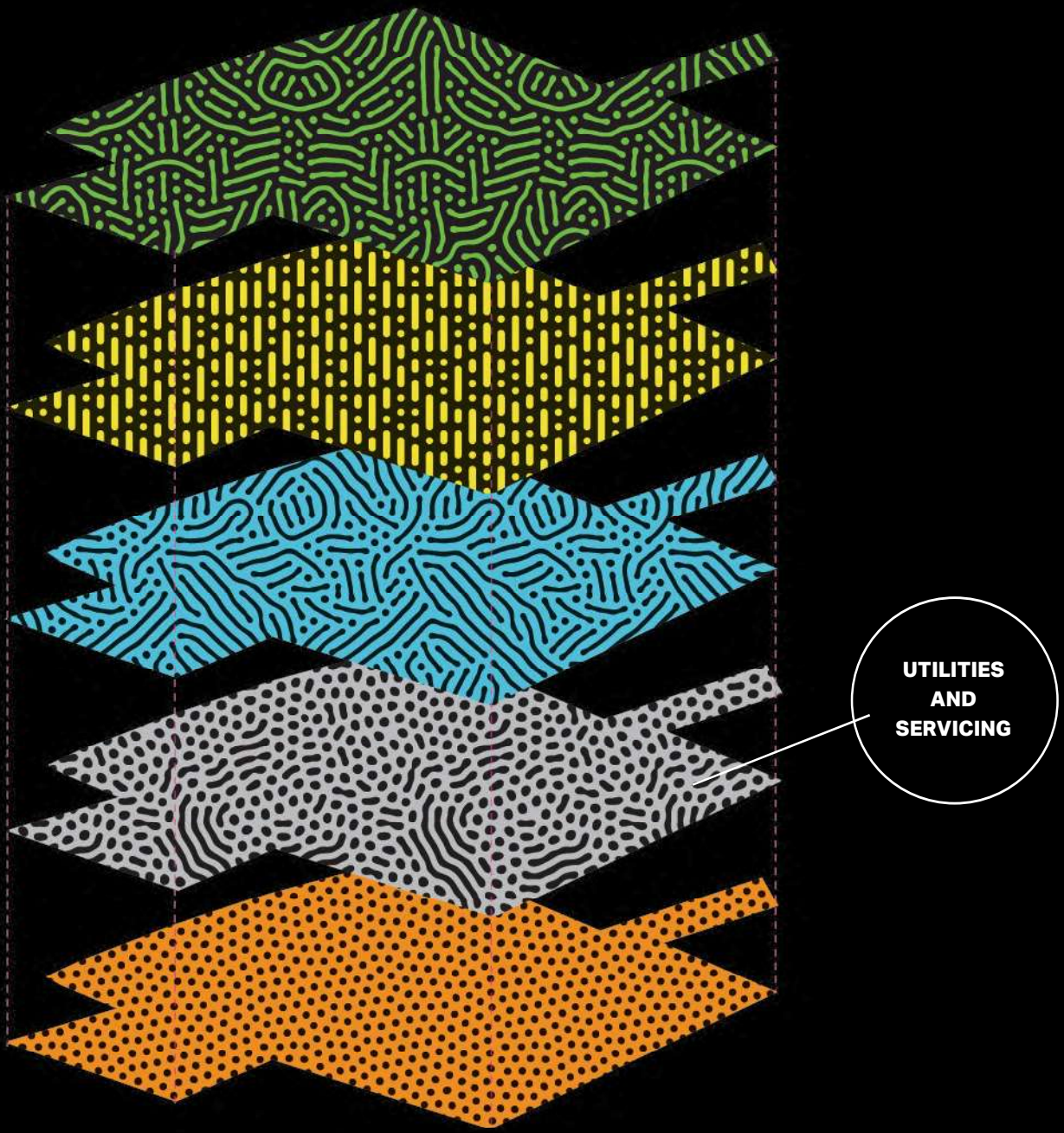
Attachment B13

Utilities and Infrastructure Servicing Study – Waterloo Estate (South) – Land and Housing Corporation

WATERLOO SOUTH

UTILITIES AND SERVICING STUDY



Prepared for

NSW Land and Housing Corporation

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AECOM

Quality information

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Revision History

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Abbreviations

ADWF	Average Dry Weather Flow
AHD	Australian Height Datum
AR&R	Australian Rainfall & Runoff
ATP	Australian Technology Park
BASIX	Building Sustainability Index
CGIs	Computer Generated Images
CICL	Cast Iron Concrete Lined
CoS	City of Sydney
DBYD	Dial Before You Dig
DCP	Development Control Plan
DIP	Design Information Pack
EP	Equivalent Population
ESD	Ecologically Sustainable Development
FSR	Floor Space Ratio
GFA	Gross Floor Area
HV	High Voltage
IBL	Internal Bitumen Lined
ISD	Integrated Station Development
LAHC	Land and Housing Corporation
LED	Light Emitting Diode
LEP	Local Environment Plan
LGA	Local Government Area
LV	Low Voltage
MGB	Mobile Garbage Bin
NBN	Network Broadband Network
NOR	Notice of Requirements
OSD	Over Station Development
PoEO Act	Protection of Environment Operations Act
RMS	Roads and Maritime Services
SCL	Steel Cement Lined
SEPP	State Environment Protection Policy
SOC	Streets Opening Conference
SSP	State Significant Precinct
UrbanGrowth NSW	UrbanGrowth NSW Development Corporation
VC	Vitrified Clay
WARR	Waste Avoidance and Resource Recovery

Executive Summary

NSW Land and Housing Corporation (LAHC) has engaged AECOM to undertake a Utilities and Servicing Study for the Waterloo Housing Estate, which comprises three stages: Waterloo South, Waterloo Central and Waterloo North. Waterloo South has been identified as the first stage for renewal and area of focus for this report. The purpose of the utilities scope is to identify existing utility infrastructure and consider any upgrades or new utility infrastructure that may be required. In doing so, this report addresses Section 1.5, 9 and 16.4 of the Waterloo Housing Estate Study Requirements/Planning Proposal.

Waterloo South is approximately 3km south of the Sydney CBD; it is bordered by Surry Hills to the north, Moore Park to the east, Alexandria to south and West. There are a number of existing utility services in close proximity to the Estate and existing servicing arrangements which are summarised below:

- **Potable Water:** Drinking water is supplied by Sydney Water from the Prospect and/or Kurnell Systems via the Potts Hill Trunk Delivery System incorporating the Potts Hill Reservoirs and Crown Street Reservoir;
- **Waste Water:** Waste water facilities are provided by Sydney Water through the Malabar Sewage treatment Plant Network;
- **Electrical:** Electricity servicing to the Estate is provided by Ausgrid via cables from the nearby Zetland Zone Substation;
- **Gas:** Jemena currently supply gas to the area through existing gas mains;
- **Telecommunications:** A number of different telecommunications providers currently service the site, including NBN, Nextgen, Optus, Telstra, Verizon and Vocus Fibre; and
- **Waste:** Waste servicing is currently provided by the City of Sydney.

The locations of these respective services are indicated in the existing combined services plan as shown in the report. It is noted that within this report individual proposed utility connections have been shown to each building to allow flexibility on the eventual building ownerships. Should the site proceed as one lot or integrated building then typically utility authorities would only provide one point of connection per lot.

As a part of this Utilities and Servicing Study, the following authority consultation has been undertaken:

- Formal feasibility applications as a part of the previous Central to Eveleigh Infrastructure Servicing Strategy;
- Attendance of utility authorities at Estate project working groups;
- Review of Stage 1 reports by utility authorities;
- Connection Application Form (NECF01) - Preliminary Enquiry submitted to Ausgrid; and
- Ongoing coordination meetings.

Indicative building service loads specifically for Waterloo South are summarised below; however, it is noted that these are provided to inform lead-in infrastructure requirements only and are subject to change as part of design development.

- Demand calculations provide the following estimated utility demand:
    - Potable Water demand between **1,300 – 1,700 kL/d**
    - Sewer Loading between **8 – 11 L/s**
    - Electrical demand between **29 – 39 MVA**
    - Gas demand between **4,200 – 5,600 m^3/day**

A formal response received from Ausgrid on 05/11/2018 (*see Appendix A)* indicated that overall, there is projected to be sufficient energy supply for the development until 2026 provided there are no other energy intensive developments in the surrounding area and additional feeders are run to the Surry Hills Zone Substation. A new substation to replace the existing Zetland Zone Substation is also in planning which may address capacity constraints beyond 2026. Note that actual required supply is subject to the final design and staging of the development.

Based on the investigations undertaken within this report, Study Requirements/Planning Proposal under Section 1.5, 9 and 16.4 have been satisfied with appropriate investigations recommended for future development applications.

Servicing Constraints affecting the Waterloo South site:

- A number of electrical High Voltage Transmission lines on Wellington, Cope, and George Street;
- A 2.5m wide potable water Pressure Tunnel and Shaft that exits the site;
- A number of large potable water services on McEvoy, Cope and George Street;
- A major Optus fibre cable route that runs along George Street;
- Large concentrations of services within footpaths that may need to be moved; and
- Above ground powerlines that may need to be moved underground.

Servicing Opportunities and needs to support the precinct:

- The site is currently well serviced by utility infrastructure;
- Existing services may have excess capacity to service the initial phases of any new development;
- There may be the opportunity to re-use old utility routes for new infrastructure;
- Areas such as the Australian Technology Park (ATP) or Green Square Town Centre may enable the sharing of sustainable utility infrastructure; and
- Required utility works may be shared with the new Sydney Metro Station.

1. Introduction

The Greater Sydney Region Plan and Eastern City District Plan seek to align growth with infrastructure, including transport, social and green infrastructure. With the catalyst of Waterloo Metro Station, there is an opportunity to deliver urban renewal to Waterloo Estate that will create great spaces and places for people to live, work and visit.

The proposed rezoning of Waterloo Estate is to be staged over the next 20 years to enable a coordinated renewal approach that minimises disruption for existing tenants and allows for the up-front delivery of key public domain elements such as public open space. Aligned to this staged approach, Waterloo Estate comprises three separate, but adjoining and inter-related stages:

- Waterloo South;
- Waterloo Central; and
- Waterloo North.

Waterloo South has been identified as the first stage for renewal. The lower number and density social housing dwellings spread over a relatively large area, makes Waterloo South ideal as a first sub-precinct, as new housing can be provided with the least disruption for existing tenants and early delivery of key public domain elements, such as public open space.

A planning proposal for Waterloo South is being led by NSW Land and Housing Corporation (LAHC). This will set out the strategic justification for the proposal and provide an assessment of the relevant strategic plans, state environmental planning policies, ministerial directions and the environmental, social and economic impacts of the proposed amendment. The outcome of this planning proposal will be a revised planning framework that will enable future development applications for the redevelopment of Waterloo South. The proposed planning framework that is subject of this planning proposal, includes:

- **Amendments to the Sydney Local Environmental Plan 2012** – This will include amendments to the zoning and development standards (i.e. maximum building heights and floor space ratio) applied to Waterloo South. Precinct-specific local provisions may also be included.
- **A Development Control Plan (DCP)** – This will be a new part inserted into 'Section 5: Specific Areas' of the Sydney DCP 2012 and include detailed controls to inform future development of Waterloo South.
- **An infrastructure framework** – in depth needs analysis of the infrastructure required to service the needs of the future community including open space, community facilities and servicing infrastructure.

1.1 The Precinct

Waterloo Estate

Waterloo Estate is located approximately 3.3km south-south-west of the Sydney CBD in the suburb of Waterloo (refer to **Figure 1**). It is located entirely within the City of Sydney local government area (LGA). Waterloo Estate is situated approximately 0.6km from Redfern train station and 0.5km from Australia Technology Park. The precinct adjoins the new Waterloo Metro Station, scheduled to open in 2024. The Waterloo Metro Quarter adjoins Waterloo Estate and includes the station and over station development and was rezoned in 2019. Waterloo Estate comprises land bounded by Cope, Phillip, Pitt and McEvoy Street, including an additional area bounded by Wellington, Gibson, Kellick and Pitt Streets. It has an approximate gross site area of 18.98 hectares (14.4 hectares excluding roads). Waterloo Estate currently comprises 2,012 social housing dwellings owned by LAHC, 125 private dwellings, a small group of shops and community uses on the corner of Wellington and George Streets, and commercial properties on the south-east corner of Cope and Wellington Streets.

A map of Waterloo Estate and relevant boundaries is illustrated in **Figure 2**.

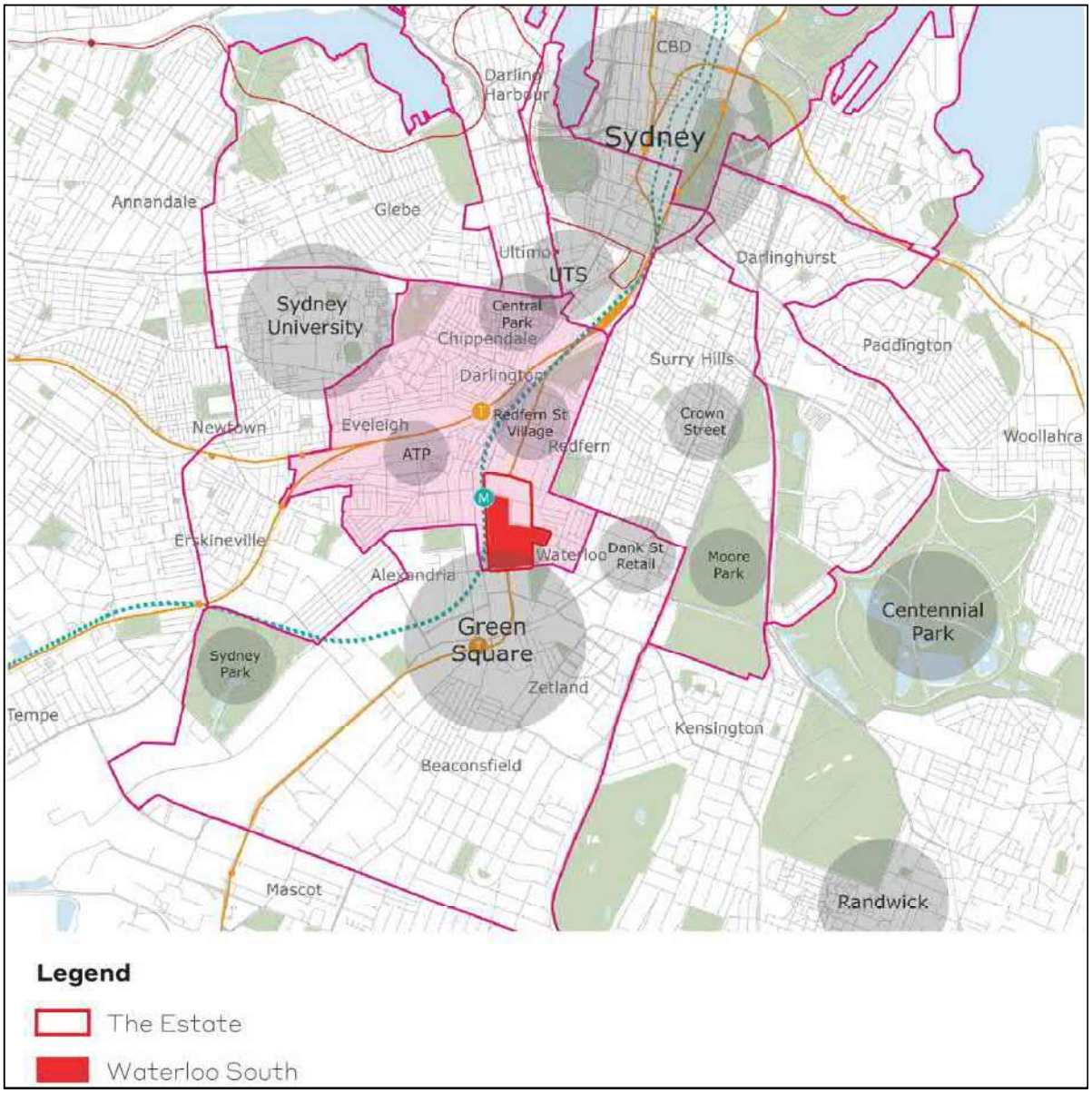


Figure 1: Location Plan of Waterloo Estate and Waterloo South

Source: Turner Studio

Waterloo South

Waterloo South includes land bounded by Cope, Raglan, George, Wellington, Gibson, Kellick, Pitt and McEvoy Streets, and has an approximate gross site area of 12.32 hectares (approximately 65% of the total Estate).

Waterloo South currently comprises 749 social housing dwellings owned by LAHC, 125 private dwellings, and commercial properties on the south-east corner of Cope and Wellington Streets. Existing social housing within Waterloo South is predominantly walk up flat buildings constructed in the 1950s and '60s, and mid-rise residential flat buildings (Drysdale, Dobell & 76 Wellington Street) constructed in the 1980s. Listed Heritage Items within Waterloo South include the Duke of Wellington Hotel, Electricity Substation 174 on the corner of George and McEvoy Streets, the terrace houses at 229-231 Cope Street and the Former Waterloo Pre-School at 225-227 Cope Street. The State Heritage listed 'Potts Hill to Waterloo Pressure Tunnel and Shafts' passes underneath the precinct.

A map of Waterloo South and relevant boundaries is illustrated in **Figure 2**.

Figure 2: Waterloo Precinct

Source: Ethos Urban

1.2 Redevelopment Vision

The transition of Waterloo Estate will occur over a 20-year timeframe, replacing and providing fit for purpose social (affordable rental) housing as well as private housing to create a new integrated and inclusive mixed-tenure community.

