outfall discharges.
2. Existence of latent capacity in existing infrastructure in established areas in Sydney where customers are using significantly less water (around one-third less) on average than they were in the 1970s, given more efficient water appliances, fittings/fixtures and behavioural changes.

Further, the absence of developer charges for the provision of water and wastewater services for areas on the government's release program means servicing costs are recovered through

service charges across Sydney Water's wider customer base and not reflected in the cost of greenfield lots.

Sydney Water's recent strategic investigation into servicing the proposed nearby Glenfield to Macarthur Priority Urban Renewal Corridor, for example, has shown that a level of growth could be accommodated utilising existing assets with minimal upgrades required compared to the more substantial capital required to service precincts within the Greater Macarthur.

Our advice is for the delivery of water and wastewater services only. The Greater Macarthur investigation area drains to a highly sensitive waterway. An integrated approach to water services including stormwater is recommended to ensure the outcomes of the waterways are effectively managed. The overall servicing strategy will need to be consistent with the Hawkesbury-Nepean wastewater strategy currently being developed by the Environment Protection Authority and Sydney Water.

I trust this information satisfies the Department's request and will assist in deliberations around where best to accommodate Sydney's growth. Should you require any further information to assist with the investigation please contact Ms Natalie Camilleri, Strategist on phone 8849-4539.

Yours sincerely

Peter Fisher
Manager, Servicing and Asset Strategy

Appendix E

Endeavour Energy Correspondence

Appendix E Endeavour Energy Correspondence

Endeavour Energy

21 May 2015

Mr Robbie Williams
Senior Civil Engineer
AECOM
PO BOX Q410
Sydney NSW 1230

Dear Mr Williams

GREATER MACARTHUR SOUTH FEASIBILITY STUDY

I refer to your letter dated 24 April 2015 regarding the infrastructure study being carried out by AECOM on behalf of the NSW Department of Planning & Environment for the Greater Macarthur South Land Release Area.

In response to your request for advice from Endeavour Energy regarding electrical infrastructure we have carried out a brief study to determine servicing requirements. A detailed response is provided in Attachment 1. Comprehensive studies for electrical servicing for a release area of this size and load would normally take 6 months. As a shorter time frame was requested by AECOM the advice provided is indicative of investment required but cannot be interpreted as our final servicing strategy should development proceed.

The load estimates provided by AECOM for residential development are consistent with our methodology however the Employment area load estimates are significantly overstated. An estimate of 27MVA has been used by Endeavour Energy.

Endeavour Energy has discussed the Greater Macarthur South Land Release proposal with Transgrid in a Joint Planning meeting held on 29 April 2015. There was in principle agreement to supply the area from Macarthur Bulk Supply Point. However, Transgrid have yet to be consulted on the 66kV network proposal put forward in Attachment 1. The 66kV network is Endeavour Energy's responsibility but Transgrid will be impacted by the number of 66kV feeder bays required at Macarthur.

In summary, a $310m investment by Endeavour Energy will be required to service the ultimate loads in the Greater Macarthur Land Release Area. This investment will be in addition to developer funded 11kV feeder and low voltage reticulation works.

Endeavour Energy has limited funds to service growth in new release areas. Large scale land release in the Greater Macarthur will need to compete for funding with the South West and North West Growth Centres. It is recommended that development in the South West Growth Centre should be allowed to reach maturity prior to allowing large scale land release in the Greater Macarthur Area.

We trust the advice provided is sufficient to inform the feasibility study. If you have any queries regarding this letter please contact me directly on

Yours faithfully

Jason Lu
Capacity Planning Manager

Attachment 1:

Greater Macarthur South Land Release Area - Initial Advice

Introduction

The NSW Department of Planning via consultants AECOM has requested advice from Endeavour Energy regarding electrical servicing requirements the Greater Macarthur Land Release Area. Given the short time frame allowed for analysis the solution presented in this paper is not a result of a comprehensive area study. It can be considered indicative of the order of magnitude of infrastructure investment required.
The boundary of the Greater Macarthur Land Release Area is Menangle Park to the north, Georges River to the east, Wilton to the south and Menangle Rd to the west. The transmission voltage supplying this area is 66kV. The existing supply in this area is via feeder 852 from Macarthur Bulk Supply Point (BSP) to Douglas Park Switching Station (SS), feeder 851 from Nepean Transmission Substation (TS) to Maldon ZS with feeder 850 connected between Maldon ZS and Douglas Park Sw Stn. The area is supplied via 11kV distribution from Maldon, Wilton and Appin Zone Substations.
The load required for the proposed 85,283 residential lots is 341MVA. The diversified load for 5.74 km^2 of employment lands is 27 MVA this gives a total load for the Greater Macarthur South area of 368MVA. The required load from Macarthur BSP at 66kV would be 112MVA and the required load from a new transmission substation at Douglas Park would be 255MVA.

