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600-660 Elizabeth Street Redfern
New South Wales Land and Housing Corporation
21-Feb-2020

Utilities & Infrastructure Servicing Strategy

600-660 Elizabeth Street Redfern

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600-660 Elizabeth Street Redfern

Client: New South Wales Land and Housing Corporation

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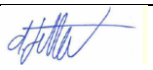
6	21-Feb-2020	Final	Daniel Fettell Principal Engineer	

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Executive Summary

NSW Land and Housing Corporation (LAHC) has engaged AECOM to undertake a Utilities and Infrastructure Servicing Strategy for 600-660 Elizabeth Street, Redfern. The main purpose of this study is to identify existing utility infrastructure and consider any upgrades or new utility infrastructure that may be required to facilitate the planning and development of the site. In doing so, this report addresses the relevant City of Sydney (CoS) Council Planning Proposal Requirements.

Elizabeth Street, Redfern is located approximately 3km south of the Sydney CBD, in the City of Sydney Local Government Authority (LGA). It is approximately 1.1 hectares in size and is part of the wider social housing estate at Redfern. There are a number of existing utility services in and around the site which are summarised below and discussed in detail in this Report:

- **Potable Water:** Drinking water is provided by Sydney Water Corporation (SWC) 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 servicing is provided by SWC with two sewer mains running through the entirety of the site;
- **Electrical:** Electricity is provided by Ausgrid via cables from the Surry Hills Zone Substation;
- **Gas:** Jemena currently supplies gas to the area through existing gas mains; and
- **Data and Telecommunications:** Some telecommunications providers have assets in the vicinity of the site such as Optus and Telstra, with future upgrades planned by NBN Co.

Previous investigations as part of the *Central to Eveleigh Infrastructure Servicing Strategy* (AECOM, 2015), in which Redfern Estate was also assessed, provided the following preliminary infrastructure assessment:

- **Potable Water:** SWC indicated that delivery systems have the capacity to service upcoming growth until 2036 but local network amplifications will be required;
- **Waste Water:** SWC indicated sufficient capacity for trunk systems and key wastewater treatment plants until 2031 but local network amplifications will be required;
- **Electrical:** While bulk supply points may have sufficient capacity, Ausgrid confirmed that a new zone substation and corresponding downstream distribution infrastructure upgrades may be required for the Central to Eveleigh growth area;
- **Gas:** Owing to the substantial increase in demand, it was inferred that upgrades would be inevitable. However, no confirmations were made by Jemena; and
- **Telecommunications:** NBN Co. relayed that telecommunications infrastructure to new developments will be provided by them as mandated by the new federal policy in 2011 on Telecommunications Infrastructure in New Developments (TIND).

Indicative building service loads are summarised below; however, it should be 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 **150 – 200 kL/d**
  - Sewer loading between **0.9 – 1.2 L/s**
  - Electrical Demand between **1.9 – 2.5 MVA**
  - Gas demand between **460 – 620 m^3/day**

Based on the investigations undertaken within this report, the relevant Planning Proposal Requirements have been satisfied with appropriate investigations recommended for future development applications.

Servicing Constraints affecting Elizabeth Street, Redfern site:

- Dual 225mm dia. sewer mains running through the site;
- Gas mains and Telstra cables running along most of the boundary of the site;
- A concentration of potable water main, stormwater pipes, gas main, Optus cable and auxiliary electrical cables along the western boundary of the site on Elizabeth Street; and
- Overhead powerlines around the site boundary on Elizabeth Street and Phillip Street which need to be undergrounded.

Servicing Opportunities and needs to support the precinct include:

- The site has minimal utility infrastructure as majority of it is vacant land, which gives an opportunity to plan the services in line with the urban design intent and sustainability outcomes;
- Existing trunk services may have capacity to service the new development without requiring substantial upgrades (local zone substation capacity to be investigated) subject to confirmation through feasibility applications to utility companies; however local amplifications are very likely;
- There may be an opportunity to re-use any redundant electrical utility routes for new infrastructure; and
- Areas such as the Australian Technology Park (ATP) or Green Square Town Centre may enable the sharing of sustainable utility infrastructure and potential recycled water networks.

1.0 Introduction

The Utilities and Infrastructure Servicing Strategy report has been prepared on behalf of NSW Land and Housing Corporation (LaHC) to accompany a Planning Proposal to be lodged with the City of Sydney (CoS).

This Planning Proposal relates to land at 600-660 Elizabeth Street, Redfern (the Site). The Planning Proposal seeks to rezone the Site to allow redevelopment for a mix of social, affordable and private housing in an integrated residential community. The aims of the Planning Proposal are to rezone the Site to R1 General Residential.

An indicative reference scheme and urban design report has been prepared by Architectus, Silvester Fuller and Tyrell (the Project Team) to support the Planning Proposal and demonstrates how the Site may be redeveloped. The indicative reference scheme comprises:

- Approximately 327 dwellings, with building heights ranging between 6 and 14 storeys;
- A mixed-use development, with over 1,500m^2 of non-residential floor space for local shops, cafes, community space and other services; and
- Three ground floor communal courtyard spaces.

Specifically, this report:

- Summarises the existing services infrastructure located within the Elizabeth Street, Redfern site;
- Considers potential external utility connections and lead-in infrastructure requirements based on advice from the relevant authorities;
- Advises on opportunities and constraints; and
- Summarises next steps including site investigation to confirm the assumptions included in this report.

This Utilities and Infrastructure Servicing Strategy considers the following services infrastructure;

- Potable Water;
- Recycled Water;
- Wastewater;
- Electrical;
- Gas;
- Data and Communications; and
- Stormwater - Parallel studies are being undertaken on Stormwater and Flooding and should be read in conjunction with this report where available.

It should be noted that this report is based on the details of existing infrastructure provided by the relevant authorities through plan drawings and correspondence with some relevant authorities. This information will need confirmation achieved through site investigation prior to commencement of detailed design. Further consultation with authorities will take place as a part of this project.

Targets for ecologically sustainable development are contained within the AECOM *Ecologically Sustainable Development Report*, these also include specific alternative supply options. It is noted that the demand profiles within this report do not include a reduction in demand based on these options but that this should be considered as part of any development application when the building form is more defined.

2.0 Overview of the project

The precinct located at 600-660 Elizabeth Street, Redfern (the site) includes government-owned land of state importance for delivering government policies relating to jobs, homes, and the provision of social and affordable housing in an inner-city location and close to existing and future public transport.

LaHC has initiated a rezoning investigation and Planning Proposal Requirements have been developed in collaboration with CoS Council and other government agencies. The requirements outline a range of investigations needed to analyse the potential impact of any planning control changes.

The project involves the residential redevelopment of the site which occupies a discrete block bounded by Kettle Street (north) and Phillip Street (south) each with 70m frontages, and Walker Street (east) and Elizabeth Street (west) each with 146m frontages (Figure 1). Located approximately 3km south of Sydney CBD in the suburb of Redfern, the precinct is entirely within the City of Sydney local government area (LGA) and has a gross site area of 10,850 sqm. The site is part of the wider social housing estate at Redfern in the vicinity of the Waterloo State Significant Precinct.

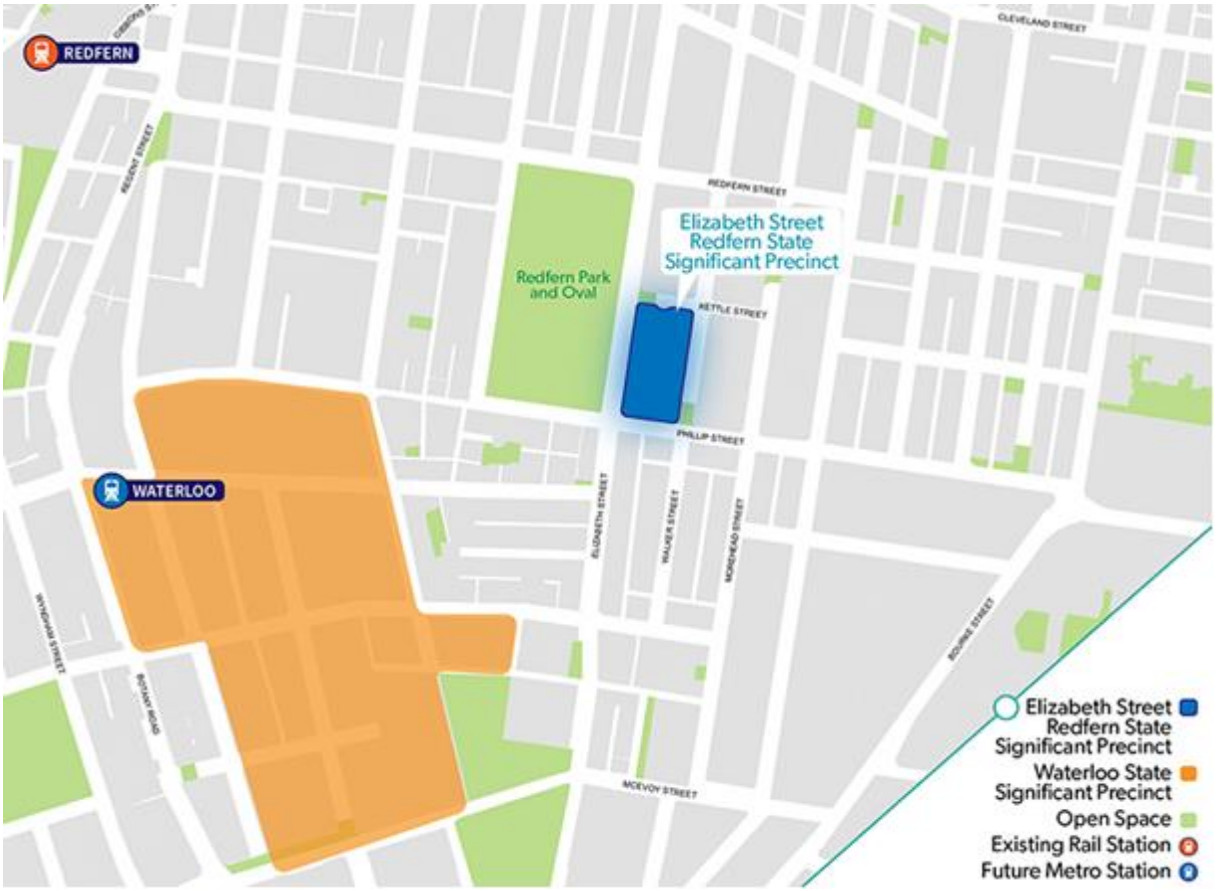


Figure 1: Map of Elizabeth Street, Redfern State Significant Precinct

2.1 Site Context

The precinct is opposite Redfern Park and Oval currently comprising two thirds of vacant land with some mature trees and the remaining third portion, at the southern end, occupied with some facilities which include a building currently leased to the Police Citizens Youth Club (PCYC) and the South Sydney Aboriginal Corporation Resource Centre (refer Figure 2 below).

Redfern train station is located approximately 900m to the east-north-east of the site, and the upcoming Waterloo Metro station approximately 700m to the east. The site is currently directly serviced by the 301, 302, 303, 343, 355 and M20 bus routes, with a southbound bus stop on the Elizabeth Street boundary. These routes connect the site with Sydney CBD, North Sydney and Chatswood to the north, with Waterloo, Zetland, Roseberry, Mascot and Botany to the south, with Newtown and Marrickville to the west, and with Moore Park and Bondi Junction to the east.