This aligns with Future Directions for Social Housing in NSW – the NSW Government's vision for social housing. It also aligns with LAHC's Communities Plus program, which is tasked with achieving three key objectives:

1. Provide more social housing
2. Provide a better social housing experience
3. Provide more opportunities and support for social housing tenants

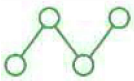
The following is LAHC's Redevelopment Vision for Waterloo Estate, which was derived from extensive consultation and technical studies:

Culture and Heritage

- Recognise and celebrate the significance of Waterloo's Aboriginal history and heritage across the built and natural environments.
- Make Waterloo an affordable place for more Aboriginal people to live and work.
- Foster connection to culture by supporting authentic storytelling and recognition of artistic, cultural and sporting achievements.

Communal and Open Space

- Create high quality, accessible and safe open spaces that connect people to nature and cater to different needs, purposes and age groups.
- Create open spaces that bring people together and contribute to community cohesion and wellbeing.



Movement and Connectivity

- Make public transport, walking and cycling the preferred choice with accessible, reliable and safe connections and amenities.
- Make Waterloo a desired destination with the new Waterloo Station at the heart of the Precinct's transport network – serving as the gateway to a welcoming, safe and active community.

Character of Waterloo

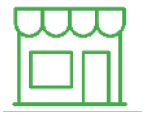
- Strengthen the diversity, inclusiveness and community spirit of Waterloo.
- Reflect the current character of Waterloo in the new built environment by mixing old and new.

Local Employment Opportunities

- Encourage a broad mix of businesses and social enterprise in the area that provides choice for residents and creates local job opportunities.

Community Services, Including Support for Those Who Are Vulnerable

- Ensure that social and human services support an increased population and meet the diverse needs of the community, including the most vulnerable residents.
- Provide flexible communal spaces to support cultural events, festivals and activities that strengthen community spirit.



Accessible Services

- Deliver improved and affordable services that support the everyday needs of the community, such as health and wellbeing, grocery and retail options.

Design Excellence

- Ensure architectural design excellence so that buildings and surrounds reflect community diversity, are environmentally sustainable & people friendly – contributing to lively, attractive and safe neighbourhoods.
- Recognise and celebrate Waterloo's history and culture in the built environment through artistic and creative expression.
- Create an integrated, inclusive community where existing residents and newcomers feel welcome, through a thoughtfully designed mix of private, and social (affordable rental) housing.

1.3 Purpose

This report relates to the Waterloo South planning proposal. While it provides comprehensive baseline investigations for Waterloo Estate, it only assesses the proposed planning framework amendments and Indicative Concept Proposal for Waterloo South.

The key matters addressed as a part of this study include:

- Identify existing utilities and potential constraints;
- Capacity assessment of existing utility infrastructure;
- Potential utility upgrades required to support the development;
- Coordination with the Ecologically Sustainable Development Report; and
- Waste management strategies;
- An infrastructure contributions framework

2. Study Requirements/Planning Proposal Requirements

On 19 May 2017 the Minister issued Study Requirements for the nominated Precinct. Of relevance to this study are the following requirements. While this project is going through a different planning pathway, the overall SSP study requirements are still relevant and addressed below.

Table 1: SSP Study Responses

Waterloo Housing Estate Study Requirements/Planning Proposal Requirements	Utilities and Servicing Infrastructure Response
Section 1. Vision, Strategic Context and Justification	
1.5 Consideration of City of Sydney planning documents, strategies and policies including, but not limited to: • Decentralised Water Masterplan 2012;	• Consideration for City of Sydney planning documentation, strategies and policies relevant to the Estate addressed in Section 5.5 and 6.5
Section 9. Utilities	
9.1. Provide a utilities and infrastructure servicing report identifying: • *existing capacity, proposed on-site generation / water recycling and required capacity and augmentations needed for the proposal* • *sustainability and climate change adaptation measures (including Water Sensitive Urban Design (WSUD); and* • *measures to manage increasing heat and changing rainfall patterns) and staging.*	• Required capacity and augmentations needed for the proposal are contained within Figures 9, 12, 16, 17, 18. These include potential amplification of trunk lead in infrastructure. • Proposed on-site generation / water recycling alternatives are listed in Section 5.5 and 6.5, a more detailed analysis is considered in the ESD Report. • Sustainability and climate change adaptation measures are considered in each section however, more details are provided in the ESD report. • Electrical loads include air conditioning allowance to manage increasing heat, further details including the effects of changing rainfall patterns are considered within the Climate Change Report and the Flooding and Stormwater Study.
9.2. The water utilities component must be prepared by a suitably qualified hydraulic consultant. The power utility requirements must be prepared by a suitably qualified (ASP) consultant.	• AECOM employ Sydney Water accredited designers and have suitably qualified hydraulic engineers who prepared the water utilities component. • AECOM employ registered Level 3 ASP personnel and suitably qualified electrical engineers prepared the power utility requirements
9.3. Prepare a utilities and infrastructure servicing report that outlines the development yield, peak demand and generation forecasts, staging information and includes a high-level assessment of the capacity of: • *the Ausgrid electrical network requirements to service the development (including on-site generation and storage) and outline the likely impacts on the broader Ausgrid electrical network. This will include direct engagement with Ausgrid on the high-level impacts to ensure early understanding of energy requirements, planned on-site generation, energy storage and visibility of any network augmentation requirements including facility site requirements, easement*	• Development yields are contained within Section 3.0, peak demands and forecasts (including staging) are contained within each utility section. • The Ausgrid requirements to service the development are contained within Section 7, these were developed through consultation with Ausgrid and include high-level impacts. Planned onsite generation is unlikely to substantially affect the peak demand even if paired with battery storage, requirements for relocation are identified but detailed analysis will form part of design development. • We cannot comment on Sydney Metro loads in this

Waterloo Housing Estate Study Requirements/Planning Proposal Requirements	Utilities and Servicing Infrastructure Response
requirements and asset relocations • *a study of forecast transport peak energy demand requirements including the proposed Waterloo metro station and potential use of electric vehicles, and* • *Sydney Water's network to service the development and the proposed servicing options considered for the development. Outline any integrated water cycle management and / or sustainability initiatives proposed for the development, including any proposed alternative water supply, proposed end uses of drinking and non-drinking water and proposed water conservation measures.*	document as they are still under consideration and will be supplied separately to the residential, retail and commercial components of the development. Allowance for electric car charging is included in Section 7.3. • The capacity of Sydney Water's network to service the development is considered within Section 5 and 6. • Integrated water cycle managements and / or sustainable initiatives are contained in each section, however more details are contained within the ESD and Water Quality, Flooding and Stormwater Reports.
9.4. The utilities and infrastructure servicing report should also identify the location of Ausgrid, Sydney Water and other services or assets in the precinct and provide proposals to mitigate the asset risks related to the development of the site.	• The location of services assets is contained within Figures 7, 9, 12, 16, 17, 18. • Proposals to mitigate risks are contained within each utility section
9.5. Integrate outcomes of the ESD Study to ensure optimisation of sustainable infrastructure opportunities.	• The outcomes of the ESD study have been incorporated within each section, noting that the final selection of ESD options will be subject to design development
9.6. Ensure compliance with current utility design standards which require all new power, communication and other utilities within new development areas to be underground.	• Current utility design standards have been complied with and are designed to be underground. It should be noted that Section 7.5 considers undergrounding of existing overhead utilities.
Section 16. ESD	
16.4. Identify and implement waste management strategies to achieve the NSW Government's Waste Avoidance and Resource Recovery Strategy 2007 (WARR) and compliments the NSW Government's Waste Less, Recycle More initiatives and EPA waste and recycling programs *Include measures to ensure effective operational waste management, for example, adequate space within buildings for waste infrastructure, accessibility for waste collection vehicles. Identify building and precinct-scale solutions.*	• Waste management strategies to achieve NSW Government's WARR initiatives have been considered in Section 12 of this report. • Measures to ensure effective operational waste management have been outlined in Section 12.2, 12.4, 12.5 and 12.6.

3. Planning Proposal

The planning proposal will establish new land use planning controls for Waterloo South, including zoning and development standards to be included in Sydney LEP 2012, a new section in Part 5 of DCP 2012, and an infrastructure framework. Turner Studio and Turf has prepared an Urban Design and Public Domain Study which establishes an Indicative Concept Proposal presenting an indicative renewal outcome for Waterloo South. The Urban Design and Public Domain Study provides a comprehensive urban design vision and strategy to guide future development of Waterloo South and has informed the proposed planning framework. The Indicative Concept Proposal has also been used as the basis for testing, understanding and communicating the potential development outcomes of the proposed planning framework.

3.1 Indicative Concept Proposal

The Indicative Concept Proposal comprises:

- Approximately 2.57 hectares of public open space representing 17.8% of the total Estate (Gross Estate area – existing roads) proposed to be dedicated to the City of Sydney Council, comprising:
    - Village Green – a 2.25-hectare park located next to the Waterloo Metro Station; and
    - Waterloo Common and adjacent – 0.32 hectares located in the heart of the Waterloo South precinct.
    - The 2.57 hectares all fall within the Waterloo South Planning Proposal representing 32.3% of public open space (Gross Waterloo South area – proposed roads)
- Retention of 52% of existing high and moderate value trees (including existing fig trees) and the planting of three trees to replace each high and moderate value tree removed.
- Coverage of 30% of Waterloo South by tree canopy.
- Approximately 257,000 sqm of GFA on the LAHC land, comprising:
    - Approximately 239,100 sqm GFA of residential accommodation, providing for approximately 3,048 dwellings comprising a mix of market and social (affordable rental housing dwellings);
    - Approximately 11,200 sqm of GFA for commercial premises, including, but not limited to, supermarkets, shops, food & drink premises and health facilities; and
    - Approximately 6,700 sqm of community facilities and early education and child care facilities.

The key features of the Indicative Concept Proposal are:

- It is a design and open space led approach.
- Creation of two large parks of high amenity by ensuring good sunlight access.
- Creation of a pedestrian priority precinct with new open spaces and a network of roads, lanes and pedestrian links.
- Conversion of George Street into a landscaped pedestrian and cycle friendly boulevard and creation of a walkable loop designed to cater to the needs of all ages.
- A new local retail hub located centrally within Waterloo South to serve the needs of the local community.
- A target of 80% of dwellings to have local retail services and open space within 200m of their building entry.
- Achievement of a 6 Star Green Star Communities rating, with minimum 5-star Green Star – Design & As-Built (Design Review certified).
- A range of Water Sensitive Urban Design (WSUD) features.

The proposed land allocation for the Waterloo South precinct is described in **Table 2** below.

Table 2: Breakdown of allocation of land within the Waterloo South

Land allocation	Existing	Proposed
Roads	3.12ha / 25.3%	4.38ha / 35.5%
Developed area (Private sites)	0.86ha / 6.98%	0.86ha / 7%
Developed area (LAHC property)	8.28ha / 67.2%	4.26ha / 34.6%
Public open space (proposed to be dedicated to the City of Sydney)	Nil / 0%	2.57ha / 20.9% (32.3% excluding roads)
Other publicly accessible open space (Including former roads and private/LAHC land)	0.06ha / 0.5%	0.25ha / 2%
TOTAL	**12.32ha**	**12.32ha**

The Indicative Concept Proposal for the Waterloo South is illustrated in **Figure 3** below.

Figure 3: Indicative Concept Proposal

Source: Turner Studio

3.4 Demand Assessment Yields

Demand calculations were undertaken based on the development yields shown below in Table 3 (LAHC, 2020)

Table 3 Demand Assessment Yields

Study Area	Apartments (No.)	Retail, Commercial & Community (m2)
Waterloo South	3,048	17,900

Please note that the apartment numbers and commercial space figures are provided for the purpose of assessing required utility infrastructure upgrades and are subject to change as a part of design development.

4. Baseline Investigations

4.1 Gathering Existing Utility Information

The preliminary information data was gathered from a range of sources. These include Dial Before You Dig (DBYD) requests, master plans, existing drawings and previous experience with the area.

4.2 Dial Before You Dig Plans

DBYD requests were submitted for the site area. The DBYD report identified a range of services present in Waterloo South and the wider Estate as summarised in Table 4.

Table 4: Summary of Existing Services

Authority Name	Phone	Utility Type
AAPT / PowerTel, NSW	1800786306	Communications
AARNet Pty Ltd, Nsw	1300275662	Communications
Airport Rail Link	0298489578 / 0413006517	Electricity
Ausgrid	0249510899	Electricity
City of Sydney (IMS)	0292659819	Council/Shire
Jemena Gas South	1300880906	Gas & Petroleum
Luminet Pty Ltd	1300586463	Communications
NBN Co, NswAct	1800626762	Communications
Nextgen, NCC - NSW	1800032532	Communications
Optus and/or Uecomm, Nsw	1800505777	Communications
PIPE Networks, Nsw	1800201100	Communications
Primus Telecom, Nsw	0294232568	Communications
RailCorp Central	0298489578 / 0413006517	Electricity
Roads and Maritime Services	0288370285	Electricity
Specialty Fashion Group	0283039855	Communications
Sydney Water	132092	Water
Telstra NSW, Central	1800653935	Communications
TransGrid	0296200422	Electricity
Verizon Business (Nsw)	0294345000	Communications
Vocus Communications	0892446114	Communications

The plans provided from these DBYD reports were assessed as a component of our capacity review.

4.3 Utility Reports

An Infrastructure and Servicing Strategy Report (2015) was developed for LAHC NSW, this included an assessment of the Estate. The results of that investigation and strategy including authority correspondence have been used in developing this Utilities and Infrastructure Servicing Study.

Additionally, a number of annual reports and master plans have been prepared by stakeholders providing information relevant to the Estate. Below is the list of reports used in this preliminary infrastructure assessment:

- A Plan for Growing Sydney, NSW Government, 2014;
- BASIX Monitoring Report - Electricity Consumptions for 2007-2009, NSW Department of Planning, 2010;

- BASIX Water Savings Monitoring – Sydney Water, 2009;
- Better Practice for Public Place Recycling, DECC 2005;
- Better Practice Guide for Waste Management Multi-unit Dwellings , DECC 2008;
- Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities, EPA, December 2012;
- Central to Eveleigh Global Precinct Opportunity, NSW Now, 2013;
- Decentralised Energy – Advanced Waste Treatment Master Plan, City of Sydney, 2014;
- Decentralised Energy – Renewable Master Plan, City of Sydney, 2013;
- Decentralised Energy – Trigeneration Master Plan, City of Sydney, 2013;
- Decentralised Water - Master Plan, City of Sydney, 2012;
- Development Control Plan - Ashmore Precinct Urban Design, City of Sydney, 2006;
- Development Control Plan - Green Square Urban Design, City of Sydney, 2006;
- Distribution and Transmission Annual Planning Report, Ausgrid, 2014;
- Distribution and Transmission Annual Planning Report, Ausgrid, 2013;
- Draft Metropolitan Strategy for Sydney To 2031, NSW Government, 2014;
- Energy Efficiency Master Plan 2015-2030, City of Sydney, 2015;
- Environmental Action 2016 – 2021 Strategy and Action Plan, City of Sydney, 2017;
- Final Report, Projected Distribution System Limitations in the Southern Zetland Load Area, Ausgrid, 2012;
- Growth Servicing Plan July 2014 to June 2019, Sydney Water, 2014;
- Growth Servicing Strategy Wastewater Network Bondi System, Sydney Water, 2014;
- North Eveleigh Concept Plan - Department of Planning, 2008;
- NSW Long Term Transport Master Plan, NSW Government, 2014;
- NSW Transmission Annual Planning Report, TransGrid, 2013;
- NSW Transmission Annual Planning Report, TransGrid, 2014;
- Sustainable Sydney 2030 Community Strategic Plan 2014;
- Sydney Local Environmental Plan 2012;
- Sydney Street Code 2013;
- Waste Not Development Control Plan Guidelines EPA 2008;
- NSW Waste Avoidance and Resource Recovery Strategy 2014-21; and
- Wastewater Systems, Sydney Water, 2014.

4.4 Development Context

The proposed Waterloo South development forms part of the larger Redfern-Waterloo Growth Centre, this growth centre includes:

- Redfern;
- North Eveleigh;
- South Eveleigh; and
- Waterloo Metro Quarter.

Other developments that are currently taking place adjacent to the Estate include:

- Green Square;
- Epsom Park;
- Lachlan and Victoria Park;
- Ashmore; and
- The Australian Technology Park.

Any required utility relocations or amplifications are required to consider the ultimate design of the Alexandria to Moore Park Connectivity Upgrade which is currently being delivered by RMS.

Additionally, this report only considers connections of utility servicing to the new development and does not include likely relocations of existing services as a result of changes to road widths, footpath levels, street lighting, undergrounding of overhead power, driveway entrances, tree planting or stormwater drainage works.

