infrastructure & development consulting

Appin & North Appin Precincts

Infrastructure Phasing Plan

October 2022

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Client	Walker Corp	**Revision**	D
Author	R. Higgisson	**Reviewed**	C. Avis

1 The Appin Project

Greater Sydney's population is projected to grow to approximately 6.1 million by 2041 – over a million more people than currently live in the region.

The NSW Government has identified Growth Areas as major development areas that will assist in accommodating this growth. The Greater Macarthur Growth Area (**GMGA**) is one such growth area and is a logical extension of the urban form of south-west Sydney. The GMGA is divided into precincts. The Appin Precinct and North Appin Precinct are the southernmost land release precincts of the GMGA. The goal is to deliver 21,000+ dwellings.

The land is to be rezoned and released for development to achieve this goal. A submission has been prepared by Walker Corporation Pty Limited and Walker Group Holdings Pty Limited (the **Proponent**) to rezone 1,378 hectares of land (**the site**) within the Appin Precinct from *RU2 Rural Landscape* to the following zones:

Urban Development Zone

Zone 1 Urban Development (UD)

Special Purposes Zone

Zone SP2 Infrastructure (SP2)

Conservation Zone

Zone C2 Environmental Conservation (C2)

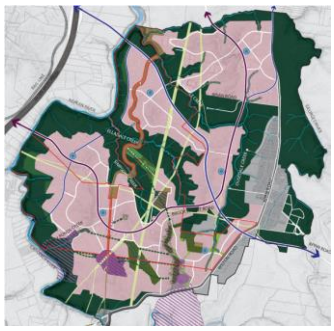
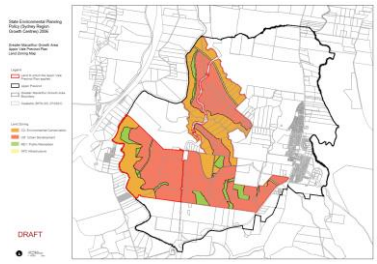
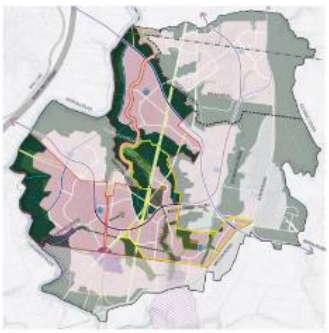
The zonings are shown on the Appin (Part) Precinct Plan (**the precinct plan**). 'The precinct plan' will be incorporated into the *State Environmental Planning Policy (Precincts – Western Parkland City) 2021* and contain the provisions (clauses and maps) that will apply to 'the site.' 'The precinct plan' envisages the delivery of 12,000+ new homes.

A structure plan has been prepared for the site and is shown on the Appin (Part) Precinct Structure Plan (**the structure plan**). It identifies staging and the first stage to be developed – Release Area 1. Release Area 1 is anticipated to deliver 3,500+ dwellings.

The submission is aligned with strategic land use planning, State and local government policies and infrastructure delivery. The development potential is tempered by a landscape-based approach that protects the environment and landscape values, shaping the character of new communities. A series of residential neighbourhoods are to be delivered within the landscape corridors of the Nepean and Cataract Rivers, supported by local amenities, transit corridors and community infrastructure.

The submission includes a hierarchy of plans. The plans and their purpose are summarised in Table 1.

Table 1 – Title and Purpose of Plans

(1) APPIN & NORTH APPIN PRECINCTS INDICATIVE PLAN	(2) APPIN (PART) PRECINCT PLAN (*THE PRECINCT PLAN*)	(3) APPIN (PART) PRECINCT STRUCTURE PLAN (*THE STRUCTURE PLAN*)
Broader context & for information purposes only. It has no statutory weight. It identifies: • *Higher-order transport network* • *Centres hierarchy* • *School sites* • *Conservation areas* • *Residential areas* • *Cultural sites and connections*	*It shows the land proposed to be rezoned (the site) and incorporated into a new schedule in the Western Parkland City SEPP 2021.* *The precinct plan contains the development provisions (clauses and maps) applicable to the site and is used in assessing development applications.*	*Structure plan for the site, showing staging of release areas.* *It illustrates land use components including (but not limited to):* • *Low and medium-density residential* • *Retail and employment centres* • *School* • *Open space* • *Drainage network/basins* • *Transport network*
		
(21,000+ dwellings)	**(12,000+ dwellings)**	**(12,000+ dwellings)** **(inc Release Area 1 - 3,500+ dwellings)**

2 Introduction

Infrastructure & Development Consulting (IDC) have been engaged by the Proponent to prepare an Infrastructure Phasing Plan to support the Appin and North Appin Precincts Indicative Plan.

The Appin and North Appin Precincts are the southernmost land release areas of the Greater Macarthur Growth Area (**GMGA**) – refer Figure 1 and Table 2 for key features of the precincts.

The Appin and North Appin Precincts immediately neighbour the suburbs of Gilead to the north, Wilton to the south and Douglas Park to the west. Dharawal National Park, a large protected national park, is located to the east. The precincts are predominately bound by waterways, with Mallaty Creek to the north, George's River to the east, Nepean River to the west and Cataract River to the south.

Figure 1 – Boundary of Appin and North Appin Precincts

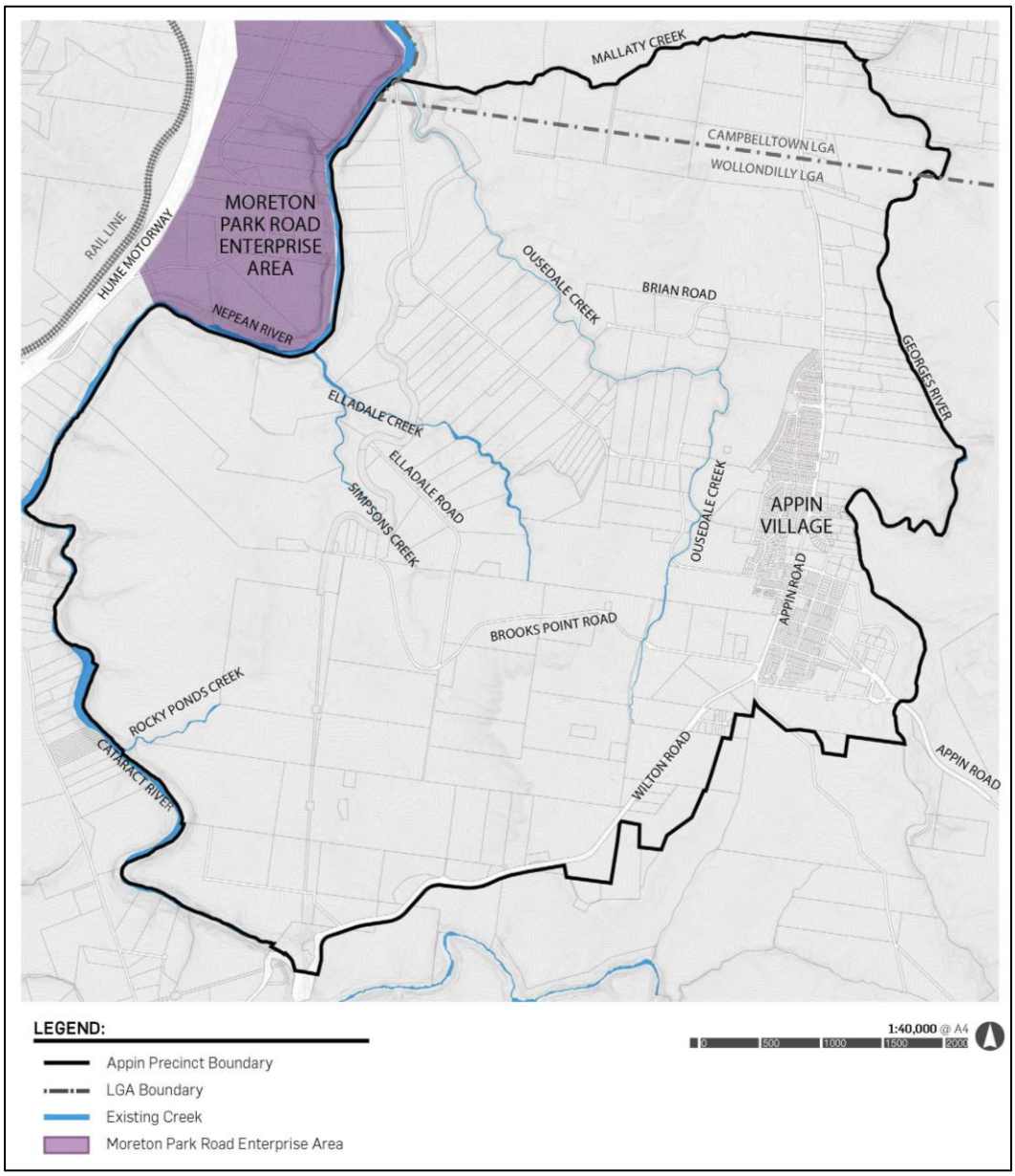
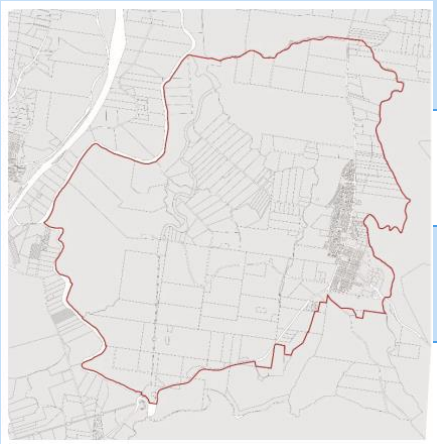


Table 2 - Summary of Appin and North Appin Precincts key attributes

	Location	Key Attributes	
Appin and North Appin Precincts		**Area**	3,826 ha
		LGA	Part Wollondilly Part Campbelltown
		Proposed # Dwellings	21,000+
		Proposed Population	65,000+

This report summarises the investigations relating to the staged implementation of trunk utilities and State and regional infrastructure, as identified in the draft GMGA Special Infrastructure Contribution (Draft SIC) for the Appin and North Appin Precincts.

Specifically, this report will outline:

- Existing utility services within the vicinity of the site
- Current and planned utility projects
- Planned infrastructure in the Draft SIC
- Implications of the above and potential servicing strategies for the proposed development within the precinct

The following analyses have been undertaken to provide a high-level strategy for servicing the precinct and to guide future detailed design. We note that the proposed servicing measures are strategic in nature and further refinement may be required during subsequent design phases of the project. However, the underlying principles and objectives of this report should be maintained.

Based on the analysis undertaken in this report, the rezoning can be supported in its current form.

2.1 Proposed Development

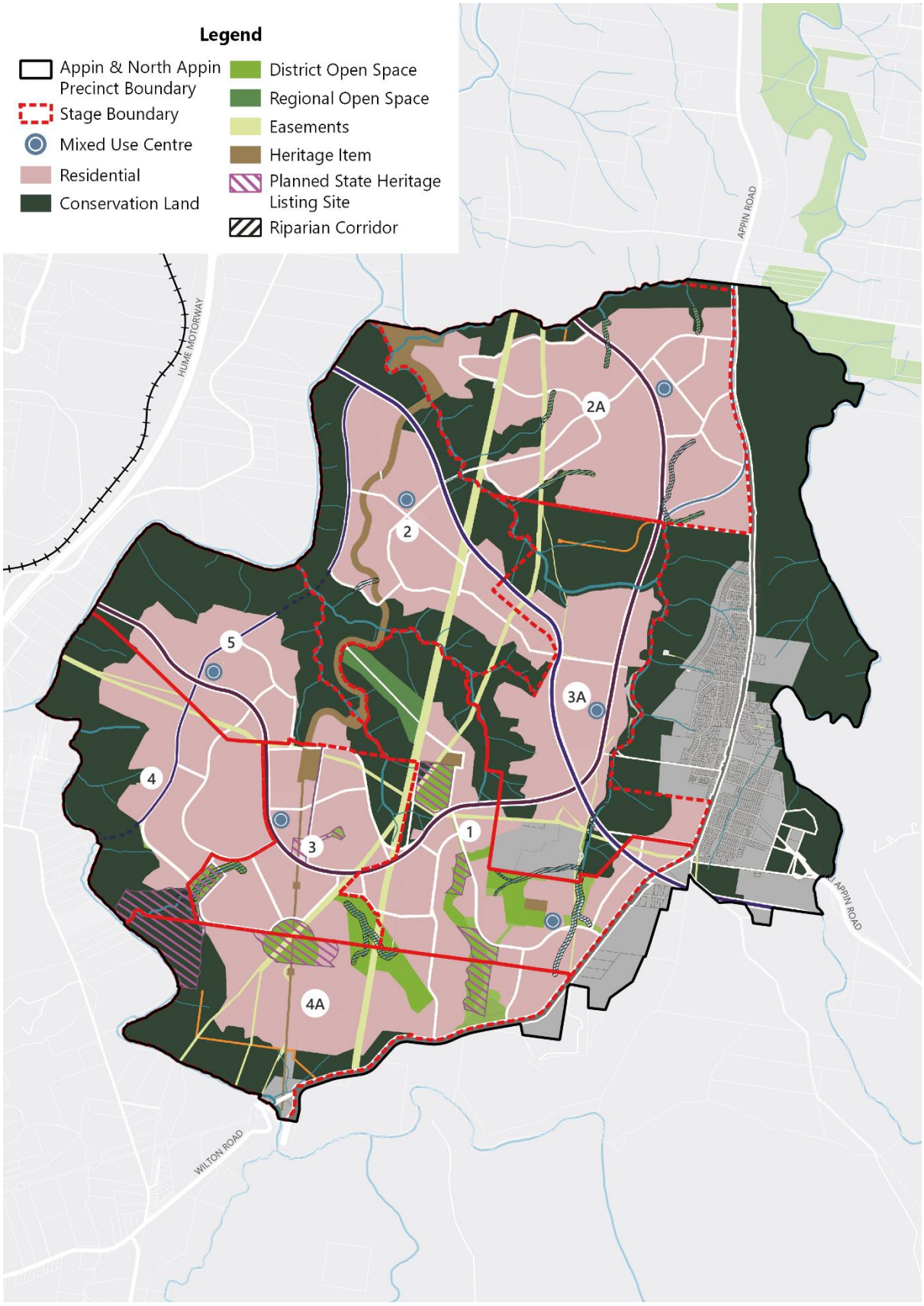
The Appin and North Appin Precincts will be rezoned to provide a mix of development typologies. Development will be delivered over eight stages and will provide approximately 21,000+ new dwellings. A breakdown of the staging is provided in Table 3 below. It is important to note that some of the development stages are not controlled by Walker Corp and as such the timing and delivery of the development of these stages is not guaranteed.

Table 3 - Proposed Development Staging

Stage	Delivery Years	Low Density Dwellings	Medium Density Dwellings	Total Dwellings
1	2026-2029	2,140	1,265	**3,405**
2	2030-2033	3,026	442	**3,468**
2A	2033-2037	4,166	188	**4,354**
3	2037-2040	1,287	2,064	**3,351**
3A	2041-2044	1,318	982	**2,300**
4	2045-2050	2,584	214	**2,798**
4A	2050-2051	630	-	**630**
5	2051-2056	1,559	-	**1,559**
TOTAL		**16,710**	**5,155**	**21,865**

The proposed layout and staging are shown in Figure 2 below. Dwelling numbers, delivery timing, stage boundaries and locations of proposed assets are indicative only and are subject to change during future phases of the project.

Figure 2 - Proposed Staging Plan



3 Stage 1

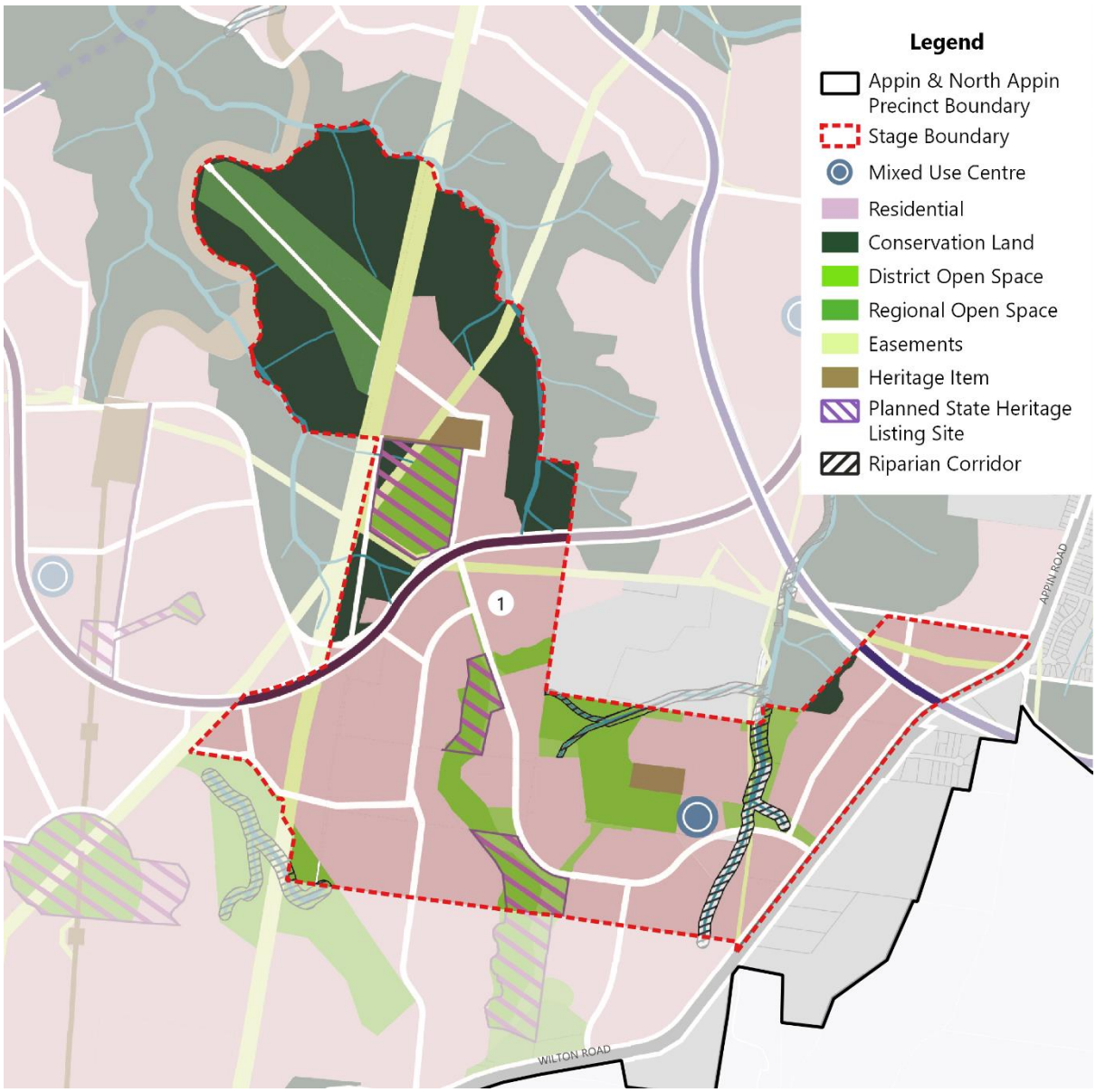
3.1 Development

Stage 1 includes the area bound by Appin Road to the east, Stage 4A to the south, Stage 3 to the west and Stages 2 and 3A to the north. Development within Stage 1 includes:

- 2,140 low density dwellings
- 1,265 medium density dwellings
- 3,750m^2 GFA retail/commercial
- Primary school (1,000 students)

Stage 1 is shown in Figure 3 below.

Figure 3 - Stage 1



3.2 Utilities Infrastructure

3.2.1 Electricity

Endeavour Energy (EE) have indicated that there is capacity for between 1,200-1,400 dwellings to be serviced using the existing Appin Zone Substation (ZS). After the initial 1,200-1,400 dwellings are delivered a new zone substation will need to be established to support further growth. Based on the current staging plan, it is anticipated that this zone substation will be required in Stage 1.