Figure 2: Aerial photograph of the site (Land and Housing Corporation, 2018)

The vacant land was previously occupied by eighteen duplexes, until their demolition in mid-2013 (refer Figure 3). While the precinct is still in the design phase it is expected to feature approximately 500 dwellings, of which up to 30% could be allocated to be social housing.

Figure 3: Aerial imagery 600-660 Redfern taken 30/2/2013 (left) and 6/11/13 (right)

3.0 Planning Proposal Requirements

The Planning Proposal Requirements issued by the CoS Council guide the development of various plans, policies and technical reports in support of the rezoning application.

Of relevance to this study are the following requirements (Table 1):

Table 1: Planning Proposal Requirements

Description	Action	Report Section
Utilities	Prepare a utilities and infrastructure servicing report that outlines and development yield, peak demand and generation forecasts, staging information and a high-level assessment of the capacity of: - The 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 to provide early input and understanding of energy requirements. - Sydney Water's network to service the development and the proposed servicing options considered for the development. Outline integrated water cycle management and potable water use reduction initiatives proposed.	*- Development yields are contained within Section 5.6, peak demands and forecasts (including staging) are contained within each utility section.* *- Required capacity and augmentation needed for the proposal are contained within Figures 8, 11, 14, 15, 18.* *- Proposed on-site generation/water recycling alternatives are listed in Section 7.5 and 8.5, 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.*
	This report should: - Identify the location of Ausgrid, Sydney Water and other services, assets or easements on the site and identify how the proposal will relocate or incorporate these. - Integrate outcomes of the ESD strategy for energy and water savings initiatives.	*- The Ausgrid requirements to service the development are contained within Section 8.* *- The capacity of Sydney Water's network to service the development is considered within Section 7 and 8.* *- Integrated water cycle managements and/or sustainable initiatives are contained in each section however; more details are contained within the ESD report.*

4.0 The Proposal

4.1 Introduction

600-600 Elizabeth Street, Redfern will be transformed into a market leading build-to-rent redevelopment featuring contemporary urban and architectural design and creating a high-quality integrated community of social, affordable and private housing.

4.2 Communities Plus Build to Rent

Communities Plus is a key program under NSW Government's *Future Directions for Social Housing in NSW*, delivering integrated social, affordable and private housing by partnering with the private and not for profit sectors including registered Tier 1 or Tier 2 Community Housing Providers (CHPs).

The Redfern project aligns with Future Directions, by providing innovative options for private sector investment in social housing under a long-term lease. The project presents an opportunity to renew and increase social housing in a well-located integrated community with good access to education, training, local employment, and close to community facilities such as shopping, health services and transport.

On 6 July 2018, the NSW Government announced the Site as the pilot for Communities Plus build-to-rent. The Project provides an opportunity for the private sector, in partnership with the not-for-profit sector, to fund, design, develop and manage the buildings as rental accommodation under a long-term lease.

Build-to-rent is a new residential housing delivery framework that is capable of providing access to broader housing choices. Established in overseas markets such as the UK and the USA, locally, build-to-rent has significant scope to provide increased rental housing supply and the opportunity for investment in residential housing in NSW.

4.3 Vision, Reference Scheme and Planning Framework

The study has been prepared to formulate and assess a suitable suite of planning controls to guide the redevelopment of the Site. A design, technical analysis and consultation process was undertaken to prepare a reference scheme which indicates how the future public domain, building form and connections could be delivered. The reference scheme (shown at Figure 4) balances the challenges and opportunities of the Site, particularly the desire to deliver high quality urban design while providing new and modern social housing in an integrated mixed tenure environment.

The reference scheme was prepared to indicate how the Site could, rather than will, be redeveloped and has been used as a basis to prepare draft amendments to the Sydney Local Environmental Plan 2012 (including zoning, height, floor space ratio and car parking controls) and the development of a new site-specific Development Control Plan which will guide the detailed design of the Site.

The proposed planning framework has regard to:

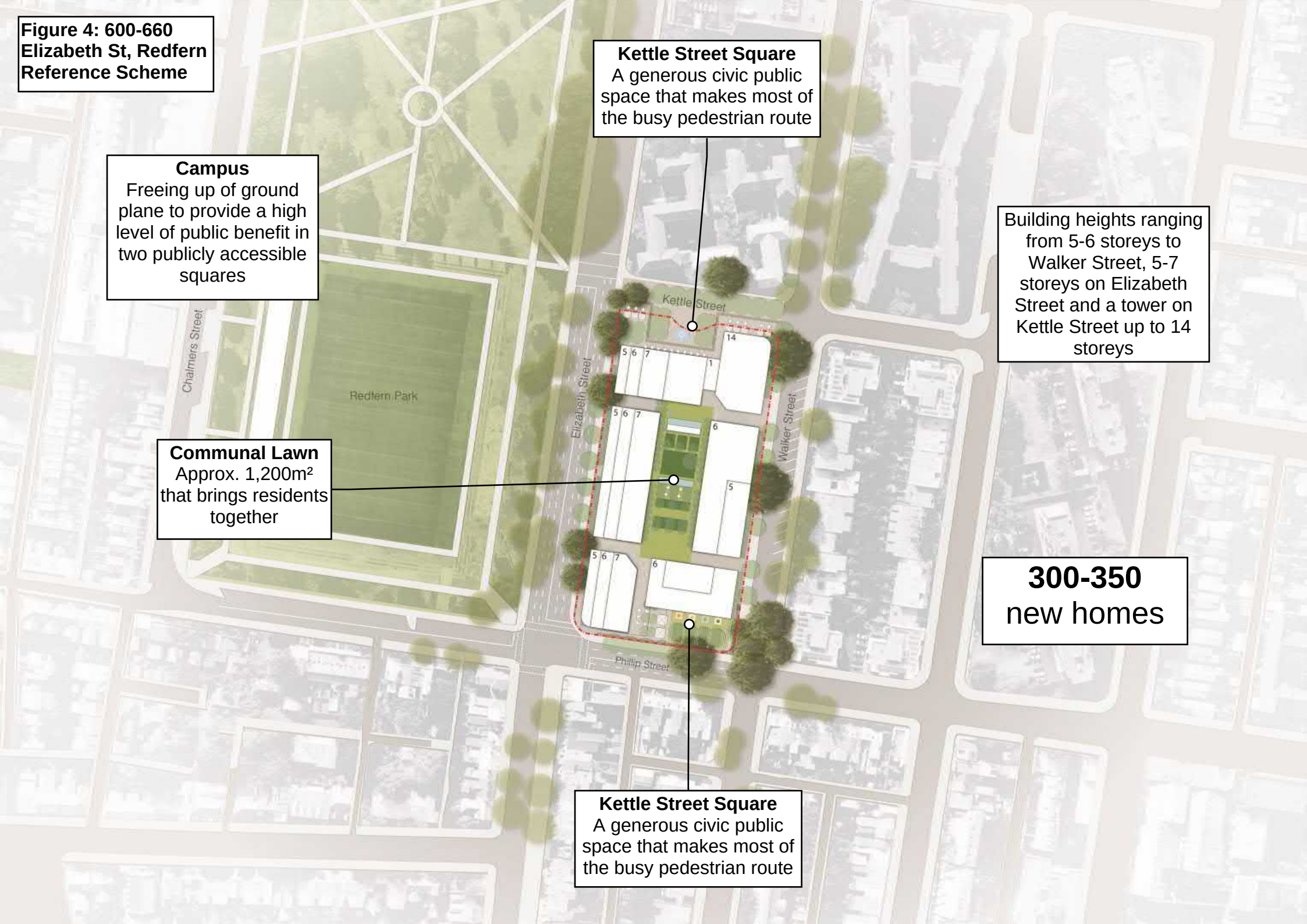
- Accessibility and connectivity of the Site to public transport, employment, shops, education and other services;
- The site and local area's rich history and cultural significance;
- The surrounding urban form and context; and
- The environmental and servicing considerations, including flooding, stormwater, traffic, utilities, noise, air quality and wind.

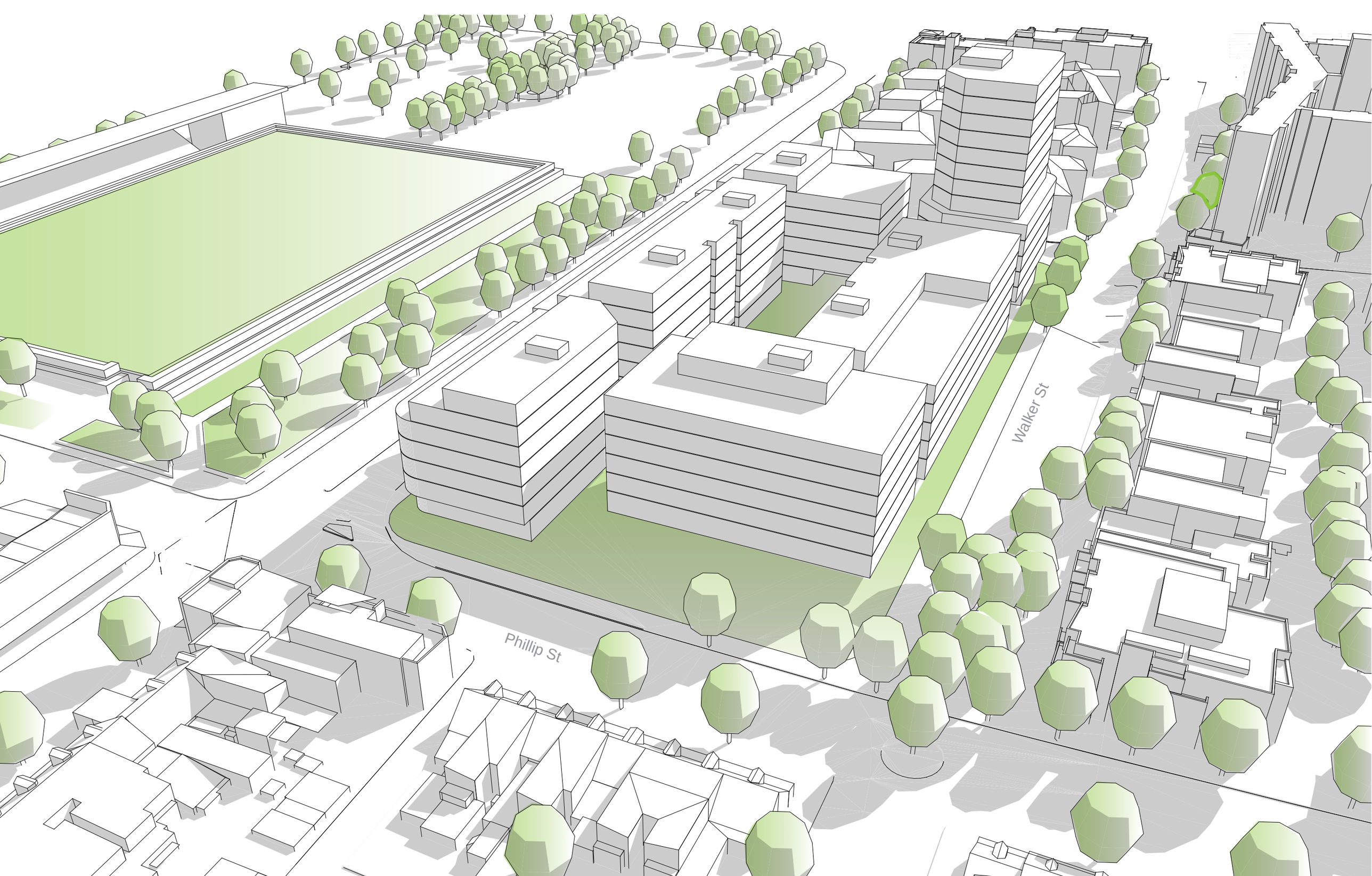
The proposed planning framework will guide future development applications for the Site which are anticipated to achieve the following:

- Approximately 327 dwellings, with a maximum FSR of 2.75:1;
- Buildings with a predominant height of 6-7 storeys with a single tower up to 14 storeys; and
- Some supporting retail and communal floor space to support the incoming population.