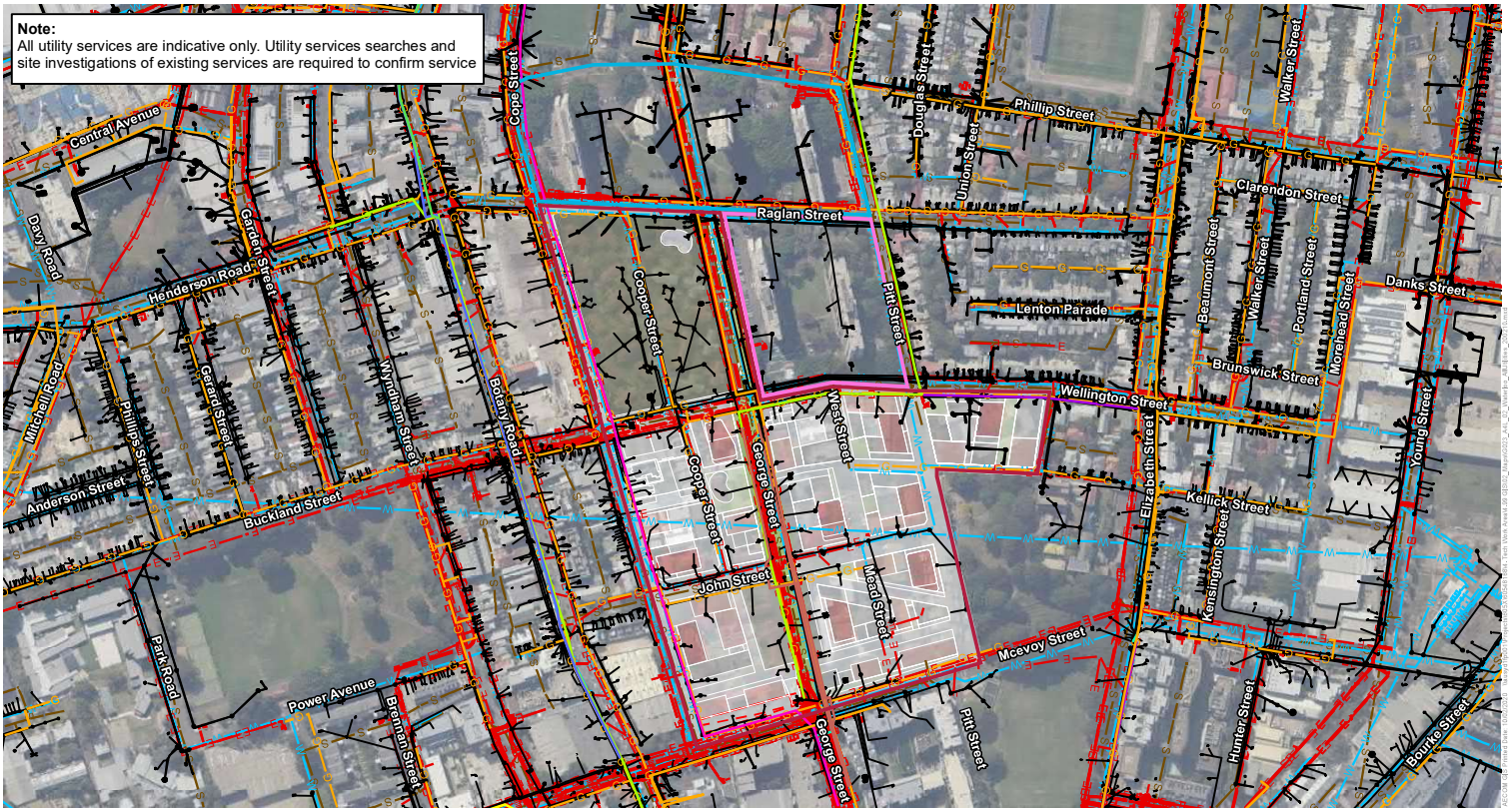
4.5 Combined Services Plan

A proposed combined services plan has been developed based on DBYD information for Waterloo South, identifying utility service locations and routes. The plan also considers the following:

- Connection to existing utility infrastructure;
- Potential development lot connection points (assuming each tower is a separate development lot); and
- Coordination between services.

The locations of these respective services are indicated in the existing combined services plan as shown in Figure 4.

All services shown schematically and are subject to changes during subsequent design stages and further inputs from relevant utility authorities. Schematic layouts for each existing utility service are outlined in individual sections of this report.



KEY

- Waterloo Central
- Waterloo North
- Waterloo South

- E AusGrid
- G Gas
- W Potable Water
- S Sewer
- AAPT
- AARNet
- AMCOM
- Nextgen
- Optus
- Primus
- Telstra
- Uecomm
- Verizon
- Vocus

AECOM

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SHEET 1 of 1 | COORDINATE SYSTEM GDA 1994 MGA Zone 56

WATERLOO SOUTH
All Existing Utilities

PROJECT
SYDNEY URBAN TRANSFORMATION

CLIENT
URBAN GROWTH NSW

DRAWN	DATE	MAP #	REV	Project
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CHECK	FIGURE			
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5. Potable Water

5.1 Background

Potable Water at the existing Waterloo South development is supplied by Sydney Water from the Prospect and/or Kurnell Systems as shown below in Figure 5.

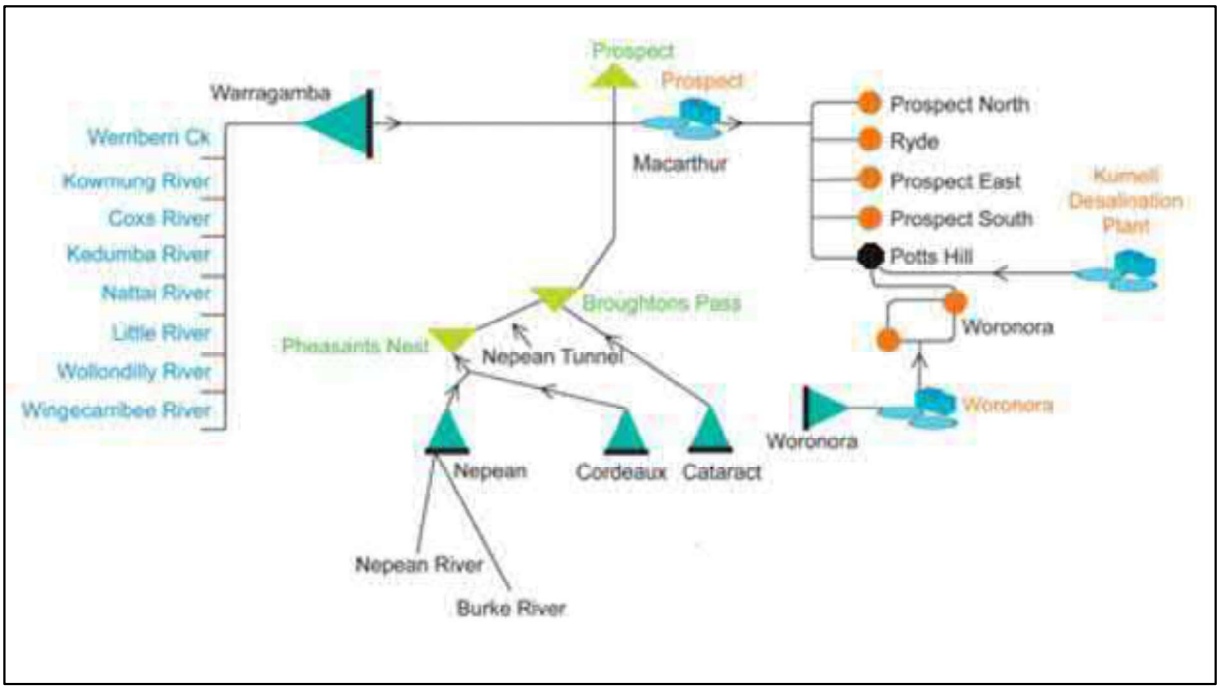


Figure 5: Potable Water Supply
(Sydney Water Corporation, 2017)

The water is supplied through the Potts Hill Trunk Delivery System incorporating the Potts Hill Reservoirs and Crown Street Reservoir. Three potable water pumping stations are located within the surrounding region potentially supplying the Estate, these are:

- Crown Street WP0001;
- Waterloo WP0008; and
- Dowling Street WP0090.

Although Sydney Water does not provide recycled water to the Estate, the adjacent Green Square Town Centre does include a privately operated recycled water scheme wherein there may be opportunities to extend this system to the Estate.

5.2 Demand Assessment

An assessment of the estimated increase in potable water demand generated from the Waterloo South development has been conducted to determine the required infrastructure upgrades associated with the development.

Demand forecasting and profiles were developed using development yields over a 15-20 year period which will be staged progressively over time. Individual project areas have been based on the average number of dwellings and proposed Gross Floor Area (GFA) for retail and commercial development outlined in the concept proposal shown in Section 3

Demand estimates for potable water have been calculated using the Design Criteria Guidelines Supplement for Single Reticulation System (Sydney Water, 2014) and is based on Maximum Daily Demand. The BASIX reduction has been taken from the Building Sustainability Index targets.

A summary of the water demand unit rates is presented in Table 5.

Table 5: Potable Water Demand Unit Rates

Land Use	Design Criteria	Units	Potable Water Demand	Sources
Multi- Unit (>140 unit/net/ha) 6-12 storey apartment	Max Day Demand	kL/unit/day	0.8	Water Supply Water Supply Code of Australia WSA 03-2011 - 3.1 (Sydney Water)
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	Building Sustainability Index Targets

5.3 Forecast Demand

An estimate of the future potable water demand for Waterloo South as a result of redevelopment has been calculated based on the figures provided by LAHC NSW. These figures provide information on the estimated number of dwellings for residential units and Gross Floor Area (GFA) for retail and commercial developments. The site has been classified as comprising of 'high density dwelling' and 'local commercial' development'.

The study area has been classified as 'multi-unit > 140 unit/net ha developments based on housing density with an equivalent potable water demand rate of 0.8 kL/unit/day. The commercial density has been estimated on an equivalent potable water demand rate of 41 kL/ha/day as shown in Table 5.

In accordance with BASIX requirement, new residential developments are required to reduce mains-supplied potable water consumption by 40% (since the BASIX amendment was introduced in 2006) compared to the average NSW dwelling. Commercial demands have not had a BASIX reduction applied. The cumulative Maximum Daily Demand (MDD) of the Waterloo SSP study area when assuming BASIX compliance is estimated to be **1,520kL/day** as shown below in .

Considering a ±15% range in development yields, the Maximum Day Demand (MDD) could vary between 1,300-1,700 kL/d.

Table 6: Estimated Cumulative Maximum Daily Potable Water Demand

Study Area	Water Demand - kL/day - Cumulative (inc BASIX)		Total per Study Area (kL/day)
	Apartments	Commercial	
Waterloo South	1440	80	**1520**

5.4 On-Site Utility Infrastructure

The existing Sydney Water potable water network within Waterloo South has been identified based on DBYD reports and is shown below in Figure 6. These records specify the presence of a number of Sydney Water mains located underneath and immediately adjacent to the site.

Key existing potable network infrastructure includes:

- A DN450mm CICL main running along Cope Street and McEvoy Street;
- A DN300mm CICL main running along Ragland Street and continuing south along George Street;
- A number of other small reticulation mains ranging in size from DN100mm to DN250mm servicing existing properties within and adjacent to the Estate; and
- A DN2475 SCL IBL Pressure Tunnel & Shaft crossing the southern portion of the site.

The depths and position of the existing reticulation mains are unknown, further investigation is required to determine the exact existing layout. In particular, the pressure tunnel and shaft. Further investigation is required to confirm the potential impacts of the design on the existing network.

The key trunk mains adjacent to the Estate are:

- An existing DN1500mm SCL IBL trunk main at the intersection of Wellington Street and Elizabeth Street, which provides connection into the Potts Hill Water Distribution System (250m adjacent to the sites eastern boundary);
- An existing DN500mm CICL main running along the south side of McEvoy Street (adjacent to the sites southern boundary); and
- An existing DN450mm CICL main running along Cope Street (adjacent to the sites western boundary).

It is noted that the above discussion only considers Sydney Water infrastructure, there is the potential that private or other authority water infrastructure is present on the site however no records of this infrastructure have been made available for this study and have not been identified on the DBYD plans. Onsite utility investigations and service searches are recommended post rezoning as a part of any future development application.

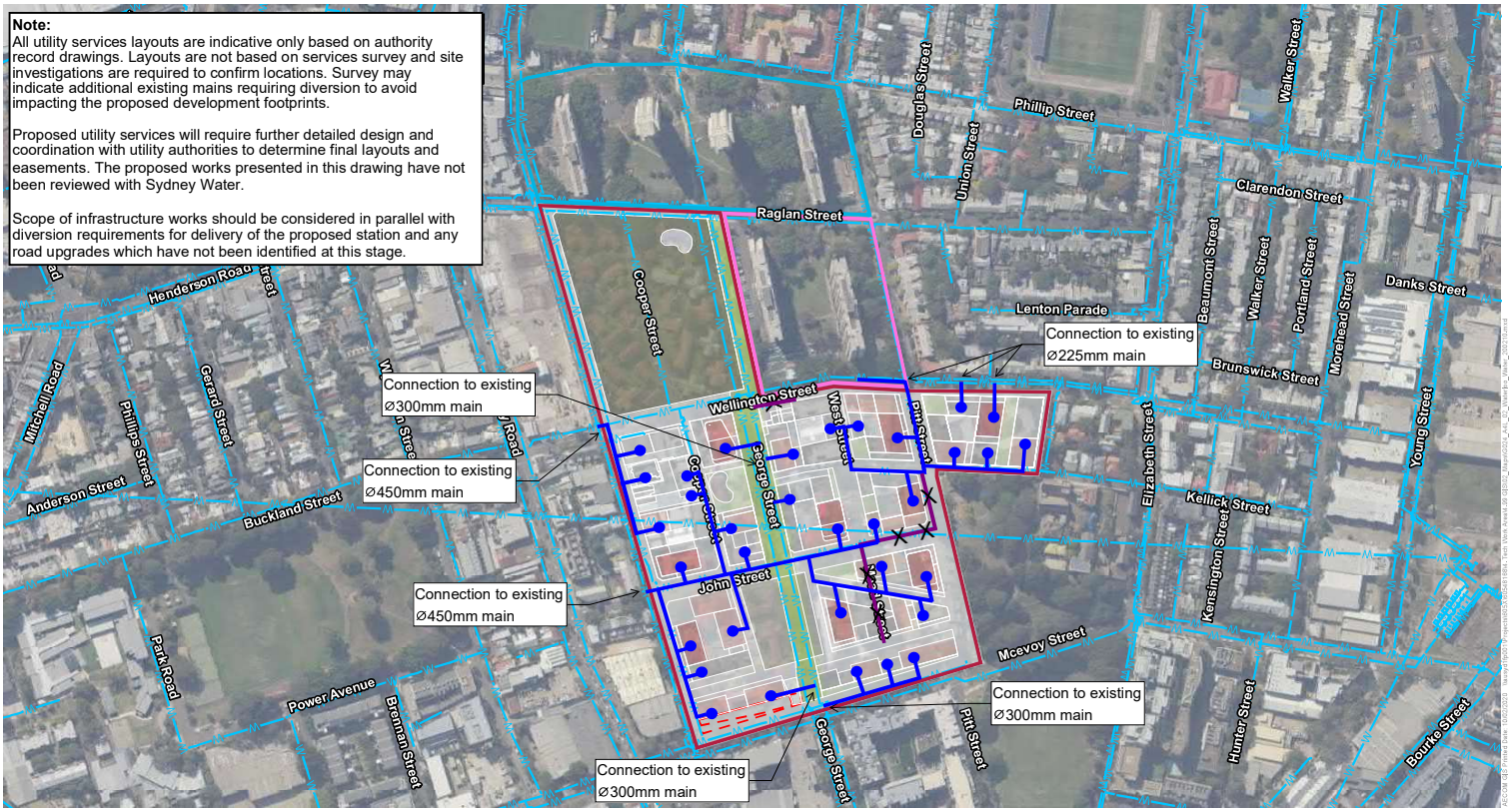
While Sydney Water have indicated that the trunk system has the capacity to service the potential development scenarios, several carrier mains running to the trunk system from the Estate may require amplification. Hydraulic modelling is required to confirm the scope of any lead-in infrastructure upgrades however it is noted that alternative water supply, proposed end uses of drinking and non-drinking water and proposed water conservation measures such as recycled water could reduce or eliminate the need to amplify surrounding water infrastructure.

5.5 Potential ESD Initiatives

This report shows “baseline” utilities responses. Key Ecologically Sustainable Development (ESD) initiatives outlined in the *City of Sydney Decentralised Water Master Plan 2012-2030* that has the potential to reduce mains potable water demand and are recommended for investigation include but are not limited to:

- Onsite rainwater reuse (embedded in current design);
- Green roofs (embedded in current design);
- High efficiency water fixtures (future consideration); and
- Stormwater harvesting and water recycling (future consideration)

Figure 6: Proposed Potable Water Connections



KEY

- Waterloo Central
- Waterloo North
- Waterloo South
- Sydney Water potable water
- Existing potable water main to be abandoned and/or relocated
- Proposed building connection
- Proposed potable water main

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WATERLOO SOUTH
Existing Water Utilities Infrastructure

PROJECT
SYDNEY URBAN TRANSFORMATION

CLIENT
URBAN GROWTH NSW

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5.6 Coordination with Other Services

Coordination of the proposed potable water infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards, these details are attached in Section 10.

In addition, Section 5.12.5.2 of the Water Services Association of Australia codes (WSA 03-2011-3.1, Sydney Water Edition – 2012) states that the clearance requirements for water mains from other service utility assets shall not be less than the minimum vertical and horizontal clearances as summarised in Figure 7.

Utility (Existing or proposed service)	Minimum horizontal clearance mm		Minimum vertical clearance[1] mm
	New main size		
	≤DN 200	>DN 200	
Water mains[2] >DN 375	600	600	300
Water mains ≤DN 375	300[3]	600	150
Gas mains	300[3]	600	150
Telecommunication conduits and cables	300[3]	600	150
Electricity conduits and cables	500	1000	225[7]
Stormwater drains	300[3]	600	150[4]
Sewers – gravity	1000[5]/600	1000[5]/600	500[4]
Sewers – pressure and vacuum	600	600	300
Kerbs	150	600[6]	150 (where possible)
NOTES – see over			

NOTES:

1 Vertical clearances apply where water mains cross one another and other utility services, except in the case of sewers where a vertical separation shall always be maintained, even when the main and sewer are parallel. *The main should always be located above the sewer to minimise the possibility of backflow contamination in the event of a main break.*

2 *Water mains includes mains supplying drinking water and non-drinking water.*

3 *Clearances can be further reduced to 150 mm for distances up to 2 m where mains are to be laid past installations such as concrete bases for poles, pits and small structures, providing the structure will not be destabilised in the process. The clearance from timber poles should be at least 200 mm and preferably 300 mm..*

4 *Water mains should always cross over sewers and stormwater drains.* For cases where there is no alternative and the main must cross under the sewer, the design shall nominate an appropriate trenchless construction technique in accordance with Clause 5.5 or other water main construction and protection treatment, effectively joint-free in the vicinity of the sewer. Refer to Standard Drawings WAT–1211-V and WAT–1255-S.