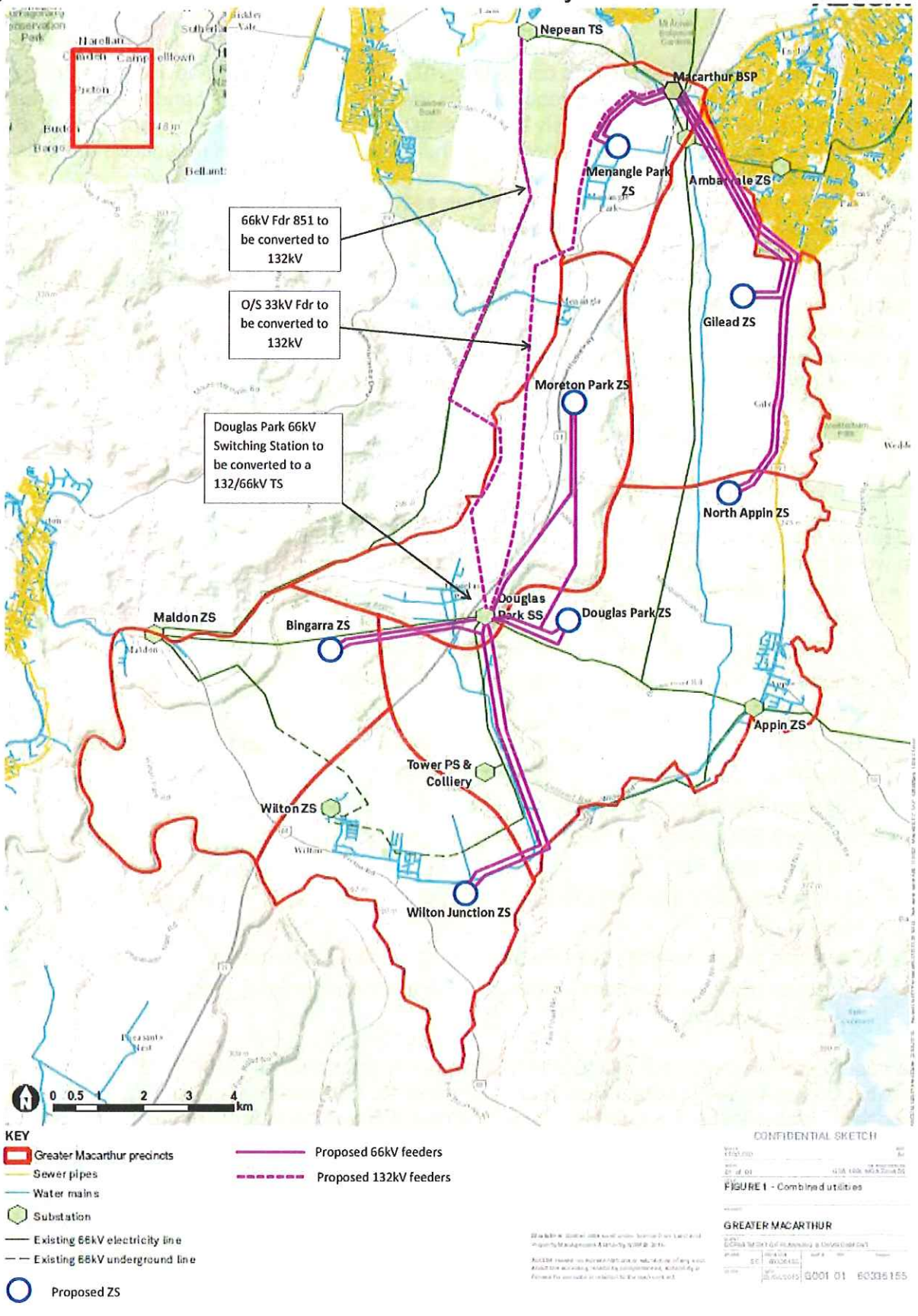
Ultimate Electrical Infrastructure Required

Endeavour Energy has developed an indicative option to supply the Macarthur South release area. The works considered as required to supply the increased load is:

- Conversion of Douglas Park SS to a 132/66kV TS, incorporating Douglas Park Zone Substation
- Augmentation of Maldon and Wilton ZSs to a firm capacity of 70 MVA.
- Augmentation of Appin ZS to a firm capacity of 35 MVA.
- Establish Bingara ZS with a firm capacity of 70 MVA.
- Establish Wilton Junction, Morton Park, North Appin, Gilead and Menangle Park zone substations each with a firm capacity of 35 MVA.
- Augment 66kV feeder 852 and out of service feeder 308 for 132kV operation.
- Augment 66kV feeder 851 from Nepean TS to Finns Rd to 132kV and establish a new 132kV line to Douglas Park TS.
- Build a new 66kV line from Douglas Park TS to Menangle Rd to join to 66kV feeder 851 to Maldon ZS.
- Establish additional 66kV feeders from Douglas Park TS to the various zone substations.
- Establish 66kV feeders from Macarthur BSP to Menangle Park, Gilead ZSs and North Appin Zone Substations.