It is expected the Site will be developed over a period of three years, once the site has been rezoned.

Figure 4: 600-660 Elizabeth St, Redfern Reference Scheme




Walker St
Phillip St

5.0 Study Methodology

5.1 Demand Assessment

The demand assessment methodology undertaken is summarised below:

- Development of forecasting and profiles of the study area and individual project areas based on the development yield for residential, retail and commercial uses provided by LAHC;
- Development of a sensitivity analysis on the service demand profiles by considering a demand range; and
- Consideration of a range of unit rates and applicable diversity rates.

5.2 Stakeholder Engagement

The infrastructure assessment methodology undertaken is summarised below:

- Contact with Sydney Water, Ausgrid, Jemena and NBN Co. to ascertain their current capacity, planned upgrades and potential supply constraints, based on base estimation of the demand generated by the proposed increase in density;
- Consultation with strategic planners within each of these organisations, responsible for overall planning of infrastructure delivery to this area being conscious of the overall extent of development planned within the catchment;
- Submission of feasibility applications/requests to each utility service provider; and
- Updates to the high-level servicing strategy based on feasibility investigations and presentations to key stakeholders to engage discussion and reach agreement prior to detailed planning/feasibility of individual projects.

5.3 Infrastructure Assessment

The infrastructure assessment methodology undertaken is summarised below:

- Assessment of the impact of the site sustainability initiatives on demand arising from the Ecologically Sustainable Development (ESD) as opposed to standard authority rates;
- Mapping the strategic infrastructure servicing the study area, including key external supply points;
- Examination of the existing system capacities to identify the optimal infrastructure connections;
- Feedback to urban planners and service authorities to understand potential future infrastructure requirements; and
- Opinion of probable costs for utility infrastructure requirements.

5.4 Identify Constraints and Potential Upgrades

The constraint and potential upgrades methodology undertaken is summarised below:

- Development of a robust plan for delivery of the infrastructure to the Site, considering regulatory requirements, physical constructability and delivery timeframes;
- Determination of infrastructure upgrades. These are population-based augmentation triggers that take into account variable development production rates; and
- Identification of alternative strategies that may be applicable for the site.

5.5 Alternative Demand and Supply Opportunities

The alternative demand and supply opportunities methodology undertaken is summarised below:

- Coordination with the ESD consultant on opportunities to reduce servicing requirements;
- Feedback on suitability for different alternative demand and supply opportunities with the ESD consultant;

- Identification of potential cost-effective opportunities in the study area, particularly in line with staging and trunk infrastructure trigger points; and
- Opinion of probable costs for alternative demand and supply opportunities.

5.6 Demand Assessment Yields

Demand calculations were undertaken based on the development yields provided by the Land and Housing Corporation (LAHC). A conservative overall development yield has been adopted for the purpose of this report and is shown below in Table 2.

Table 2 Demand Assessment Yield (LAHC, 2020)

Study Area	Timeframe (Yrs)	Residential Apartments (No.)	Residential GFA (m^2)	Retail/Comm GFA (m^2)	Total Development GFA (m^2)
600-660 Elizabeth St, Redfern	3 yrs	327	27,909	1,907	**29,816**

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.

6.0 Information Gathering

6.1 Gathering Existing Utilities Information

The preliminary information data has been gathered from a range of resources. These include Dial Before You Dig (DBYD) requests, master plans, previous experiences from work done within the area and condition reports.

6.2 Dial Before You Dig Plans

DBYD requests were undertaken from the site area. The DBYD report identifies a range of services present within the study area and is summarised in Table 3 below.

Table 3 Summary of Existing Services

Authority Name	Phone	Utility Type
Ausgrid	0249510899	Electricity
City of Sydney	0292659333	Council/Shire
Jemena Gas	1300880906	Gas & Petroleum
Optus and/or Uecomm	1800505777	Communications
PIPE Networks	1800201100	Communications
Roads and Maritime Services	0288370285	Electricity
Sydney Water	132092	Water
Telstra NSW	1800653935	Communications

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

6.3 Utility Reports

Central to Eveleigh Infrastructure Servicing Strategy Report (AECOM, 2015) was developed for UrbanGrowth NSW Development Corporation (UGDC), this included an assessment of the Elizabeth Street Redfern site. The results of that investigation and strategy including authority correspondence have been used in developing this Utilities and Infrastructure Servicing Strategy.

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

- A Metropolis of Three Cities - the Greater Sydney Region Plan, 2018;
- Central City District Plan, 2018;
- BASIX Monitoring Report - Electricity Consumptions for 2007-2009, NSW Department of Planning, 2010;
- BASIX Water Savings Monitoring – Sydney Water, 2012;
- Better Practice for Public Place Recycling Dec 2005;
- Better Practice Guide for Multi-Unit Dwellings provides waste management strategies for multi-unit residential developments Dec 2008;
- Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities EPA December 2012;
- 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;
- Distribution and Transmission Annual Planning Report, Ausgrid, 2017;
- 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 2017-2022, Sydney Water 2017;
- Growth Servicing Strategy Wastewater Network Bondi System, Sydney Water, 2014;
- NSW Streets Opening Conference, Guide to Codes and Practices for Streets Opening, 2009;
- NSW Transmission Annual Planning Report, TransGrid, 2017;
- Sustainable Sydney 2030 Community Strategic Plan 2014;
- Sydney Local Environmental Plan 2012;
- Sydney Street Code 2013;
- Towards our Greater Sydney 2056 (the revision of A Plan for Growing Sydney), Greater Sydney Commission (GSC), 2016;
- Waste Not Development Control Plan Guidelines EPA 2008; and
- Wastewater Systems, Sydney Water, 2014.

6.4 Development Context

The Elizabeth Street, Redfern study area forms part of the larger Redfern-Waterloo Growth Centre which includes:

- Redfern;
- North Eveleigh;
- South Eveleigh; and
- Waterloo Housing Estate.

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

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

Any required utility relocations or amplifications as a result of this project will also need to consider the ultimate design of neighbouring urban renewal projects.

This report only considers connections of utility servicing to new development on the site 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.

6.5 Combined Services Plan

A proposed combined services plan has been developed for the site, identifying utility service locations and routes throughout the study area. The plan also considers the following;

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

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.

A combined trunk services plan shown in Figure 5 has been included to inform this report.

Note:
All utility services layouts are indicative only based on authority record drawings. Layouts are not based on services survey and site investigations are required to confirm locations. Survey may indicate additional existing mains requiring diversion to avoid impacting the proposed development footprints.

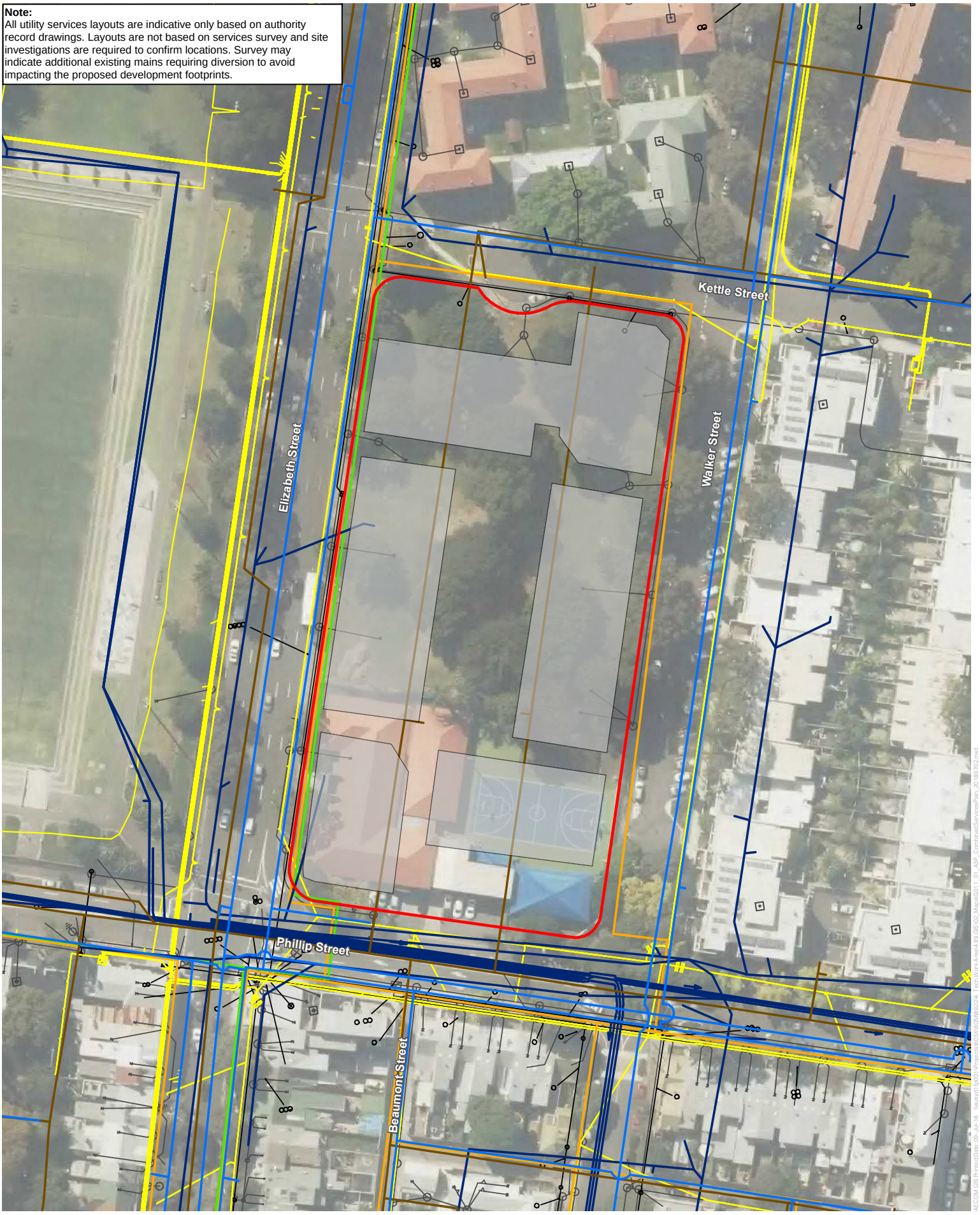


FIGURE 5 - EXISTING COMBINED SERVICES PLAN

AECOM

N 0 5 10 20 m

KEY

Site boundary
Water main
Sewer main
Stormwater main
Electrical cable
Gas main
Optus cable
Telstra main cable
Telstra cable

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7.0 Potable Water

7.1 Background

Potable Water at the existing Elizabeth Street, Redfern site is supplied by Sydney Water from the Potts Hill / Prospect and Kurnell Systems as shown below in Figure 6.