The new ZS would be located to the west of the existing Appin ZS, close to the transmission lines. EE have advised that the current design specification for a new zone substation require an approximately 8,280m^2 site. An indicative location is shown in Figure 4 below.

In addition to the zone substation, EE have noted that Transgrid will require a site for a future Bulk Supply Point (BSP). The BSP will be located north of the future Appin ZS and must be located close to transmission lines. Transgrid have not finalised the site requirements at this stage, however based on the land used at Macarthur BSP, to the north of Appin, a site roughly 26,000m^2 in size is possible.

While it is not expected that the new BSP would be required to support Stage 1, its location would likely be contained within the Stage 1 boundary. We therefore recommend the BSP site be dedicated with the Stage 1 works to ensure efficient delivery at a later date. The location of the future BSP and zone substation shown in Figure 4 below is conceptual only and is subject to change in location, and/or stage.

The anticipated electrical demand for Stage 1 has been calculated using standard After Diversity Maximum Demand (ADMD) rates per dwelling and per GFA for non-residential uses. These rates have been extracted from Endeavour Energy's Growth Servicing Plan. For the purpose of this assessment, we have assumed that schools will generate the same demand as commercial land uses.

High voltage feeders will be extended from the new ZS to development fronts. Based on an assumed 3,405 dwellings, three new 11kV feeders would be required to support development. Feeder locations have not been shown on Figure 4 for clarity.

Table 4 - Stage 1 Electricity Demand

Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	8.6	1.9
Medium Density Residential	4.0/dwelling	5.1	1.1
Retail	0.1/sqm GFA	0.3	0.1
Commercial	0.085/sqm GFA	0.1	0.0
School	0.085/sqm GFA	0.8	0.2
Total		**14.7**	**3.3**

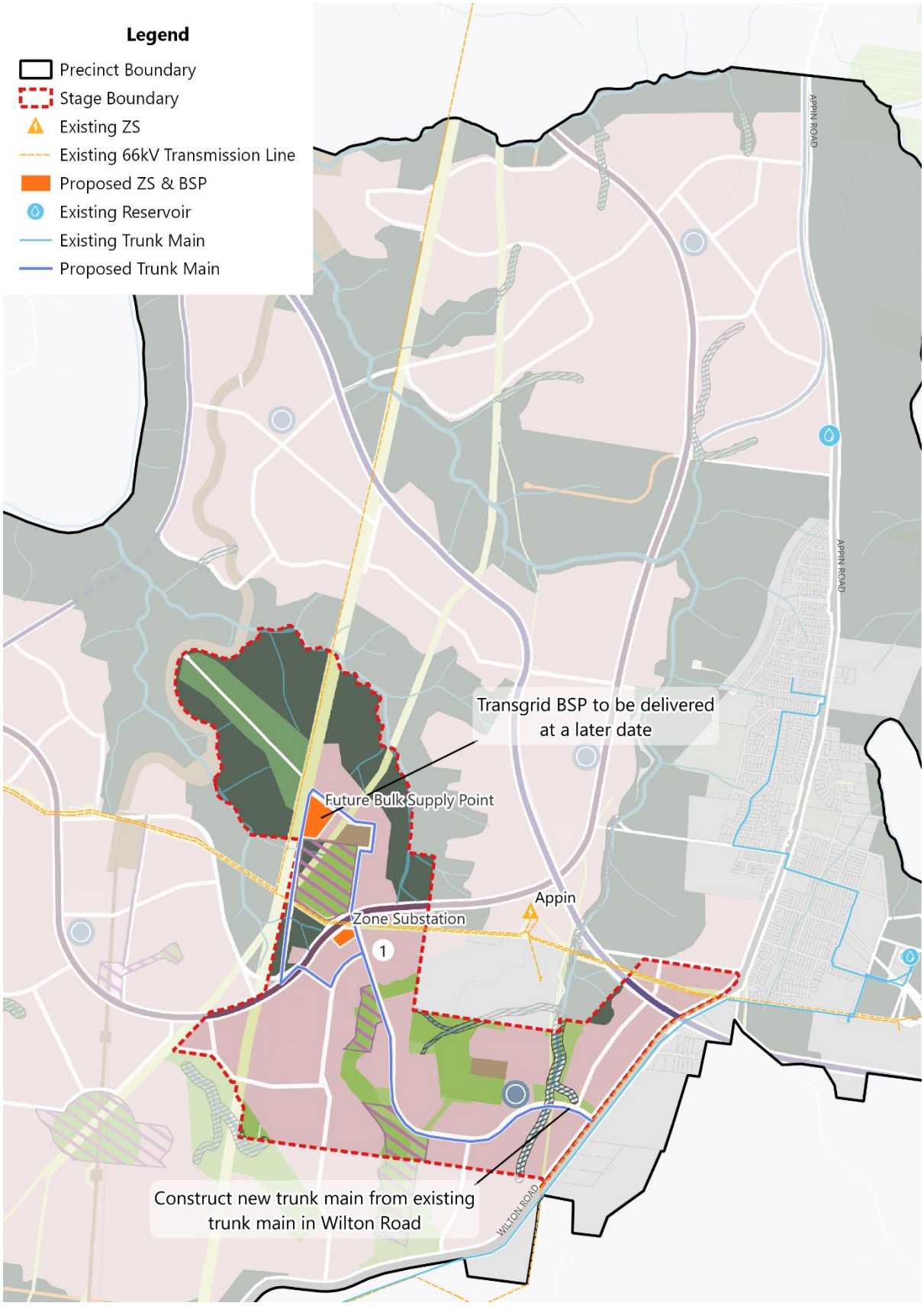
3.2.1 Potable Water

Sydney Water have indicated that the precinct will be serviced from the Macarthur Water Filtration Plant (WFP). The Macarthur WFP is located adjacent the employment lands, on the southern side of Wilton Road.

Sydney Water have indicated the Macarthur WFP is being upgraded to improve reliability. These works are due to be completed by 2026. The proposed development is not reliant on the upgrade, and it is expected that the Macarthur WFP will have sufficient capacity to support all development within the Appin Vale precinct.

To supply Stage 1, new mains will be constructed off the existing 300mm trunk main on Wilton Road.

Figure 4 - Stage 1 Water & Electricity Infrastructure



3.2.2 Sewer

Existing development in the Appin township is serviced by the Glenfield Water Recycling Plant (WRP), located approximately 23km north east of Appin. The existing infrastructure supporting Appin has not been sized to support the significant growth planned and Sydney Water have confirmed there is no available capacity in the existing Appin SPS to service additional dwellings.

Sydney Water have indicated that in the short to medium term, sewer flows from new dwellings should be treated at the Glenfield WRP. This arrangement is likely to operate for up to 10 years (until a new Treatment Plant is commissioned) and would therefore support development in Stages 1 and 2.

New trunk infrastructure will be required to transfer flows from Appin Vale to the existing sewer infrastructure located within Rosemeadow. This would include a new sewer pump station (SPS) adjacent the existing SPS in Appin, and a rising main following a similar alignment to the existing rising main in Appin Road.

Stage 1 falls into four sewer catchments:

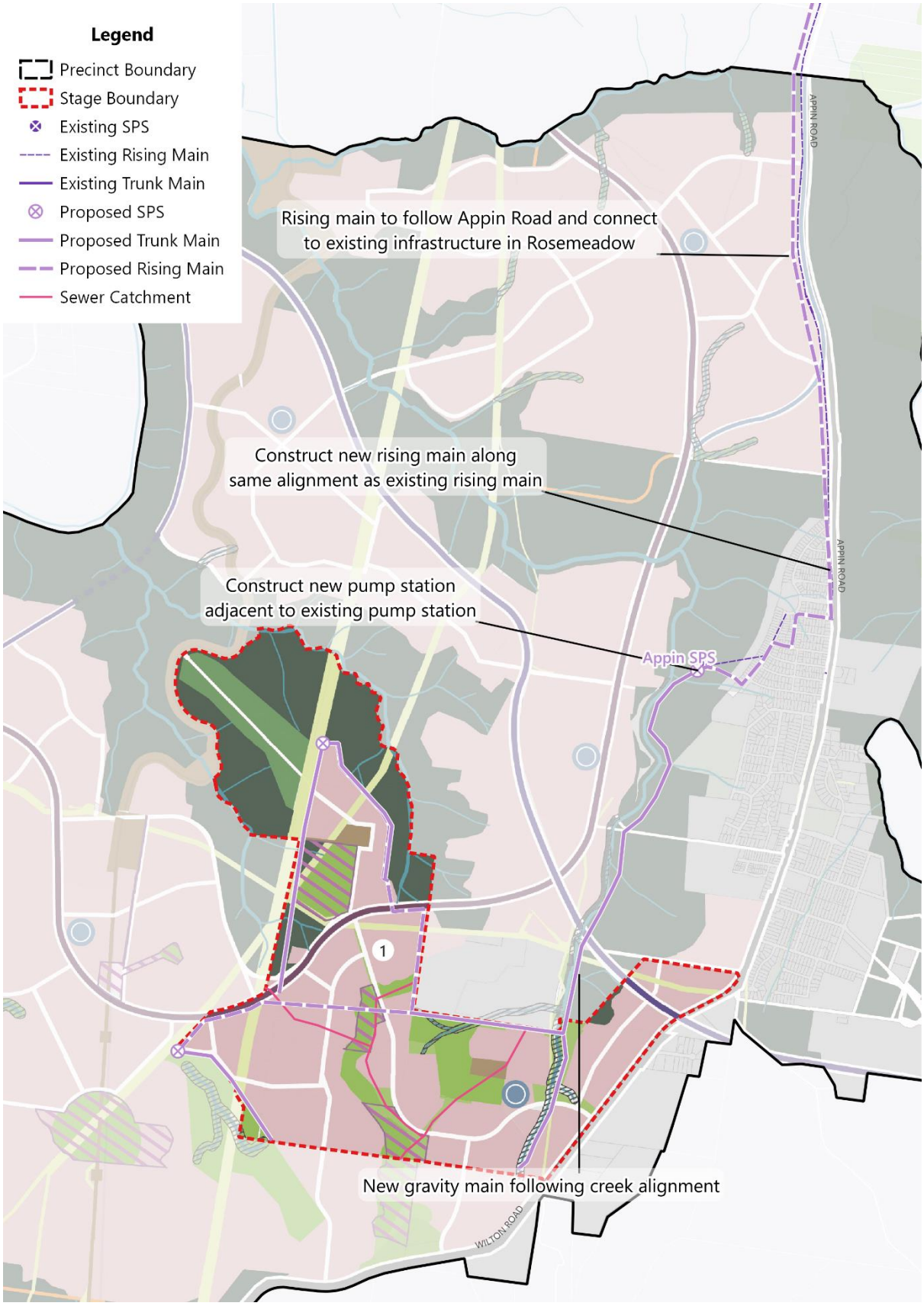
- The eastern catchment which drains to Ousedale Creek
- The central catchment which drains to Ousedale Creek
- The western catchment which drains to Rocky Ponds Creek, through Stage 3
- The northern catchment which drains to Simpsons and Elladale Creeks

Two pump stations would be required to transfer flows from the western and northern catchments to a single discharge point in the eastern catchment. From the eastern catchment, a gravity main would transfer flows to the new Appin SPS where flows would be pumped to the Glenfield WRP via Rosemeadow. This arrangement is shown in Figure 5 below.

3.2.3 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 5 - Stage 1 Sewer Infrastructure



3.3 SIC Infrastructure

3.3.1 Roads

WSP have prepared a Strategic Transport Assessment to support the development of the Appin Precinct. The report makes several recommendations regarding the staging and delivery of SIC roads supporting Appin.

To support development in Stage 1, Appin Road between North Appin and South Gilead will be upgraded from one lane per direction to two lanes per direction. Part of the North-South Transit Corridor will also be delivered. This road will include two lanes per direction, with the first stage including the extent within Stage 3A as well as a connection to Appin Road north of the Appin township. These works are required to be delivered by the 3,001st registered lot, which is expected to occur during Stage 1.

Site access in the south will occur via a new access road off Wilton Road, and the intersection at Appin Road and Church Street will be upgraded to a signalised intersection to support the additional dwellings, this is required by the 1,051st registered lot. Site access in the north will occur via a new access road off Brooks Point Road.

In addition to these works, two additional sections of Appin Road are expected to be upgraded by others:

- Appin Road north of Gilead will be duplicated to two lanes in each direction by 2026.
- Appin Road from South Gilead to Gilead will also be duplicated to two lanes in each direction by 2029, in line with the completion of Stage 1 lots.

3.3.2 Schools

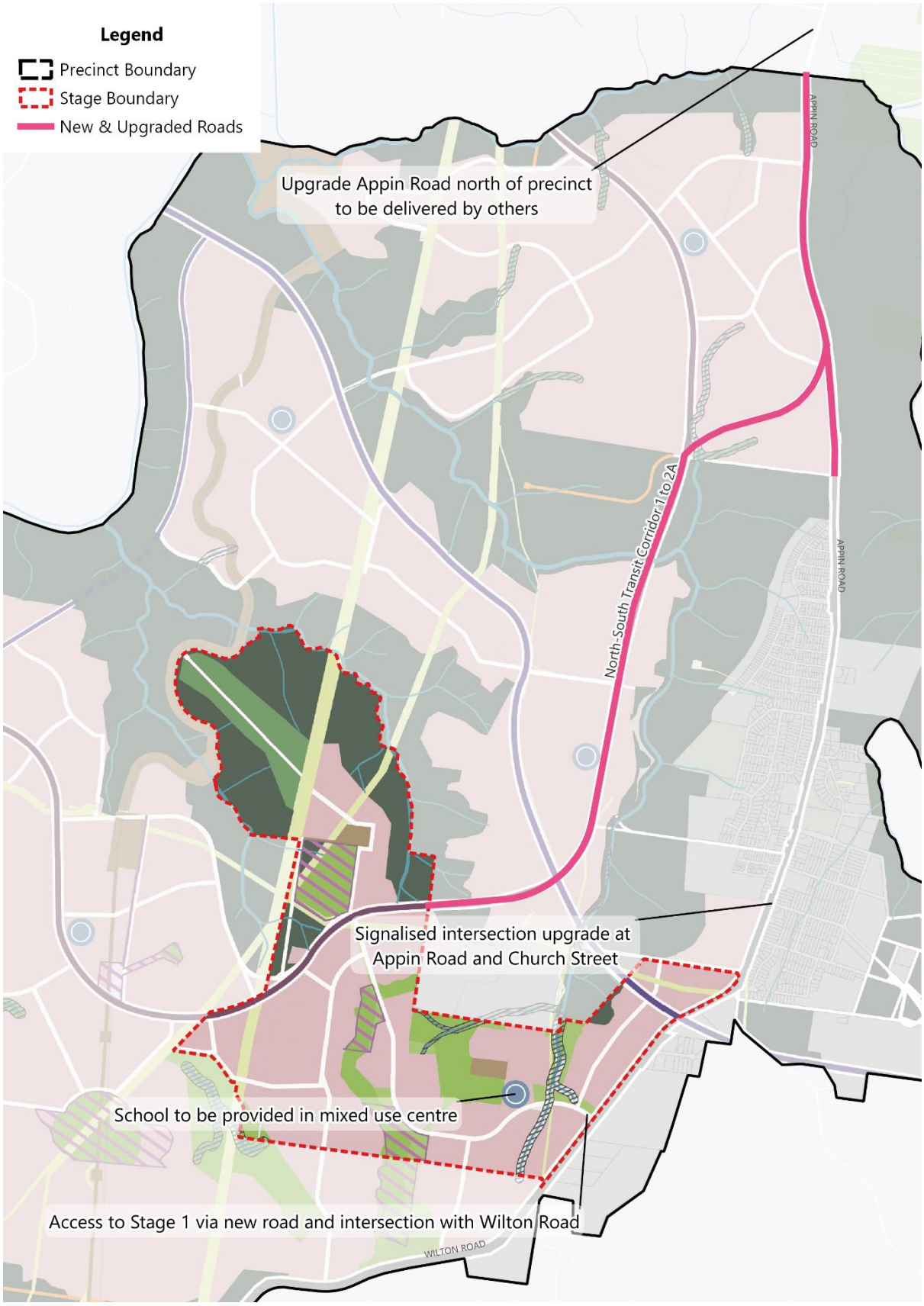
There is one existing primary school within the Appin precinct, Appin Public School, which is located on a 2.7ha site and has 355 students enrolled. The location of the school catchment is likely to cover part of the incoming population generated by the proposed development.

Given the maximum size of a primary school is 1,000 students, the Appin Public School has significant potential for upgrade and expansion and is likely to have capacity for primary school enrolments associated with the early stages of delivery of the Appin Structure Plan. The school will also contribute to the long-term supply of primary school places across Appin.

The Structure Plan will provide six additional primary schools and three high schools. The schools will be provided as three standalone primary schools and three co-located primary and high schools. School sites to be delivered by land dedication or alternative delivery arrangement authorised by School Infrastructure NSW.

Stage 1 includes a primary school with capacity for 1,000 students which will be delivered in the initial stages to provide for growth as the development progresses. While the school in Stage 1 is being delivered it is expected that the existing capacity in Appin Public School would be increased to accommodate initial demand generated by the development. The proposed location is shown in Figure 6.

Figure 6 - Stage 1 SIC Infrastructure



3.4 Infrastructure Summary

A summary of the infrastructure requirements associated with Stage 1 is provided in Table 5 below.