The cost to provide the above electrical infrastructure is estimated at $310m. This does not include costs to purchase zone substation sites or easements for transmission mains. Figure 1 shows the proposed Greater Macarthur Land Release area development boundary and the proposed sub-transmission infrastructure.
Transgrid established Macarthur BSP 330/132/66kV substation to supply the South West Growth Centre. Macarthur BSP may need to be augmented to supply both the South West Growth Centre and the Greater Macarthur South development areas. This will be determined by Transgrid in consultation with Endeavour Energy and is not included in estimated costs stated above.

Figure 1: Greater Macarthur Land Release AreaBoundary & Sub-transmission Infrastructure



Staging of Development

Based on a high level review of existing infrastructure, locations ready for short term development (within 5 year timeframe) have been identified.
Development could occur within the existing supply areas of Maldon, Wilton and Appin ZS's It would be desirable to have developments close to the zone substations or next to existing developed areas Wilton ZS – Currently supplies Wilton township and Bingara Gorge development. Capacity could be made available for developments outside of these areas.
Appin ZS – The Northern part of the Appin Township has been developed in the past few years with 320 residential lots. There are two more parcels which can be developed into approximately 300 lots.
Currently Ambarvale ZS supplies the Menangle Park area. There is capacity to supply the initial 200 lots. Ultimately a new zone substation will be established to supply the 5000 lots in the proposed Menangle Park release area.
At this stage the proposed 1,700 residential lots at Gilead can be supplied from Ambarvale ZS by establishing two new 11kV feeders.
In terms of developing new infrastructure there is a major threshold issue for the 66kV network with the proposed option. When 66kV feeder capacity on 851/852 is exhausted by short term development connecting to existing substations, a transmission substation will need to be established ($60m). Timing of this is made more complex by a generation source fuelled by methane gas produced as a by-product of local mining operations (Tower/Appin). Generation is limited to 55MW due to environmental restrictions and actual levels are variable.
For new zone substations there are options to stage investment by using 66kV packaged substations or redeployment of mobile substations. The Menangle Park substation will initially be established using a mobile substation.

Issues

The proposed solution has a number of issues:

1) There is space available at Macarthur BSP to terminate the five 66kV feeders shown in Figure 1. Transgrid did not install the full number of 66kV feeder circuit breakers and they will be installed reactively upon requests from Endeavour Energy.
2) Acquisition of easements / line routes.. The transmission feeder routes shown in Figure 1 indicate electrical connectivity and are not shown in identified construction corridors.
3) No formal consultation with Transgrid has been entered into regarding the proposed solution shown in Figure 1.

Appendix F

TransGrid Correspondence

Appendix F TransGrid Correspondence

Correspondence includes information not publicly available and has therefore been removed from the report.

Appendix G

Jemena Correspondence

Appendix G Jemena Correspondence

Jemena Limited
ABN 95 052 167 405

Level 9-15
99 Walker St
North Sydney NSW 2060
PO Box 1220
North Sydney NSW 2060
T +61 2 9867 7000
F +61 2 9867 7010
www.jemena.com.au

11 June 2015
AECOM
Level 21/420 George Street
SYDNEY NSW 2000
Attn. Robbie Williams

RE: **Greater Macarthur South: Jemena Feasibility Application**

Dear Sir,

Thank you for your letter 24 April 2015 in regards to increased usage in the Greater Macarthur South area.

The following map you provided has been labelled by us in the different precinct areas. Precinct 1, 2, 3 and 5 have very low prospects of gas being available. There are significant costs getting to these areas which would make the project commercially unviable.

Precinct 4 – there is currently a small gas network around Appin. This could accommodate a small amount of growth but over and above this would require significant investment. There are large areas in this precinct which has no gas coverage.

Precinct 6 – there is currently a small gas network around Wilton town centre and Bingara Gorge (Wilton Parklands). This could accommodate a small amount of growth but over and above this would require significant investment. There are large areas in this precinct which has no gas coverage.