5 Where a parallel sewer is at the minimum vertical clearance lower than the water main (500 mm), maintain a minimum horizontal clearance of 1000 mm. *This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance is increased to 750 mm.*

6 Clearance from kerbs shall be measured from the nearest point of the kerb. *For water mains ≤DN 375 clearances from kerbs can be progressively reduced until the minimum of 150 mm is reached for mains ≤DN 200.*

7 An additional clearance from high voltage electrical installations should be maintained above the conduits or cables to allow for a protective barrier and marking to be provided.

Figure 7: Sydney Water Clearances between Water Mains and Underground Services

(WSA 03-2011-3.1, Sydney Water Edition – 2012)

5.7 Approvals and Next Steps

Sydney Water formal approvals are typically provided as a part of a Section 73 process, these will likely be required for each lot. However, site wide strategy drawings can be submitted to Sydney Water as a part of the applications to establish a Head Deed.

The potable water strategy is to be confirmed through hydraulic modelling, with separate reports outlining the modelling outcomes to be submitted to Sydney Water.

The key next steps in progressing the delivery of potable water infrastructure through detailed design, including the formal approval process for Sydney Water infrastructure consists of the following:

1. Undertake hydraulic modelling to confirm the extent of any lead-in infrastructure upgrades required – Post Rezoning/Development Application;
2. Undertake site investigations to confirm the layout and extent of existing on site infrastructure (including non-Sydney Water infrastructure) – Post Rezoning/Development Application;
3. Develop an overall water master plan for the Estate including staging considerations and agree this with Sydney Water – As a part of Development Applications;
4. Develop diversion strategy (including any interim works to suit staging) and protection/build-over requirements for infrastructure that cannot be diverted - As a part of Development Applications;
5. Establish a Head Deed to be signed by required parties (Sydney Water, Designer, WSC, Developer, Constructor) – As a part of detailed design;
6. Submit application/s for individual detailed design packages to be submitted to Sydney Water with drawing of proposed works in stages, Section 73– As a part of detailed design;
7. Sydney Water to issue of Notice of Requirements (NOR) with their requirements for water main layout, sizing and funding matters confirmed– As a part of detailed design; and
8. Detailed design to be progressed based on the NOR and submitted to Sydney Water for approval – As a part of detailed design;

It is noted that the above is for delivery of the water network through the new street network, it is expected that the buildings will still need to make separate applications for connection.

6. Wastewater

6.1 Background

Sydney Water wastewater facilities service Waterloo South which is processed through the Malabar Sewage treatment Plant Network (Botany) which has a capacity of 416 ML/d and services an area of 627km^2. The local sewer catchments are shown below in Figure 8.

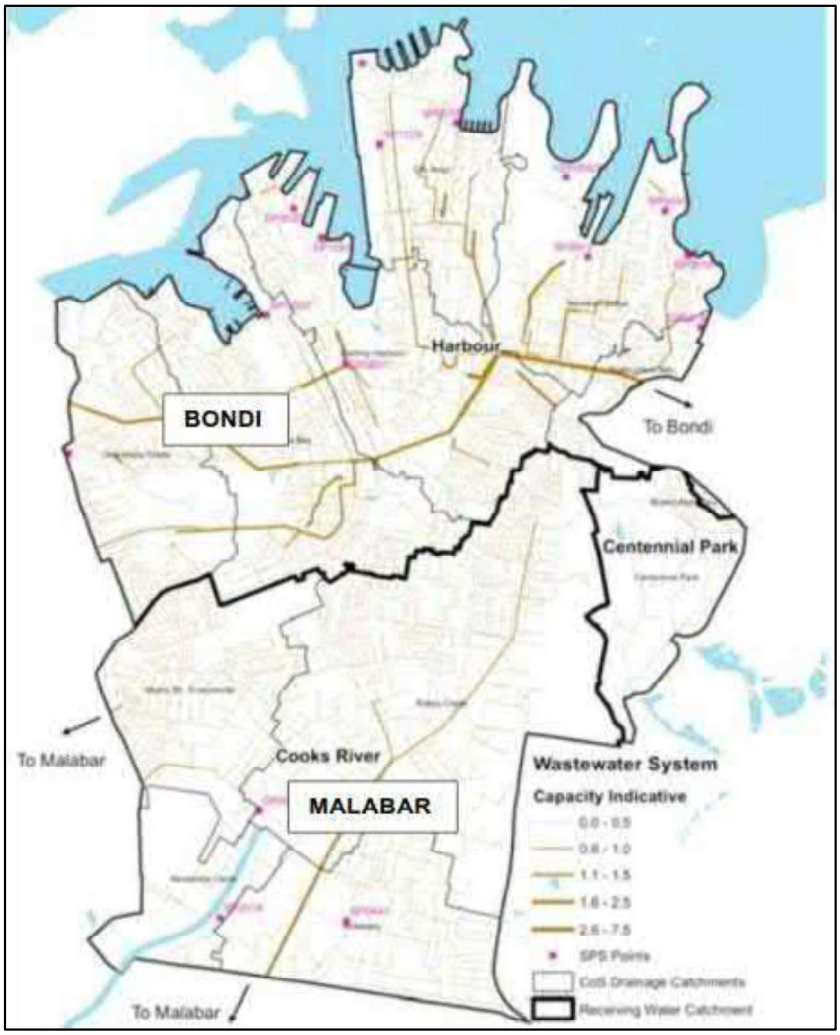


Figure 8: Sydney Water Sewer Catchment Plan
(Sydney Water, 2015)

Potential development scenarios considered within this report indicate there will be a substantial increase in sewer loading throughout the Estate.

6.2 Demand Assessment

An assessment of estimated sewer loading resulting from the development in Waterloo South has been undertaken to assist in determining the required infrastructure upgrades. Demand forecasting and profiles were developed for the Estate using development yields over a 15-20 year period which will be staged progressively over time. Individual project areas have been based on the average number of residential dwellings, and Gross Floor Area for retail and commercial development outlined in the concept proposal shown in Section 3.

The design criteria used to forecast future sewer loading are 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 for a particular land use. The BASIX reduction has been taken from the Building Sustainability Index targets, these are summarised below in Table 7.

Table 7: Sewer Design Loading Criteria

Land Use	Units	Potable Water Demand	Sources
High Density Residential	EP/dwelling	2.5	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)
ADWF	L/s	0.0017	SWC Area Planning Design Criteria Guide: WSA 02-2002- 3.0 (Sewer Code of Australia)
BASIX Reduction	%	40	Building Sustainability Index Targets

6.3 Forecast Demand

An estimate of forecasted wastewater loading has been calculated based on figures provided by LAHC NSW (refer Section 3) specifically on the number of dwellings for residential units and the Gross Floor Area for commercial areas.

In accordance with the Sydney Water criteria guide, the Estate has been classified as comprising of 'high density dwellings' and 'local commercial' development with an Equivalent Population (EP) per dwelling. The Average Dry Weather Flow (ADWF) per Equivalent Population (EP) has been taken as 150 L/day or 0.0017L/s (ADWF(L/s) = 0.0017 * EP.

Under BASIX requirement, new residential developments are required to reduce wastewater loading by 40% (since the BASIX amendment was introduced in 2006) compared to the average NSW dwelling. Under this scenario, the ADWF allowing for BASIX for the entire Estate is calculated to be approximately **22 L/s** as shown in Table 8.

This is consistent for Waterloo South.

Considering a ±15% variance in development yields, the ADWF could vary between 8-11 L/s.

Table 8: Estimated Average Dry Weather Flow (ADWF) including BASIX (L/s)

Study Area	Wastewater – ADWF (L/s) – Cumulative (incl. BASIX)		Total (L/s)
	Apartments	Commercial	
Waterloo South	9.5	0.28	**9.73**

6.4 On-Site Utility Infrastructure

The existing Sydney Water wastewater network has been identified based on Dial Before You Dig (DBYD) records. These indicate the presence of a number of existing wastewater mains throughout the Waterloo South development.

Waterloo South is located within the Malabar catchment, with wastewater directing flows towards the Malabar Wastewater Treatment Plant to the south-east of the Estate.

The existing internal wastewater network primarily consists of the following:

- A DN600mm VC main running along Cope Street (western boundary of the site), between Wellington Street and McEvoy Street;
- A DN450mm VC main running through the centre of George Street, between Wellington Street and McEvoy Street;
- A DN400 VC running south along Cope Street; and
- A number of smaller reticulation mains ranging in size from DN225mm to DN300mm servicing individual building lots.

Similar to the potable water network, the exact depths and positions of the existing reticulation mains are unknown. Further investigation is required to determine the exact layout and depths of services; this should an investigation of the levels of the existing infrastructure from manhole surveys. It is also noted that the above discussion only considers Sydney Water infrastructure.

The existing and proposed wastewater infrastructure is outlined below in Figure 9. Onsite utility investigations and service searches are recommend post rezoning as a part of any future development application.

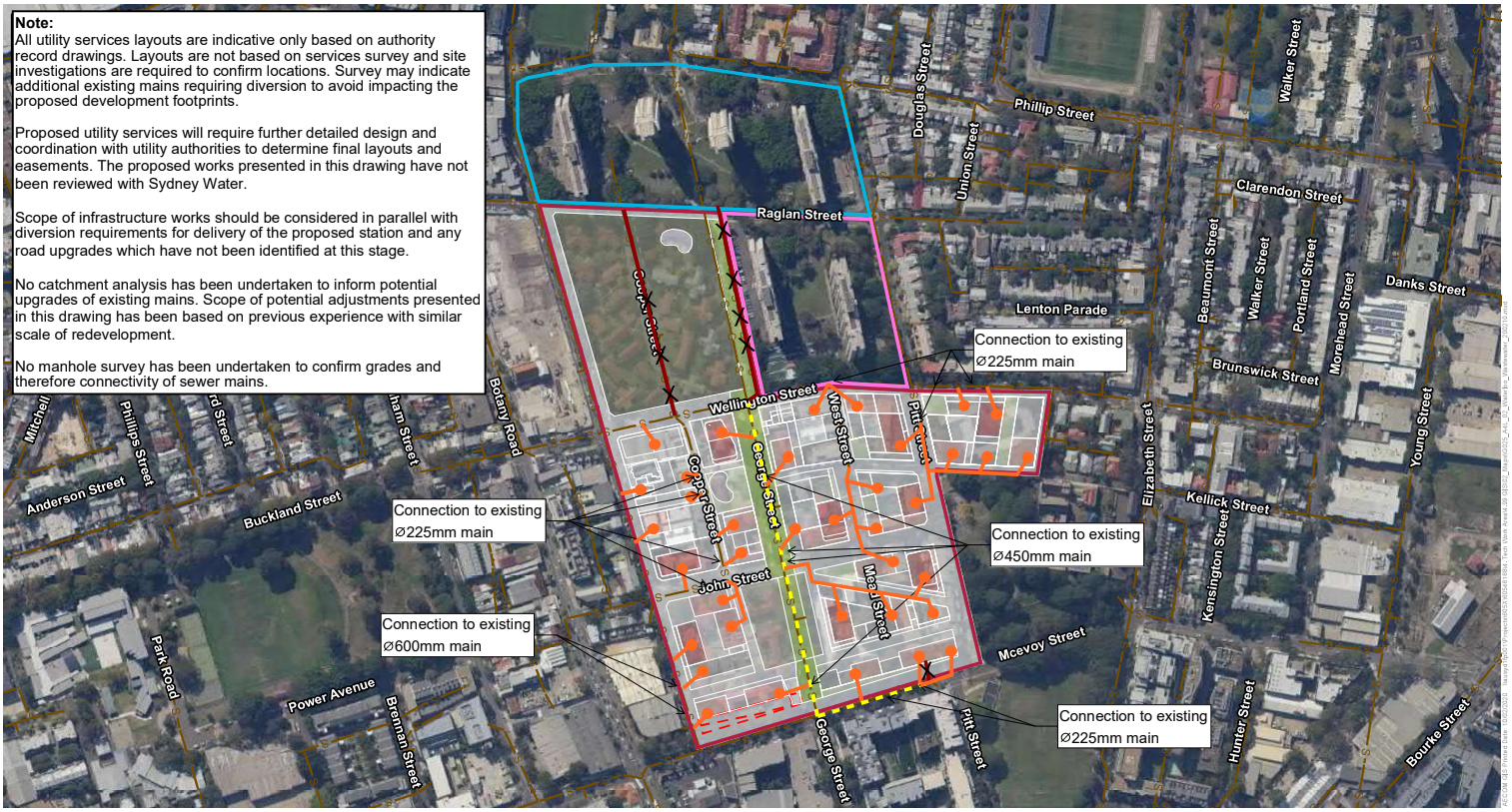
While Sydney Water have indicated that the trunk system has the capacity to service the potential development scenarios, several carrier mains running to the trunk system from the Estate may require amplification. Hydraulic modelling is required to confirm the scope of any lead-in infrastructure upgrades however it is noted that alternative end uses of drinking and non-drinking water such as recycled water could reduce or eliminate the need to amplify surrounding wastewater infrastructure.

6.5 Potential ESD Initiatives

This report shows “baseline” utilities responses. Key Ecologically Sustainable Development (ESD) initiatives outlined in the *City of Sydney Decentralised Water Master Plan 2012-2030* that have the potential to reduce wastewater demand and are recommended for investigation include but are not limited to:

- Onsite rainwater reuse (embedded in current design);
- Blackwater / greywater use including split system (future consideration); and
- Wastewater harvesting and water recycling (future consideration)

Figure 9: Proposed Waterloo Wastewater Plan



KEY

- Waterloo Central
- Waterloo North
- Waterloo South
- Sydney Water wastewater
- Existing wastewater main to be abandoned and/or relocated
- Proposed trunk main amplification
- Proposed building connection
- Proposed wastewater main

AECOM

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WATERLOO SOUTH
Existing Wastewater Utilities Infrastructure

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SG	10/02/2020	G025	01	60548168
CHECK	FIGURE			
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6.6 Coordination with Other Services

Coordination of Sewer Infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards, these details are attached in Section 10.

In addition, Section 4.4.5.2 of Water Services Association of Australia codes (WSA 02-2002-2.2, Sydney Water Edition – Version 3) states the clearance requirements for sewers in Table 4.2, as summarised below in Figure 10 which indicates existing wastewater locations and potential connection points.

Utility (Existing service)	Minimum horizontal clearance mm		Minimum vertical clearance[1] mm
	New sewer size		
	≤DN 300	>DN 300	
Sewers ≤DN 300	300	600	150[2]/300
Sewers >DN 300	600	600	300
Gas mains	300[3]	600	150[2]/300
Telecommunication conduits and cables	300[3]	600	150[2]/300
Electricity conduits and cables	500	1000	225[2]/300
Drains[7]	300[3]	600	150[2 and 4]/300[4]
Water mains	1000[5]/600	1000[5]/600	500[4]
Kerbs	150	600[6]	150 (where practicable)

NOTES:

1 Vertical clearances apply when sewers cross one another, except in the case of water mains when a vertical separation shall always be maintained, even when the sewer and main are parallel. *The sewer should always be located below the main to minimise the possibility of backflow contamination in the event of a main break.*

2 A minimum vertical clearance of 300 mm applies if the size of either the existing service or proposed sewer is >DN 300.

3 *Clearances can be further reduced to 150 mm for distances up to 2 m when passing installations such as poles, pits and small structures, providing the structure is not destabilised in the process.*

4 *Sewers should always cross under water mains and stormwater drains.* If this requirement cannot be met, consult Sydney Water in respect of alternatives such as adjusting the water main or stormwater drain. Where a sewer crosses a water main at or close to 90 degrees, the vertical clearance may be reduced to not less than 200 mm provided that the sewer is concrete encased and a 50 mm compressible material is placed over the encasement. The encasement shall not have any joints within 1000 mm either side of the water main and shall conform to Drawing SEW–1205-V.

5 When the sewer is at the minimum vertical clearance below the water main (500 mm) maintain a minimum horizontal clearance of 1000 mm. *This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance increases to 750 mm.*

6 Clearance from kerbs shall be measured from the nearest point of the kerb.

7 A sewer to be constructed under an existing or proposed stormwater pipe or channel ≥DN 375 shall be concrete encased. The concrete encasement shall extend at least one metre each side of the stormwater pipe or channel. Clearances between the sewer and other services shall be measured from the outer surface of the concrete encasement.

Figure 10: Sydney Water Clearance between Sewers and Other Underground Services
(WSA 02-2002-2.2, Sydney Water Edition – Version 3)

6.7 Approvals and Next Steps

The sewer strategy is to be confirmed through hydraulic modelling, with separate reports outlining the modelling outcomes to be submitted to Sydney Water. Further discussion is also to be undertaken with Sydney Water to confirm lead-in infrastructure requirements and to check inverts of gravity pipes to ensure falls are achievable.

The key next steps in progressing the delivery of sewer infrastructure through detailed design including the formal approval process for Sydney Water infrastructure consists of the following:

1. Undertake hydraulic modelling to confirm extent of any lead-in infrastructure upgrades required – Post Rezoning/Development Application;
2. Undertake site investigations to confirm the layout and extent of existing on site infrastructure (including non-Sydney Water infrastructure) – Post Rezoning/Development Application;
3. Develop an overall wastewater master plan for the Estate including staging considerations and agree these with Sydney Water. Being a gravity service this will need to include consideration of the depth of the existing sewer infrastructure to be maintained and/or connected to (based on manhole survey) and proposed grading of the site - As a part of Development Applications;
4. Develop a diversion strategy (including any interim works to suit staging) and protection/build-over requirements for infrastructure that cannot be diverted - As a part of Development Applications;
5. Establish a Head Deed to be signed by required parties (Sydney Water, Designer, WSC, Developer, Constructor) – As a part of detailed design;
6. Submit application/s for individual detailed design packages to be submitted to Sydney Water with drawing of proposed works in stages, Section 73 – As a part of detailed design;
7. Sydney Water to issue of Notice of Requirements (NOR) with their requirements for water main layout, sizing and funding matters confirmed – As a part of detailed design; and
8. Detailed design to be progressed based on the NOR and submitted to Sydney Water for approval – As a part of detailed design;

It is noted that the above is for delivery of the wastewater network through the new street network, it is expected that the buildings will need to make separate applications for connection.