Table 5 - Stage 1 Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Electricity	Transgrid Bulk Supply Point Land Dedication Only (approx. size)	26,000	m^2
	Endeavour Energy Zone Substation	8,280	m^2
	11kV Feeders (lengths tbc subject to subdivision design)	3	item
Water	Trunk Mains	5,200	m
Sewer	Trunk Gravity Mains	7,300	m
	Rising Mains (includes mains along Appin Road)	13,600	m
	Sewer Pump Station	3	Item
Roads	Appin Road Upgrade – North Appin to South Gilead	2,300	m
	North South-Transit Corridor Part 1 – Stage 1 to Stage 2	4,200	m
School	Primary School (1,000 students)	1.5	Ha

4 Stage 2

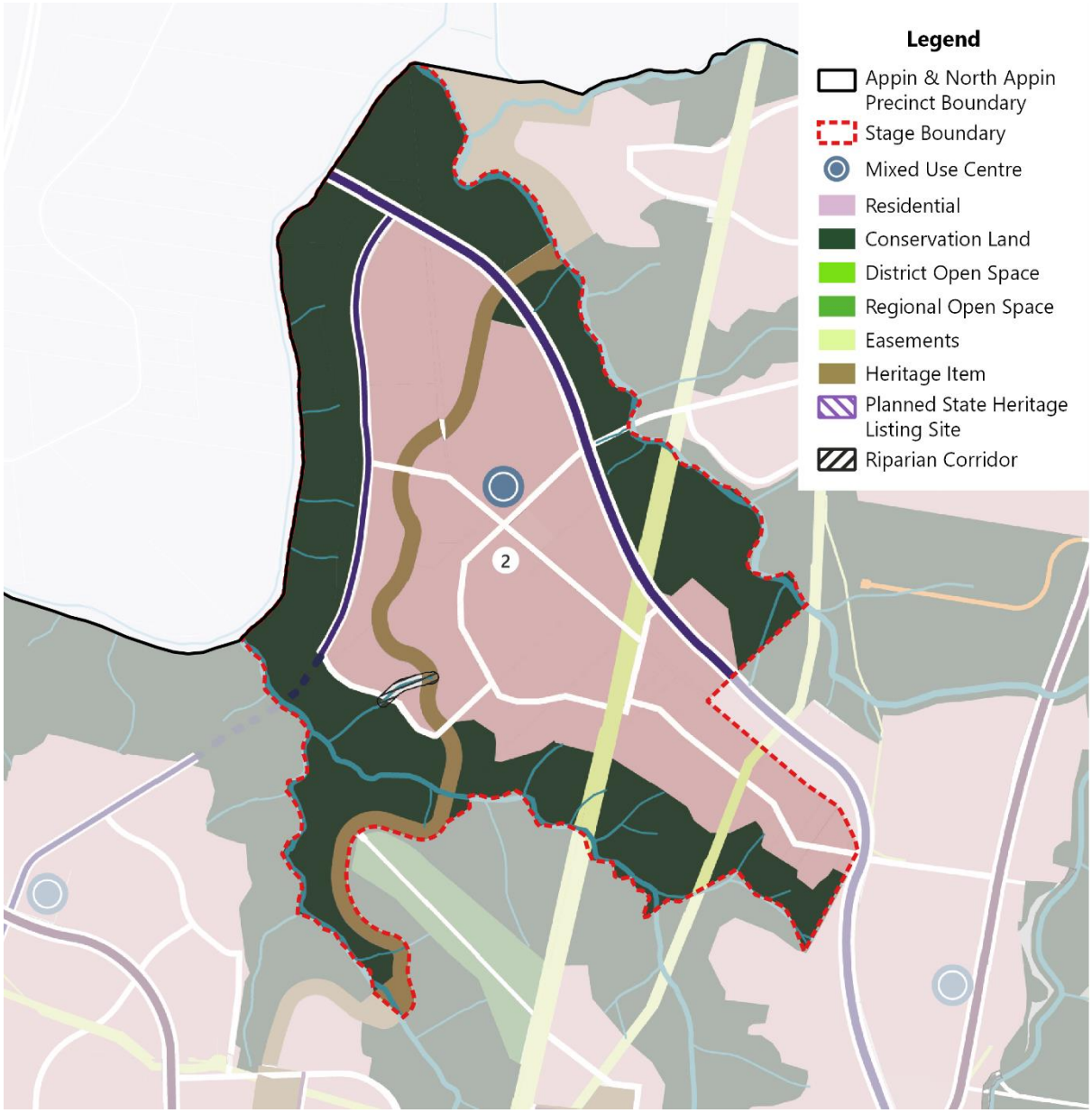
4.1 Development

Stage 2 includes the area bound by Stages 2A and 3A to the east, Stage 1 to the south and the Nepean River to the west and north. The stage includes the following development:

- 3,026 low density dwellings
- 442 medium density dwellings
- 3,000m^2 GFA retail/commercial
- Primary school (1,000 students)

Stage 2 is shown in Figure 7 below.

Figure 7 - Stage 2



4.2 Utilities Infrastructure

4.2.1 Electricity

Development within Stage 2 will be supplied via the new Appin ZS, located within Stage 1. High voltage feeders will be extended from the new ZS to development fronts. Based on an assumed 3,468 dwellings, three new 11kV feeders would be required to support development.

Table 6 - Stage 2 Electricity Demand

Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	12.1	2.7
Medium Density Residential	4.0/dwelling	1.8	0.4
Retail	0.1/sqm GFA	0.2	0.1
Commercial	0.085/sqm GFA	0.1	0.0
School	0.085/sqm GFA	0.8	0.2
Total		**14.9**	**3.3**

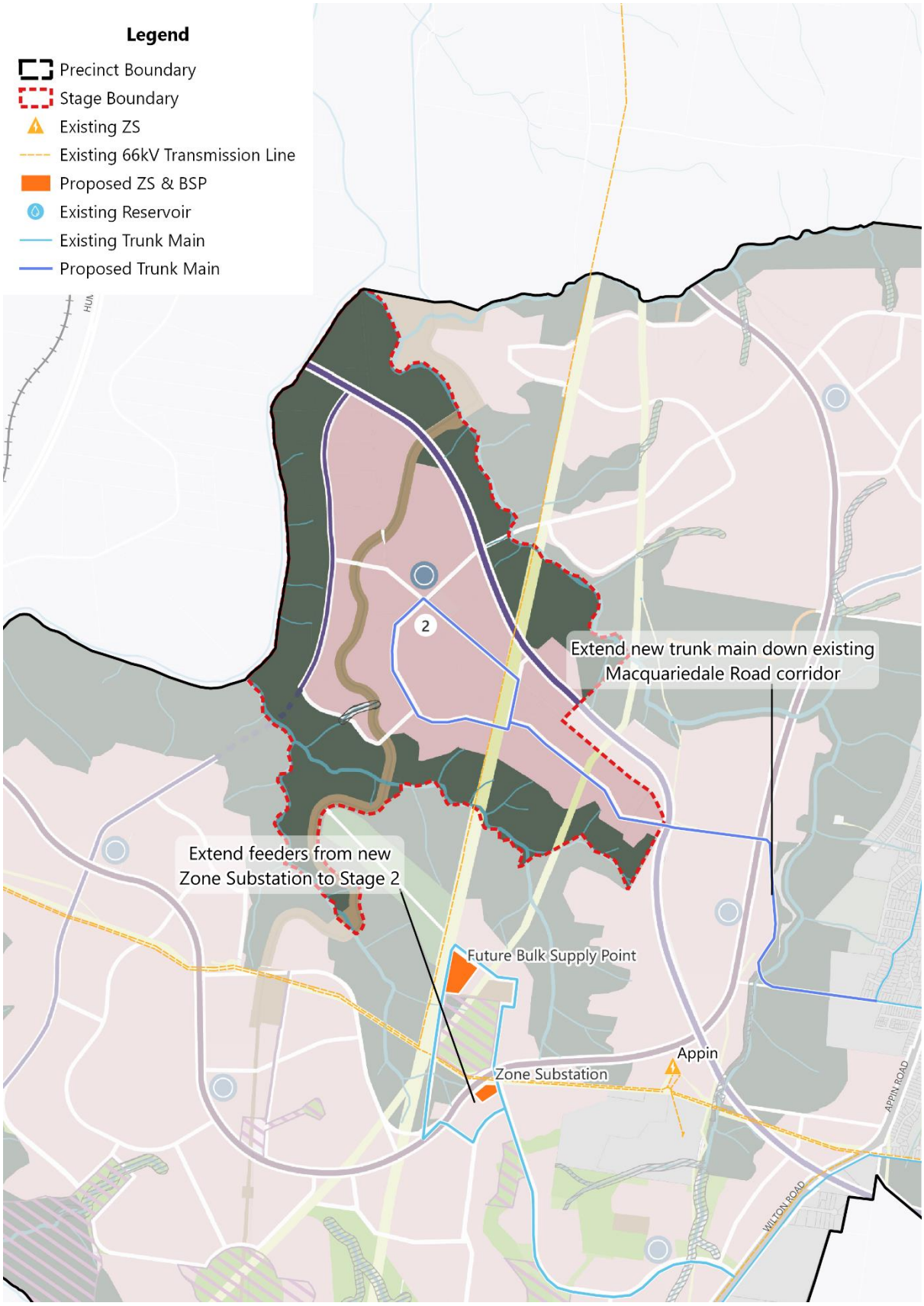
4.2.2 Potable Water

Stage 2 will likely be serviced by extending the existing 300mm trunk main located in Macquariedale Road along the existing road corridor to the development front. Smaller reticulation mains will extend from this trunk main to supply individual dwellings.

4.2.1 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 8 - Stage 2 Water & Electrical Infrastructure



4.2.2 Sewer

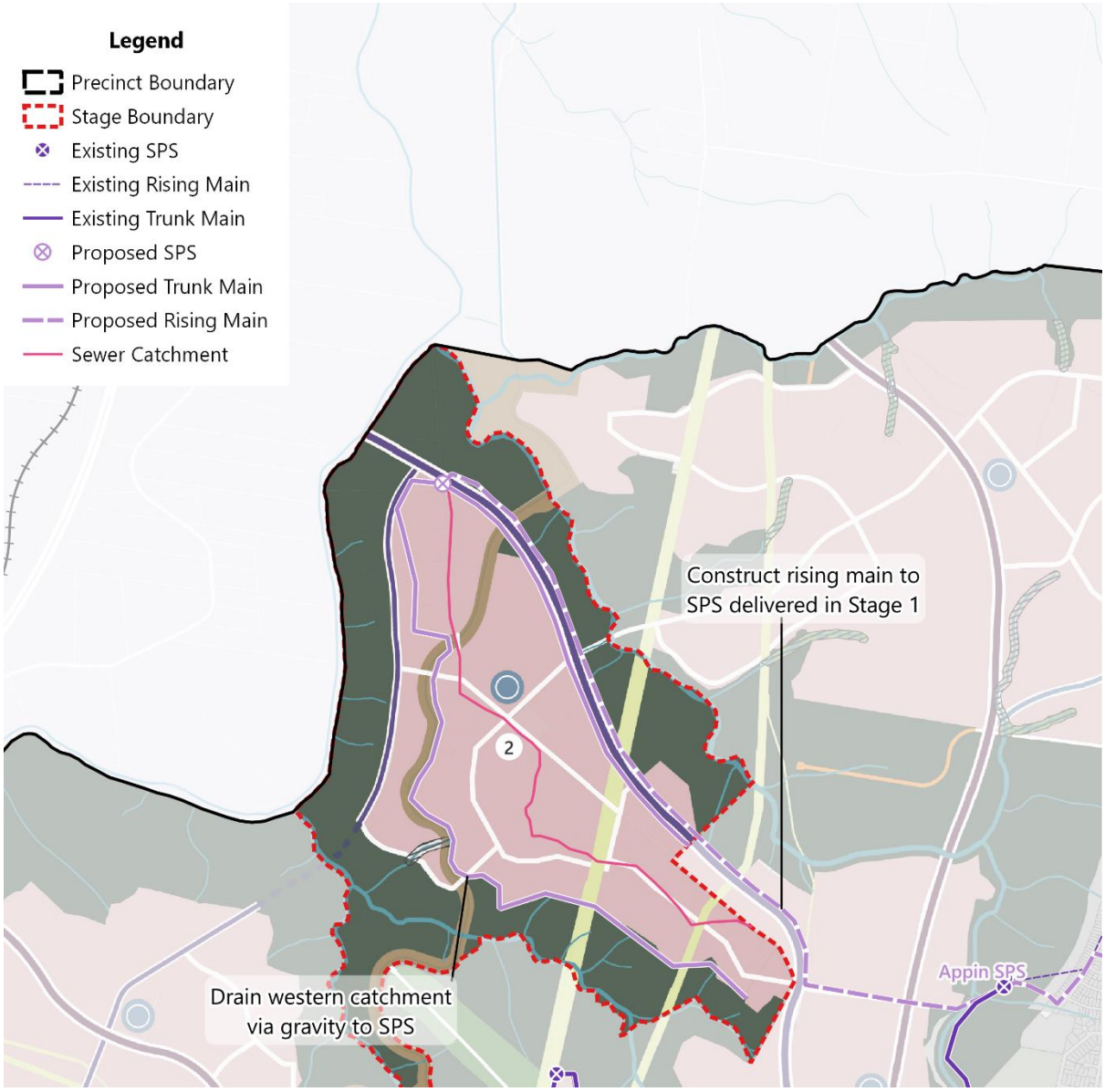
Stage 2 falls into two main sewer catchments:

- The northern catchment draining towards Ousedale Creek
- The western catchment draining towards the Nepean River

Both catchments can be drained via gravity to a low point at the northern end of development. From the low point, a new sewer pump station will transfer flows to the new Appin SPS via a rising main constructed along the existing Macquariedale Road corridor and crossing the Ousedale Creek corridor. This arrangement is shown in Figure 9 below.

The SPS within Stage 2 will ultimately transfer flows from the whole Appin precinct to a new wastewater treatment plant. This SPS should be sized sufficiently to support this growth (approximately 21,000+ dwellings).

Figure 9 - Stage 2 Sewer Infrastructure



4.3 SIC Infrastructure

4.3.1 Roads

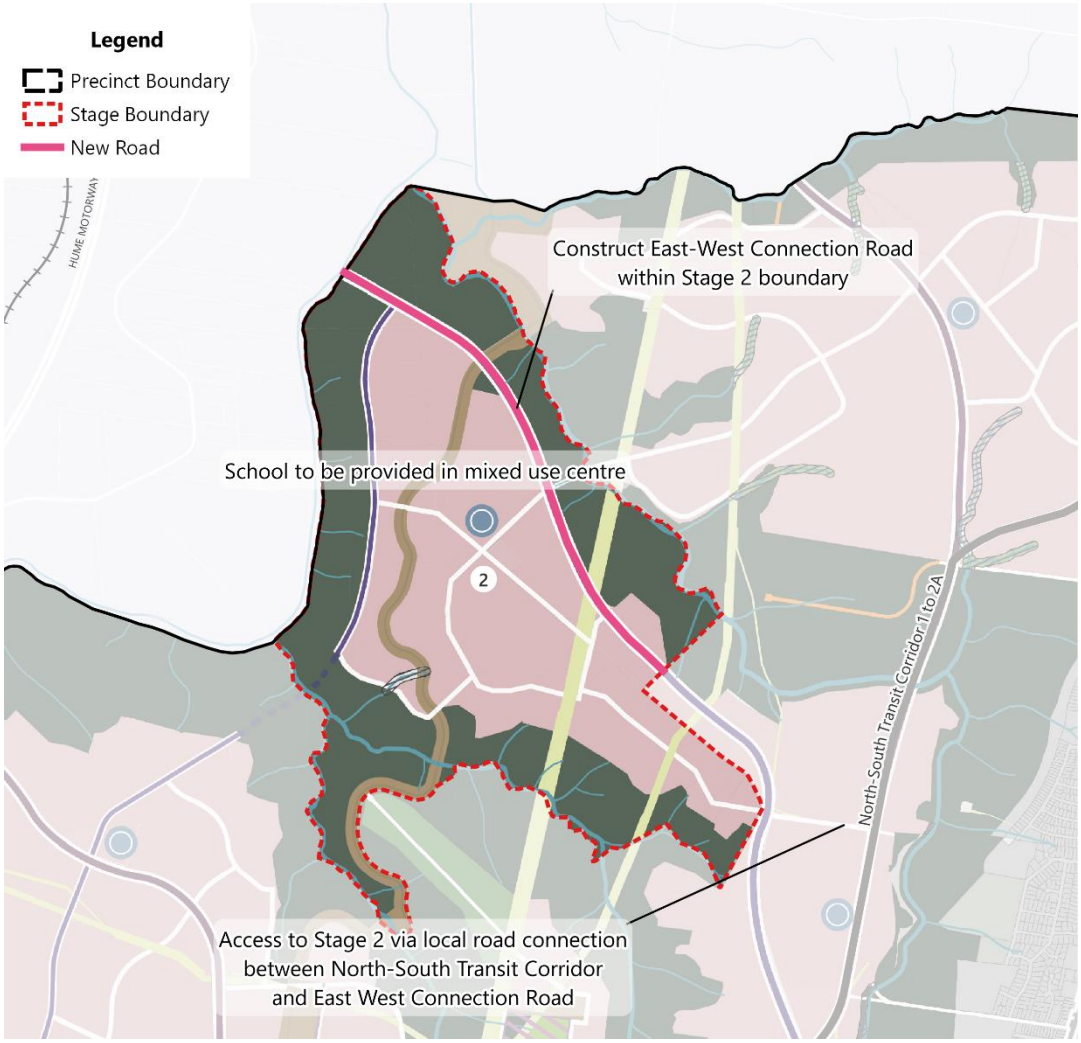
The key arterial road connection within Stage 2 is Part 1 of the East-West Connection Road, which will provide site access. The East-West Connection Road will provide two travel lanes in each direction and will extend the length of the Stage 2 boundary. Local road connections will be utilised to access Stage 2 from the east. The extents are shown in Figure 10 below.

Another development stage may be delivered simultaneously with Stage 2, which would bring forward the delivery of the link from the East-West Connection Road to the Hume Highway, this is required to support 8,000 dwellings.

4.3.2 Schools

Stage 2 includes a primary school with capacity for 1,000 students. The land for this school will be dedicated as part of the SIC (or delivered through alternative arrangements authorised by the state government). The proposed location is shown in Figure 10.

Figure 10 - Stage 2 SIC Infrastructure



4.4 Infrastructure Summary

A summary of the infrastructure required to support Stage 2 is provided in Table 7.

Table 7 - Stage 2 Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Electricity	11kV Feeders (lengths tbc subject to subdivision design)	3	item
Water	Trunk Mains	5,600	m
Sewer	Trunk Gravity Mains	6,400	m
	Rising Mains	4,100	m
	Sewer Pump Station	1	Item
Roads	East-West Connection Road Part 1	2,700	m
School	Primary School (1,000 students)	1.5	Ha

5 Stage 2A

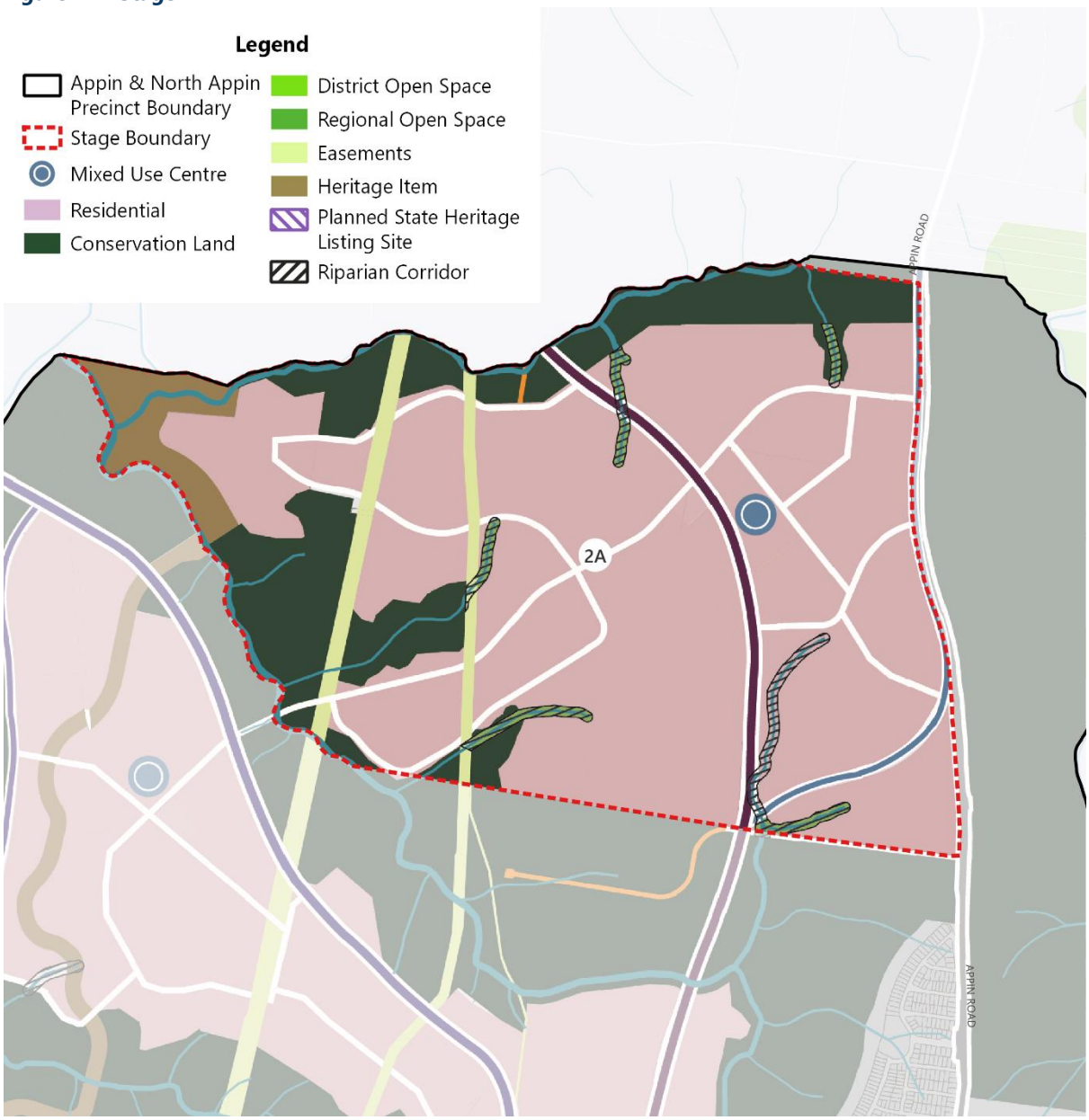
5.1 Development

Stage 2A includes the area bound by Mallaty Creek to the north, Appin Road to the east, Stage 3A to the south and Stage 2 to the west. Stage 2A includes the following development:

- 4,166 low density dwellings
- 188 medium density dwellings
- 3,000m^2 GFA retail/commercial
- Combined primary and secondary school (3,000 students)

Stage 2A is shown in Figure 11 below.