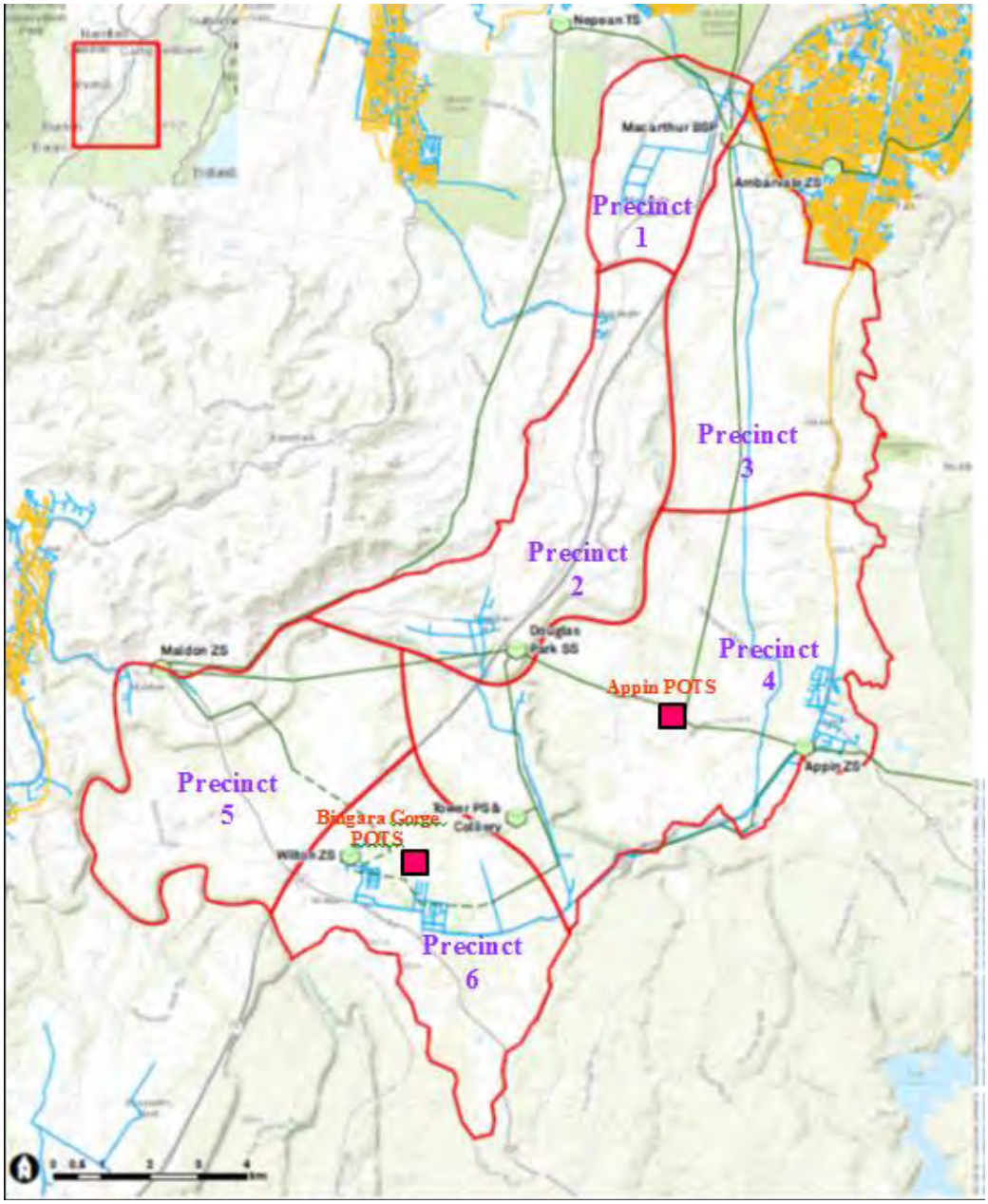
In summary this region has low prospects of having gas available to a significant portion of the forecast growth without significant contributions towards infrastructure.

If you have any further questions please contact me.

Regards,

Philip Glasscock

Philip Glasscock
Network Development Manager – NSW/ACT
Jemena



Appendix H

NBN Co Correspondence

Appendix H NBN Co Correspondence

From:	Matthew Schwabrow
To:	Borgonia, Stephanie
Cc:	Williams, Robbie H J; Mason, Rob; Bessell, Steven
Subject:	RE: Greater Macarthur - NBN Feasibility Application [SEC=UNCLASSIFIED]
Date:	Monday, 18 May 2015 10:09:47 PM
Attachments:	image001.png image002.png image003.png image004.png image005.png image006.png image007.png image008.png image009.png image010.png

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UNCLASSIFIED

Hi Stephanie,

Thankyou for the opportunity and patience for Nbn to provide input into Greater Macarthur feasibility study.