7. Electrical

7.1 Background

Electrical servicing to Waterloo South is provided by Ausgrid. Projections produced as part of the *C2E Infrastructure Servicing Strategy Report* (AECOM, 2015) indicate that there will be a substantial increase in electrical demand throughout the Estate. There may not be sufficient capacity within the local zone substation to supply the proposed demand at Waterloo.

Augmentation or consolidation works of feeder cables to Surry Hills Zone Substation will be required to service the development area beyond 2026 and a new 132/11kV Zone Substation is anticipated to replace the current Zetland zone substation (*See Appendix A*).

7.2 Demand Assessment

An assessment of the estimated electrical demand for Waterloo South has been undertaken to assist in determining the required infrastructure upgrades. Demand forecasting and profiles were calculated for the Estate using development yields over a 15-20 year period which will be staged progressively over time. Individual project areas have been based on the average number of dwellings and proposed Gross Floor Area (GFA) for retail and community/cultural developments outlined in the concept proposal shown in Section 3 and in Table 9 below.

Table 9: Forecast Development Yield

Forecast Breakdown	Development Yield (Stage 1)
Apartments (No.)	3,048
Retail Floor space (m2)	11,200
Community/Cultural Space	6,700
Lifts* (No.)	330
Carparking* (m2)	60,000 (1,815 car spaces for Waterloo South)
Electric Car Charging	30 (assumed)

Electrical demand for the Estate has been determined based on maximum AS3000 Table C3 and Ausgrid NS109 Table B rates unless indicated otherwise. Endeavour Energy recommended After Diversity Maximum Demand (ADMD) rates were also used to estimate residential dwelling electrical demand. These are shown respectively in Table 10 , Table 11 and Table 12.

Table 10: AS3000:2007 - Table C3 Maximum Demand (non-domestic installations)

Type of occupancy		Energy demand	
		Range, VA/m^2	Average, VA/m^2
Offices	Light and Power	40-60	50
	Airconditioning		
	- cooling	30-40	35
	- reverse cycle	20-30	25
	- zonal reheat	40-60	50
	- variable volume	20	20
Carparks	Open air	0-10	5
	Basement	10-20	15
Retail shops	Light and power	40-100	70
	Airconditioning	20-40	30
Warehouses	Light and power	5-15	10
	Ventilation	5	5
	Special equipment	(use load details)	
Light industrial	Light and power	10-20	15
	Ventilation	10-20	15
	Airconditioning	30-50	40
	Special equipment	(use load details)	
Taverns, licensed clubs	Total	60-100	80
Theatres	Total	80-120	100

Table 11: Ausgrid NS109 - Table 4 Guide to Typical Load Densities

Type of Development		Range VA/m^2	Average VA/m^2
Offices -	- Not air-conditioned	40-60	50
	- air-conditioned - cooling only	70-100	85
	- reverse cycle	60-90	75
	- electrical reheat open areas	80-120	100
	- electrical reheat zonal or package units	90-130	110
	- variable volume	60-80	70
Car parking	- open air	0-10	5
	- ventilated	10-20	15
Warehousing	- unventilated	5-15	10
	- ventilated	10-20	15
Shops	- Not air-conditioned	40-100	70
	- air conditioned	60-140	100
Shopping centres (assumed air-conditioned shops)	- Not air-conditioned public areas	60-140	100
	- air conditioned public areas	80-160	120
Industrial	- light	10-20	15
	- if ventilated add	10-20	15
	- if air-conditioned add (see note)	30-50	40
Theatres, halls, etc	- ventilated	50-70	60
	- air-conditioned	80-120	100
Hotels, Taverns, Restaurants (Residential section, use Annexure C)		60-100	80

Table 12: Endeavour Energy Growth Servicing Plan 2018 – Table 1 – ADMD by application

Level of Network	Residential Dwelling Type	ADMD kVA	Example Application
Distribution Substation and Low Voltage network	Detached House	5 (medium) 6.5 (large)	Size Distribution Transformer
	Apartments	3.5	
11kV feeders	Detached House	4	Area Studies
	Apartments	3	
Zone Substation	Detached House	3.2	Summer Demand Forecast
	Apartments	2.4	
	Detached House	4	Area Planning
	Apartments	3	

For Waterloo South we have adopted the following load ranges based on a combination of defined unit rates and past AECOM experience with building developments. The rates from Endeavour Energy are assumed to be inclusive of diversity however the Ausgrid rates are assumed not to include diversity, therefore a 0.8 diversity factor has been applied to the Ausgrid rates:

- Apartments = 3,000 VA / dwelling
- Commercial floor space = (100 * 0.8 Diversity) VA / m2
- Retail floor space = (250 * 0.8 Diversity) VA / m2
- Community / cultural space = (100 * 0.8 Diversity) VA / m2
- Lifts = (80,000 * 0.8 Diversity) VA / unit
- Carparking = (15 * 0.8 Diversity) VA / m2
- Electric Car Charging = 7kW with 60% diversity

7.3 Forecast Demand

Table 13 below summarises the total maximum electrical demand for the site, to develop this demand profile we have made the following assumptions based on the latest information provided in the nominated kit of parts and the concept proposal outlined in Section 3:

Table 13: Total Maximum Electrical Demand

Electrical Loads	Quantity	Unit	kVA / unit (incl. Diversity Factor)	Subtotal kVA (ADMD)
Apartments	3,000	no.	3.0	9,000
Retail	11,200	m^2	0.20	2,240
Community/Cultural Space	6,700	m^2	0.8	1,340
Lifts	330	no.	64	21,120
Total				**33,700**

The overall peak electrical demand for all buildings and carparks following development has been estimated to be approximately **34MVA**. Considering a ±15% to account for future design development, this increases electrical demand to be approximately 29 - 39 MVA. It is noted that the above loads currently do not account for BASIX reduction factors.

The impact of Photo Voltaic (PV) cells have not been accounted for in this electrical demand estimation as ESD options will be subject to design development. However, based on information provided in the accompanying AECOM *Ecologically Sustainable Development 2019* study, an optimised spatial configuration of rooftop elements has a potential PV generation capacity of 4MVA which can be reduced from the above total electrical demand. Other options to achieve a 50% renewable energy target such as power purchasing agreements, embedded networks and other governance and planning measures have not been considered as part of this assessment.

It should be noted that while a gas connection has been allowed for and indicative gas demand rates have been developed, the above table assumes that apartments use electricity rather than gas for cooktops and heating. Preliminary demand assessments indicate that adoption of gas cooktops will reduce the total electrical demand by 0.8MVA.

7.4 On-Site Utility Infrastructure

The existing Ausgrid electrical infrastructure on the site has been identified based on Dial Before You Dig (DBYD) records and information provided from the *Ausgrid Distribution and Transmission Annual Planning Report, 2018.* Waterloo South falls within the Eastern Suburbs load area and is serviced by substations and feeders as shown in Figure 11 below.

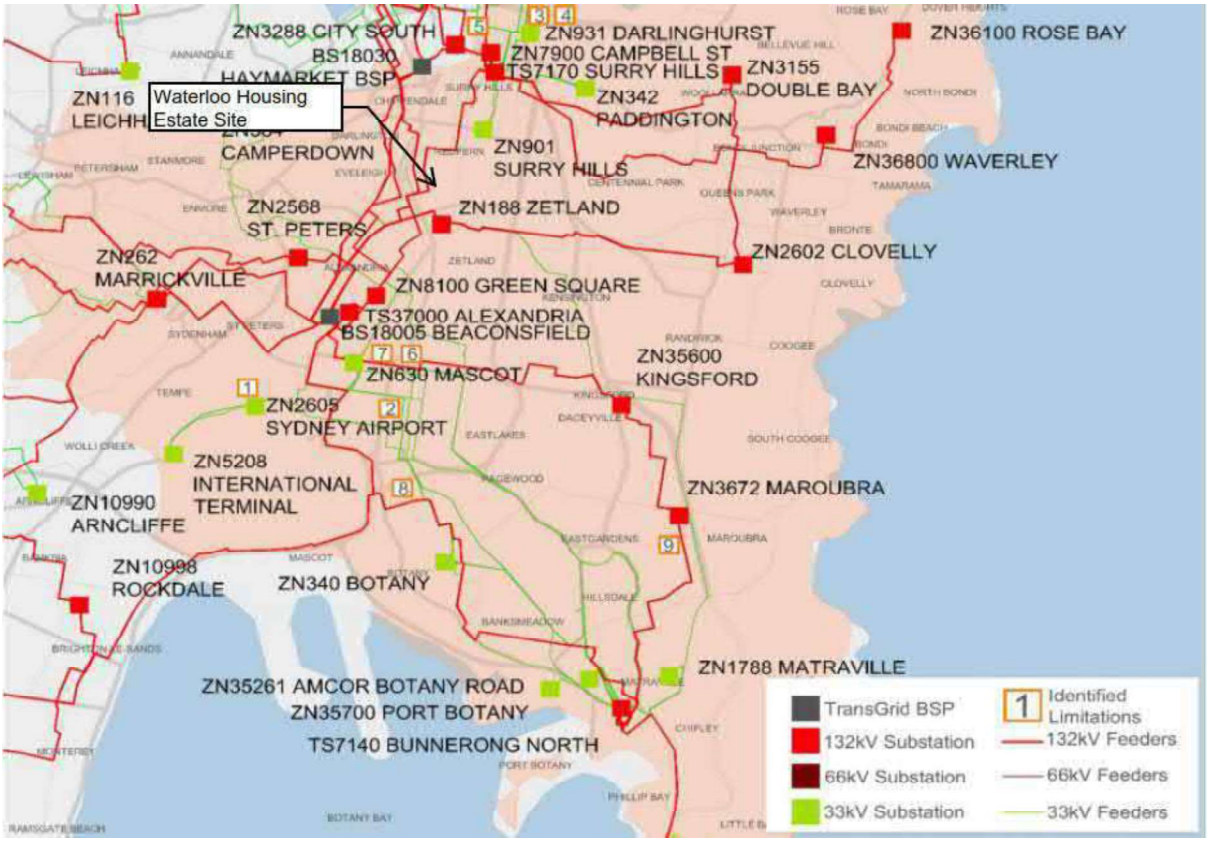


Figure 11: Eastern Suburbs load area *(Ausgrid, 2018)*

There are a number of existing electrical assets within the site boundary, in particular:

- A large concentration of LV distribution cables and conduits within George Street, McEvoy Street, Wellington Street and Elizabeth Street;
- Existing overhead power running along streets; and,
- A number of above-ground distribution substations stepping down the 11kV supply located on McEvoy Street, George Street, Cope Street, Phillip Street, Raglan Street, and Pitt Street.

The exact depths and positions of the existing reticulation mains are unknown thus further investigation is required to determine the exact existing layout. If any new 11kV reticulation is required within 4 metres of the existing HV cables, ratings assessments are required to demonstrate to Ausgrid's satisfaction that there are no mutual heating issues between cables.

Zetland has limited capacity to service the full requirements of the development. Capacity can either be provided during the early stage development from existing feeders or via temporary feeders from Green Square. While formal enquiries have been submitted to Ausgrid, feedback has not been received at the time of writing of this report. Preliminary consultation with Ausgrid has indicated that it is likely that the final stage of Waterloo South will require servicing from a new zone substation in a location to be provided and confirmed by Ausgrid. There is also an increase in development load applications in this extended area due to the proposed Sydney Metro Waterloo Station.

7.5 Undergrounding of Existing Electrical

Current utility design standards require all new utilities to be constructed underground and it is expected that all existing aerial infrastructure would be abandoned or relocated underground. Figure 12 shows the existing overhead electrical infrastructure within the proposed site. Consideration of adequate space provision should be made during further design development to plan for undergrounding of these existing cables.

Figure 12: Botany Road *(Google Maps, 2019)*

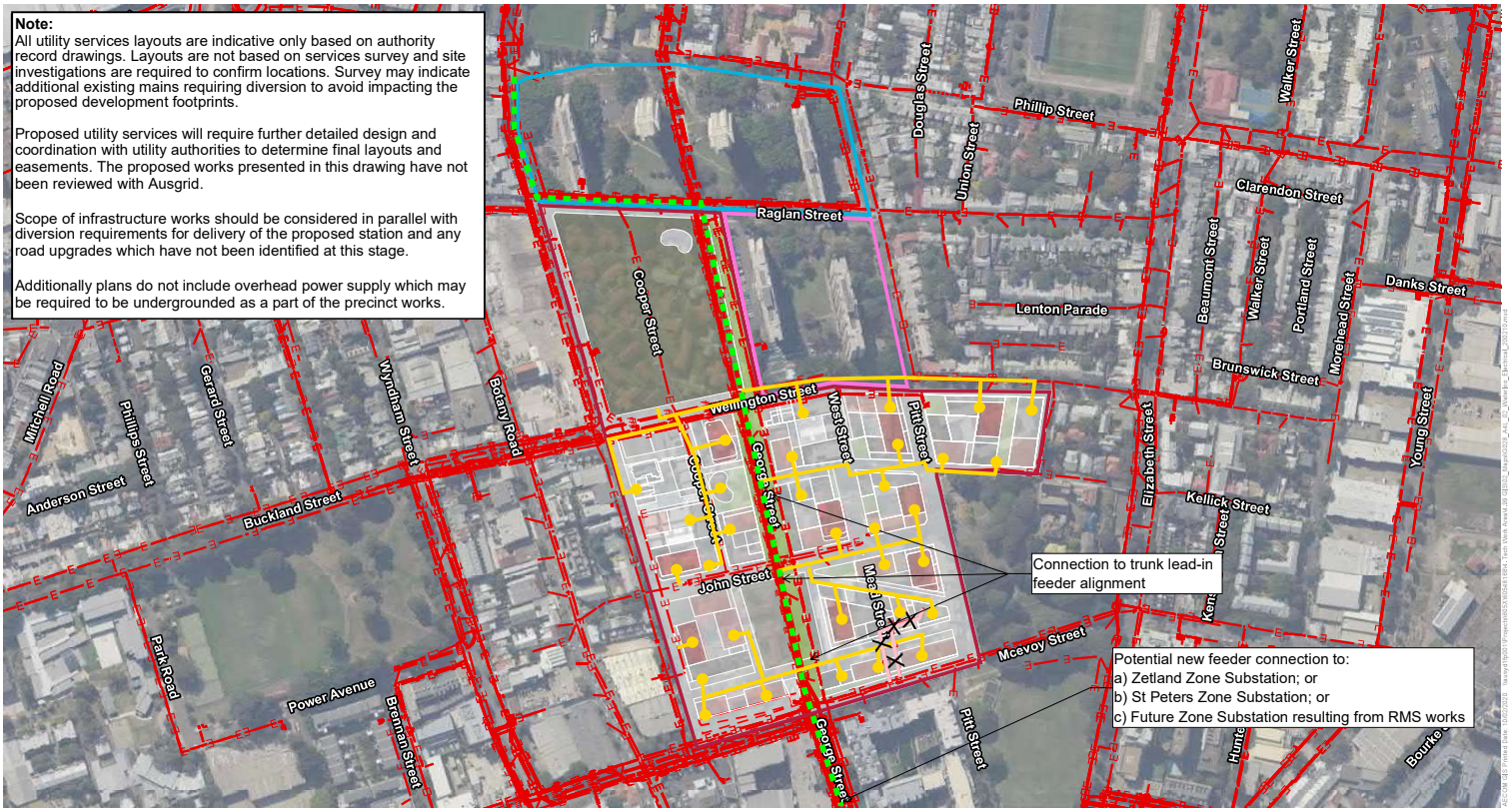
7.6 Potential ESD Initiatives

This report shows “baseline” utilities responses but key Ecologically Sustainable Development (ESD) initiatives recommended for further investigation as a part of detailed design include:

- Solar PV (embedded into current design);
- Building orientation (embedded into current design);
- Natural ventilation of common areas (embedded into current design);
- Electric car charging (future consideration);
- Centralised heat extraction system (future consideration);
- Geothermal cooling (future consideration);
- Smart metering (future consideration); and
- Glazing options to improve thermal comfort and reduce heating and cooling loads.

It is noted that these would have an impact on the final electrical peak demand and associated infrastructure upgrade requirements.

Figure 13: Waterloo Electrical Plan



KEY

- Waterloo Central
- Waterloo North
- Waterloo South
- Ausgrid line
- Existing electrical underground ducts abandoned and/or relocated
- Proposed trunk lead-in feeder line
- Proposed building connection
- Proposed electrical ducts and feeders

AECOM

0 50 100 m

CONFIDENTIAL GIS MAP

SCALE 1:5,000 | SIZE A4
SHEET 1 of 1 | COORDINATE SYSTEM GDA 1994 MGA Zone 56

WATERLOO SOUTH
Existing Electrical Utilities Infrastructure

PROJECT
SYDNEY URBAN TRANSFORMATION

CLIENT
URBAN GROWTH NSW

DRAWN	DATE	MAP #	REV	Project
SG	10/02/2020	G028	01	60548168
CHECK	FIGURE			
DF	3			

7.6 Coordination with Other Services

Coordination of the proposed electrical infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards (these details are attached in Section 10).