Figure 11 - Stage 2A



5.1 Utilities

5.1.1 Electricity

Endeavour Energy have indicated that a second zone substation will be required to support development in the northern part of the precinct. The North Appin ZS would be located within Stage 2A, adjacent the existing transmission lines. A minimum 8,280m^2 site would be required, with an indicative location shown in Figure 12 below.

High voltage feeders will be extended from the new ZS to development fronts. Based on an assumed 4,354 dwellings, four new 11kV feeders would be required to support development. Feeder locations have not been shown on Figure 12 for clarity.

Table 8 - Stage 2A Electricity Demand

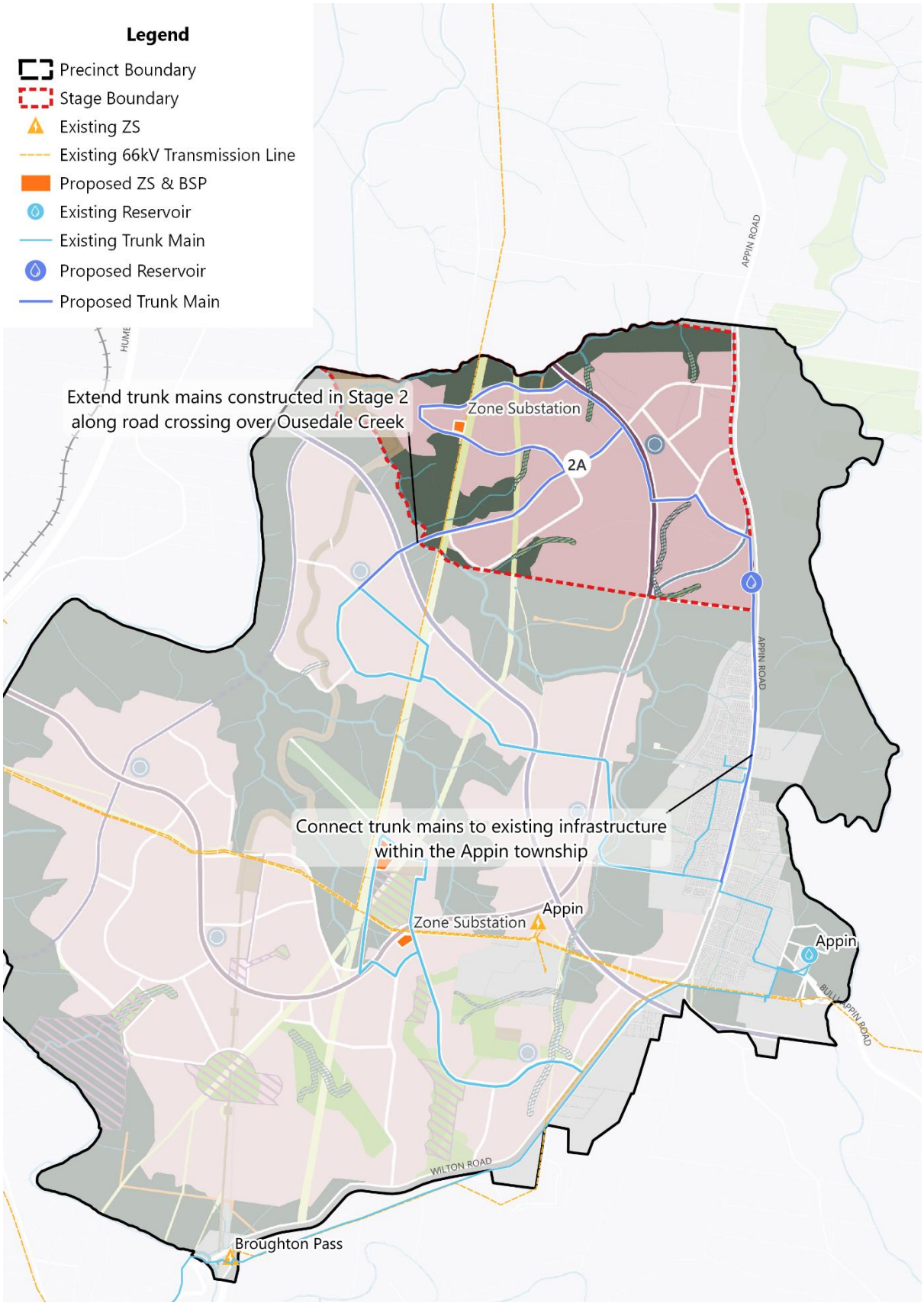
Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	16.7	3.7
Medium Density Residential	4.0/dwelling	0.8	0.2
Retail	0.1/sqm GFA	0.2	0.1
Commercial	0.085/sqm GFA	0.1	0.0
School	0.085/sqm GFA	2.2	0.5
Total		**19.9**	**4.4**

5.1.2 Potable Water

Sydney Water have indicated a new potable water reservoir will be required to support development in Appin. An indicative location for a new reservoir is shown in Figure 12, however the preferred location will be subject to Sydney Water assessment.

Stage 2A will be serviced by extending the recently constructed mains within Stage 2. A collector road crossing over Ousedale Creek will be used to connect potable water infrastructure between the stages. Trunk mains will connect to the new reservoir and extend along Appin Road to connect back to existing trunk infrastructure within the Appin township. Trunk mains will run along key road corridors within Stage 2A, with smaller reticulation mains provided in local roads to supply individual dwellings.

Figure 12 - Stage 2A Water & Electrical Infrastructure



5.1.3 Sewer

Sydney Water are planning for a new treatment plant to support development within the Appin precinct and surrounding area. Planning and delivery for a new treatment plant is expected to take between 7-10 years. To provide a conservative estimate for this assessment, as advised by Sydney Water, we have assumed the new treatment plant will be operational in 10 years, by 2032. This date aligns with the current delivery timing for Stage 2A.

No location has been determined for the Upper Nepean Treatment Plant (TP), however for the purpose of this assessment we have shown an indicative location near the Nepean River on Figure 13 below. Please note this location is indicative only and the final location will be subject to detailed assessment by Sydney Water.

Once the Upper Nepean TP is operational, it is expected that initial stages of development which previously utilised the Glenfield WRP will be switched over to the new treatment plant. All future development will also utilise the Upper Nepean TP.

To transfer flows to the Upper Nepean TP, the SPS constructed at the low point in Stage 2 will be utilised, with a new rising main constructed along the East-West Connection Road and Hume Highway. It is expected this rising main would need to cross the rail corridor, depending on the final location of the TP. A preferred configuration for this connection will be confirmed by Sydney Water and could be potentially located further to north to support adjacent developments.

Within Stage 2A, development falls into three sewer catchments:

- Northern catchment draining to Mallaty Creek
- South eastern catchment draining to Lily Ponds Gully, a tributary of Ousedale Creek
- Southern catchment draining to Ousedale Creek

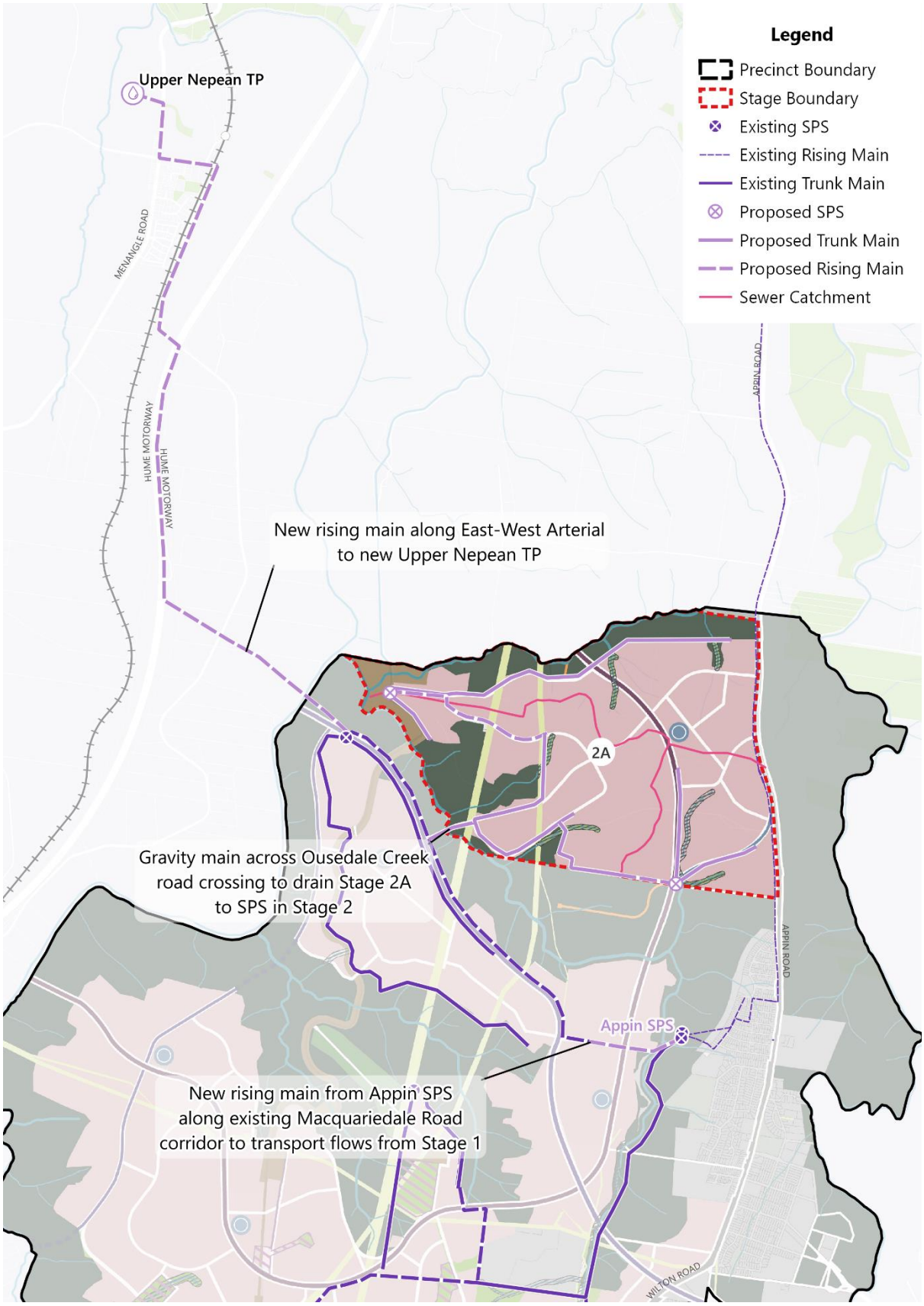
Two pump stations would be required to transfer flows from the northern and south eastern catchment to the discharge point in the southern catchment. From the southern catchments, a main would be constructed along the Ousedale Creek road crossing, connecting to the SPS in Stage 2. This arrangement is shown in Figure 5 below.

In addition, to transfer flows from Stage 1 to the Upper Nepean TP a new rising main from the Appin SPS would be constructed along the existing Macquariedale Road corridor, connecting to a gravity main in Stage 2. The rising main along Appin Road used to transfer flows to the Glenfield WRP would be decommissioned.

5.1.1 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 13 - Stage 2A Sewer Infrastructure



5.2 SIC Infrastructure

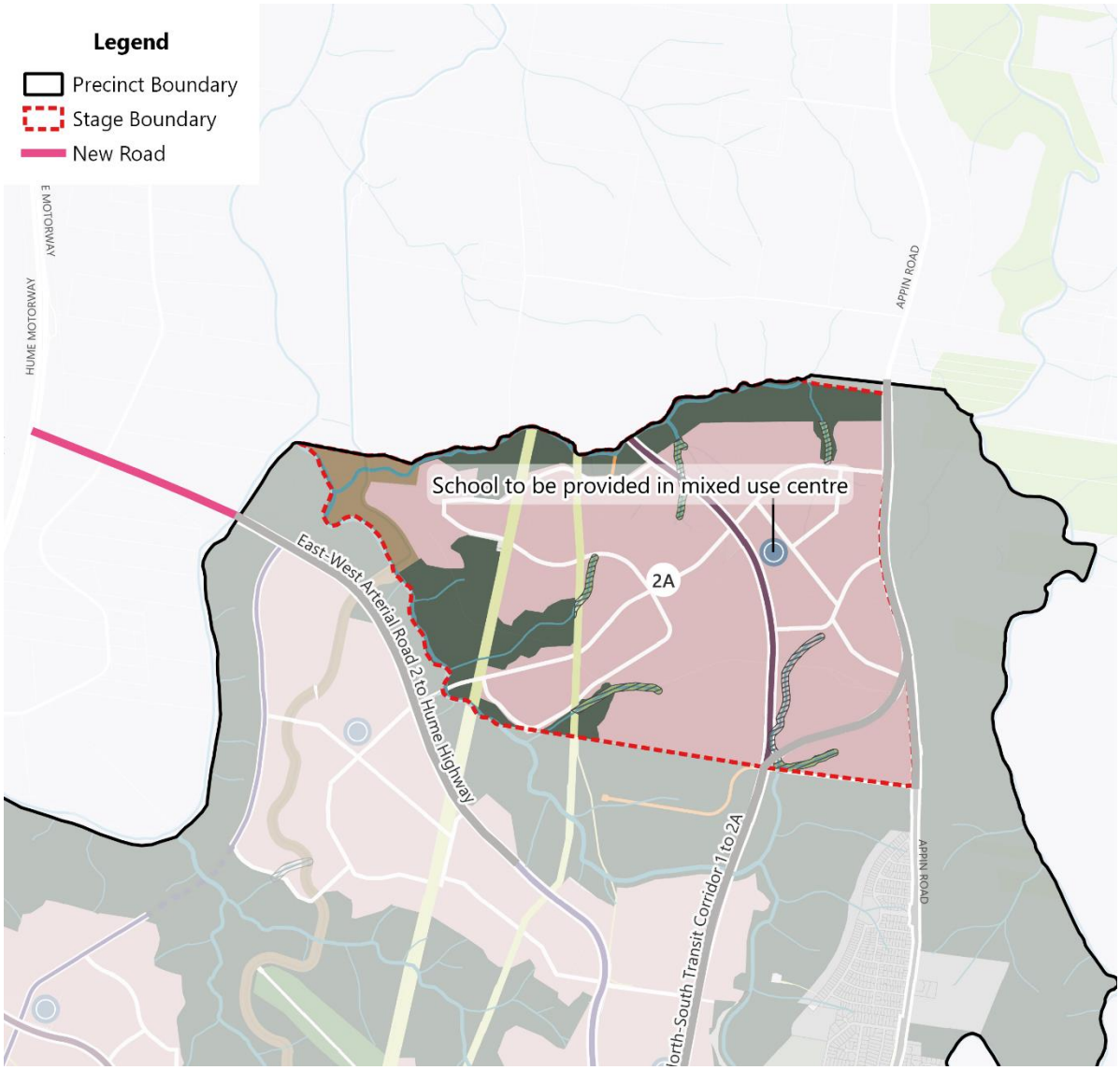
5.2.1 Roads

The connection of the East-West Connection Road to the Hume Highway will be required when the Appin Precinct reaches 8,000 new dwellings. This is anticipated to occur within Stage 2A; however it should be noted that if Stages 2 and 2A are developed concurrently, this infrastructure would be delivered earlier. This connection will relieve pressure on Appin Road and provide additional access to the development.

5.2.2 Schools

Stage 2A includes a combined primary and secondary school with capacity for 3,000 students. The land for this school will be dedicated as part of the SIC and the proposed location is shown in Figure 14.

Figure 14 - Stage 2A SIC Infrastructure



5.1 Infrastructure Summary

A summary of the infrastructure required to support Stage 2A is provided in Table 9 below.

Table 9 - Stage 2A Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Electricity	11kV Feeders (lengths tbc subject to subdivision design)	4	item
Water	Trunk Mains	10,200	m
	Reservoir	1	item
Sewer	Trunk Gravity Mains	8,400	m
	Rising Mains	9,300	m
	Sewer Pump Station	2	Item
Roads	East-West Connection Road Part 1 (Hume Highway Connection)	1,600	m
School	Combined Primary and Secondary School (3,000 students)	4.0	Ha

6 Stage 3

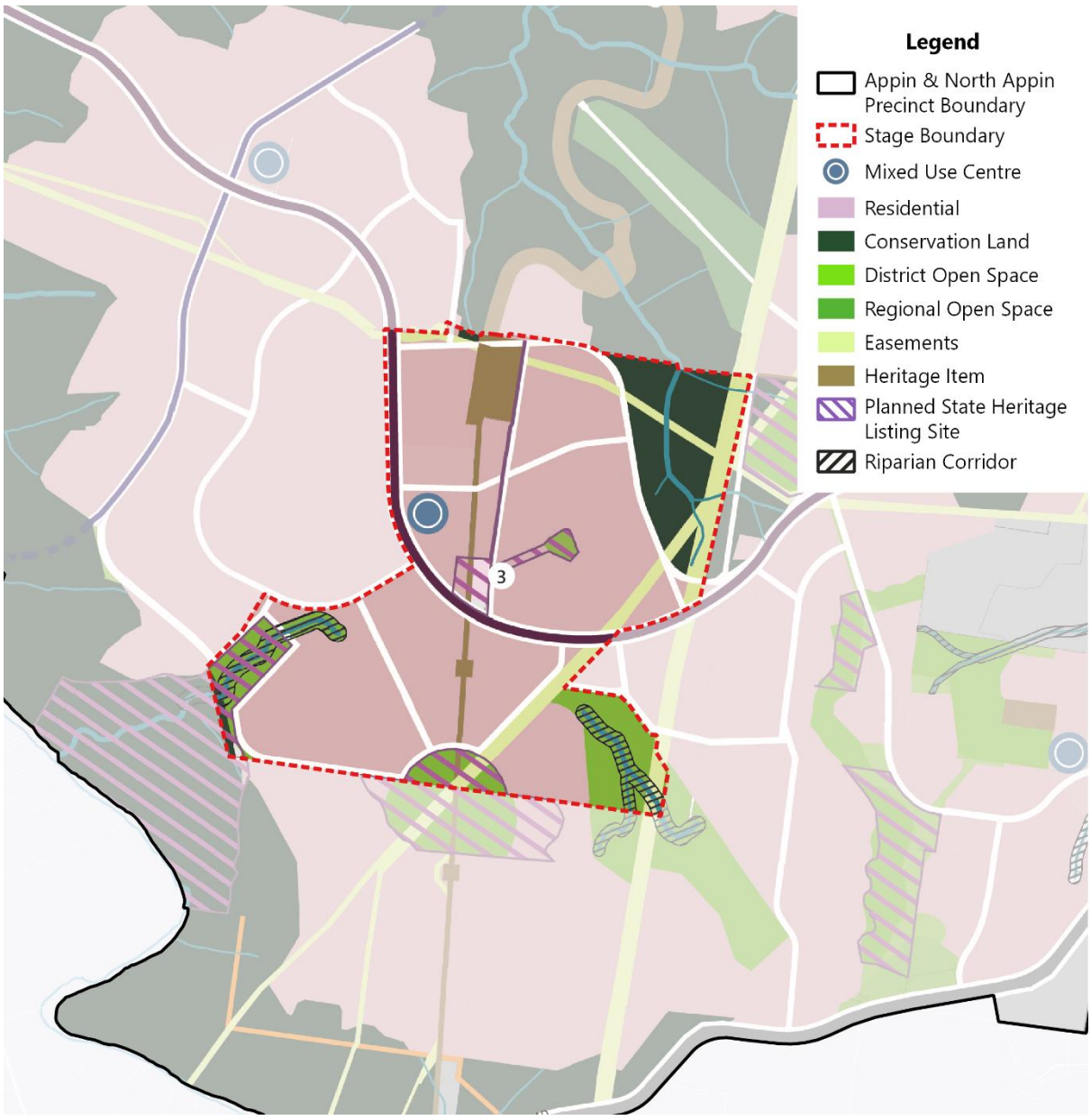
6.1 Development

Stage 3 includes the area bound by Stage 1 to the north and east, Stage 4A to the south and Stages 4 and 5 to the west. Development within Stage 3 includes:

- 1,287 low density dwellings
- 2,064 medium density dwellings
- 3,000m^2 GFA retail/commercial
- Combined primary and secondary school (3,000 students)

Stage 3 is shown in Figure 15 below.