The Telecommunications Infrastructure in New Developments ('TIND') Policy sets out the Federal Government's approach to providing telecommunications infrastructure in new developments. The Policy has been under review since 2014 and it is anticipated that a new version of the TIND Policy will be released in May/June 2015. The draft TIND Policy was released in December 2014 and is available at communications.gov.au.

Although the New TIND Policy is yet to be published, nbn is beginning to operationalise some of the key policy changes related to cost recovery. Once the final New TIND Policy has been released, we understand aspects of it will apply from the 1 March 2015, consistent with the draft policy released on 11 December 2014 and as publicly advised by the Department of Communications on 27 February 2015. As contemplated by the draft policy, nbn expects that the proposed charges under the New Policy will apply to all new development applications which have been approved on or after 1 March 2015 and will begin entering into agreements that reflect the terms of the New Policy from 13 April 2015.

Please see responses to the required questions:

- Outline of the current NBN servicing arrangements for the proposed development;

Nbn New Developments is a demand driven program and assesses applications received by Developers. The criterial for acceptance of these applications are primarily assessed by its location relative to the Nbn footprint. With this in mind the Greater Macarthur catchment areas does meet this criterial and therefore would meet the primary assessment values. We have also already engaged with multiple LGA's and Developers relating to this region and have preliminary coverage acceptance from Nbn Planning. Final approval is required via a formal application and feasibility assessment.

- Identification of the existing capacity of the NBN network to service the projected growth;

nbn is a National infrastructure rollout covering 8Million+ dwellings inclusive of the projected New Development dwellings created by the property industry demands. **nbn** Planning has met with the majority of LGA's relating to this region and part of this process involved the collation of projected future growth for the purpose of capacity planning to meet these needs.

- Details of any planned infrastructure works to support development within the catchment which could be expanded to support the development;

This is managed in two major streams.

1: Co Developments

The Co-Development Program was established to leverage synergies between **nbn's** planned construction and third party construction projects. The process allows both **nbn** and third parties to actively engage with each other for the purpose of early identification and leverage of viable common build activities.

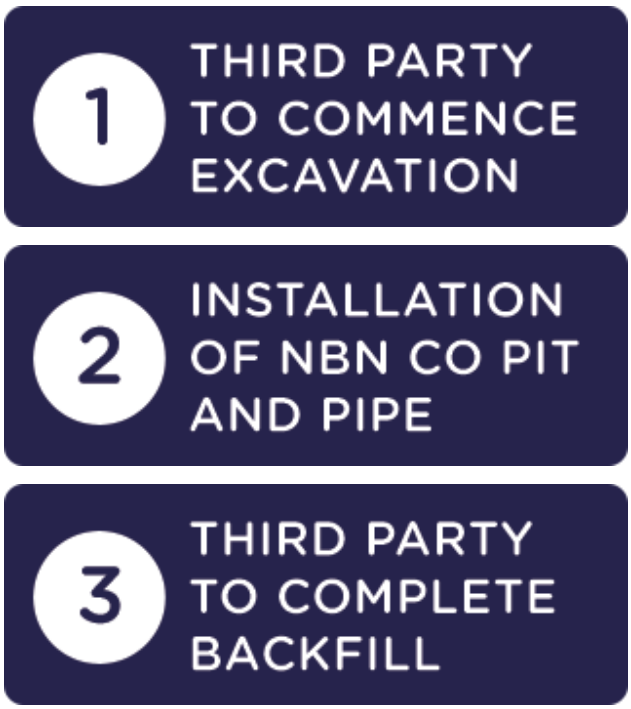
If a local government or property developer has plans to construct new infrastructure or the road authorities have planned road works, **nbn** could investigate the possibility of installing **nbn**

conduits and pits at the same time, where feasible. This may achieve shared efficiencies whilst minimising both the community impact and cost.

Potential projects for co-development may include:

- Road works
- Works around rail corridors
- Construction of major sites
- Upgrades on communication assets
- Utility works
- Footpath works
- Cycleway construction

Typical co-development construction process



How it works

Projects will be assessed against a set of criteria set by **nbn** to determine whether the project aligns with the **nbn**™ network construction plans. Importantly the project must be within the national rollout area.

Applicants are encouraged to register their interest early by submitting a completed co-development project form. **nbn** will then assess the proposed third party project before proceeding with discussions which may, in **nbn**'s sole discretion, lead to a co-development.

2: New Developments

nbn is enabling new developments to connect to the nbn™ network to deliver the benefits of fast broadband upfront in the new build process.

New developments include all types of developments and constructions, regardless of the number of lots, premises or units involved; whether they are broadacre greenfield or brownfield infill; and regardless of whether they are residential, commercial, industrial, government or of some other type.