Ausgrid's specification "NS130: Specification for Laying of Underground Cables up to 22kV" does not provide specific information on clearances from other services. If the electrical services are installed within the standard allocation, the separations given by the other services provider should apply for all crossings. Where a reduced allocation is proposed, separations should be determined in consultation with Ausgrid.

In addition to the above, all works will also comply with Ausgrid Network Standards NS 156 "Working near or around underground cables".

7.7 Approvals and Next Steps

Ausgrid formal approvals are usually provided for individual detailed design packages. It is possible to submit precinct wide drawings to establish a Case for the entire area with Ausgrid.

The key next steps in progressing the delivery of electrical infrastructure through detailed design including the formal Ausgrid approval process consists of the following:

1. Undertake site investigations to confirm the layout and extent of existing services (including non-Ausgrid assets) – Post Rezoning/Development Application;
2. Confirm arrangements for supply and ownership of street lighting – As a part of Development Applications;
3. Confirm extent of existing infrastructure that can be abandoned and/or requires diversion - – Post Rezoning/Development Application;
4. Develop duct masterplan and make submission to set up case with Ausgrid – As a part of Development Applications;
5. Develop staged designs for delivery of the new infrastructure – As a part of detailed design;
6. Liaise with City of Sydney to confirm requirements for undergrounding of existing infrastructure – As a part of Development Applications;
7. Ausgrid to provide detailed requirements – As a part of Development Applications, As a part of detailed design;
8. Ausgrid to issue Design Information Pack (DIP), Design Contract & Deed of Agreement As a part of detailed design; and
9. Submit detailed design of individual packages for approval - As a part of detailed design;

It is noted that the above is for delivery of the duct network through the new street network, it is expected that the buildings will need to make separate applications for connection, including installation of new feeders.

During the design of the Estate, consideration must be given to the likely provider of the bulk supply to the site to avoid this being a negotiation between multiple developers.

8. Gas

8.1 Background

Gas servicing to Waterloo South is provided by Jemena. Projections produced as part of the *C2E Infrastructure Servicing Strategy Report* (AECOM, 2015) indicate that there will be a substantial increase in gas demand throughout the wider Estate. Whilst there is a substantial distribution network in the area, it is predominately comprised of small connections providing supply at a low pressure.

As a part of the *C2E Infrastructure Servicing Strategy Report* (AECOM, 2015) Jemena indicated that although they have the ability to service the general Estate they have not confirmed whether the existing infrastructure within Waterloo South has sufficient capacity. Confirmation of capacity and potential required upgrades will be received when formal connection applications are received.

The following table outlined the rates used to derive the estimated gas demand within the Estate area, applied to residential dwellings only.

Table 14: Gas Demand Unit Rates

Building Type	Peak Demand Rate	Unit
Residential	2.169863014	m^3/day/dwelling
BASIX Reduction	25	%

8.2 Demand Assessment

An assessment of the gas demand has been undertaken to assist in determining the required infrastructure upgrades associated with the Estate. Demand forecasting and profiles were calculated for the Estate using development yields over a 15-20 year period which will be staged progressively over time. Individual project areas have been based on the average number of dwellings and proposed Gross Floor Area (GFA) for retail and commercial development outlined in the concept proposal shown in Section 3

Jemena use an energy demand of 20 gigajoules (GJ) per year to estimate the average annual domestic usage of natural gas for residential dwellings. This usage rate typically equates to a natural gas hot water tank, cook top and heating point. Peak demand and annual gas demand are also dependent on the plant supplying the project area.

When contacting Jemena they confirmed that different rates are to be used for commercial spaces however they were unable to confirm estimated rates, as such this has been excluded from this assessment. However, the demand from commercial land uses is expected to be substantially less than from residential usage. It should be noted that the gas demands do not account for alternative supply scenarios such as trigeneration.

8.3 Forecast Demand

Table 15 presents the estimated natural gas usage for Waterloo South, assuming supply to residential properties only. A BASIX reduction of 25% has been applied to the gas demand.

While gas usage can increase under BASIX to offset electrical demand, gas prices have a much greater effect on demand. Due to this variability, it has been assumed that there is no net increase or reduction consequent of BASIX compliant dwellings.

The average cumulative gas demand is estimated to be approximately **4,900 m^3/day** as shown in Table 15. Considering a ±15% range for development yields, the gas demand could vary from approximately 4,200 – 5,600 m^3/day which includes the BASIX reduction.

Table 15: Estimated Cumulative gas demand assessment (incl. BASIX)

Study Area	Gas – m^3/day – Cumulative (incl. BASIX)		Total (m^3/day)
	Apartments	Commercial	
Waterloo South	4890	n/a	**4,890**

8.4 Existing On-Site Utility Infrastructure

There is currently an extensive network of gas mains within the Estate, in particular:

- An external secondary trunk main (1050kPa) that lies approximately 150m of the Estate's southern border at the corner of George Street and Allen Street; and
- A number of medium pressure 210kPa network mains servicing the existing buildings.

The existing and proposed services are shown below in Figure 14. The exact depths and positions of the existing reticulation mains have not been confirmed and further investigations will likely be required to determine the extent of diversions required.

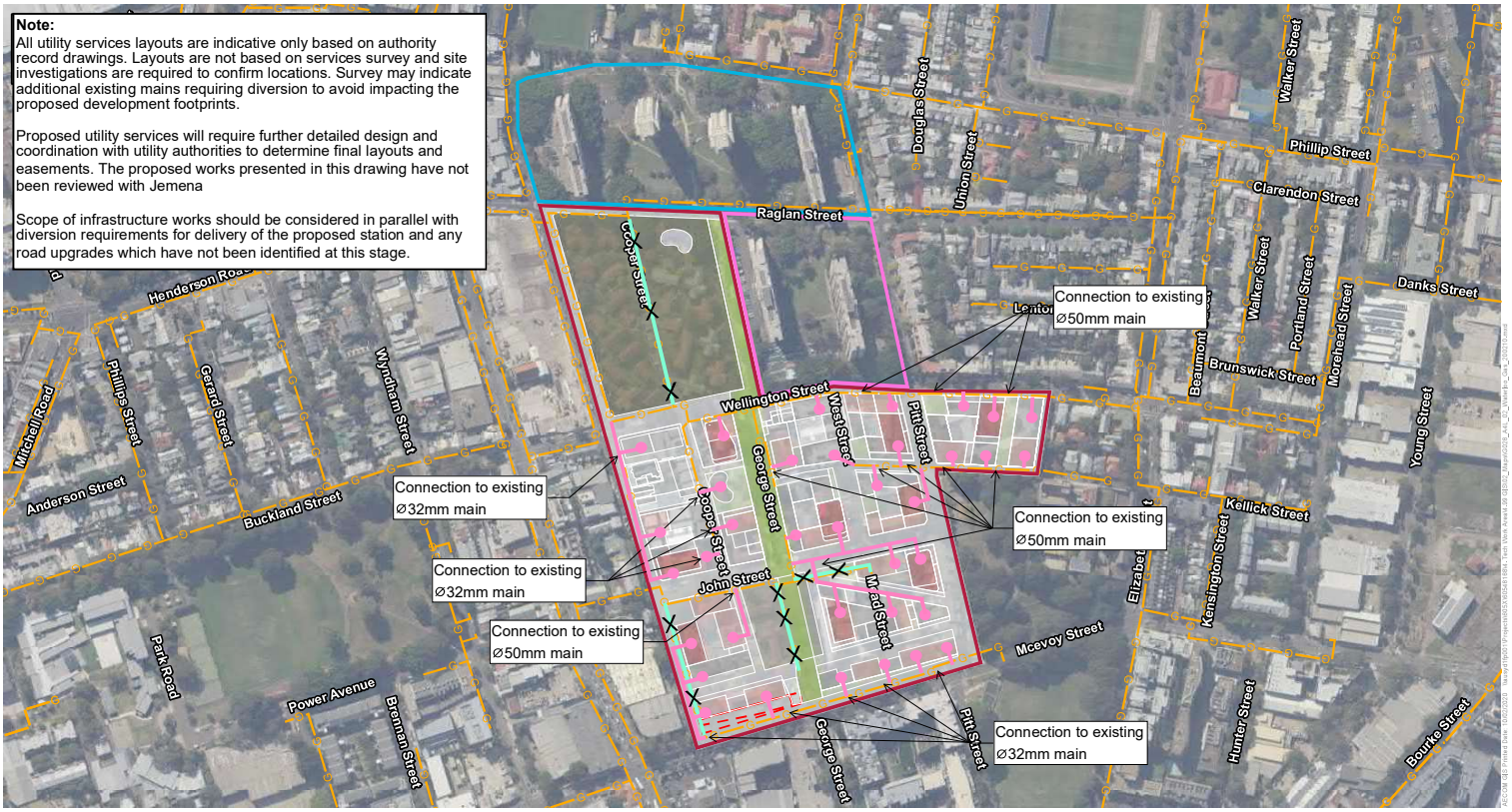
Onsite utility investigations and service searches are recommend post rezoning as a part of any future development application.

8.5 Potential ESD Initiatives

It is noted that mains gas, while currently less carbon intensive than grid electricity per unit of energy, is still a fossil fuel and releases greenhouse gases during combustion. If the goal is to transition to a zero carbon economy by 2050, the focus naturally must be on minimising the use of energy and lowering energy emissions overall.

As a part of future design development, consideration should be given to using a sustainable electrical supply rather than gas for heating and cooking.

Figure 14: Waterloo Gas Plan



KEY

- Waterloo Central
- Waterloo North
- Waterloo South
- G Jemena gas main
- Existing gas main to be abandoned and/or relocated
- Proposed building connection
- Proposed gas main

AECOM

0 50 100 m

CONFIDENTIAL GIS MAP

SCALE 1:5,000 | SIZE A4
SHEET 1 of 1 | COORDINATE SYSTEM GDA 1994 MGA Zone 56

WATERLOO SOUTH
Existing Gas Utilities Infrastructure

PROJECT
SYDNEY URBAN TRANSFORMATION

CLIENT
URBAN GROWTH NSW

DRAWN	DATE	MAP #	REV	Project
SG	10/02/2020	G026	01	60548168
CHECK	FIGURE			
DF	3			

8.6 Coordination with Other Services

Coordination of the proposed gas infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards (these details are attached in Section10).

Jemena provide guidance on horizontal and vertical clearances, the minimum separations between electrical and natural gas mains are provided in Table 1.0 of "Natural Gas Requirements for Developer Provided Trench" as summarised in Table 16.

Table 16: Jemena minimum separation between utilities

Utility	Minimum Separation	
	Gas Mains up to 75mm diameter	Gas Mains of 110mm diameter or larger
Telecommunication cables and/or conduits	150 mm	300 mm
Protected[2] Low Voltage electricity cables	150 mm	300 mm
Protected[2] High Voltage electricity cables	300 mm	300 mm

1. *Separations relate to distances between conduits/cables peripheries*
2. *"Protected" refers to mechanical protection of the cables, which usually takes the form of either polymeric strips (at least 3 mm thick) or clay brick*
3. *The above table is considered to provide desirable minimum separations. Consideration should be given for the need to access for future maintenance of services when determining the required separations*

8.7 Approvals and Next Steps

Jemena does not have a formal approval process at the rezoning phase. Supply arrangements are to be confirmed by Jemena as part of their quotation for construction following submission of applications for connection.

The formal approval process for provision of Jemena infrastructure to be progressed through detailed design processes consists of the following main steps:

1. Undertake site investigations to confirm the layout and extent of existing services (including non-Jemena infrastructure) – Post Rezoning/Development Application;
2. Submit masterplan including staging of delivery to Jemena for agreement – As a part of detailed design;
3. Submit application for design to Jemena for individual detailed design packages (to include proposed alignment) – As a part of detailed design; and
4. Jemena will provide a quote for construction works – As a part of detailed design;

It is noted that the above information is for delivery of the Jemena network through the new street network, it is expected that the buildings will need to make separate applications for connection.

9. Data and Telecommunications

9.1 Background

A number of communication providers have assets running adjacent to and intersecting Waterloo South:

- NBN Co, NswAct
- Nextgen, NCC - NSW
- Optus and/or Uecomm, Nsw
- PIPE Networks, Nsw
- Telstra NSW, Central
- Verizon Business (Nsw)
- Vocus Fibre Pty Ltd (NSW)

Due to the scale of development expected on the site it is expected that new telecommunications servicing will be provided by the National Broadband Network (NBN). A map showing the current rollout of the NBN network in the area is provided below in Figure 15.

It is noted that this figure does not include backhaul costs or pulling cables and assumes that existing conduits can be linked to new cables.

9.2 Demand Assessment

No demand has been calculated for telecommunications infrastructure as it cannot be estimated in the same way as other utilities.

9.3 On-Site Utility Infrastructure

On-site utility infrastructure for each telecommunications service is summarised below, Figure 15 shows the proposed telecommunication connection route for Waterloo South.

Telstra
Underground Telstra services are located in the streets forming the boundary of the site as well as servicing existing lots within the Waterloo South. It has been assumed that the existing Telstra services will be required to be abandoned, relocated or replaced as a part of the site redesign, due to the fact that the existing levels are unlikely to be consistent with the proposed building locations. This assumption is to be confirmed during detailed design of the Waterloo South.

In adherence to Section 9.6 of the study requirements, it is likely that existing overhead Telstra infrastructure will need to be relocated underground within the site and the bounding roads.

Optus/Southern Cross
Optus has a major network critical cable located on George Street, running through the entirety of the site. The exact location of this cable is to be confirmed through site investigations which will determine the allowable extent of works in Henderson Road and Alexander Street.

Currently no connection to the Optus network is proposed as part of the Waterloo South works. Onsite utility investigations and service searches are recommended post rezoning as a part of any future development application.

Uecomm
Uecomm has a limited number of assets present adjacent to Waterloo South, beginning on Wellington Street at the Pitt Street intersection, and continuing eastward. It has been assumed at this stage that existing Uecomm services are to be retained and left in their existing position. No connections to the Uecomm network are proposed as part of the Waterloo South works.

AAPT

AAPT has a number of assets present within Waterloo South. AAPT has ducts travelling on the eastern side of George Street up until the intersection with John Street, where third party ducts for AAPT assets are utilised. No connections to the AAPT network are proposed as part of the Waterloo South works.

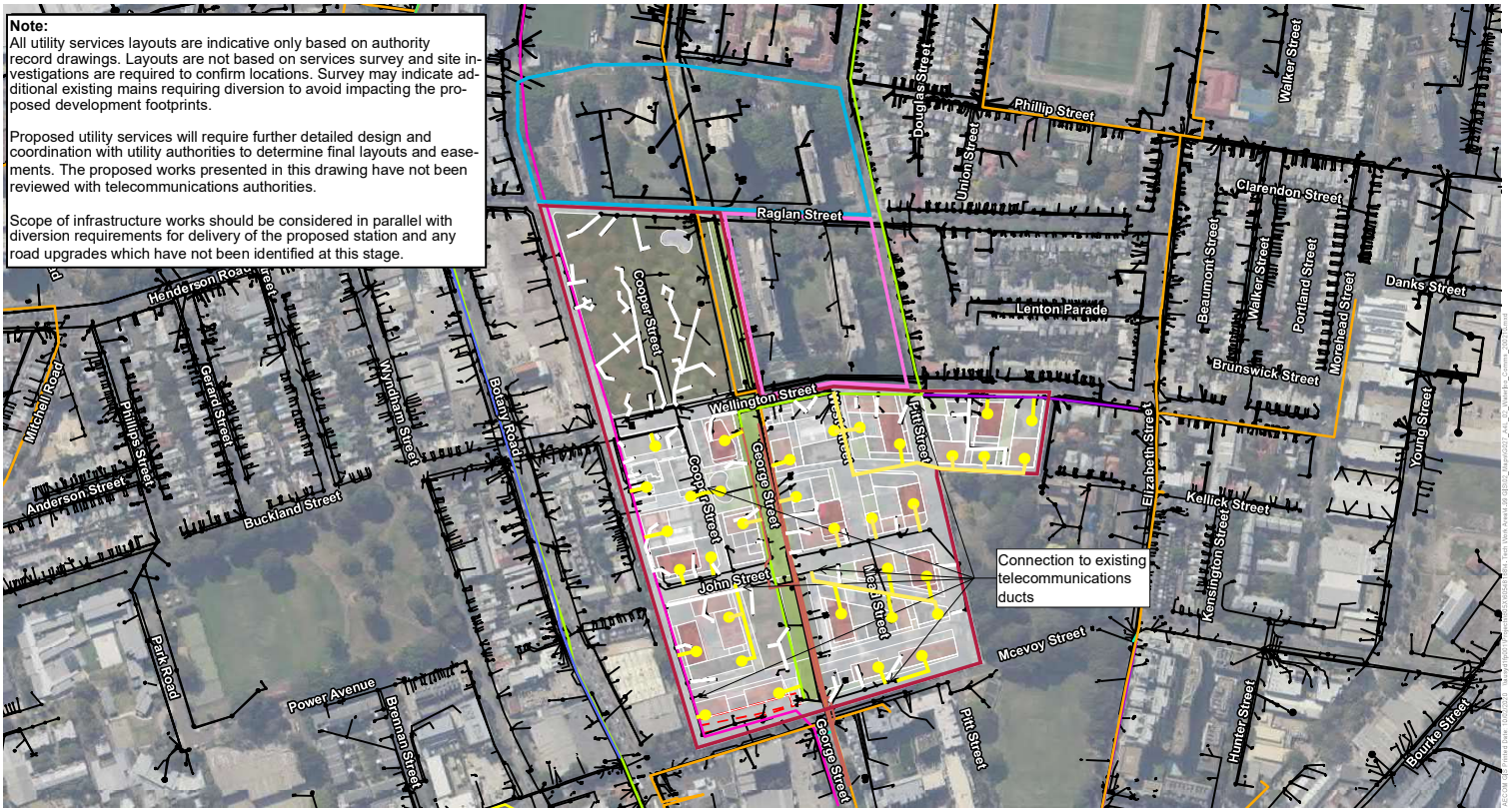
Nextgen

Nextgen has a number of assets in third party ducts within and adjacent to the site. The internal Nextgen asset travels up the western side of George Street, turns onto the southern kerb of Wellington Street and continues to travel up Pitt Street, adjacent to the sites eastern boundary. There is another Nextgen asset on the western kerb of Cope Street, adjacent to the sites western boundary. No connections to the Nextgen network are proposed as part of the Waterloo South works.