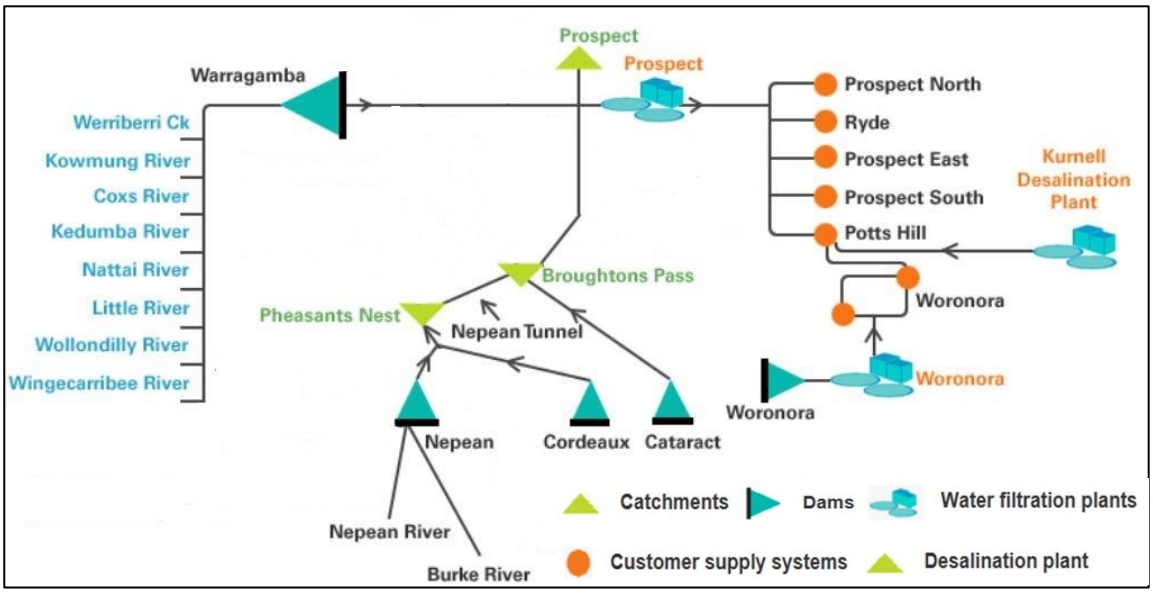


Figure 6: Potable Water Supply

(Sydney Water Corporation, 2018)

Potable Water is supplied through the Potts Hill 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 Site, these are:

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

As a part of the *Central to Eveleigh Infrastructure Servicing Strategy* (AECOM, 2015), an increase in potable water demand throughout Redfern Estate (including the site) was noted and local infrastructure upgrades were recommended. Sydney Water indicated that the trunk system has the capacity to service the potential development.

Although Sydney Water does not provide recycled water to the Site, the nearby Green Square Town Centre does include a privately-operated recycled water scheme wherein there may be opportunities to extend this system. Future detailed development applications relating to the Site may consider the opportunity to integrate with this scheme.

The Australian Technology Park (ATP) is an adjacent precinct which currently has recycled water infrastructure including reticulation within roads and dual pipes within buildings that could supply non-potable uses. Should the Site be water positive then the ATP could serve as a potential source of recycled water demand. Future detailed development applications for the Site may consider the opportunity to integrate the system used in this existing scheme.

7.2 Demand Assessment

An assessment of the estimated increase in potable water demand generated from the Elizabeth Street, Redfern development yield has been conducted to determine the required infrastructure upgrades associated with the development.

Demand forecasting and profiles were developed for the site using development yields over a 3-year period. 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 demand assessment yields presented in Section 5.6.

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 4.

Table 4 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

7.3 Forecast Demand

An estimate of the future potable water demand for Elizabeth Street, Redfern has been calculated based on a reference scheme provided by LAHC. These figures provide information on the estimated number of dwellings for residential use and Gross Floor Area (GFA) for non-residential 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 4.

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 Site study area when assuming BASIX compliance is estimated to be **170 kL/day** as shown below in Table 5.

Considering a ±15% range in development yields, the Maximum Day Demand (MDD) could vary between 150-200 kL/d.

Table 5 Estimated Cumulative Maximum Daily Potable Water Demand

Study Area	Water Demand - kL/day - Cumulative (inc BASIX)		Total – kL/day
	Residential	Non-Residential	
600-660 Elizabeth St, Redfern	160	10	170

7.4 On-Site Utility Infrastructure Assessment

The existing Sydney Water potable water network within the 600-660 Elizabeth St, Redfern site has been identified based on DBYD reports incorporated in Figure 8. These records specify the presence of a number of Sydney Water mains located underneath and immediately adjacent to the site.

Key existing potable water network infrastructure includes:

- DN200 CICL main underneath Elizabeth Street;
- DN150 CICL main running underneath Walker Street;
- DN150 and DN100 CICL main running underneath Phillip Street; and
- DN100 CICL main underneath Kettle Street.

The depths and position of the existing reticulation mains are unknown, further investigation is required to determine the exact layout and confirm the potential impacts of the proposed design on the existing network.

The key trunk mains adjacent the site are:

- DN1000 GRP main running underneath Elizabeth Street;
- DN750 CICL main underneath Phillip Street;
- DN300 CICL main underneath Walker Street;

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 site 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.

7.5 Potential ESD Initiatives

This report shows “baseline” utilities responses but 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 which are recommended for further investigation include but are not limited to:

- Onsite rainwater reuse;
- Green walls and green roofs;
- High efficiency water fixtures; and
- Stormwater harvesting and water recycling
- Water Sensitive Urban Design (WSUD)

Note that implementation of WSUD improves stormwater flow and water quality. However, it does not have a direct impact on potable water usage unless integrated with treatment that enables stormwater consumption for approved use.

7.6 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 discussed in Section 13.1.

In addition, Section 5.12.5.2 of the Water Services Association of Australia codes (WSA 03-2011-3.1, Sydney Water Edition – 2014) 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 – 2014)

7.7 Approvals and Next Steps

For any development lot, developers are required to undertake Sydney Water formal approvals which 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 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 site 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 SWC 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 street network, it is expected that the buildings will still need to make separate applications for connection.

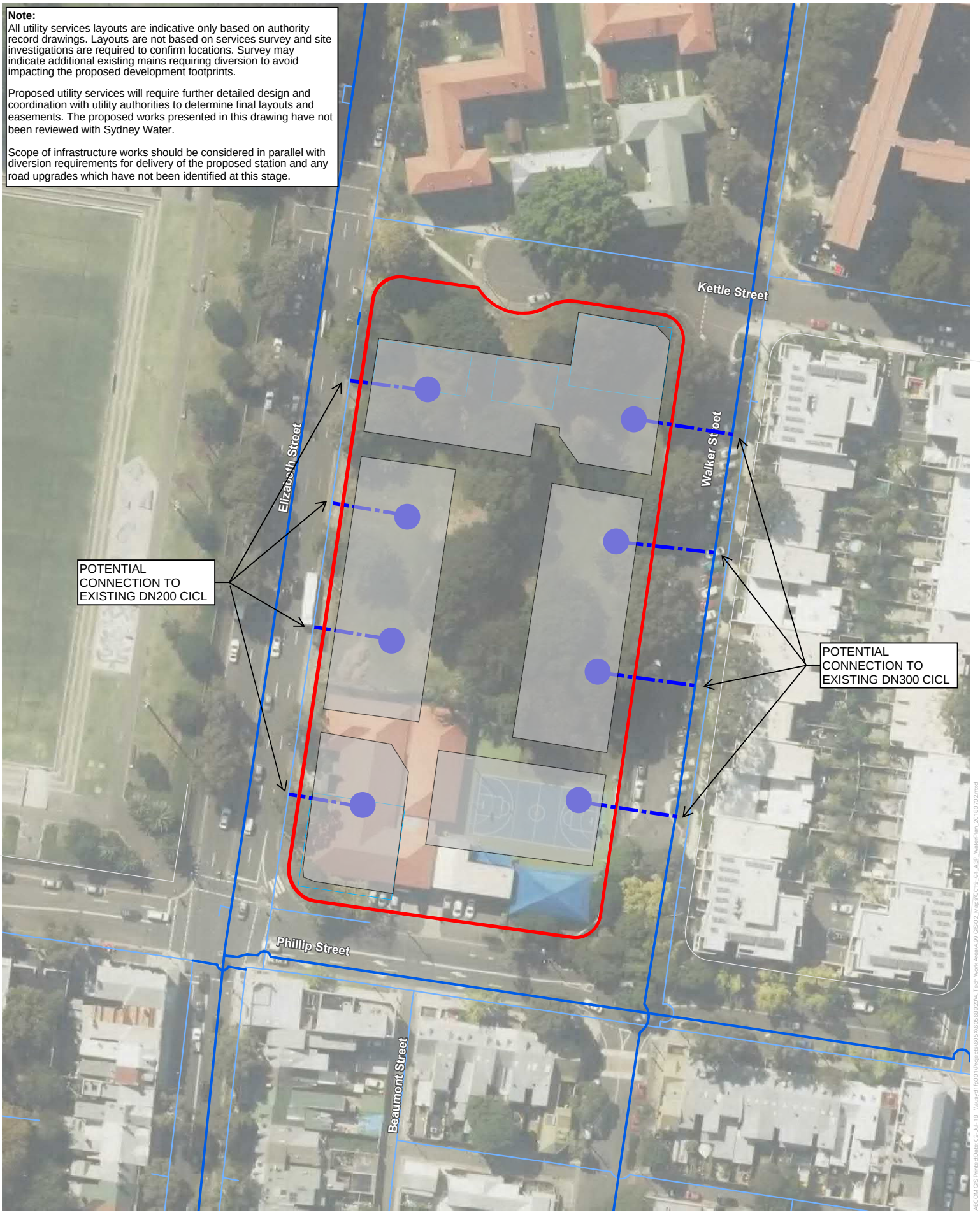


FIGURE 8 - **POTABLE WATER PLAN** (**ASSUMING SEPERATE BUILDING CONNECTIONS**)

AECOM

0 5 10 20 m

KEY

- Site boundary

Potable Water

- Water trunk main
- Water main
- Proposed building connection
- Proposed Water main

8.0 Wastewater

8.1 Background

Sydney Water wastewater facilities service the Elizabeth Street Redfern site 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 9.