- Other major development currently allowed for in the area as part of NBN's infrastructure planning;

Refer above

- Summary of the infrastructure augmentations likely required to the NBN network to service the development;

Being fundamentally constructed on demand the network to service this development will be new and therefore no network augmentation will be required

- Funding arrangements for infrastructure upgrades to the meet the increased telecommunications demand;

Please refer to the TIND policy for details.

- Guidance on timeframes for forward planning of infrastructure works.

Nbn requires a minimum of 6 months notification prior to service required dates. Ideally the primary team of the specific projects / developments will engage with Nbn as early as possible

Regards,

Matthew Schwabrow
Developer Manager - New Developments
Network Engineering and Deployment

Appendix I

Service Infrastructure Staging Comments from Stormwater, Social Infrastructure and Transport Planning Standpoints

Appendix I Service Infrastructure Staging Comments from Stormwater, Social Infrastructure and Transport Planning Standpoints

Stormwater Staging Words (GHD)

The proposed servicing staging for the study area is shown in Figure 8-1.

Implementation of the stormwater infrastructure is consistent with the proposed staging. The stormwater discharging from a particular Stage does not drain into and through another development Stage so there is no interaction of stormwater infrastructure between the Stages.

The consistency results from the proposed residential development areas being located effectively along ridge lines with perimeter roads being used to collect runoff within each development stage and direct that runoff to the provided stormwater infrastructure elements comprising detention basins and integrated bioretention areas. Discharges from the detention basins will be directed to natural watercourses direct from the more elevated development areas.

Even with the use of perimeter roads to direct runoff to the stormwater elements and allowing for some landform regrading during the development process there will be a significant number of stormwater management elements within each development stage. This is a natural consequence of the development being along the ridge areas and the shape of the development areas.

The proposed stormwater works have been located to provide appropriate protection to the Upper Canal throughout the development while remaining consistent with the proposed staging of the works.

It is considered appropriate, that within each development stage, the location of the stormwater treatment measures and the design of the perimeter road should be co-ordinated and concept designed prior to release of the stage to ensure the integrated functioning of these elements.

Indicative Staging of Social Infrastructure (GHD)

In determining staging for the provision of social infrastructure across the Greater Macarthur Investigation Area, it is important to acknowledge that there are many variables that will influence the rate of demand for a facility. These variables include:

- Services provided by existing facilities within the region and their ability to accommodate an increase in demand as a result the increase in population.
- Demographic composition of the potential future community and the influence this has on the demand for social infrastructure.
- Operational model for each social infrastructure type and the influence this has on facility provision.

The Social Infrastructure Assessment for the Greater Macarthur Investigation Area has developed for each type of Social Infrastructure a process for assessing when new facilities are required that can be adapted for different growth scenarios. The process referred to as a 'Continuum for Adapting to Different Growth Scenarios' has been designed to assist in identifying the phases for facility planning and investigating options for increasing capacity. In addition it identifies situation based thresholds for determining when new facilities are required.

Although these Continuums have been developed to assist with determining when a new facility is required at the detailed phase of planning, they can be used at this earlier Strategic Phase to provide guidance with regards to identifying the potential social infrastructure facilities that should be developed in accordance with the staging proposed by AECOM.

Table 1 presents the social infrastructure facilities that should be developed in accordance with the staging proposed by AECOM. The recommendations in this table are high level and have been calculated based on the full development scenario for each Stage being achieved. The findings presented in Table 1 have been provided to assist with the next phase in the planning process when further detail would be made available with regards to the distribution of the proposed population and how the new population would relate to existing facilities within the region. It is anticipated that a Social Infrastructure Plan would be prepared for each development stage at the Detailed Planning Phase, and these Social Infrastructure Plans would address the variables identified above that influence how a new facilities are planned for and provided.

Table 9-1: Social infrastructure facilities to be provided in accordance with the staging proposed by AECOM for the Greater Macarthur Investigation Area

Type of facility	Facility	Rate of provision	Centre hierarchy (based on Urbis classification)	Stage 1 (10,545 dwgs and 28.050 pop)	Stage 2 (22,395 dwg and 59,571 pop)	Stage 3 (9,855 dwgs and 26,215 pop)	Stage 4 (19,665 dwgs and 33,795)	Stage 5 (12,705) dwgs)	Stage 6 (10,125 dwgs and 26,933 pop)	Total (85,290 dwgs and 226,873)
Education	Primary schools	One primary school per 2,000-2,500 new dwellings.	Village	Four primary schools within precinct	Nine primary schools within precinct	Two primary schools	Four primary schools	Five primary schools	Two primary schools	26 primary schools
	High school	One high school per 6,000 – 7,500 new dwellings.	Town centre	One high school	Three high schools	One high school	Two high schools	Two high schools	One high school	10 high schools
	School for specific purpose	One School for Specific Purpose per 17,000 new dwellings.	Strategic centre	Expansion of Mary Brooksbank School	One school for specific purpose	One school for specific purpose to be developed across Stage 3 and 4		One school for specific purpose to be developed across Stage 5 and 6		Three schools for specific purpose
Justice	Court	No court facility required	N/A	Use of existing court facilities						
	Prison	One prison per 250,000 people	Not within a centre but with sufficient access for workers.	Development of a new prison facility that will service the South West and Greater Macarthur Region.						