Figure 15 - Stage 3



6.2 Utilities

6.2.1 Electricity

Development within Stage 3 will be supplied via the Appin ZS. The calculated electrical demands are provided in Table 14. Based on the below demands, we would expect three to four feeders would be required to support development in Stage 3. Feeders have not been shown on Figure 16 for clarity.

Table 10 - Stage 3 Electricity Demand

Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	5.1	1.1
Medium Density Residential	4.0/dwelling	8.3	1.8
Retail	0.1/sqm GFA	0.2	0.1
Commercial	0.085/sqm GFA	0.1	0.0
School	0.085/sqm GFA	2.0	0.5
Total		**15.7**	**3.5**

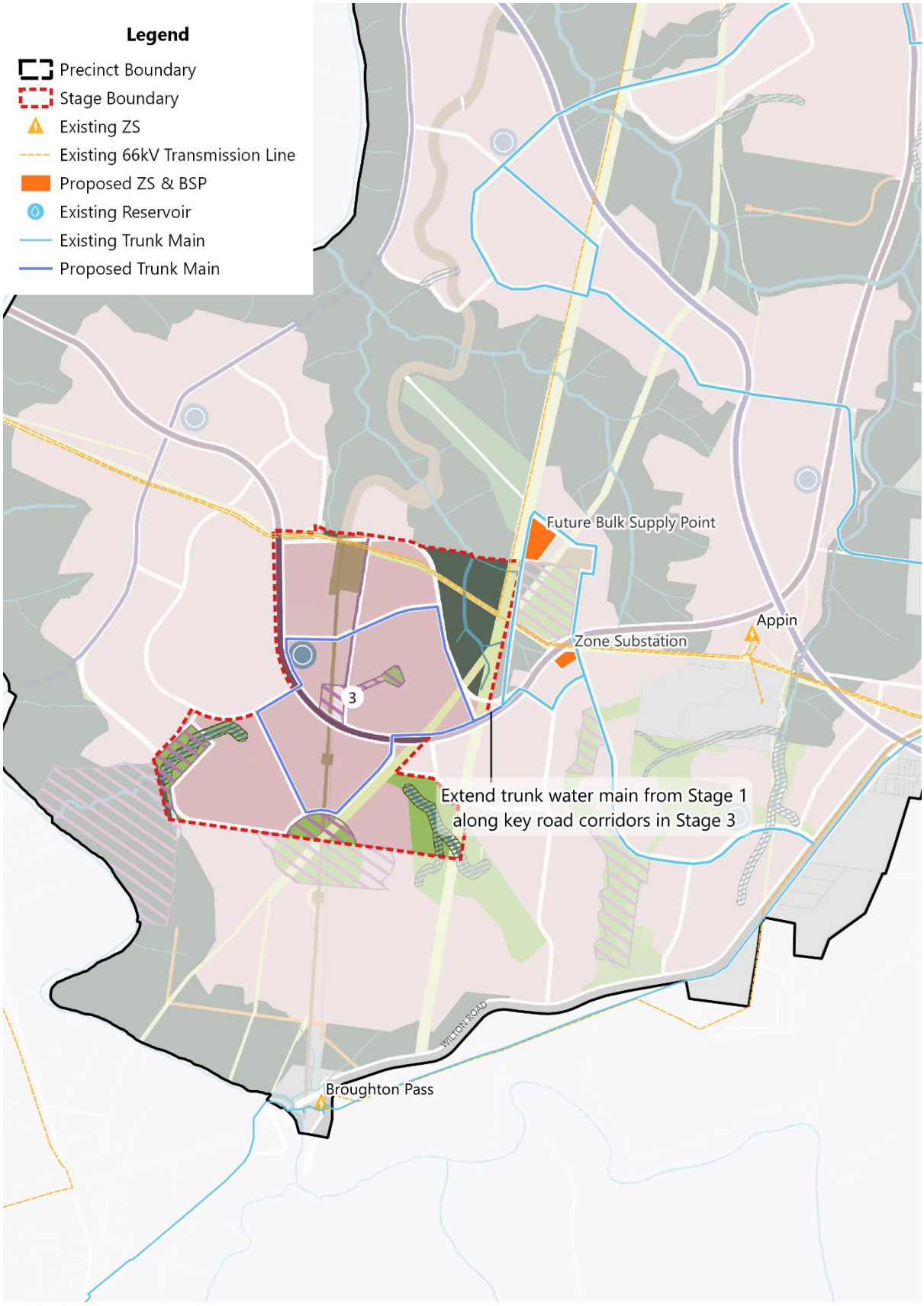
6.2.2 Potable Water

Stage 3 will receive potable water servicing by extending the mains in Stage 1. A 375mm trunk main will be constructed as a loop traversing collector roads. Smaller reticulation mains will extend from this trunk main along local roads to supply individual dwellings.

6.2.1 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 16 - Stage 3 Water & Electrical Infrastructure



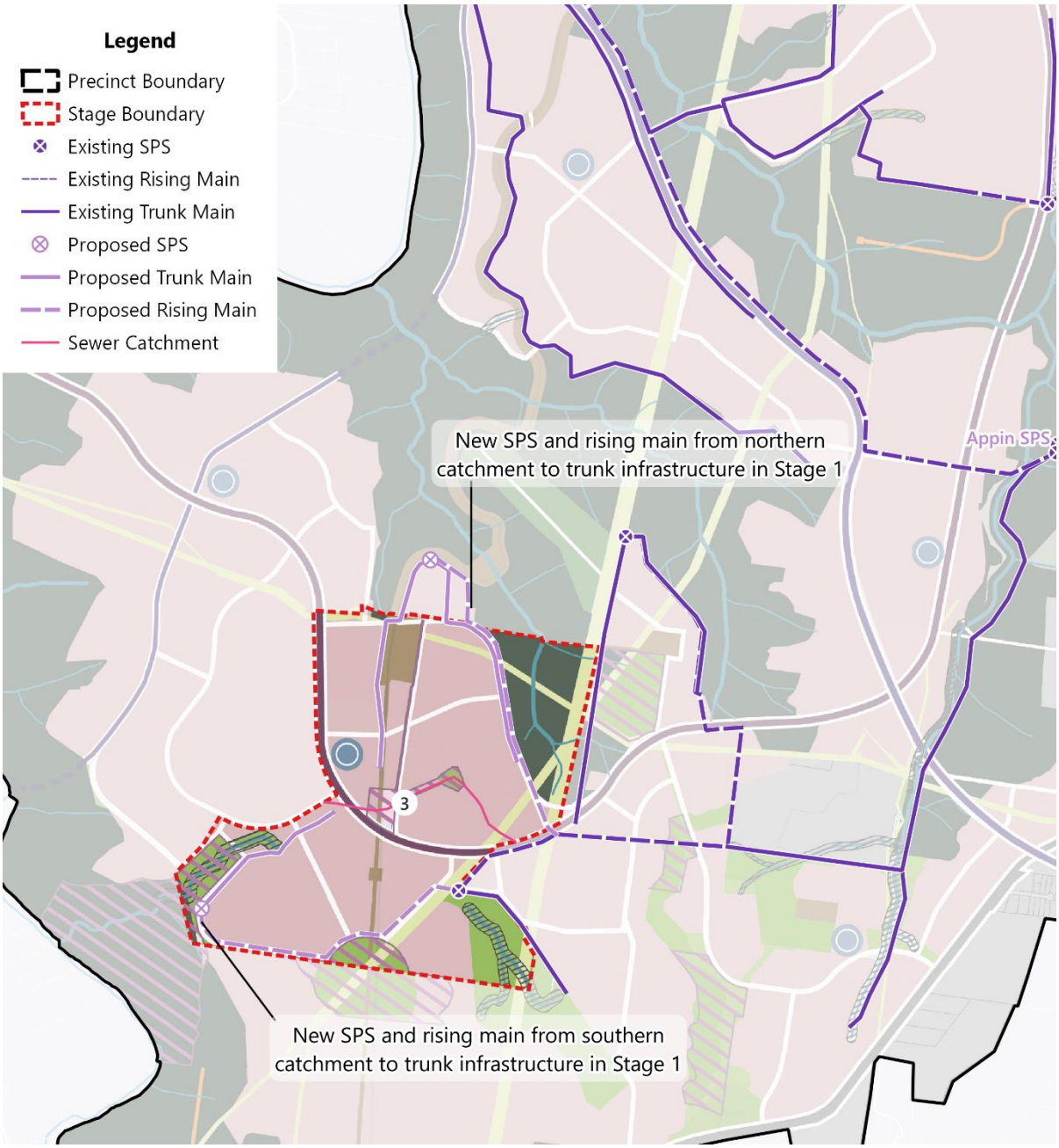
6.2.2 Sewer

Within Stage 3, development falls into two sewer catchments:

- Northern catchment draining to Simpsons Creek
- Southern catchment draining to the Nepean River

Two pump stations would be required to transfer flows from the northern and southern catchments to the trunk infrastructure located in Stage 1. From Stage 1, flows would be transferred via the Appin SPS and Stage 2 SPS to the Upper Nepean TP. This arrangement is shown in Figure 17 below.

Figure 17 - Stage 3 Sewer Infrastructure



6.3 SIC Infrastructure

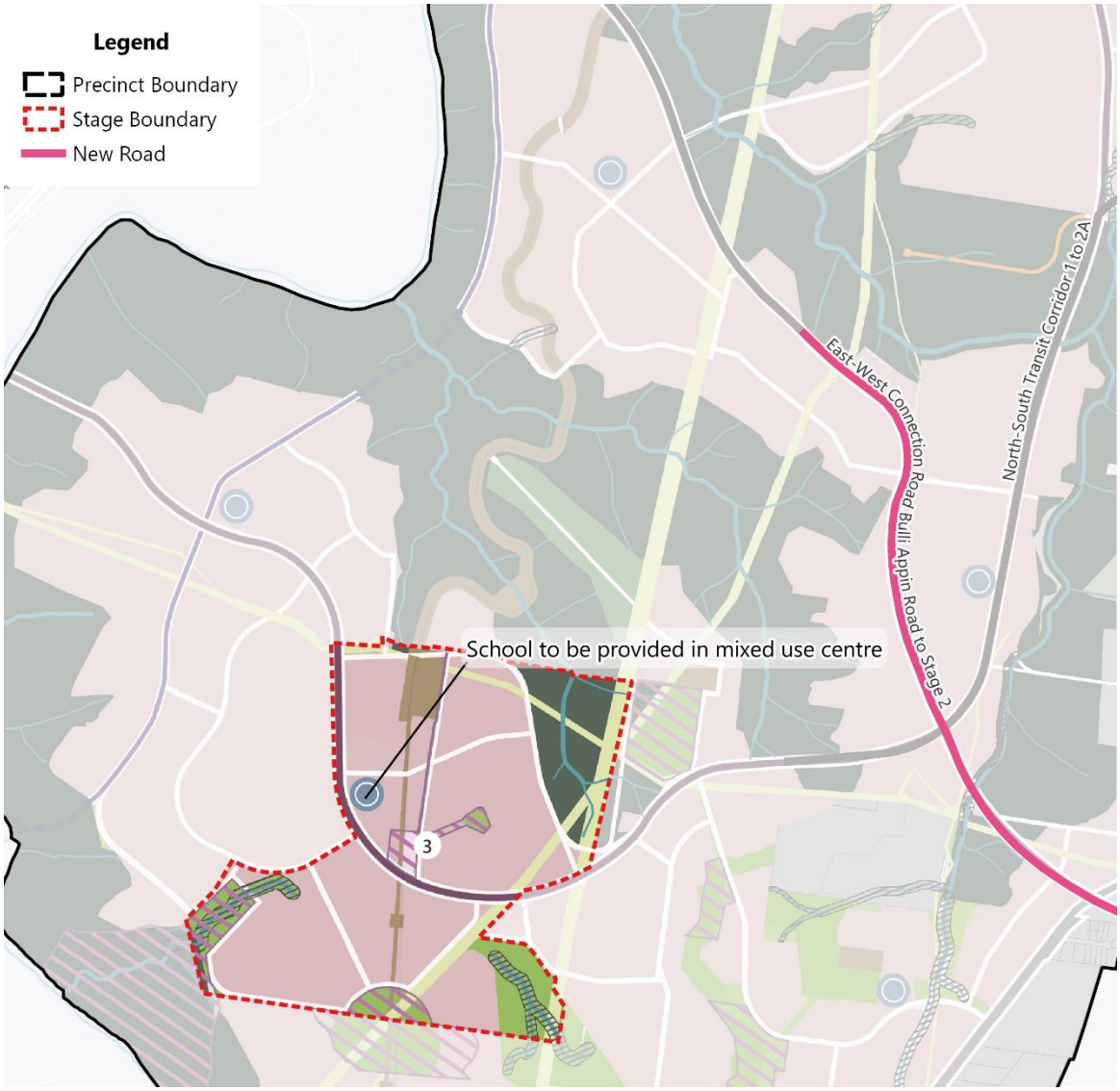
6.3.1 Roads

Stage 3 will include the construction of Part 2 of the East-West Connection Road. This section will connect Part 1 of the East-West Connection Road (constructed in Stage 2) to Appin Road and will be required to support 14,000 new dwellings, which is expected to occur towards the end of Stage 3. Delivery of this road is expected to relieve pressure on Appin Road through the Appin township. The extent of works is shown in Figure 18 below.

6.3.2 School

Stage 3 includes a combined primary and secondary school with capacity for 3,000 students. The land for this school will be dedicated as part of the SIC and the proposed location is shown in Figure 18.

Figure 18 - Stage 3 SIC Infrastructure



6.4 Infrastructure Summary

A summary of the infrastructure required to support Stage 3 is provided in Table 11 below.

Table 11 - Stage 3 Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Electricity	11kV Feeders (lengths tbc subject to subdivision design)	3	item
Water	Trunk Mains	4,300	m
Sewer	Trunk Gravity Mains	3,100	m
	Rising Mains	3,300	m
	Sewer Pump Station	2	Item
Roads	East-West Connection Road Part 2 – Stage 3 to Appin Road	5,900	m
School	Combined primary and secondary school (3,000 students)	4	Ha

7 Stage 3A

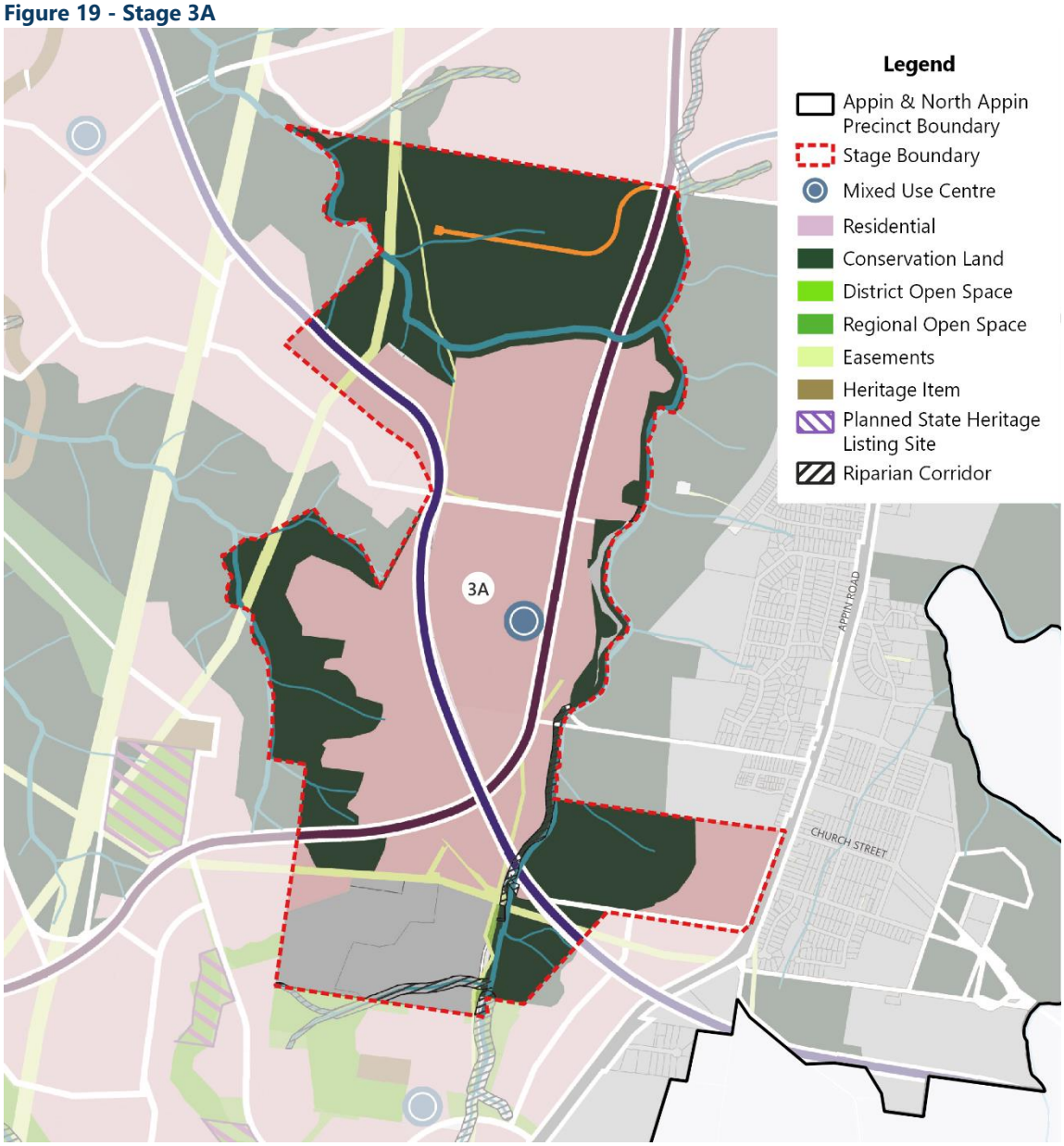
7.1 Development

Stage 3A includes the area on the eastern boundary of the precinct. The stage is bound by Stage 2A to the north, the existing Appin township to the east, Stage 1 to the south and Stage 2 to the west. Development within Stage 3A includes:

- 1,318 low density dwellings
- 982 medium density dwellings
- 30,000m^2 GFA retail/commercial
- Combined primary and secondary school (3,000 students)

Stage 3A is shown in Figure 19 below.

Figure 19 - Stage 3A



7.2 Utilities

7.2.1 Electricity

Development within Stage 3A will be supplied via the North Appin ZS. The calculated electrical demands are provided in Table 12. Based on the below demands, we would expect three feeders would be required to support development in Stage 3A.