Primus

Primus has limited assets within Waterloo South. Their asset runs along the eastern side of Cope Street, adjacent to the western boundary. No connections to the Primus network are proposed as part of the Waterloo South works.

Figure 15: Proposed Waterloo Communications Plan



KEY

- Waterloo Central
- Waterloo North
- Waterloo South
- AAPT
- AARNet
- AMCOM
- Nextgen
- Optus
- Primus
- Telstra
- Uecomm
- Verizon
- Vocus
- Proposed communications ducts
- Existing Telstra ducts and cables to be removed
- Proposed building connection

AECOM

0 50 100 m

CONFIDENTIAL GIS MAP

SCALE 1:5,000 | SIZE A4
SHEET 1 of 1 | COORDINATE SYSTEM GDA 1994 MGA Zone 56

WATERLOO SOUTH
Existing Communications Infrastructure

PROJECT
SYDNEY URBAN TRANSFORMATION

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URBAN GROWTH NSW

DRAWN	DATE	MAP #	REV	Project
SG	10/02/2020	G027	01	60548168
CHECK	FIGURE			
DF	3			

9.4 Coordination with Other Services

Coordination of the proposed communications infrastructure with other services in the proposed street network would generally be based on the Streets Opening Conference standards (these details are attached in Section 10).

The clearances for NBN services from other utilities is given in Section 5.2.13 of "New Development: Deployment of the NBN Co Conduit and Pit Network – Guidelines for Developers", these requirements are presented in Figure 16 below.

Service Item		Minimum Radial Clearances*1
Gas Pipe	Over 110 mm	300 mm
	110 mm or Less	150 mm
Power	High Voltage	300 mm
	Low Voltage	100 mm*2
Water Mains	High Pressure/Capacity	300 mm
	Local Reticulation	150 mm
Sewer	Main	300 mm
	Connection Pipe	150 mm
Other Telecommunications	100 mm*1	

* 1 – Reduced separation is possible where all parties (including NBN Co) are consulted and agreement is reached.

* 2 – Only where protection barriers are used, for example, conduit, bedding, marker tape and cover batten.

Figure 16: NBN Clearances from Other Carriers and Underground Services

9.5 Approvals and Next Steps

Confirmation is required from NBN Co that the site is eligible for supply from their network. Following this an initial application is required and a formal agreement entered into with NBN Co. prior to construction works commencing (this does not prevent designs from being approved).

The next steps generally consist of:

1. Undertake site investigations to confirm the layout and extent of existing services (including private infrastructure associated with previous land-uses) – Post Rezoning/Development Application;
2. Liaise with Telstra and Optus to confirm the requirement for diversion and/or relocation of their existing infrastructure – Post Rezoning/Development Application;
3. Confirm proposed infrastructure master plan (including staging) and in principle supply arrangements with NBN or other provider - As a part of Development Applications;
4. Initial application submitted to NBN Co. for supply of the site from their network - As a part of Development Applications;
5. NBN Co. to confirm supply can be provided and provide draft agreement – As a part of detailed design;
6. Revisions of agreement where required – As a part of detailed design;
7. NBN Co. agreement to be signed – As a part of detailed design;
8. Liaise with Telstra and Optus for quote for diversions or abandonments including any interim works – As a part of detailed design; and
9. Submit detailed design of individual packages for approval – As a part of detailed design;

It is noted that the above is for delivery of the NBN pit and pipe network through the new street network, it is expected that the buildings will need to make separate applications for connection.

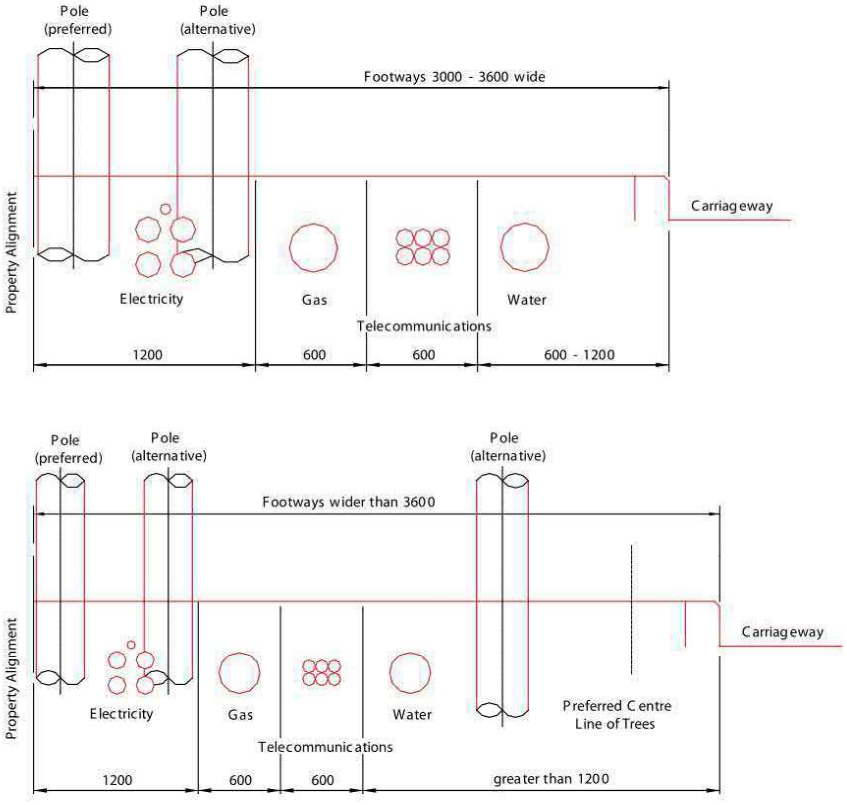
10. Utility Service Corridors

10.1 Streets Opening Conference Service Corridors

The “Guide to Codes and Practices for Streets Opening” by the NSW Streets Opening Conference (SOC), 2009 provides guidelines for service allocations within the footpath.

It has been assumed that the majority of new utility infrastructure for Waterloo South will be within new footpaths; these should follow the allocations shown below in Figure 17.

It is noted that City of Sydney generally requires the street lighting to be located adjacent to the kerb line, particularly if it is their asset.



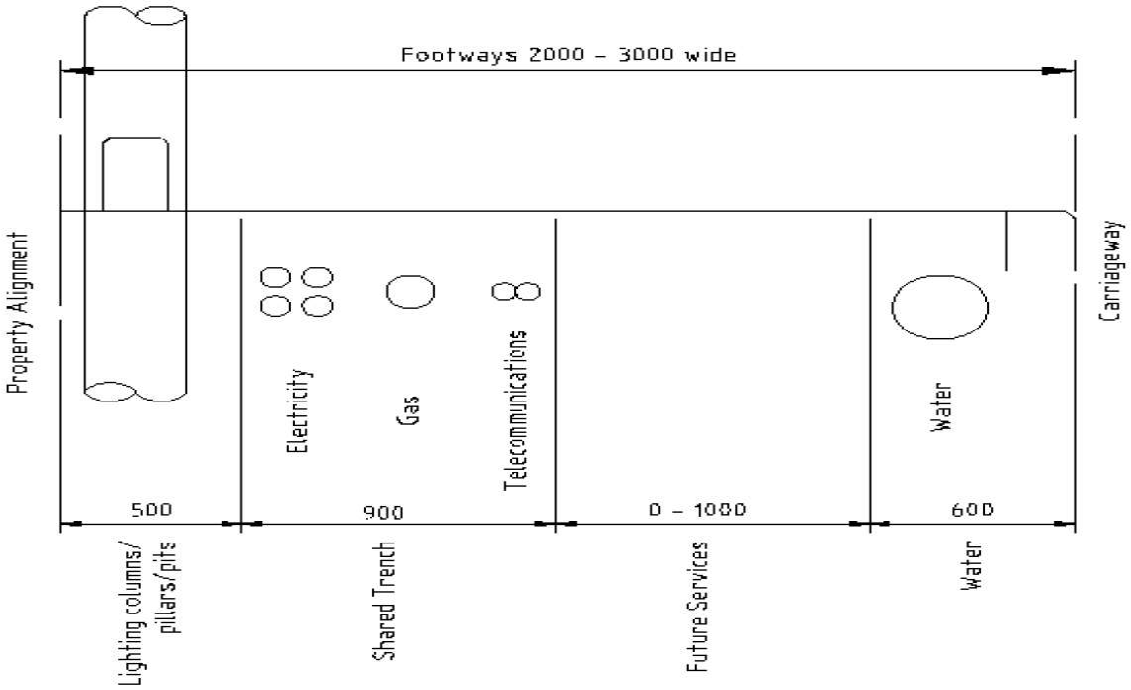
Notes:

1. These allocations apply throughout NSW except where noted in Section 6.4.
2. Where a Utility/Service Provider providing underground Services wishes to encroach on space allocated to another Utility/Service Provider, it should consult and seek agreement with the other. Both Utility/Service Providers should record such encroachments on their respective mapping systems.
3. The narrower water allocation shown may not be sufficient to include recycled water mains.
4. The preferred position for poles or street lighting columns is adjacent to the property alignment. Alternative positions are shown.
5. Where the erection of power poles in the 0-1200 mm allocation is impracticable, these may be located in the water allocation by agreement with the appropriate Public Authority.
6. No specific allocation for trees can be identified for footways up to 3600 mm wide. Consultation with Utility/Service Providers is required and due regard must be given to tree species.
7. Pillars/pedestals/Service pits etc should be located in a position that is set back from street intersections.
8. See Section 6.6 for guidance on new poles and pole replacements.

Figure 17: Streets dedicated after 1 January 1991 (SOC, 2009)

Where shallow footpaths between 2-3m are required, then shared trench arrangements may be used as shown below in Figure 18.

Again, it is noted that City of Sydney generally requires the street lighting to be located adjacent to the kerbline, particularly if it is their asset.



Notes:
1. The allocation of space in narrow footways, whether new or pre-existing, was adopted for the first time in the 2002 edition of the Guide to Codes and Practices for Streets Opening.
2. Where it is intended to lay more than one type of Service, shared trenching should be used. However, this does not always allow for large structures and trunk lines.
3. Where a Utility/Service Provider providing underground Services wishes to encroach on space allocated to another Utility/Service Provider, it should consult and seek agreement with the other. Both Utility/Service Providers should record such encroachments on their respective mapping systems.
4. Footways of width less than 2000 mm require special consideration to accommodate Services. Contact the Conference Secretariat for information concerning such designs, community title situations and other special situations. Refer to clauses 3.5 and 6.6 .
5. The variable allocation of 0-1000 mm provides for future extensions.
6. The preferred position for poles, pillars, cabinets and street lighting columns is adjacent to the property alignment.
7. Where the erection of power poles in the 0-500 mm allocation is impracticable, these may be located in the water allocation by agreement with the appropriate Utility/Service Provider.
8. No specific allocation for trees can be identified for footways up to 2000 mm wide. Consultation with Utility/Service Providers is required and due regard must be given to tree species.
9. Pillars/pedestals/Service pits etc should be located in a position that is set back from street intersections.
10. See Section 6.6 for guidance on new poles and pole replacements.

Figure 18: Allocation of space in narrow footways (SOC, 2009)

The shared trenching arrangement is not considered appropriated where main/trunk services are provided; this includes any potential HV electrical feeders.

Furthermore, while Ausgrid has shared trench agreements with Telstra, no such agreement exists with NBN Co. therefore shared trenching is not considered desirable for the Waterloo South site.

Further consultation will also be required with the City of Sydney to confirm if street lighting will be separate from the electricity supply, if so the standard allocation may require revision.

11. Rail Tunnel

The T8 Airport & South Line rail tunnel currently runs underneath George Street within Waterloo South as shown in Figure 19. Record drawings and long sections from Railcorp indicate that the rail tunnel between Redfern Station and Green Square Station has a depth from surface ranging between 20-30m. Further investigation is required to confirm the exact location and geometry of the rail tunnel and associated easements. This will allow checks to be made on clearances between the rail tunnel and its easements against the development basement and foundation levels proposed as part of the Estate development plan.

Specifically, post rezoning, potential impacts from the development of the Estate on the existing Airport line should be reviewed against the following guidelines:

- Development Near Rail Tunnels (Nov, 2018);
- Technical note – TN 043: 2017 External Developments Standard; and
- Airport Line Tunnel Protection Guidelines, Part B (Technical Matters), Rail Access Corporation 2000 (see **Waterloo Geotechnical and Contamination Report)**

Besides the key loading and/or structural requirements outlined in the guidelines, other items that should be considered include:

- Clearance assessments;
- Construction management plans (during detailed development stage);
- Ensuring there is no change in the flow direction, quantity or quality of surface water within the rail corridor; and
- There being no potential track movements.

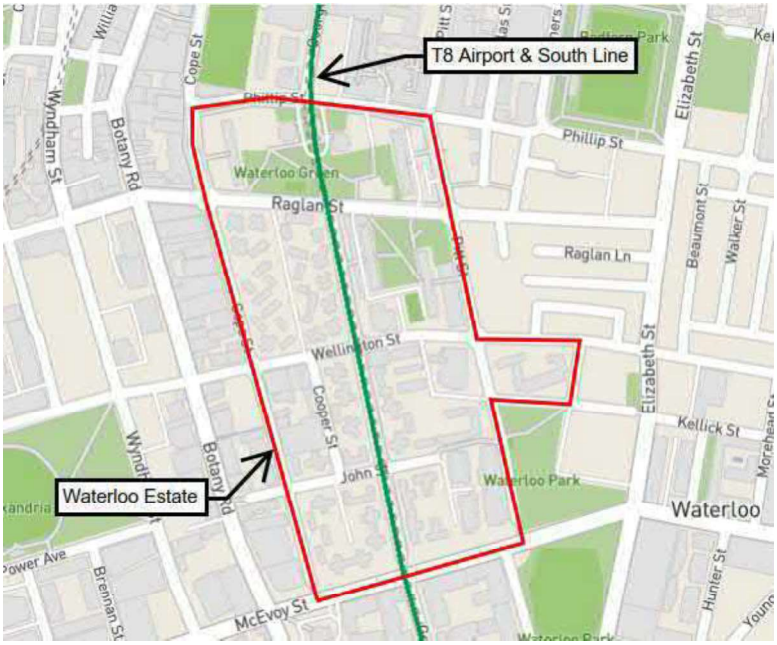


Figure 19: T8 Airport and South Line Rail Alignment (Transport NSW, 2019)

12. Waste and Recycling

This chapter outlines options and guidance for managing residential and non-residential waste and recycling at Waterloo South. This strategy considers relevant legislation and requirements for rezoning, in addition to the following:

- Characterisation of waste and recycling streams;
- Quantification of estimated waste and recycling volumes;
- A management system for storing, transferring and collecting waste and recycling; and
- A review of opportunities for recycling technology and equipment.

12.1 Legislation

12.1.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations (POEO) Act 1997* establishes management and licensing requirements along with other provisions to deliver environmentally appropriate outcomes. The POEO Act also establishes the ability to set various waste management requirements via the regulations. It is the primary piece of legislation regulating pollution control and waste disposal in NSW.
The POEO Act defines waste as:

- Something that is discharged or deposited in the environment such that it causes an alteration in the environment; or
- Something that is discarded, rejected, unwanted, surplus or abandoned; or
- Any processed, recycled, re-used or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations; or,
- Anything prescribed by the regulations to be waste.

A material or product is not precluded from being waste under NSW law merely because it may be processed, recycled, re-used or recovered.

Waste is generally categorised into three groups:

- Municipal Solid Waste (MSW) – largely comprising of household waste but often including other council wastes such as street sweepings and rubbish collection from bins in parks and public spaces;
- Commercial and Industrial (C&I) waste – the waste made by businesses or industry. However, if business waste is collected by the local council it may be categorised as MSW; and
- Construction and Demolition (C&D) waste – the waste produced in construction and building activities including demolition.

Across Australia C&D waste from the building sector and C&I waste from other businesses are generally larger sources of waste than MSW from households.

12.1.2 Waste Avoidance and Resource Recovery Act 2007

The Waste Avoidance and Resource Recovery Strategy 2007 (WARR Strategy 2007) provides a framework for maximising conservation of our natural resources and minimising environmental harm from waste management and disposal of solid waste. These drivers are very important against a backdrop of a growing population in NSW and a healthy economy that is producing more goods and services.

The WARR Strategy identifies waste avoidance and resource recovery goals and targets in four key areas:

1. Preventing and avoiding waste;
2. Increasing recovery and use of secondary materials;
3. Reducing toxicity in products and materials; and
4. Reducing litter and illegal dumping.

Targets in the WARR Strategy are:

- Increase in recycling of municipal solid waste from baseline 26% to 66% in 2014;
- Increased recycling of commercial and industrial waste from baseline 28% to 63% in 2014; and
- Increased recycling of construction and demolition waste from baseline 65% to 76% in 2014

12.1.3 Container Deposit Scheme

The NSW container deposit scheme (CDS), Return and Earn, began rolling out across NSW on 1 December 2017. The scheme was established under the *Waste Avoidance and Resource Recovery Amendment (Container Deposit Scheme) Act 2016 No 57* and the *Waste Avoidance and Resource Recovery (Container Deposit Scheme) Regulation 2017*.

The scheme enables individuals and businesses to return eligible containers and receive 10c per container. As of January 2019 there are no reverse vending machines or donation stations in the Waterloo area. John Smith Café is currently the only over the counter site accepting return and earn containers.