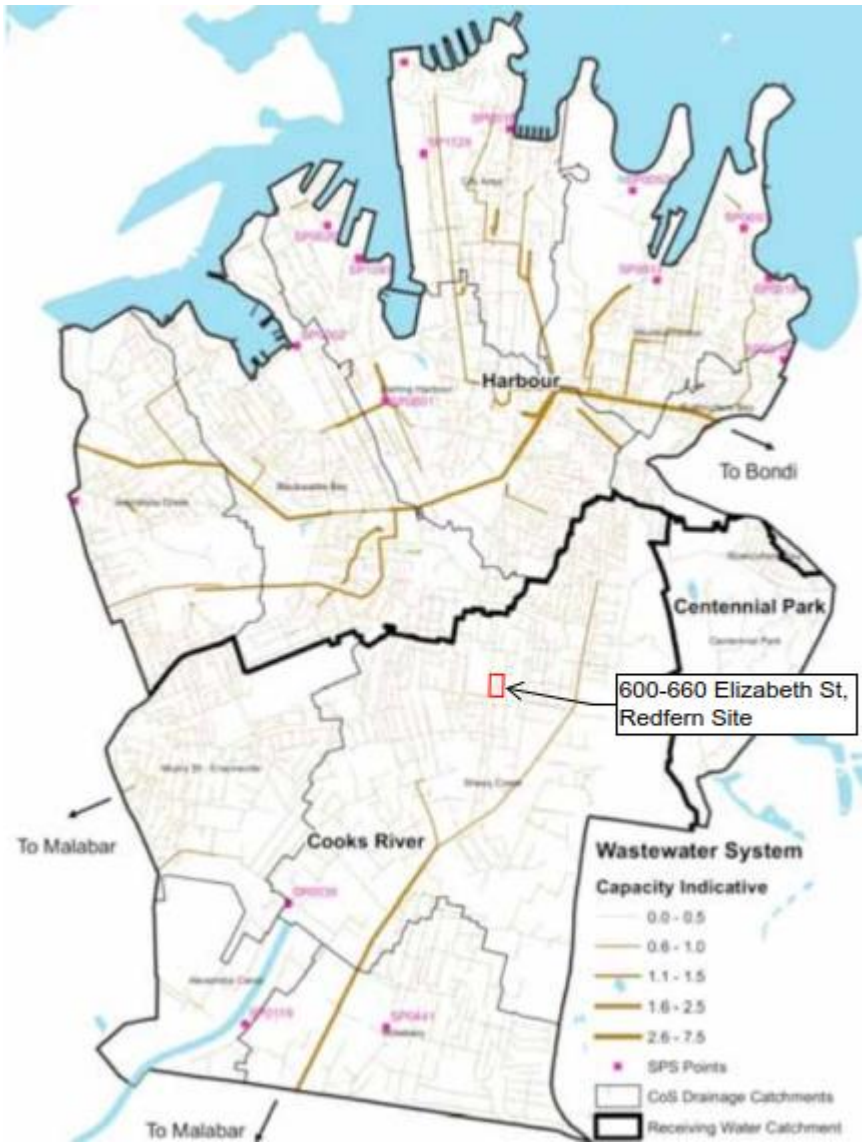


Figure 9: Wastewater Network System
(CoS Decentralised Water Masterplan, 2012)

Potential development scenarios considered within the report indicate there will be an increase in sewer loading throughout the site. As a part of the *Central to Eveleigh Infrastructure Servicing Strategy* (AECOM, 2015), Sydney Water indicated that the trunk system has the capacity to service the potential development, however, carrier mains running to the trunk system from the Site may require amplification.

8.2 Demand Assessment

An assessment of estimated sewer loading resulting from the development of the Elizabeth Street Redfern site has been undertaken to assist in determining the required infrastructure upgrades. Demand forecasting and profiles were developed for the site using development yields over a 3-year period. Individual project areas have been based on the average number of residential dwellings, and Gross Floor Area for retail and community developments outlined in the reference scheme shown in Section 5.6.

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 6.

Table 6 Sewer Design Loading Criteria

Land Use	Units	Wastewater 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

8.3 Forecast Demand

An estimate of forecasted wastewater loading has been calculated based on figures provided by LAHC (refer Section 5.6) specifically on the number of dwellings for residential units and the Gross Floor Area for retail and community designated 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 site is calculated to be approximately **1 L/s** as shown in Table 7.

Considering a ±15% variance in development yields, the ADWF could vary between 0.9 – 1.2 L/s

Table 7 Estimated Average Dry Weather Flow (ADWF) including BASIC (L/s)

Study Area	Wastewater - ADWF (L/s) - Cumulative (inc BASIX)		
	Residential	Non-Residential	Total
600-660 Elizabeth St, Redfern	1.03	0.01	1.04

8.4 On-Site Utility Infrastructure Assessment

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 Elizabeth Street Redfern.

The Site is located within the Malabar catchment, with wastewater directing flow towards the Malabar Wastewater Treatment Plant to the south of the site.

The existing internal wastewater network primarily consists of the following:

- Dual DN225mm SGW mains running through the site. About one-third of one of these mains, in the southern portion of the site and on the Elizabeth Street side, is shown to be rehabilitated;
- A DN225mm SGW main running along Kettle Street with a DN225 VC branch connected to the Site;
- A DN300mm VC running along Phillip Street; and
- A DN450mm CI main running along Elizabeth Street which is connected to a Relined DN400mm SGW rehabilitated main in the bottom half of the street.

The exact depths and positions of the existing reticulation mains are unknown. The existing wastewater infrastructure is outlined in Figure 11 at the end of this section. It is important to note that wastewater is a gravity service and for the proposed servicing design to work hydraulically, the levels of manholes should be surveyed to confirm that the falls are achievable – this should be done as part of design development.

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 site 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.

8.5 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;
- Blackwater / greywater use including split system; and
- Wastewater harvesting and water recycling.

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

8.6 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 discussed in Section 13.1.

In addition, Section 4.4.5.2 of Water Services Association of Australia codes (WSA 02-2002-2.2, Sydney Water Edition – Version 4) 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 4)

8.7 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 gratify pipes to ensure falls are achievable.

The key next steps in progressing the delivery of sewer infrastructure through design development, 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 Site 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 SWC 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 street network, depending on the strata arrangement individual buildings will still need to make separate applications for each connection.

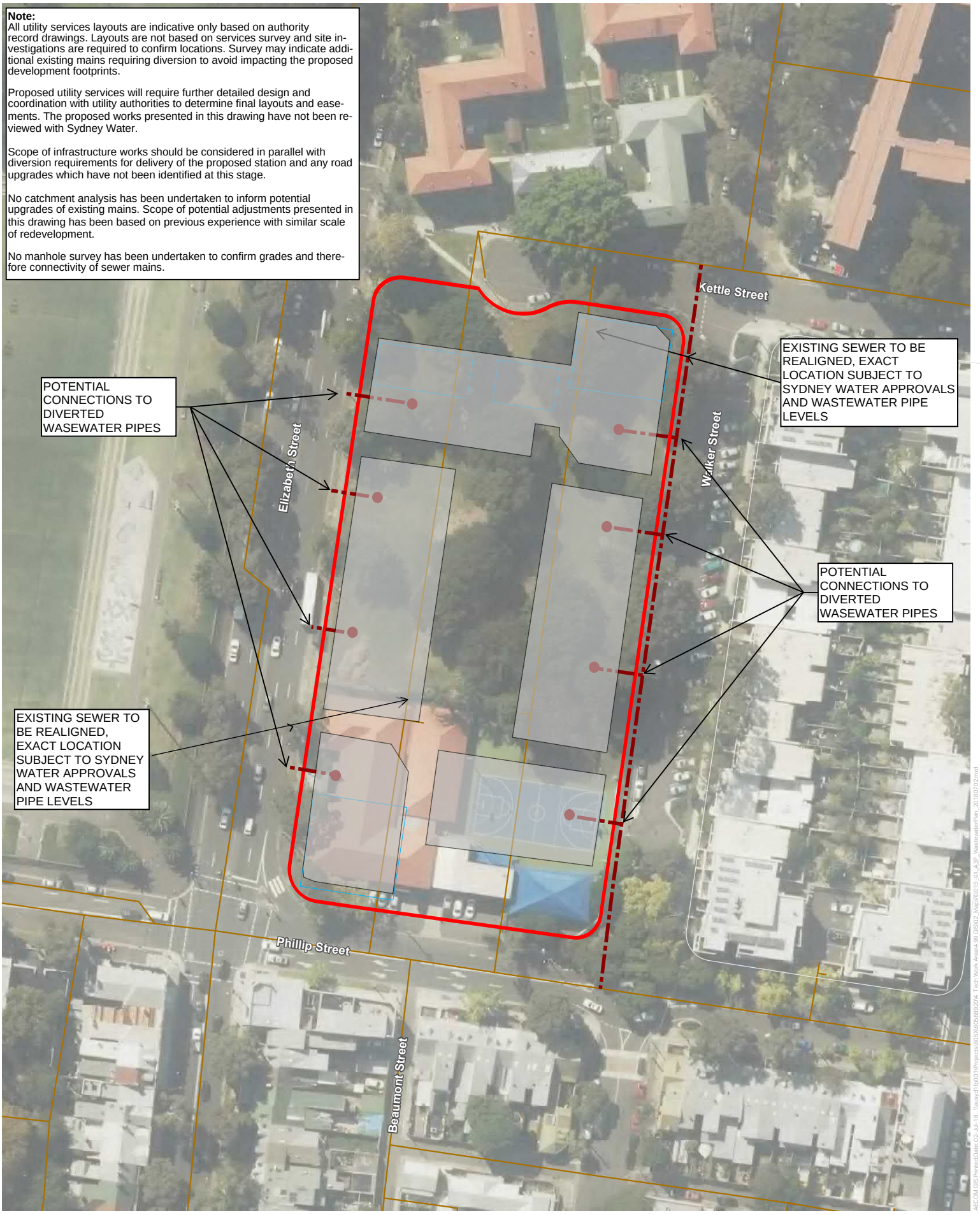


FIGURE 11 - **WASTEWATER PLAN** (**ASSUMING SEPERATE BUILDING CONNECTIONS**)

AECOM

0 5 10 20 m

KEY

Site boundary

Wastewater

Sewer main

Proposed building connection

Proposed sewer main

9.0 Electrical

9.1 Background

Electrical servicing to the Elizabeth Street Redfern site is provided by Ausgrid. Projections produced as part of the *Central to Eveleigh Infrastructure Servicing Strategy Report* (AECOM, 2015) indicate that there will be a substantial increase in electrical demand throughout the Site. However, there are no plans to renew the balance of the Redfern Estate. A preliminary enquiry has been submitted to Ausgrid to ascertain the capacity of the local zone substation and determine if it can service the proposed renewal of the site.

9.2 Demand Assessment

An assessment of the estimated electrical demand for the Elizabeth Street Redfern site has been undertaken to assist in determining the required infrastructure upgrades. Demand forecasting and profiles were calculated for the site using development yields over a 3 year period. 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 by the development yield in Section 5.6 and in Table 8 below.

Table 8 Forecast Development Yield

Forecast Breakdown	Cumulative Development Yield
Apartments (No.)	327
Retail / Commercial Space (m^2)	1907
Lifts (No.)	12 (assumed)
[1]Carparking (m^2)	4,600 (assumed)
Electric Car Charging	Nil (assumed)

1 Carparking area is an approximation only to accommodate electrical loads and is subject to further design development

Electrical demands for the Site has been determined based on AS3000 Table C3 and Ausgrid NS109 Table B rates unless indicated otherwise. Ausgrid recommended After Diversity Maximum Demand (ADMD) rates were also used to estimate residential dwelling electrical demand. These are shown respectively in Table 9 and Table 10.

Table 9 Ausgrid NS109 - Table 4 Guide to Typical Load Densities

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

Table 10 Endeavour Energy Growth Servicing Plan 2019 - 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 the site, the following load ranges have been adopted 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 while the Ausgrid rates do not. Therefore, a diversity factor of 0.8 has been applied to the Ausgrid rates as shown in Table 11.