Table 12 - Stage 3A Electricity Demand

Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	5.3	1.2
Medium Density Residential	4.0/dwelling	3.9	0.9
Retail	0.1/sqm GFA	2.5	0.6
Commercial	0.085/sqm GFA	0.4	0.1
School	0.085/sqm GFA	2.0	0.5
Total		**14.2**	**3.1**

7.2.2 Potable Water

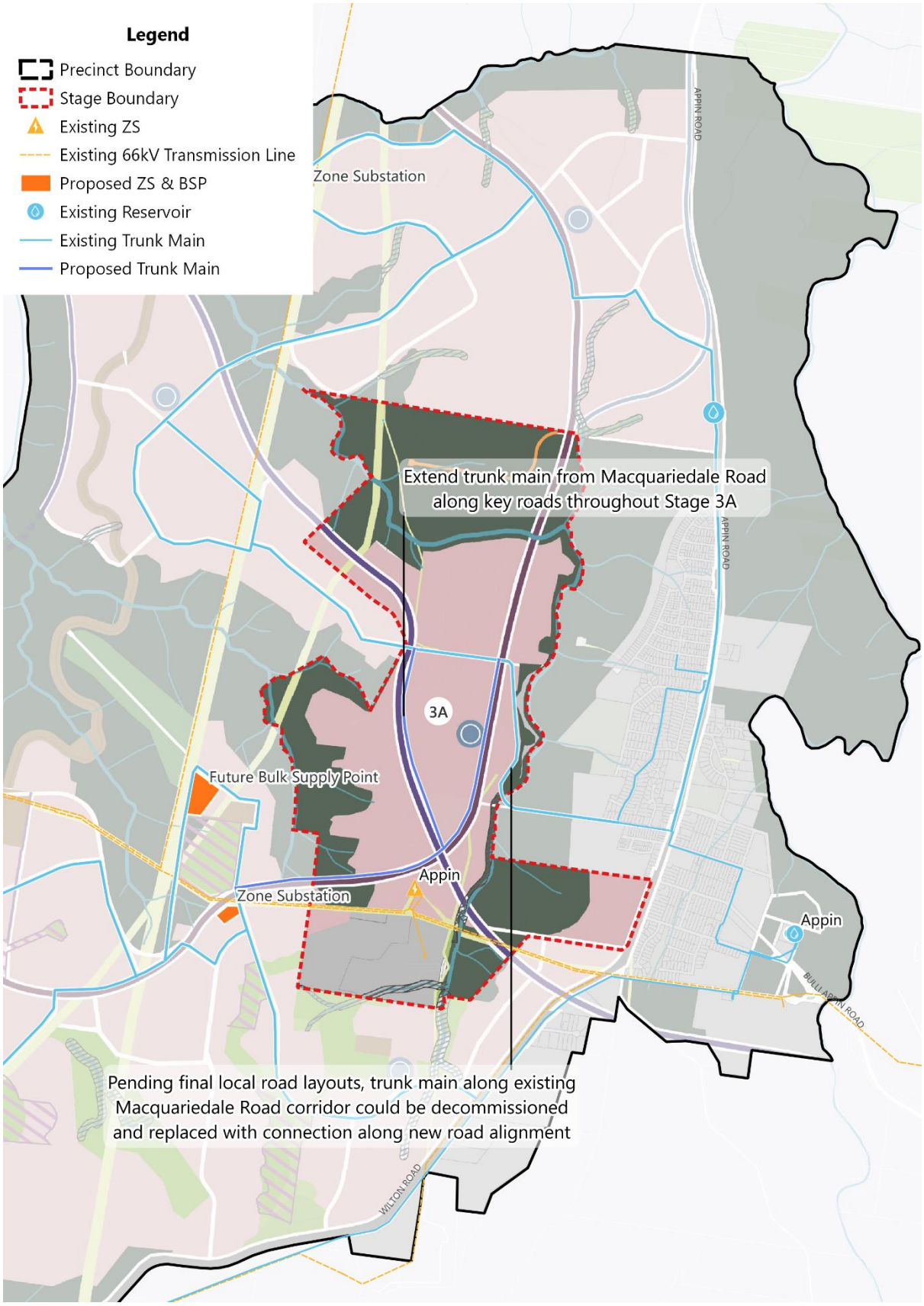
Stage 3A will leverage the trunk main constructed along Macquariedale Road to support Stage 2. The existing Macquariedale Road alignment appears to follow the lot boundaries on the eastern side of Stage 3A. The final local road layout is unknown at this stage, however should Macquariedale Road be demolished, the main along this road could be decommissioned and an alternative connection constructed along the collector road connecting the North-South Transit Corridor to the Macquariedale Road extents outside the precinct boundary.

Trunk mains will be extending along key roads throughout the stage, with smaller reticulation mains constructed along local roads to supply individual lots. The proposed trunk water infrastructure is shown in Figure 20 below.

7.2.1 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 20 - Stage 3A Water & Electrical Infrastructure



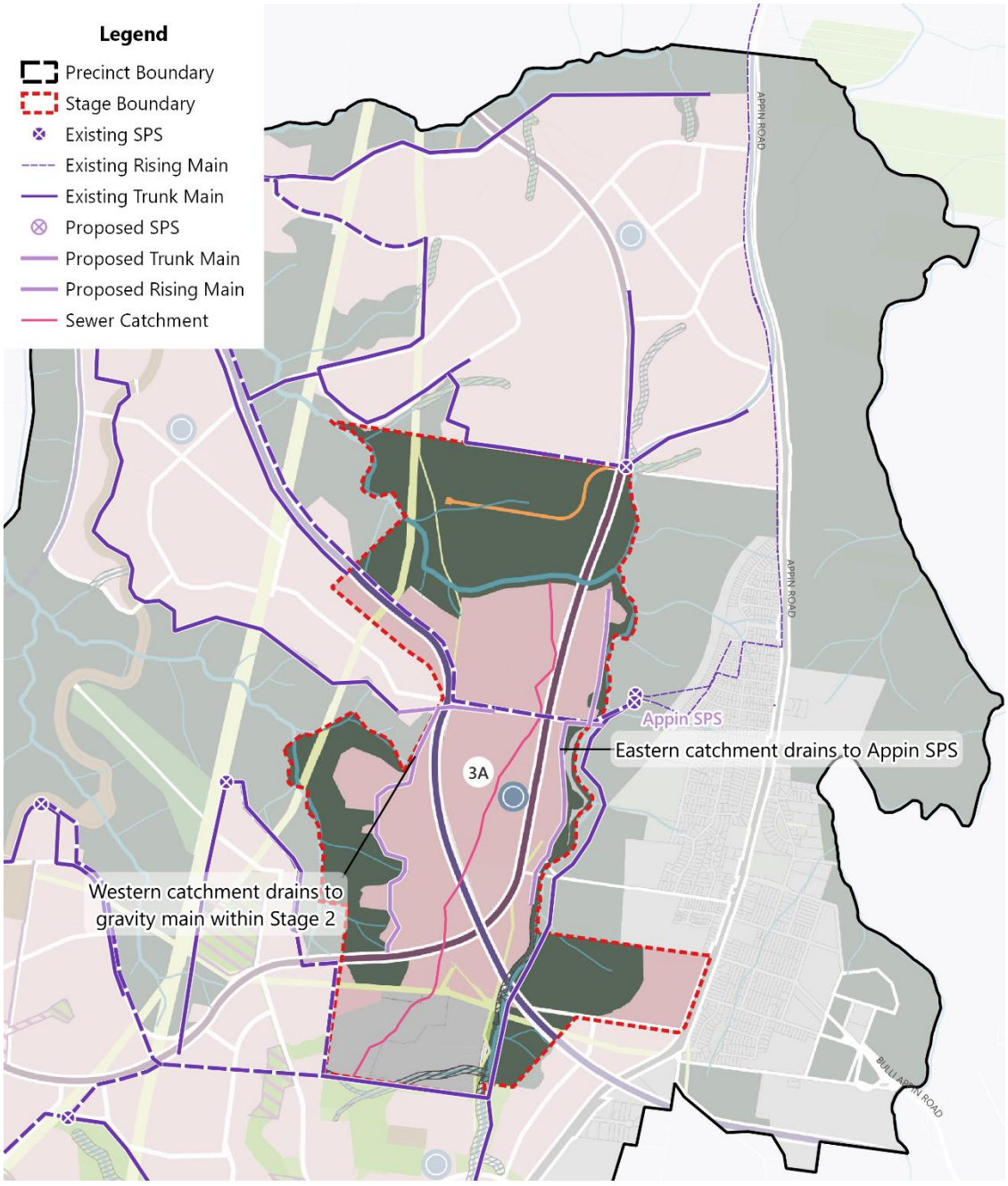
7.2.2 Sewer

Stage 3A falls into two sewer catchments:

- Western catchment draining to Elladale Creek
- Eastern catchment draining to Ousedale Creek

The western catchment will drain to the gravity main along Macquariedale Road. The eastern catchment will drain via gravity to the Appin SPS. A new gravity main will be constructed along the development boundary before crossing the creek to connect to the trunk main draining to the Appin SPS. This arrangement is shown in Figure 21 below.

Figure 21 - Stage 3A Sewer Infrastructure



7.3 SIC Infrastructure

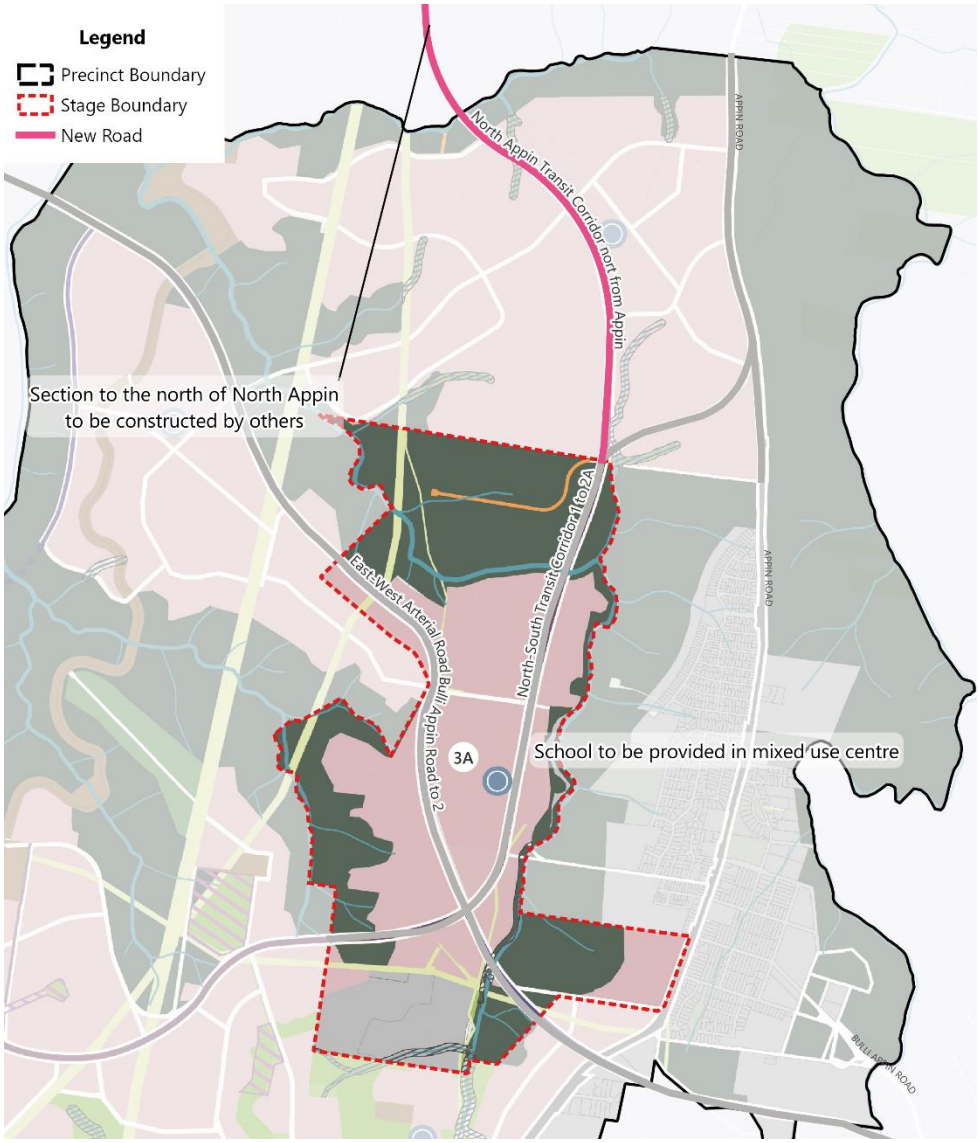
7.3.1 Roads

Stage 3A works will include Part 2 of the North-South Transit Corridor which will be constructed within Stage 2A. This connection will enable high quality and efficient public transport services to operate to Macarthur Station once sections to the north are completed by other developers. Part 2 of the North-South Transit Corridor is required to support 14,600 dwellings, however it may be delivered earlier, to align with development within Stage 2A.

7.3.2 School

Stage 3A includes a combined primary and secondary school with capacity for 3,000 students. The land for this school will be dedicated as part of the SIC and the proposed location is shown in Figure 22.

Figure 22 - Stage 3A SIC Infrastructure



7.4 Infrastructure Summary

A summary of the infrastructure required to support Stage 3A is provided in Table 13.

Table 13 - Stage 3A Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Electricity	11kV Feeders (lengths tbc subject to subdivision design)	3	item
Water	Trunk Mains	3,600	m
Sewer	Trunk Gravity Mains	3,600	m
Roads	North-South Transit Corridor Part 2 – Stage 2A & North	2,200	m
School	Combined primary and secondary school (3,000 students)	4	Ha

8 Stage 4

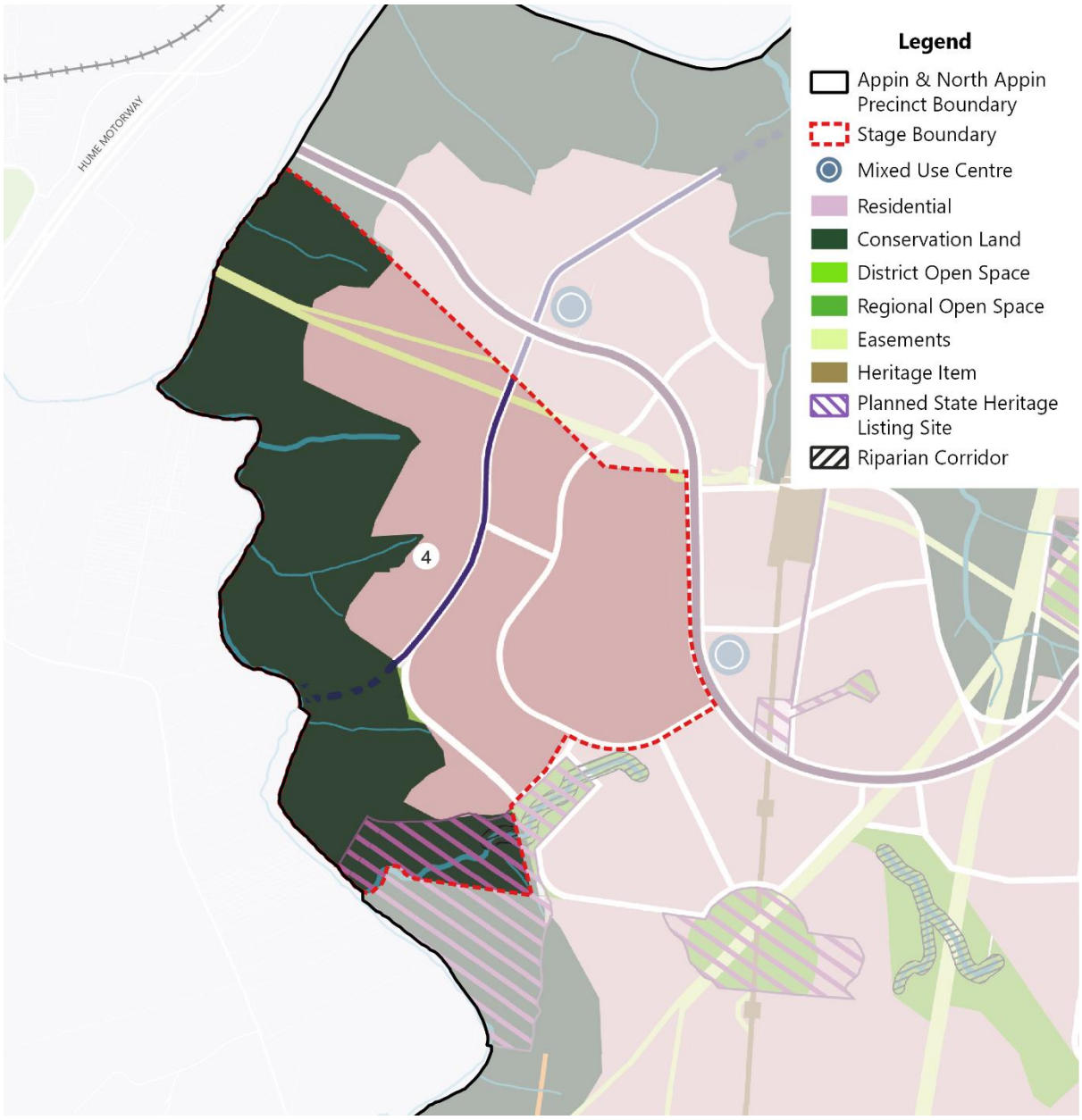
8.1 Development

Stage 4 includes the area on the western boundary of the precinct. Stage 4 is bound by Stage 5 to the north, Stage 3 to the east, Stage 4A to the south and the Cataract and Nepean Rivers to the west. Development within Stage 4 includes:

- 2,584 low density dwellings
- 214 medium density dwellings

Stage 4 is shown in Figure 23.

Figure 23 - Stage 4



8.2 Utilities

8.2.1 Electricity

Development within Stage 4 will be supplied via the Appin ZS. The calculated electrical demands are provided in Table 14. Based on the below demands, we would expect 2-3 feeders would be required to support development in Stage 4. Feeder locations have not been shown in Figure 24 for clarity.