Type of facility	Facility	Rate of provision	Centre hierarchy (based on Urbis classification)	Stage 1 (10,545 dwgs and 28.050 pop)	Stage 2 (22,395 dwg and 59,571 pop)	Stage 3 (9,855 dwgs and 26,215 pop)	Stage 4 (19,665 dwgs and 33,795)	Stage 5 (12,705) dwgs)	Stage 6 (10,125 dwgs and 26,933 pop)	Total (85,290 dwgs and 226,873)
Emergency services	Ambulance	Rate of provision is based on the number of calls to 000. As a population rate one hub could be required to support 250,000 people.	Not necessarily within a centre but with good access to surrounding centres.	Ambulance standby point	Development of Ambulance Hub in Wilton Junction that can service the GMIA	Ambulance standby point	Ambulance standby point	Ambulance standby point	Ambulance standby point	One ambulance hub and a minimum of five standby points.
	Fire	To be confirmed with Fire								
	Police	Rate of provision is based on crime rate. Major centres require one police station. Town centres	Town centre for police shopfront Strategic centre for police station (e.g. Wilton	Police shopfront in town centre	Police station in Wilton Junction	Police shopfront in town centre	Police station in West Appin	Police shopfront in town centre	Police shopfront in town centre.	Two police stations and four police shopfronts

Type of facility	Facility	Rate of provision	Centre hierarchy (based on Urbis classification)	Stage 1 (10,545 dwgs and 28.050 pop)	Stage 2 (22,395 dwg and 59,571 pop)	Stage 3 (9,855 dwgs and 26,215 pop)	Stage 4 (19,665 dwgs and 33,795)	Stage 5 (12,705) dwgs)	Stage 6 (10,125 dwgs and 26,933 pop)	Total (85,290 dwgs and 226,873)
		require a police shop front.	Junction)							
Health	Integrated Health Facility with inpatient facilities	One facility per 200,000 to 250,000	Strategic centre (e.g. Wilton Junction)	-	Integrated health facility in Wilton Junction	-	-	-	-	One integrated health facility
	Regional integrated primary care clinic with day surgery facilities	One facility per 75,000 to 100,000	Town centre (e.g. West Appin or Maldon)	-	-	-	Regional integrated primary care clinic in West Appin	-	-	One regional integrated primary care clinic
	Primary care clinic	One facility per 15,000 to 18,000	Town centre	Primary care clinic		Primary care clinic		Primary care clinic		Three primary care clinic
Cemetery	Cemetery	Additional burial sites required to service population.	Within a 30-45 minute drive of the Greater Macarthur Investigation Area	Allow in planning controls for burial sites.						
Cultural	Cultural	To be	Two		One facility		One facility			Two

Type of facility	Facility	Rate of provision	Centre hierarchy (based on Urbis classification)	Stage 1 (10,545 dwgs and 28.050 pop)	Stage 2 (22,395 dwg and 59,571 pop)	Stage 3 (9,855 dwgs and 26,215 pop)	Stage 4 (19,665 dwgs and 33,795)	Stage 5 (12,705) dwgs)	Stage 6 (10,125 dwgs and 26,933 pop)	Total (85,290 dwgs and 226,873)
facilities	facilities	confirmed with Arts NSW	facilities							facilities
Open space	Regional open space	1 Regional park: 50,001 – 150,000 people			One regional park		One regional park		One regional parks	Three regional parks
	District open space	1 District park: 20,001 – 50,000 people		District park	District Park	District Park	District Park	District Park	District Park	Six district parks

AECOM

Transport Planning (AECOM)

To	David Fitzgibbon (DP&E)	Page	1
CC	Robbie Williams (AECOM) David Gray (TfNSW) Matthew Dudley (TfNSW) Brett Linnane (AECOM		
Subject	GMLRI – Staging Comments		
From	Andy Yung (AECOM)		
File/Ref No.	60342504	Date	10-Jun-2015

A potential staging plan of development within the study area has been established based on the services infrastructure requirements through assessment of existing and proposed capacity, and discussion with DP&E and utility providers. This development staging was solely based on utility infrastructure requirement, however it is understood other drivers including transportation; social infrastructure and stormwater possess capability to alter the staging sequence.