The CDS has been implemented in NSW to reduce public place litter and rewards citizens for recycling. The addition of a reverse vending machine at Waterloo South is likely to have a positive impact on visual amenity and general hygiene in shared community spaces.

12.2 Operational Waste

The operational waste management strategy in this WMP has been developed by adopting the waste hierarchy as a framework for waste management practices to achieve the best environmental outcomes. The preferred order of adoption is as follows:

- **Avoid** the potential of waste generation;
- **Reduce** waste during operations;
- **Re-use** waste where applicable;
- **Recycle** waste whenever possible;
- **Recovery** of waste materials; and
- **Disposal** of waste when there is no reuse or recycling potential.

Waste minimisation measures have been considered and would continue to be developed and implemented during the operations. Waste prevention and minimisation would be addressed, where feasible, through the use of efficient operation techniques to minimise generation of waste not suitable for re-use or recycling.
Cleaner production techniques have been identified as applicable to the reduction of waste at Waterloo South. Some of the techniques include but are not limited to:

- Application of most efficient processes and/or “green technology” to ensure sustainable uses of energy, water and natural resources;
- Adopting a *cradle-to-cradle* (regenerative) approach in design and planning of operational works;
- Promotion of safe handling procedures of products in line with regulations and industry best practices; and

- Implementation of sustainable procurement practices for example the use of biodegradable tableware instead of plastic-based products (especially in public dining spaces). This may be achieved through the use of 'green contracts' with retailers, which identify requirements for use of reusable and/or recyclable consumer products as part of their leasing agreement.

12.2.1 Stream Characterisation

Source separation involves identification and separation of waste into common material streams or categories at the point of generation for separate collection. This aids material reuse and improves recycling, thereby capturing reusable or recyclable material that would otherwise end up in landfill. All waste materials generated during operation would be identified and classified in line with the *Waste Classification Guidelines* (EPA, 2014) prior to separation.
Appropriate receptacles would be provided for all spaces and retailers across the Estate for residual waste and reusable/recyclable materials. These receptacles would be clearly marked and identifiable to retail staff and the public to encourage correct source separation. All receptacles would be placed in allocated waste holding areas, the location of which is yet to be determined during design development.
Based on the mixed-use area types of Waterloo South, it is anticipated the following streams will be generated onsite and will be source separated for collection:

- General waste;
- Food and garden organics (FOGO);
- Co-mingled recycling;
- Paper / cardboard;
- Soft plastics; and
- Hard / bulky goods.

12.3 Area Schedule

12.3.1 Non- residential

According to the indicative Concept Proposal, the ground floor areas (GFAs) outlined in Table 17 below have been nominated for retail/commercial and community use. It should be noted that the actual make up of retail and commercial space is subject to change during the detailed design phase.

Table 17: Area schedule for non-residential spaces

Non-residential Use	Total Estate GFA (m^2)
Retail	11,200
Community/Cultural	6,700
Total Non-Residential	**17,900**

This breakdown has been provided for the purpose of waste infrastructure assessment and is subject to change as detailed design continues.

12.3.2 Residential

According to the indicative Concept Proposal, the GFAs outlined in Table 18 have been nominated for residential dwellings:

Table 18: Area schedule for residential spaces at Waterloo South

Residential Use	GFA (m^2)	No. of Dwellings
LAHC Land	239,000	3,000

This breakdown has been provided for the purpose of waste infrastructure assessment and is subject to change as detailed design continues.

12.4 Waste Generation Forecasting

To accurately estimate the volume of waste and recycling generated at Waterloo South, waste generation rates from the City of Sydney Guidelines for Waste Management in New Developments 2018 (CoS Guidelines) have been used. These generation rates are considered a requirement for all new developments in the City of Sydney local government area.

Using the GFAs for non-residential spaces outlined in Table 17 and applying them to the CoS Guidelines waste generation rates, the estimated volume of waste to be generated per use is provided below in Table 19 for non-residential uses.

Table 19: Estimated volume of waste and recycling to be generated by non-residential spaces

Non-residential	General waste (L / day)	Recycling (L / day)	Food waste (L / day)
Retail	4,978	31,740	1,450
Community	1,992	2,433	578
Cultural	353	882	88
Total	**7,323**	**35,055**	**2,116**

Using the number of dwellings outlined in Table 18 and applying them to the CoS waste generation rates for residential dwellings, the estimated volume of waste to be generated each week for all residential units at Waterloo South is provided below in Table 20.

Table 20: Estimated volume of waste and recycling to be generated by all residential units at Waterloo South

Residential Units	General waste (L / week)	Recycling (L / week)
LAHC Land	360,000	360,000

**Food organics may be source-separated onsite; however CoS do not currently offer food organics bins for all residents in the LGA. Independent treatment systems may be utilised on site as part of a private contract.*

Although the volumes outlined in Table 20 seem large, the waste generation rates in the CoS Guidelines require all multi-unit dwellings to be provided with two 120L bins for general waste and recycling. Garden organics bins are an opt-in service offered by the Council for multi-unit dwellings. During this early stage of design the requirements laid out in the CoS Guidelines should be accounted for, and further consultation with Council regarding waste generation rates may occur during detailed design. Solutions for compacting, onsite processing and general management are discussed in the next section.

12.5 Management Strategy

The preferred management strategy for collecting and storing waste will be finalised during the design development phase of this project.

Storage Room

Identifying the best location for a waste storage area is a challenge in many developments. It should however be a balance between convenience to residents, space, access, noise, security, planning requirements and architectural integration.

All waste and recycling generated at Waterloo South should be transferred to a communal storage room dedicated for waste and recycling only. The CoS Guidelines stipulate that waste storage for residents should be separate to waste storage for retail/commercial tenants.

The storage room for retail/commercial tenants should be large enough to host the volume of waste and recycling detailed in Table 19, in addition to any onsite processing equipment such as cardboard or plastic balers. The retail/commercial waste storage room should also allow space for storing all public place waste and recycling generated in community green spaces. For retail/commercial waste, the indicative size of the storage room required for the entire development is based on collection of both general waste and recycling seven days per week, which should be factored into design.

The storage room for residents should be large enough to host the volume of waste and recycling detailed in Table 20, in addition to any onsite processing equipment for food organics, and a dedicated area for hard / bulky waste storage.

For residential buildings greater than three storeys, a chute system and room should be provided in the shared basement for the safe transfer of garbage bags from residents who dispose of these at each level. Retail/commercial tenants should not be able to store any waste and recycling in this room.

It is recommended all waste storage rooms for both residents and retail/commercial tenants are located in the basement for an efficient collection process.

Collection

A bin collection roster should be developed and an appointed caretaker or staff member would manage and monitor all waste-related activities in the storage rooms. Design provisions should be made to allow for the safe transfer of bins from all generating areas and temporary storage areas to the basement storage rooms e.g. ramps with suitable gradients, signage, unobstructed passageway, etc.

The basement should be easily accessible for residents and tenants to dispose of hard/bulky waste that would otherwise block the chute (such as large volumes of cardboard, expanded polystyrene or white goods), and its design should safely and adequately allow for City of Sydney standard waste collection vehicles.

The basement collection point would allow sufficient height, width and length clearances for standard City of Sydney collection vehicles as a minimum, with consideration to any processing equipment or large compactors that may also need emptying during collection. It should be noted that collection points for both residential and non-residential waste and recycling can be shared.

For safe collection of mobile garbage bins (MGBs) from the basement, the following traffic design requirements should apply:

- Forward in, forward out movement of trucks;
- All truck manoeuvring to occur on-site;
- The ramp gradient should not exceed 1:8 with a transition of 1:12 for 4 metres at the lower end.
- Loading bay should be in close proximity to the waste storage room;
- The full length of the truck is contained in the loading bay, not within the driveway; and
- The waste storage room should be located within close proximity to the nominated waste collection zone.

The location, size and access requirements of the loading bays and dedicated waste collection zones will be outlined once architectural drawings of the buildings have been developed.

12.6 Opportunities

12.6.1 Automated Waste Collection System

Automated Waste Collection Systems (AWCS) use networks of underground pipes to transports waste (residual, organic and recyclables) at high speeds (60-70km/hour) from connected inlets to a central collection station (located not more than 4km from the original disposal inlet) one waste fraction at a time. AWCS offer numerous environmental, social and technical advantages including:

- Saving floor space;
- Improved amenity due to reduced truck movements in local areas;
- Minimal collection vehicle access specifications and requirements;
- Offering joint residential and commercial collection opportunities if Multi-Unit Dwellings are part of a mixed-used development; and
- Potential to increase recycling and landfill diversion rates.

12.6.2 Balers

Balers are used to compress materials such as paper/cardboard and soft plastics into bales for easy handling and transport. Cardboard balers could be used in residential Multi-Unit Dwellings. In the last decade online shopping has offered convenience to urban residents, thus increasing the amount of cardboard and soft plastics generated in residential buildings. Baling cardboard and soft plastics in many cities has thus become more common.

Vertical balers are recommended for residential developments, due to their smaller space requirements. Some important considerations include safety issues to prevent use by untrained personnel and bale size for easy manageability by building maintenance staff or caretakers.

It should be noted that in Australia, the majority of councils do not offer separate paper and cardboard or soft plastics collection services, and this would vary between all waste service contractors and their infrastructure capabilities. Potential beneficial arrangements could be made with re-processors and recyclers, who could collect the baled materials for free.

12.6.3 Underground Bins

Underground bins use hidden capacity by installing large collection containers below ground level for collection of garbage and recyclables. The general user does not see the container but simply a small portion of the container or a small bin above ground. These bins offer the advantage of having a large storage capacity (sizes up to 5,000 L) that can effectively manage the waste from many dwellings, with a small, above-ground footprint requirement. Smart sensors could be installed to notify Council or the responsible waste contractor when the bin is full, which would in turn trigger the dispatch of a collection vehicle.

Figure 20: Waste collection for Molok underground bins

A specially adapted waste collection vehicle collects waste from underground bins. For example, a vehicle that has been modified with a hook-arm or crane attaches to the bin and draws it from the ground, as is shown in Figure 20. The bin is held over the hopper of the waste collection vehicle and emptied by a trapdoor system or by pulling a cord holding the lining at the base of the bin (this differs between bin manufacturers). An appropriate location for the bin and access for collection vehicles are therefore very important due to the servicing method.

12.6.4 Underground Compactors

Similar to underground bins, it is possible to have compactors hidden below ground with waste receptacles sitting on ground level for users to dispose of their waste. The key difference between underground bins and compactors is that the volume of waste stored in the compactor can be up to five times that of what can be stored in bins, therefore reducing the frequency of collection, which is beneficial on residential sites.
Some benefits of having waste compacted underground is a reduction in odour, a reduction in collection costs, minimal impact on space, and the size of the compactor can be tailored according to the waste being generated onsite.

12.6.5 Public Place Waste

A strategy for management of public waste may include use of solar compaction bins. A compaction bin can have a capacity of 600L which would assist in reducing collection frequencies. When bins are near capacity (85% capacity) a communication is sent to an online waste management system to alert that collection is required. These bins are also used to reduce pest access and prevent windblown litter. Approximately 24 × 600L smart compaction bins would be placed in public areas for collection of source-separated organic waste, residual waste and comingled recyclables.

13. Conclusion

A number of utility constraints that affect Waterloo South include:

- Demand calculations provide the following estimated utility demand:
    - Potable Water demand between **1,300 – 1,700 kL/d**
    - Sewer Loading between **8 – 11 L/s**
    - Electrical demand between **29 – 39 MVA**
    - Gas demand between **4,200 – 5,600 m^3/day**
- A number of electrical High Voltage Transmission lines on Wellington, Cope, and George Street;
- A 2.5m wide potable water Pressure Tunnel and Shaft that runs underneath the site;
- A number of large potable water services on McEvoy, Cope and George Street;
- A major Optus fibre cable route that runs along George Street;
- Large concentrations of services within footpaths that may need to be moved; and
- Aboveground powerlines that may need to be moved underground.

Opportunities and needs to support Waterloo South include:

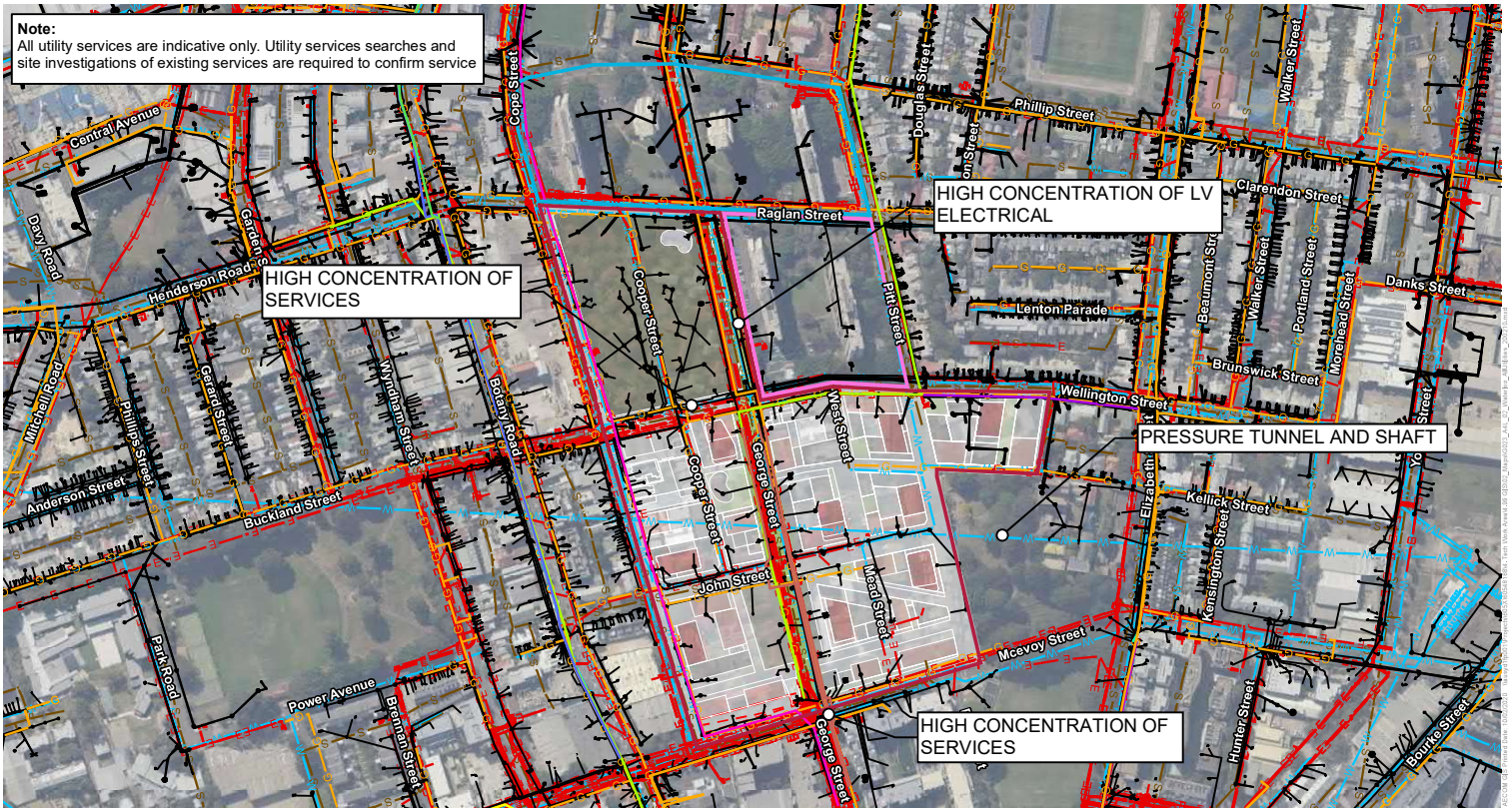
- The site is currently well serviced by utility infrastructure;
- Existing trunk services may have excess capacity to service the initial phases of any new development. Based on Ausgrid commentary, there is sufficient supply for the development until 2026 provided no energy intensive developments occur.
- There may be the opportunity to re-use old utility routes for new infrastructure;
- Areas such as the Australian Technology Park (ATP) or Green Square Town Centre may enable the sharing of sustainable utility infrastructure; and
- Required lead-in utility works may be shared with the new Sydney Metro Station, in particular shared trenches may reduce capital costs.

Future work that is required to enable detailed development applications includes:

- Further coordination with utility authorities to confirm lead-in infrastructure requirements and routes;
- Potential hydraulic modelling to confirm potable and wastewater lead-in infrastructure upgrades;
- After further assessment of ESD options to take forward into detailed design, confirm the effects on utility supply and lead-in infrastructure requirements and routes; and
- Augmentation or consolidation works of feeder cables to Surry Hills Zone Substation will be required to service the development area beyond 2026 and a new 132/11kV Zone Substation is anticipated to replace the current Zetland zone substation.

These constraints and opportunities are show in Figure 21. Based on the investigations undertaken within this report, Study Requirements under Section 1.5, 9 and 16.4 have been satisfied with appropriate investigations recommended for future development applications

Figure 21: Constraints and Opportunities



KEY

- Waterloo Central
- Waterloo North
- Waterloo South
- AusGrid
- Gas
- Potable Water
- Sewer
- AAPT
- AARNet
- AMCOM
- Nextgen
- Optus
- Primus
- Telstra
- Uecomm
- Verizon
- Vocus

AECOM

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CONFIDENTIAL GIS MAP

SCALE 1:5,000 | SIZE A4

SHEET 1 of 1 | COORDINATE SYSTEM GDA 1994 MGA Zone 56

WATERLOO SOUTH
All Existing Utilities

PROJECT
SYDNEY URBAN TRANSFORMATION

CLIENT
URBAN GROWTH NSW

DRAWN	DATE	MAP #	REV	Project
SG	10/02/2020	G023	01	60548168
CHECK	FIGURE			
DF	3			

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