Table 14 - Stage 4 Electricity Demand

Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	10.3	2.3
Medium Density Residential	4.0/dwelling	0.9	0.2
Total		**11.2**	**2.5**

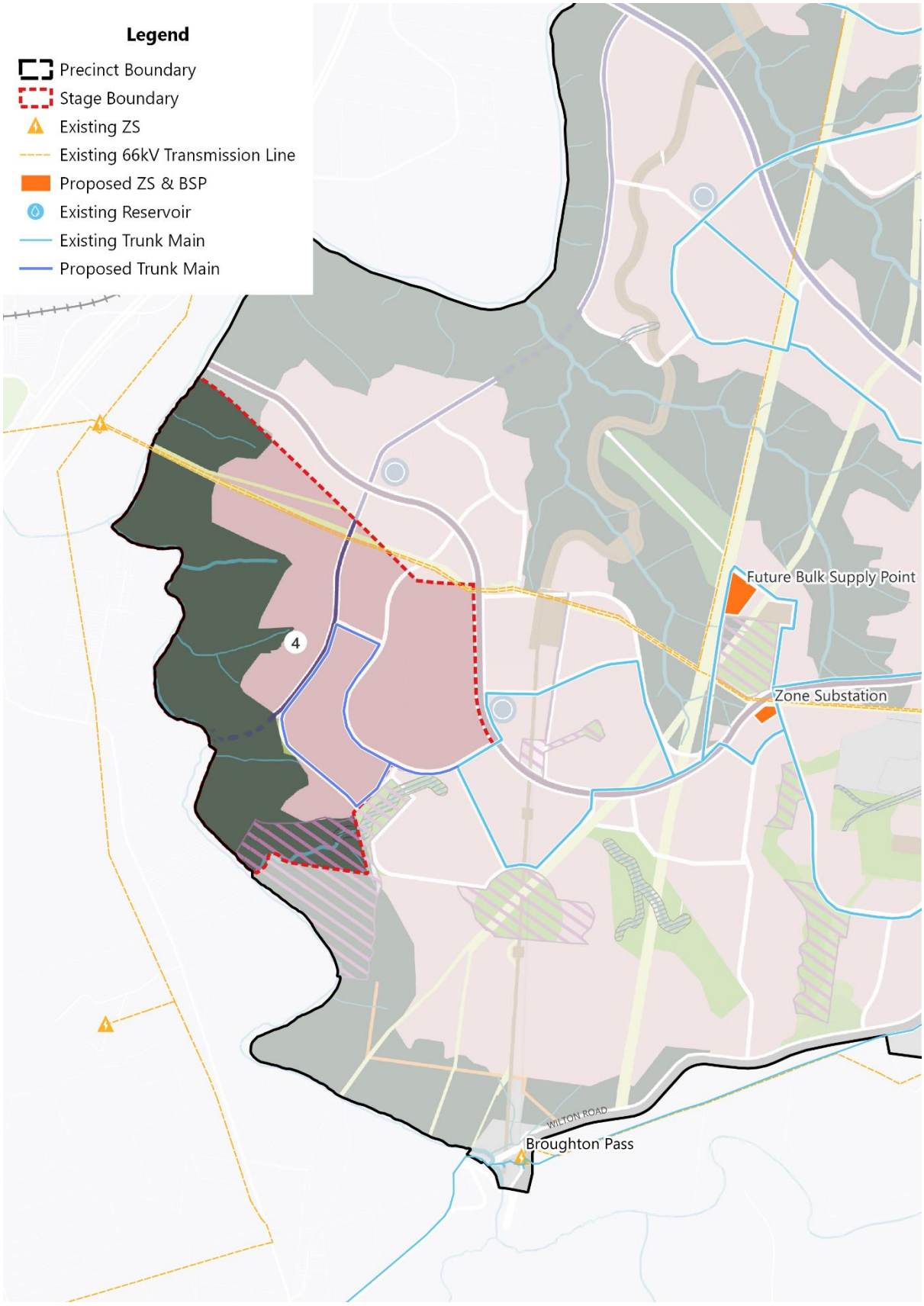
8.2.2 Potable Water

Trunk mains constructed within Stage 3 will be extended along the proposed collector roads within Stage 4. Smaller reticulation mains will extend from this trunk main along local roads to supply individual dwellings.

8.2.1 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 24 - Stage 4 Water & Electrical Infrastructure

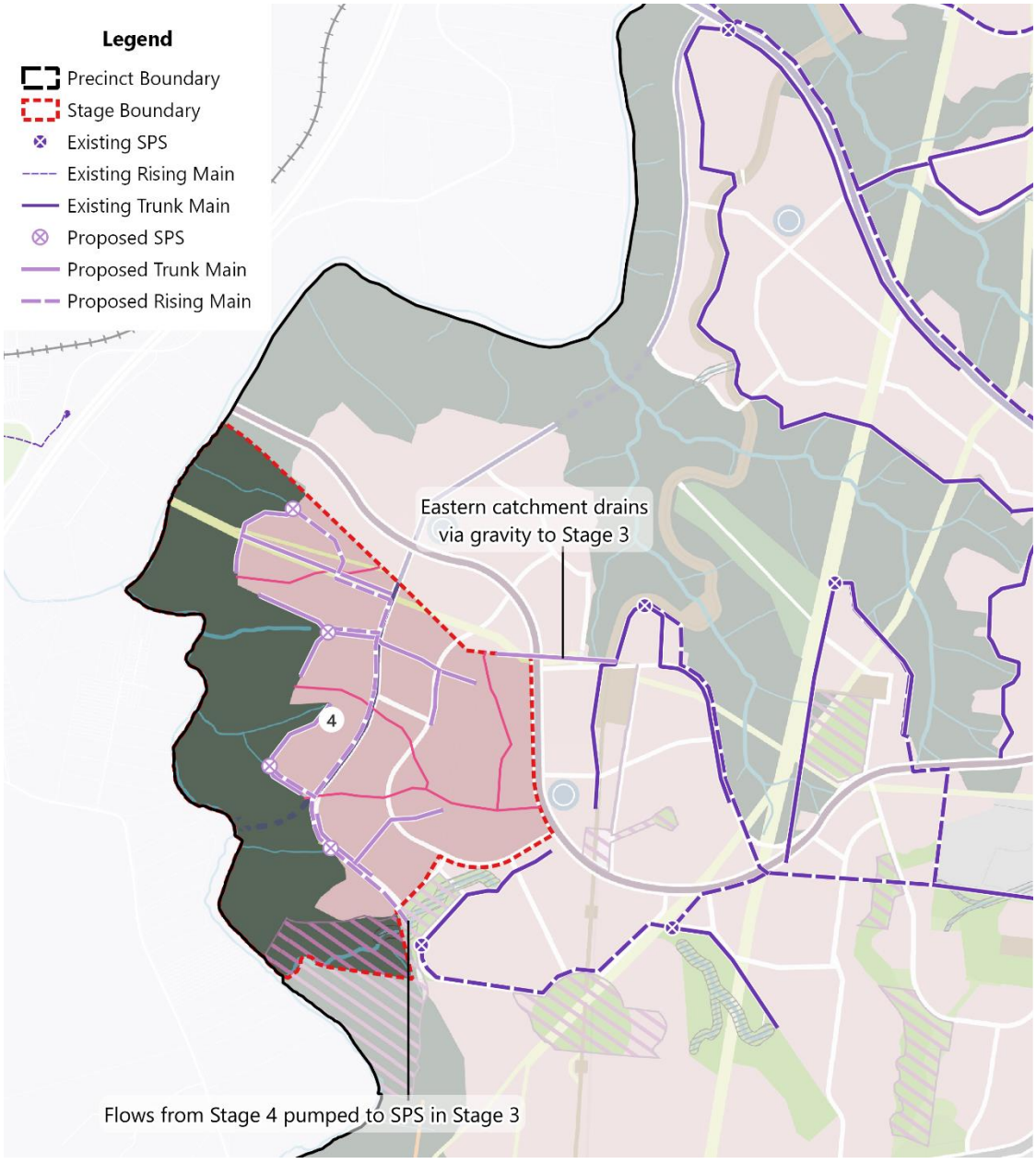


8.2.2 Sewer

Development in Stage 4 falls into five sewer catchments, four of which drain towards the Cataract and Nepean Rivers, with a small catchment on the eastern stage boundary draining towards Stage 3. Sewer from Stage 4 will be transferred to the Appin SPS via Stages 3 and 1, then to the Nepean TP.

Each catchment draining towards the Cataract and Nepean Rivers will include a small SPS which will pump flows to the SPS within the western catchment in Stage 3. There may be opportunities to minimise the number of pump stations required through site grading. This will be confirmed during the detailed design phase. A potential sewer servicing arrangement (assuming each catchment requires a pump station) is shown in Figure 25.

Figure 25 - Stage 4 Sewer Infrastructure



8.3 Infrastructure Summary

A summary of the infrastructure required to support Stage 4 is provided in Table 15 below.

Table 15 - Stage 4 Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Electricity	11kV Feeders (lengths tbc subject to subdivision design)	2-3	item
Water	Trunk Mains	3,200	m
Sewer	Trunk Gravity Mains	5,000	m
	Rising Mains	3,300	m
	Sewer Pump Station	4	Item

9 Stage 4A

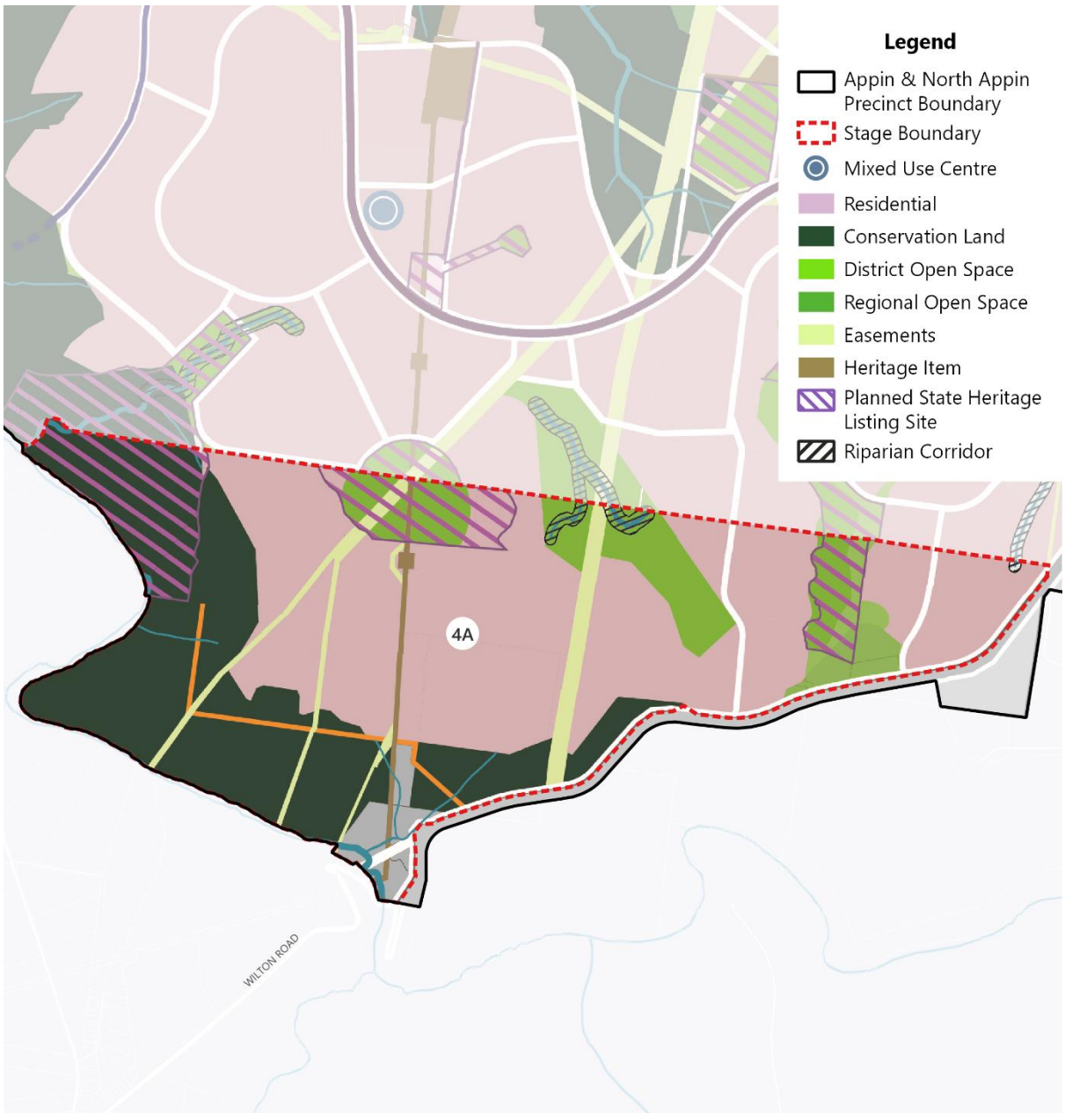
9.1 Development

Stage 4A includes the area at the southern end of the precinct. It is bound by Stages 1, 3 and 4 to the north, Wilton Road to the south and east and the Nepean River to the west. Development within Stage 4A includes:

- 630 low density dwellings

Stage 4A is shown in Figure 26 below.

Figure 26 - Stage 4A



9.2 Utilities

9.2.1 Electricity

Development within Stage 4A will be supplied via the Appin ZS. The calculated electrical demands are provided in Table 16. Based on the below demands, we would expect that the proposed development could likely be supported using spare capacity in existing feeders delivered in Stages 3 and 4. If a new feeder is required, it would likely originate from the Appin ZS.

Table 16 - Stage 4A Electrical Demand

Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	2.5	0.6
Total		**2.5**	**0.6**

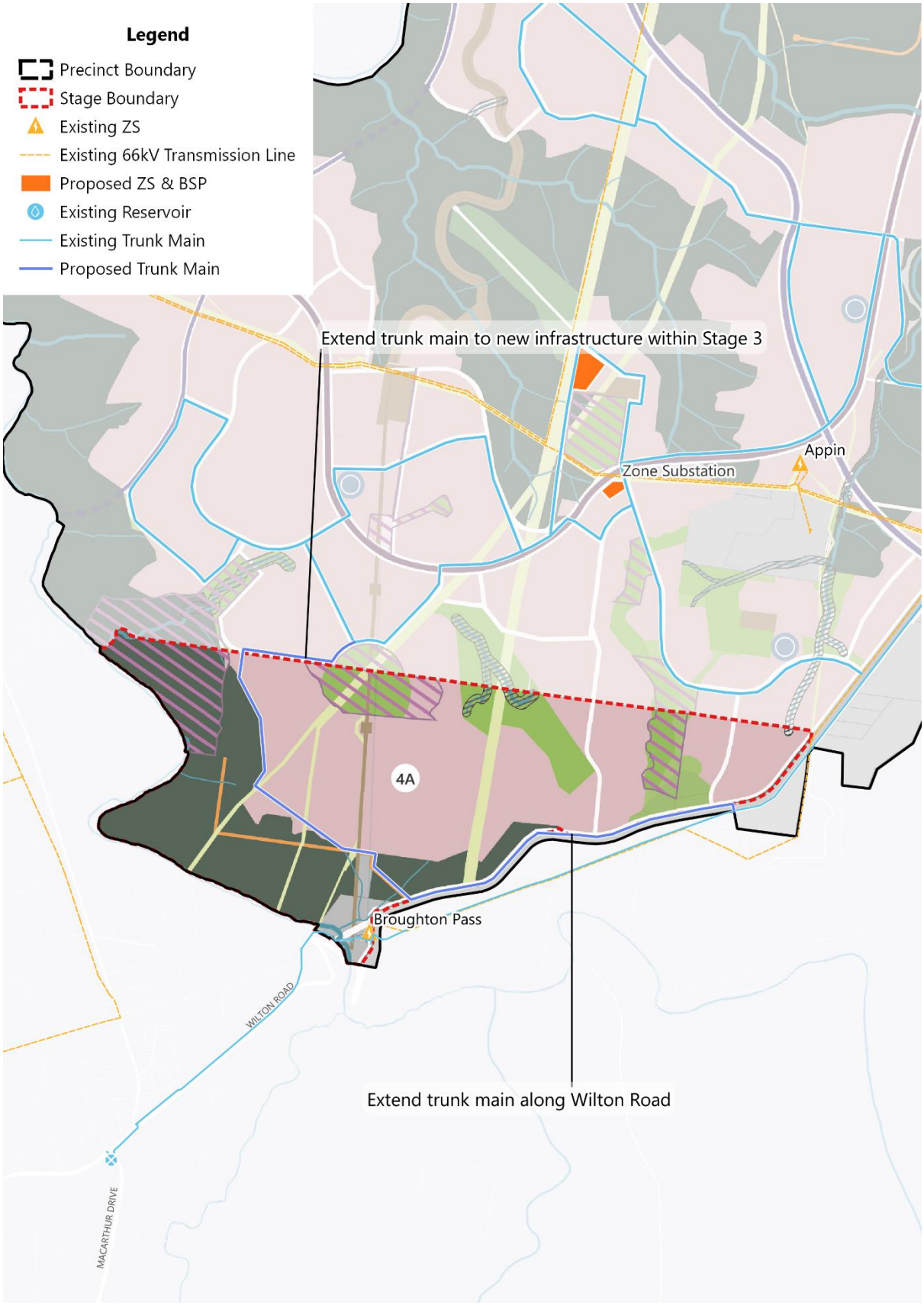
9.2.2 Potable Water

Existing water mains will be extended down Wilton Road to supply development in Stage 4A. No local road network has been developed at this stage, however an indicative watermain network is shown in Figure 27 below. Mains within Stage 4A will be connected back to trunk infrastructure within Stage 3 to create a loop.

9.2.1 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 27 - Stage 4A Water & Electrical Infrastructure



9.2.2 Sewer

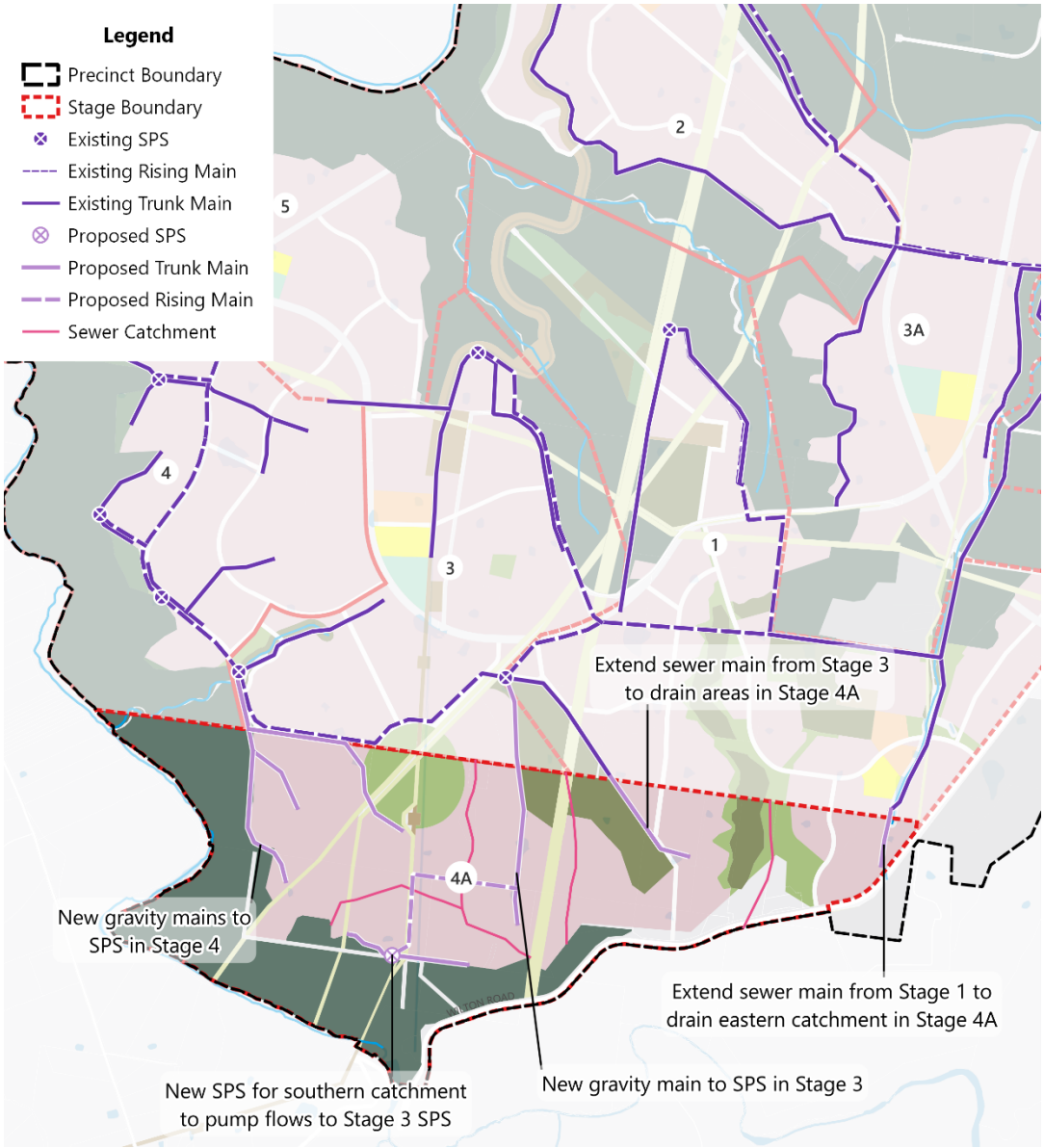
Stage 4A falls into four sewer catchments:

- Western catchment draining northwards to an SPS in Stage 4
- Central catchment draining northwards to an SPS in Stage 1
- Southern catchment draining southwards to the Cataract River
- Eastern catchment draining northwards to a trunk main in Stage 1

The western, central, and eastern catchments can be serviced by extending gravity mains constructed to support the adjacent stages.