Table 11 Adopted Maximum Electrical Demand Unit Rates

Electrical Loads	Unit	kVA / unit	Diversity Factor	kVA / unit (incl. Diversity Factor)	Source
Apartments	no.	3.0	-	3.0	*Endeavour Energy Growth Servicing Plan 2019 – Table 1*
Commercial	m^2	0.1	0.8	0.08	*Ausgrid NS109 – Table 4*
Retail	m^2	0.25	0.8	0.20	*Assumed Value*
Community/Cultural Space	m^2	0.1	0.8	0.08	*Ausgrid NS109 – Table 4*
Lifts	no.	80	0.8	64	*AECOM Experience*
Carparks	m^2	0.015	0.8	0.012	*Ausgrid NS109 – Table 4*
Electric Car Charing	no.	7	0.6	4.67	*Assumed Value*

9.3 Forecast Demand

Table 12 below summarises the total maximum electrical demands for the site using the latest development yields provided by LAHC as outlined in Section 5.6.

Table 12 Total Maximum Electrical Demand

Electrical Loads	Quantity	Unit	kVA / unit (incl. Diversity Factor)	Subtotal kVA (ADMD)
Apartments	327	no.	3.0	981
Commercial	-	m^2	0.08	-
Retail	1907	m^2	0.20	381
Community/Cultural Space	-	m^2	0.08	
Lifts	12	no.	64	768
[1]Carparks	4,600	m^2	0.012	56
Electric Car Charing	-	no.	4.67	-
Total				**2,186**

1 Carparking area is an approximation only to accommodate electrical loads and is subject to further design development

The overall peak electrical demand for all buildings and carparks following development has been estimated to be approximately **2.2 MVA**. Considering a ±15% range to account for future design development, electrical demand is expected to be between 1.9 – 2.5 MVA. It should be 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, PV systems have the

ability to reduce electrical demand and assist in managing peak demand. The extent of this reduction is dependent on the PV array size and associated operational losses.

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.

9.4 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.* The Elizabeth Street, Redfern site falls within the Eastern Suburbs load area and is serviced by substations and feeders as shown in Figure 12 below.

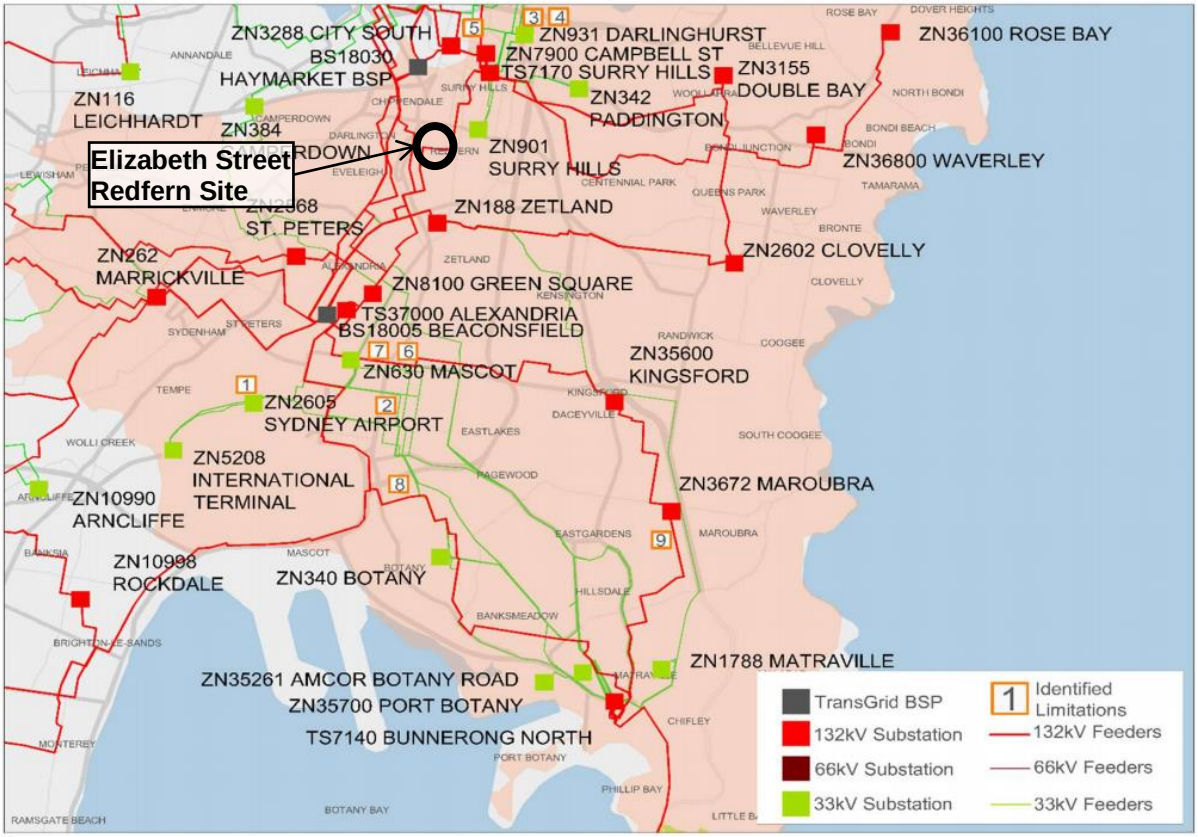


Figure 12: Eastern Suburbs load area *(Ausgrid,2018)*

There are a number of existing electrical assets within and adjacent to the Site boundary. These include:

- A large concentration of HV (including some 33kV feeder cables from substation ZN901 in Surry Hills) and auxiliary distribution cables along Elizabeth Street and Phillip Street on the opposite site of the site boundary; and
- Existing overhead power lines running along streets and underground to overhead (on pole) cables. See Figure 13.

Figure 13: Existing overhead power cables around site

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 meters of the existing HV cables, ratings assessments are required to demonstrate to Ausgrid's satisfaction that there are no mutual heating issues between cables.

While formal enquiries on existing and future capacities have been submitted to Ausgrid, feedback has not been received at the time of writing of this report.

The existing Ausgrid infrastructure is outlined in Figure 14 at the end of this section. This plan only considers Ausgrid infrastructure and there may be private electrical infrastructure present on the site.

9.4.1 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 within the Site study area would be abandoned or relocated underground. Figure 13 shows the existing overhead electrical infrastructure within the proposed site. Consideration of adequate space provisions should be made during further design development to plan for undergrounding of these existing cables.

9.5 Infrastructure Assessment

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

- Bulk Supply Points;
- Zone Substations;
- High Voltage Feeders; and
- Pole transformer and kiosk substations.

9.5.1 Bulk Supply Points

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

In NSW these Bulk Supply Points are operated and managed by TransGrid. Supply to the zone substations within the Site study area primarily comes from the Beaconsfield and Haymarket BSPs.

9.5.2 Zone Substations

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

The Site study area is situated within the Eastern Suburbs load area and is serviced by the Surry Hills 33kV substation ZN901. Various substations within the load areas are approaching capacity or are at their end of service life, which may impose constraints into the Site. Currently, substation ZN901 is undergoing upgradation work in three stages. Three groups of switchgear are being replaced as they are more than 50 years old. This work is expected to be completed by early 2020.

According to the Ausgrid *Distribution and Transmission Annual Planning Report 2018,* identified system limitations nearby the study area include:

- Darlinghurst ZS by 2020

While no continual limitations for Surry Hills ZN901 substation have identified in the latest Ausgrid report, new developments in the area, the Sydney Metro Waterloo Station as well as Sydney Airport Corporation Limited (SACL) projected increase in demand over the medium and long term, may necessitate further upgrades to Darlinghurst ZS as shown in Figure 12.

9.5.3 High Voltage Feeders

Underground and overhead high voltage feeders pass the electricity from zone substations through to distribution substations. Distribution substations include pole transformer and kiosk substations as well as substations in the basements of commercial buildings.

Ausgrid cables within the load areas approaching their end of service life impose additional constraints on the electrical supply of the Site load area. If a new zone substation is required, then the augmentation of the existing feeder network and provision of new feeders interconnecting zone substations will likely be required. Currently, no system limitations have been identified for feeders near the study area in Ausgrid *Distribution and Transmission Annual Planning Report 2018*.

9.5.4 Pole Transformer, Kiosk Substations and Chamber Substations

Pole transformer substations decrease the electricity from the incoming overhead feeder to the level suitable for a household electrical service. The electricity is then passed onto the residence through overhead service lines.

Kiosk substations are located next to residential properties or roadways. Connected to the underground feeder network, their role is to decrease the electricity voltage for residential use. From the kiosk substation, the electricity is then passed through underground low voltage lines to a pillar before connecting through to residences.

Chamber substations area also used, located within multi-story residential buildings these are connected to the underground feeder network and reduce the electricity voltage before distributing it throughout the building.

It is anticipated new distribution pad mount substations, or ductwork for chamber substations, will be required to supply the majority of the additional electrical demand however this is usually defined during the detailed design stage.

9.6 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:

- Passive design;
- Energy efficiency;
- Solar PV;
- Green infrastructure and tree canopy cover; and
- Cool roofs and pavements

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

9.7 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 13.1).

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".

9.8 Approvals and Next Steps

The developer is required to engage Ausgrid to confirm the requirements for connection when formal connection application is received. They will then assess the connection requirements and make a connection offer under the National Electricity Rules.

The current plan is focused on utility supply infrastructure and does not include an allowance for adjustments of existing infrastructure layouts to suit site works.

These potential diversions will be considered within the detailed precinct specific reports along with a refinement of the electrical connection strategy as further coordination with Ausgrid progresses.