From a transport infrastructure staging perspective, typically the release of development will drive the need for infrastructure. However, Government intervention, in the form of early public transport would be important to attract early jobs and create employment momentum. Similarly, providing large catalytic social infrastructure would provide an employment stimulus.

The following commentary is provided to discuss if the staging plan (based on infrastructure requirements) has any alignment or synergies with the development of transport infrastructure proposed for the GMLRI.

Infrastructure staging	**Alignment or synergies with transport infrastructure staging**
Stage 1: Menangle Park and Mt Gilead	The early release of these areas that are closest to the existing urban areas of Campbelltown / Macarthur can leverage off extension and upgrade of existing infrastructure including Hume Highway, Appin Road, Southern Highlands Line, and the proposed Spring Farm Parkway, combined with new / extended bus services to and from existing centres at Campbelltown and Macarthur. It should not trigger a step change / increase in regional infrastructure upgrades. It should be noted that the SWRL extension may also serve part of this precinct. Corridor should be preserved for future public transport provisions to connect to other precincts to the south.
Stage 2: Wilton	Given Wilton is located furthest away from the existing urban areas of Campbelltown / Macarthur and the significant scale of the development proposal, significant regional infrastructure upgrades of the road network (particularly the Hume Highway and Picton Road) and the public transport network through rail (electrification of the T2 line) or bus servicing and infrastructure may be required between Wilton and Campbelltown / Macarthur. This would be in order to provide appropriate level of service and public transport serviceability for future residents and employees in this area. Therefore significant cost is expected to be associated with the development of this precinct before the development of most of the other precincts in GMLRI.
Stage 2A & 2B: South East Wilton and Maldon	It is assumed that the scale of development of these two areas would be relatively small and can be predominantly serviced by the existing Southern Highlands Line and some local road upgrades of Picton Road and Menangle Road. However, if the scale of these precincts were to become larger and generate enough traffic demand, then significant regional infrastructure will be required to cater for the traffic / transport needs of the development. This may not be justified if these precincts proceed before the development of most of the other precincts in GMLRI.

Stage 3: Gilead	The development of this area (Mt Gilead and Campbelltown South) will require additional regional infrastructure upgrades at Appin Road and possibly part of the Macquariedale Road and its interchange with the Hume Highway (subject to level of development). It may also trigger the construction of the first stage of the public transport corridor connecting Mt Gilead into Campbelltown and Macarthur or the SWRL extension (with the intention of Stage 2 extension to Appin). This stage of development may follow Stage 1 or happens in parallel with Stage 1.
Stage 4: West Appin	The development of this area (Appin) follows naturally from Stage 3 with extension of road network and public transport corridor to Appin. This would also trigger the construction of the Macquriedale Road and its interchange with the Hume Highway. If Stage 4 were to happen earlier, then it may trigger the Macquriedale Road and its interchange with the Hume Highway as well as perhaps early construction of either electrification of Southern Highlands Line to a new station at Macquariedale Road and construction of the public transport corridor to southern Appin.
Stage 5: Menangle & Douglas Park	Douglas Park precinct may trigger the connection into the Macquriedale Road interchange with the Hume Highway (and depending on growth in the south, upgrade of Hume Highway to Narellan Road) as well as the electrification of T2 Line to a new station at Macquariedale Road along with the upgrade of the existing Douglas Park Station. Therefore, it should follow or happens in parallel with Stage 4.
Stage 6: Cataract	This area is quite physically separated from other development precincts. The main connection to this precinct is via the existing Douglas Park Drive and connection to Douglas Park Station. Early modelling suggests that upgrades to Douglas Park Drive are not warranted from a road capacity viewpoint whether this land is released or not. However, currently poor conditions at its weir crossing of the Nepean River, may result in any significant development driving the need to fund a new crossing. This would be relatively costly in the context of the amount of developable land available. Given the above constraints, it is considered that this area should to be developed last and remain as rural use.

Overall, it makes sense that the northern precincts of GMLRI (Stages 1 and 3) be developed first, followed by the precincts in the central part of GMLRI (Stages 4 and 5). Stages 4 and 5 could happen earlier but would trigger the need for Macquariedale Road and its interchange with the Hume Highway (and upgrade of Hume Highway to Narellan Road) as well as the electrification of Southern Highlands Line to a new station at Macquariedale Road.

Stage 2 development would require significant regional infrastructure upgrades and therefore significant cost is expected to be associated with the development of this precinct before the development of most of the other precincts in GMLRI.

Note that the above qualitative review is of preliminary nature, subject to further detailed investigations and traffic modelling to confirm the final staging plan for the proposed transport infrastructure.

Andy Yung

Associate Director