The southern catchment will require a sewer pump station located at the catchment low point, near the southern boundary. This pump station will transfer flows to the central catchment where it will drain via gravity to a SPS in Stage 1. This arrangement is shown in Figure 28.

Figure 28 - Stage 4A Sewer Infrastructure



9.3 Infrastructure Summary

A summary of the infrastructure required to support Stage 4A is provided in Table 17 below.

Table 17 - Stage 4A Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Water	Trunk Mains	5,000	m
Sewer	Trunk Gravity Mains	5,400	m
	Rising Mains	1,000	m
	Sewer Pump Station	1	Item

10 Stage 5

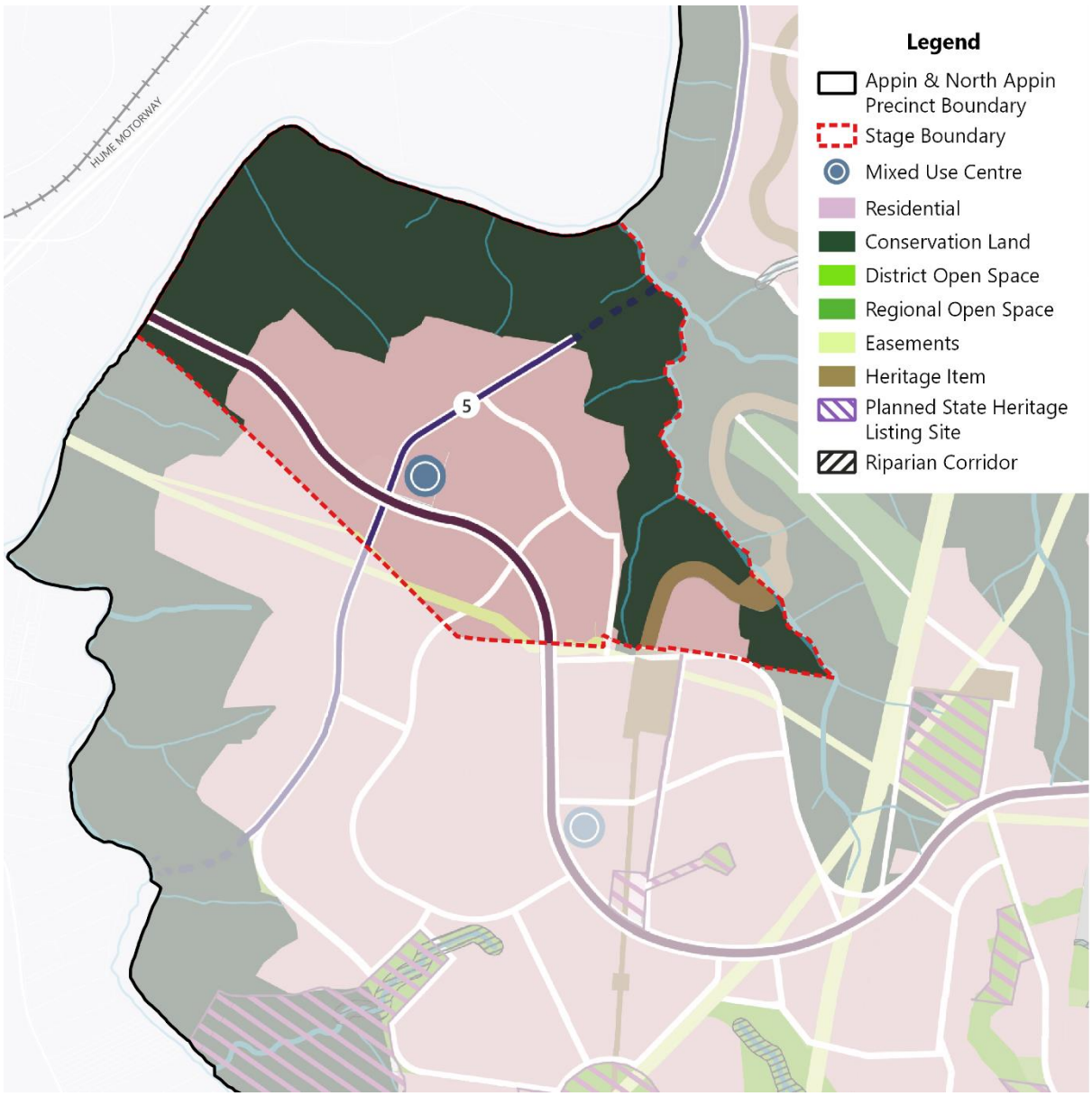
10.1 Development

Stage 5 includes the area bound by Stages 1 and 2 to the east, Stage 3 to the south, Stage 4 to the west and the Nepean River to the north. Development within Stage 5 includes:

- 1,559 low density dwellings
- 2,250m^2 GFA retail
- 750m^2 GFA commercial
- Primary school (1,000 students)

Stage 5 is shown in Figure 29 below.

Figure 29 - Stage 5



10.2 Utilities

10.2.1 Electricity

Development within Stage 5 will be supplied via the Appin ZS. The calculated electrical demands are provided in Table 18. Based on the below demands, we would expect one or two feeders would be required to support development in Stage 5. Feeder locations are not shown in Figure 30 for clarity.

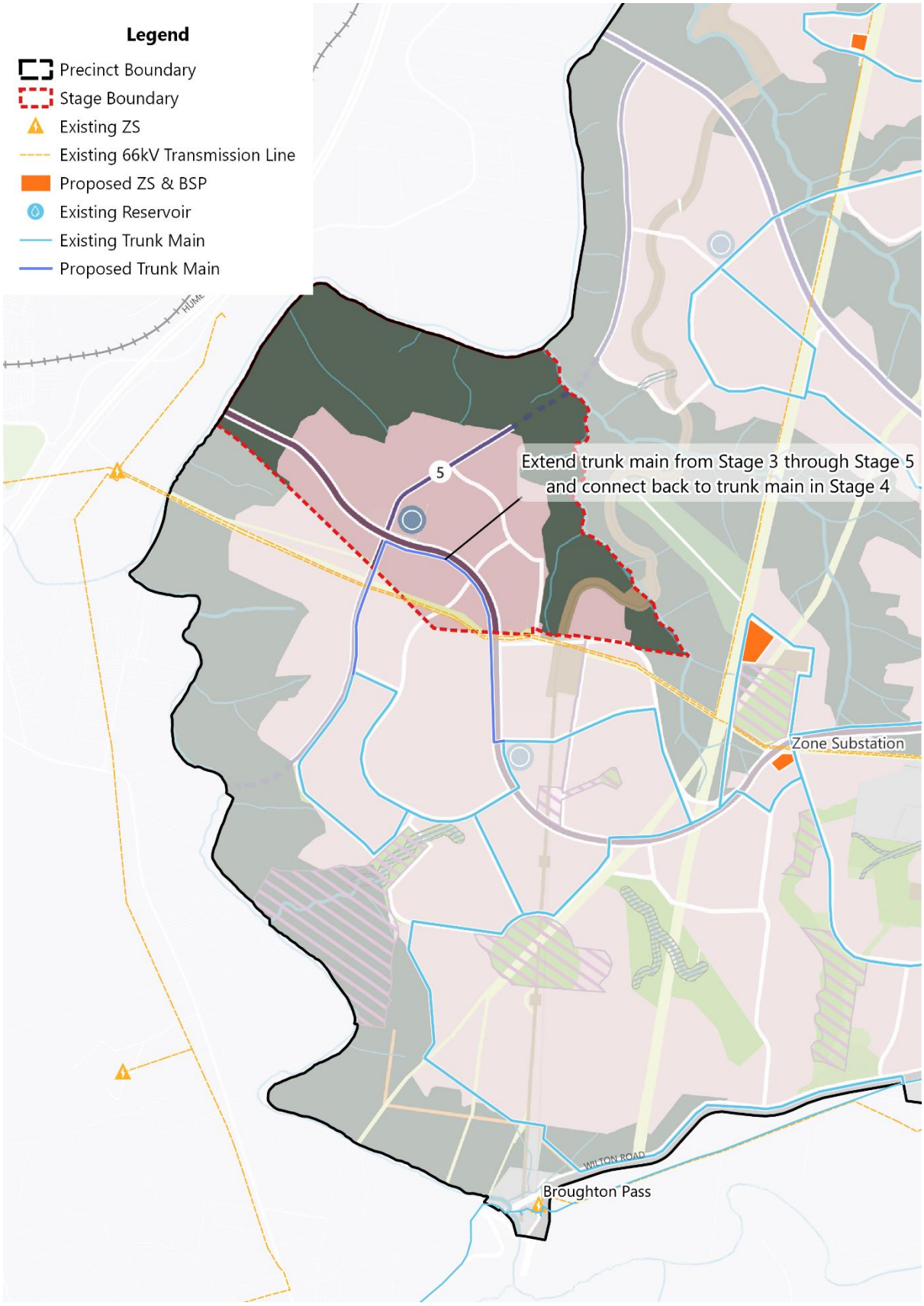
Table 18 - Stage 5 Electricity Demand

Development Type	ADMD Rate (kVA)	Total ADMD (MVA)	Approx. Feeders
Low Density Residential	4.0/dwelling	6.2	1.4
Retail	0.1/sqm GFA	0.2	0.1
Commercial	0.085/sqm GFA	0.1	0.0
School	0.085/sqm GFA	0.8	0.2
Total		**7.3**	**1.6**

10.2.2 Potable Water

Trunk potable water infrastructure within Stages 3 and 4 will be extended along key road corridors within Stage 5 to support development. An indicative layout of trunk water mains is shown in Figure 30 below.

Figure 30 - Stage 5 Water & Electrical Infrastructure



10.2.3 Sewer

Stage 5 drains to three sewer catchments:

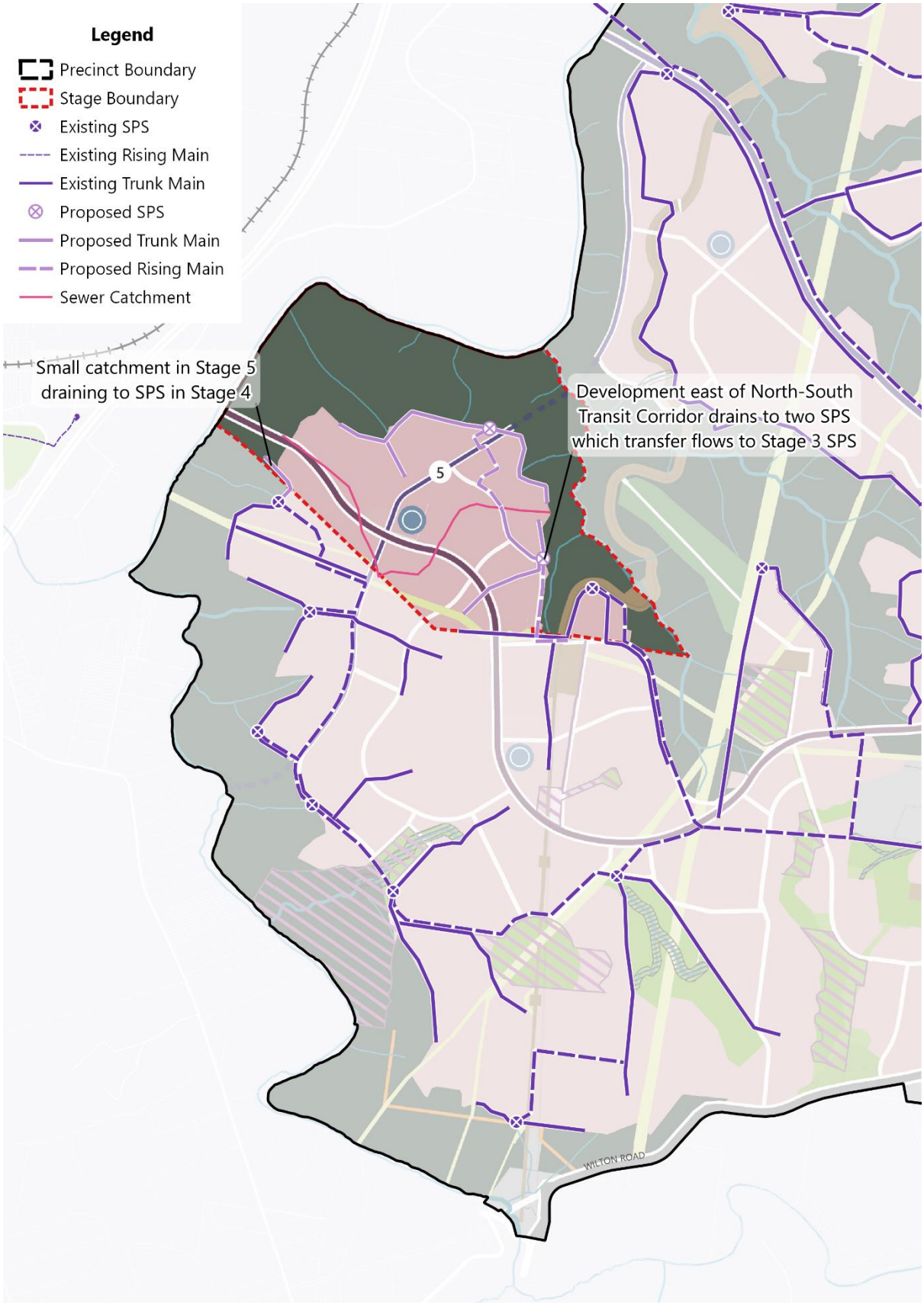
- Western catchment draining to a pump station located in Stage 4
- Northern catchment draining towards the Nepean River
- Eastern catchment draining towards Simpsons Creek

Two new SPS will be required to transfer flows from the northern and eastern catchments to the SPS in Stage 3. The western catchment will drain via gravity to a SPS in Stage 4. The trunk infrastructure required to support Stage 5 is shown in Figure 31.

10.2.1 Telecommunications

NBN Co. telecommunications infrastructure is available in the Appin region. It is anticipated that fixed line technology will be extended from the existing Appin township to supply new development in the Appin Precinct. New infrastructure will be constructed within the standard trench allocation within the road reserve of all new roads and will be provided to match the pace of development.

Figure 31 - Stage 5 Sewer Infrastructure



10.3SIC Infrastructure

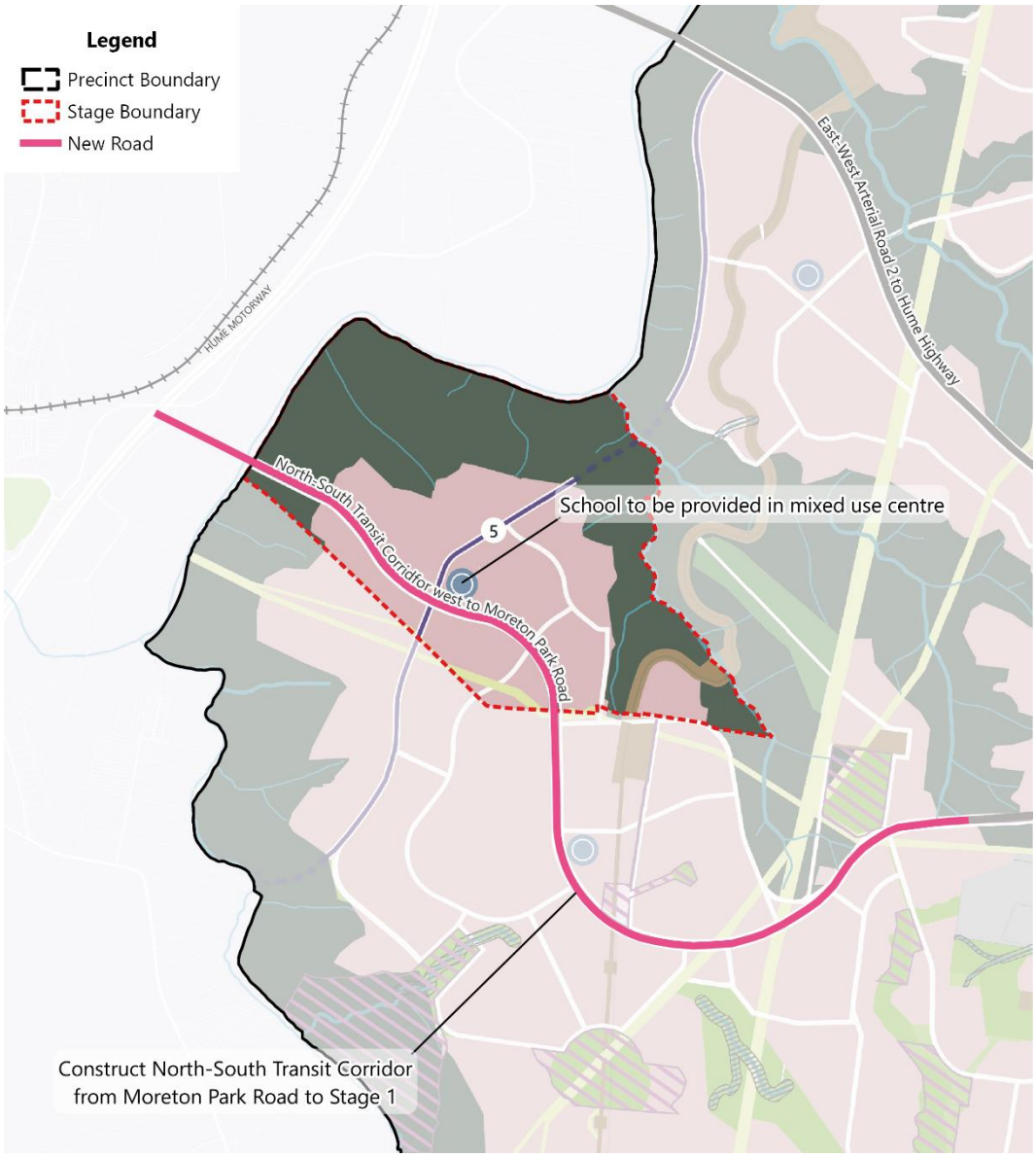
10.3.1 Roads

Stage 5 works will include Part 3 of the North-South Transit Corridor, which will connect Part 1 (delivered in Stage 1) with Moreton Park Road. This section of the road will complete the transit corridor and will enable public transport services to extend to Douglas Park Station. Delivery of this part of the corridor is subject to government strategy and connections to existing Train Stations.The extents are shown in Figure 32 below.

10.3.2 School

Stage 5 includes a primary school with capacity for 1,000 students. The land for this school will be dedicated as part of the SIC and the proposed location is shown in Figure 32.

Figure 32 - Stage 5 SIC Infrastructure



10.4 Infrastructure Summary

A summary of the infrastructure required to support Stage 5 is provided in Table 19 below.

Table 19 - Stage 5 Infrastructure Summary

Infrastructure Type	Description	Quantity	Unit
Electricity	11kV Feeders (lengths tbc subject to subdivision design)	1	item
Water	Trunk Mains	2,300	m
Sewer	Trunk Gravity Mains	3,500	m
	Rising Mains	1,500	m
	Sewer Pump Station	2	Item
Roads	North-South Transit Corridor Part 3 – Stage 5 to Morton Park Road	5,900	m
School	Primary School (1,000 students)	1.5	Ha

11 Conclusion

The above infrastructure phasing plan outlines how utilities, key roads and school infrastructure will be delivered across the Appin Precinct to match the development rollout. Based on current advice from Sydney Water and Endeavour Energy, the proposed development could be adequately serviced using the infrastructure strategy outlined in the report above.