The key next steps in progressing the delivery of electrical infrastructure through detailed design including the formal Ausgrid approval process consists of the following (in conjunction with further Ausgrid coordination and consultation with RMS on coordinating lead-in infrastructure):

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

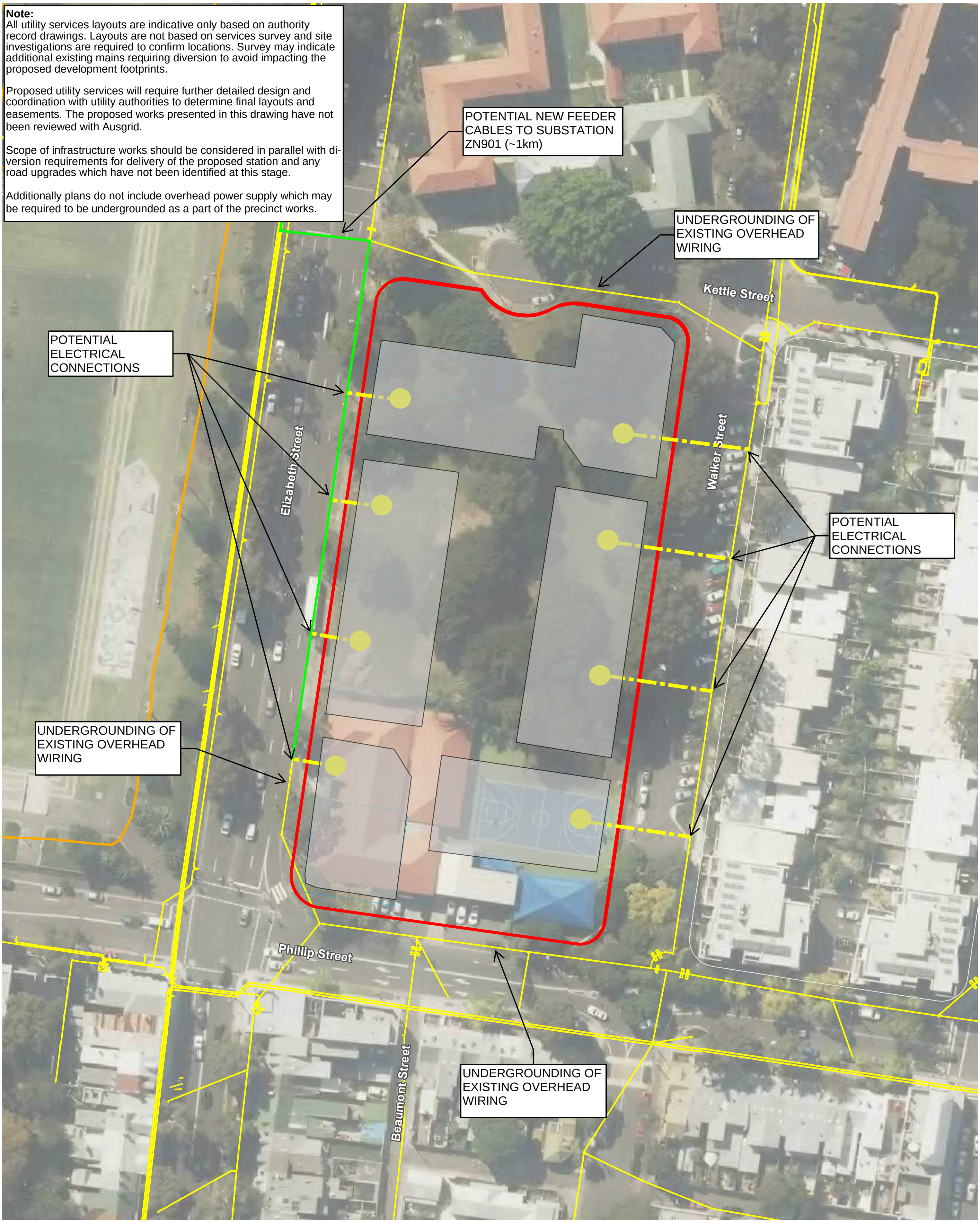


FIGURE 14 - **ELECTRICAL PLAN (ASSUMING SEPERATE BUILDING CONNECTIONS)**

AECOM

0 5 10 20 m

KEY

Site boundary

Electrical

- Ausgrid cable
- City of Sydney underground cable
- Proposed building connection
- Proposed LV Electrical
- Potential new feeder cables

10.0 Gas

10.1 Background

Gas servicing to the Elizabeth Street, Redfern site is provided by Jemena. Projections produced as part of the *Central to Eveleigh Infrastructure Servicing Strategy Report* (AECOM, 2015) indicate that there will be a substantial increase in gas demand throughout the Site. 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 *Central to Eveleigh Infrastructure Servicing Strategy Report* (AECOM, 2015) Jemena indicated that although they have the ability to service the general Site, they have not confirmed whether the existing infrastructure around study area has sufficient capacity. Confirmation of capacity and potential required upgrades will be received when formal connection applications are received.

10.2 Demand Assessment

An assessment of the gas demand has been undertaken to assist in determining the required infrastructure upgrades associated with Elizabeth Street, Redfern. Demand forecasting and profiles were calculated for the site using development yields over a 3-year period. 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 proposed development yields shown in Section 5.6.

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.

Table 13 below outlines the rates used to derive the estimated gas demand within the Site, applied to residential dwellings only.

Table 13 Gas Demand Unit Rates

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

10.3 Forecast Demand

Table 14 presents the estimated natural gas usage for the Site, 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 **540 m^3/day** as shown below. Considering a ±15% range for development yields, the gas demand could vary from approximately 460 - 620 m^3/day which includes the BASIX reduction.

Table 14 Estimated Cumulative Gas Demand Assessment (incl. BASIX)

Study Area	Gas - m3/day - Total (inc BASIX)	
	Residential	Non-Residential
600-660 Elizabeth St, Redfern	540	n/a

10.4 On-Site Utility Infrastructure Assessment

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

- A 75mm nylon main located 1.5m away from the boundary line of the precinct on Elizabeth Street;
- A 32mm nylon main inserted into 6-inch cast iron main located 2m away from boundary line on Kettle Street;
- A 32mm nylon main inserted into 3-inch cast iron main located 5.3m away from boundary line on Walker Street; and
- A medium pressure 210kPa network main connected to the above nylon mains, running across Phillip Street.

The existing and proposed services are shown below, the exact pressure rating, 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.

Limited information was available outlining the capacity of the Jemena network. A plan showing the existing Jemena network is shown in Figure 15 at the end of this section.

Further investigation is required to determine if gas mains have spare capacity and if reticulation lines require upgrades to service the future redevelopments.

10.5 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.

10.6 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 Section 13.1).

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 15.

Table 15: 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*

10.7 Approvals and Next Steps

When developing lots, individual developers are required to complete a connection application which needs to be lodged with Jemena, within ten business days they will provide an offer for connection service or advise that an offer will be made for a negotiated service.

The terms of the offer will depend on the site-specific information and if upgrades are required to the system to service the estimated demand, and if the offer is accepted, Jemena will schedule and perform the required gas connections.

The current study is focused on utility supply infrastructure and does not include an allowance for adjustments of existing infrastructure layouts to suit site works.

Jemena does not have a formal approval process, with supply arrangements being confirmed by Jemena as part of their quotation for construction to be provided following submission of applications for connection.

The 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 is for delivery of the gas network through the street network, it is expected that the buildings will need to make separate applications for each connection.

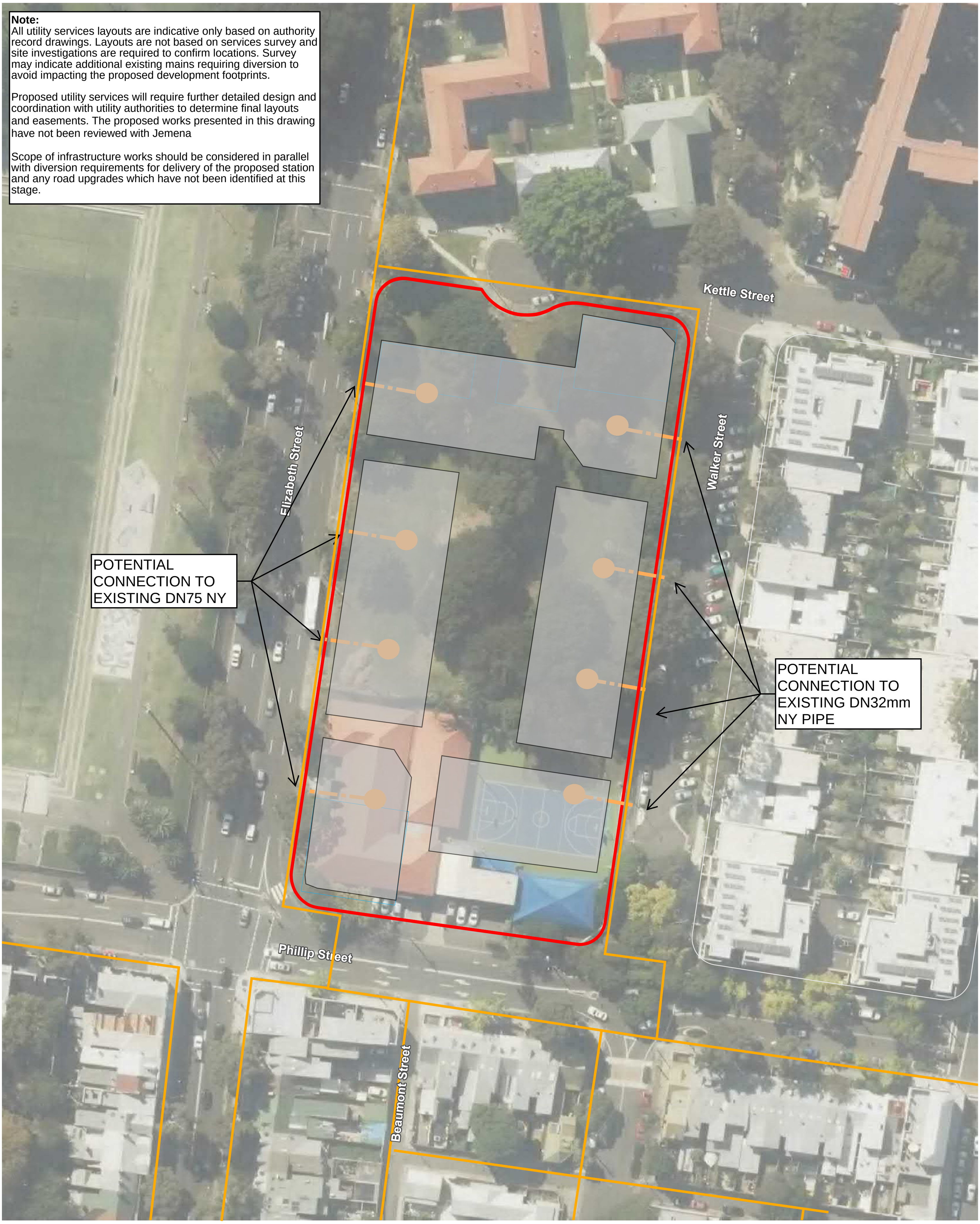


FIGURE 15 - **GAS PLAN (ASSUMING SEPERATE BUILDING CONNECTIONS)**

AECOM

0 5 10 20 m

KEY

Site boundary

Jemena

Gas main

Proposed building connection

Proposed gas main

11.0 Data and Telecommunications

11.1 Background

The following communication providers have assets running adjacent to and intersecting the Elizabeth Street, Redfern site:

- Optus and/or Uecomm, NSW; and
- Telstra NSW, Central

11.2 Demand Assessment

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

11.3 On-Site Utility Infrastructure

On-site utility infrastructure for each telecommunications service is summarised below, Figure 18 (at the end of this section) shows the proposed telecommunication connection route for the Site.

Telstra

Underground Telstra services are located in the streets forming the boundary of the site as well as servicing the location of former dwellings within the Site. Some of the existing Telstra services will be required to be abandoned, relocated or replaced as a part of the site development, 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 the detailed development application process. It is also likely that City of Sydney will require any existing overhead Telstra infrastructure to be relocated underground within the site and the bounding roads.

Optus/Southern Cross

Optus has an underground cable running near the boundary of the site along Elizabeth Street. The exact location of this cable is to be confirmed through site investigations. Connection to the Optus network is subject to detailed design phase. Onsite utility investigations and service searches are recommended post rezoning as a part of any future development application.

11.4 Infrastructure Assessment

There is some data and communications infrastructure present in and around the site. The Australian Government has issued a policy *Telecommunications in new developments – a guide for industry* (Department of Communications and the Arts, 2016) on the provision of telecommunications infrastructure in new developments which ascertains the role of Telstra and NBN Co. as infrastructure providers of the last resort (IPOLR) as follows.

- *NBN Co. is the IPOLR in developments of 100 lots or more within its fixed-line footprint and in areas where its fixed-line network is available, or the NBN rollout has been announced.*
- *Telstra is the IPOLR in developments of less than 100 lots where NBN's fixed-line network is not available and has not been announced. Telstra also covers developments outside the NBN fixed-line footprint in NBN fixed-wireless and satellite areas.*

For the Site, the planned NBN Co. coverage was identified on their website as shown in Figure 16. It is expected to be available by June 2020. NBN Co. will be responsible for installation of the fibre network in the new development and covers the cost of installation to a point. Developers are required to install and fund fibre-ready pit and duct infrastructure to NBN Co.'s specifications where such infrastructure doesn't already exist. Once the developer has demonstrated to have met the specifications, the ownership of this infrastructure will be required to be transferred to NBN Co. as a condition of servicing the development.

Figure 16: Planned NBN Coverage *(NBN, 2019)*

11.5 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 13.1).

The clearances for NBN Co. 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 17 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 17: NBN Clearances from Other Carriers and Underground Services

11.6 Approvals and Next Steps

Once the concept masterplans have been finalised these will be issued formally to NBN Co. to assess the potential backhaul costs. Once the detailed design is undertaken applications to connect will be completed, three months' notice is required for each stage prior to the commencement of construction or civil works.

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 between NBN Co. and the developer prior to construction works commencing (this does not prevent designs from being approved).

The next steps generally consist of the following:

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 existing telecommunication providers 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 Co. 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 existing telecommunication providers for quotes 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 Co. pit and pipe network through any public domain and depending on the precinct delivery model, individual buildings may be required to make separate applications for connection.

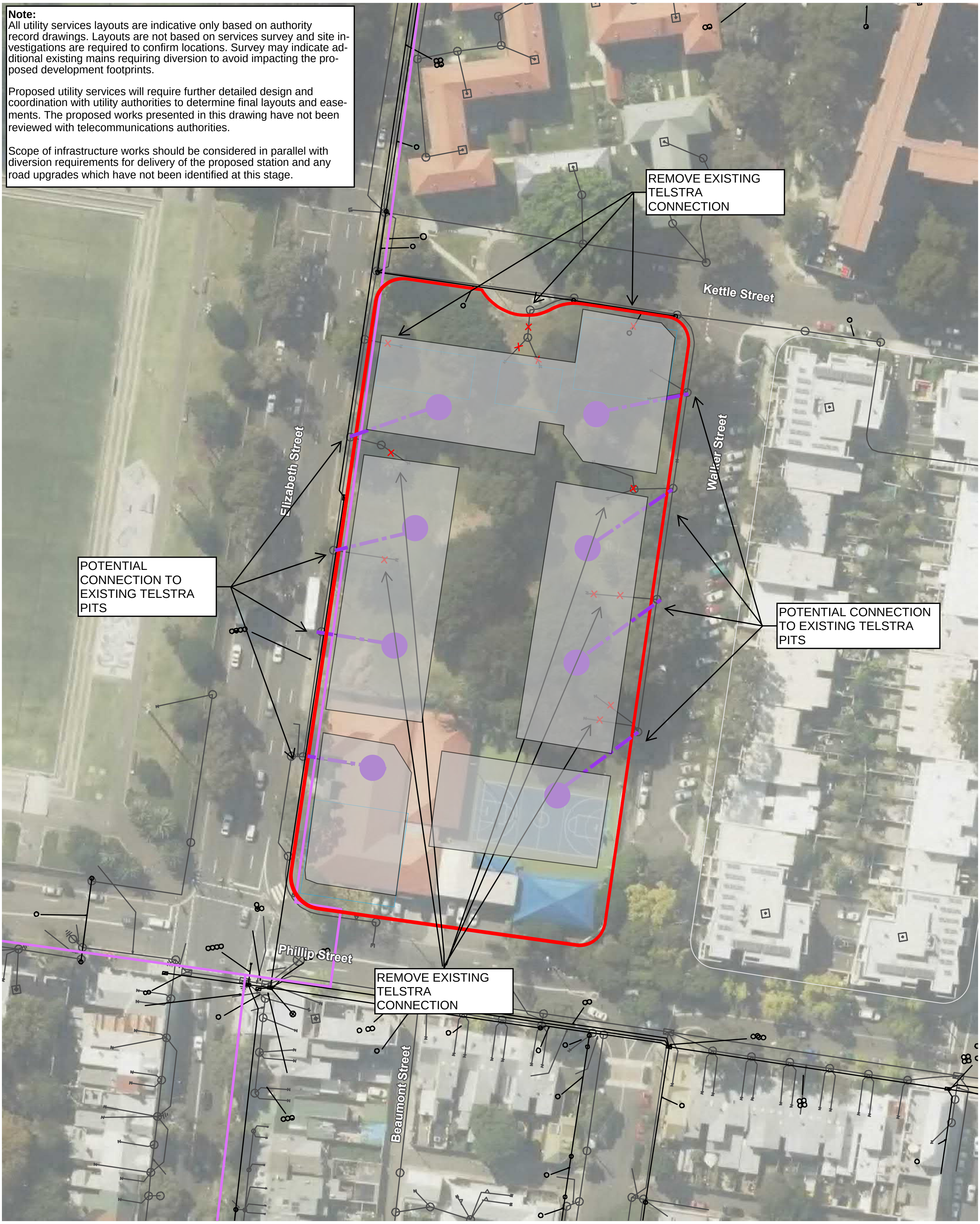


FIGURE 18 - **COMMUNICATIONS PLAN (ASSUMING SEPERATE BUILDING CONNECTIONS)**

AECOM

0 5 10 20 m

KEY

Site boundary

Communications

- Optus
- Telstra main cable
- Telstra cable
- Proposed building connection
- Proposed comms connection

12.0 Integrated Water Cycle Management (IWCM)

This section evaluates the potential for adoption of an Integrated Water Cycle Management approach for the Precinct which includes rainwater harvesting and stormwater recycling to achieve outcomes for a Green Star accreditation. This section should be read in conjunction with the AECOM *Ecologically Sustainable Development Report.*

12.1 Residential Demands

The target dwelling yield for the precinct as indicated by the proposal is 327. For residential water demand estimation, an occupancy rate for multi residential developments within the City of Sydney (2 people/apartment occupancy) is adopted. As such, the future population is expected to be around 650 residents within the subject area.

The *City of Sydney Decentralised Water Masterplan 2012-2030* provides a basis for determining the split of potable and non-potable water use in multi dwelling apartments. This study found that multi-unit dwellings consume approximately 156kL/dwelling/year and approximately 42% of these demands could be supplied by non-potable water. Applying this water usage rate to the proposed dwelling yield gives an indicative water usage volume for the proposed development. A breakdown of typical potable and non-potable water demands is provided in Table 16 which includes the volume of potable water that can be reduced through ESD measures like rainwater harvesting and stormwater recycling.

Table 16 Potential Water Usage

Water Uses (kL/dwelling/yr)		Residential Water Split	Adopted Total Demand for Precinct	Potable Water Substitution by ESD Measure	Residual Potable Water Dmand	Waste Water	BASIX Benchmark for Potable Water Use	BASIX Target for Potable Water Use
Non Potable	Toilet	18%	28.1	28.1	0	28.1	32.5	19.5
	Washing	15%	23.4	23.4	0	23.4	27.1	16.3
	Irrigation	4%	6.2	6.2	0	0	7.2	4.3
	Outdoor	5%	7.8	7.8	0	0	9.0	5.4
	Total	42%	**65.5**	**65.5**	**0**	**51.5**	**75.9**	**45.5**
Potable	Basin	5%	7.8	0	7.8	7.8	9.0	5.4
	Kitchen	5%	7.8	0	7.8	7.8	9.0	5.4
	Leaks	5%	7.8	0	7.8	7.8	9.0	5.4
	Shower	37%	57.7	0	57.7	57.7	66.8	40.1
	Bath	4%	6.2	0	6.2	6.2	7.2	4.3
	Dishwasher	2%	3.1	0	3.1	3.1	3.6	2.2
	Total	**58%**	**90.5**	**0**	**90.4**	**90.4**	**104.8**	**62.9**
Total Usage / Dwelling (kL/yr)			**156**	**65.5**	**90.4**	**141.9**	**180.7**	**108.4**
Total Usage for 500 dwellings (ML/yr)			**78**	**33**	**45**	**71**	**90**	**54**

Note: 1. The Basix benchmark for potable water use is 247.5 L/person/day = 181 kL/dwelling/year, assuming an occupancy ratio of 2 people / dwelling.

2. The Basix target for potable water use is 60% x 247.5 L/person/day = 108 kL/dwelling/year, assuming an occupancy ratio of 2 people / dwelling.

Utilizing ESD measures for all non-potable water uses has the potential to achieve a reduction in potable water consumption of 50% when measured against the BASIX benchmark, which is an improvement of 10% over the target reduction of 40%.

12.2 Water Balance

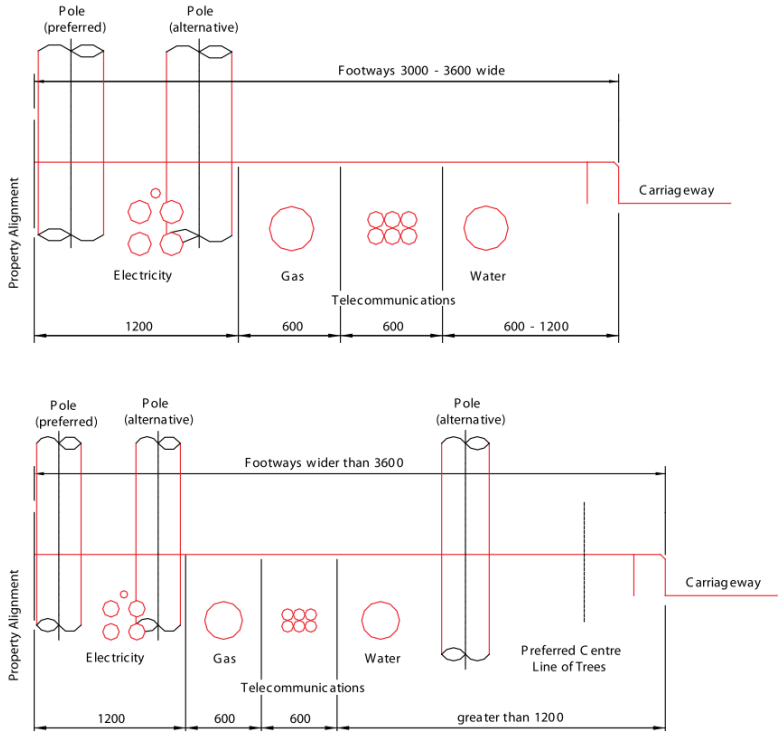
Based on Table 16 potable water supply will generally be used for potable demands (58% of residential water split) while harvested rainwater and recycled stormwater may be used for non-potable water uses (42% of residential water split) such as toilet flushing, laundry, irrigation of green areas. The annual water balance for the proposed development will depend upon the final approach adopted and should be clarified during the detailed design phase as well as subsequent detailed development applications for the development.

13.0 Utility Services Corridors

13.1 Street 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 the Site will be within new footpaths; these should follow the allocations shown in Figure 19. It is further noted City of Sydney generally requires the street lighting to be located adjacent to the kerbline, particularly if it is their asset.



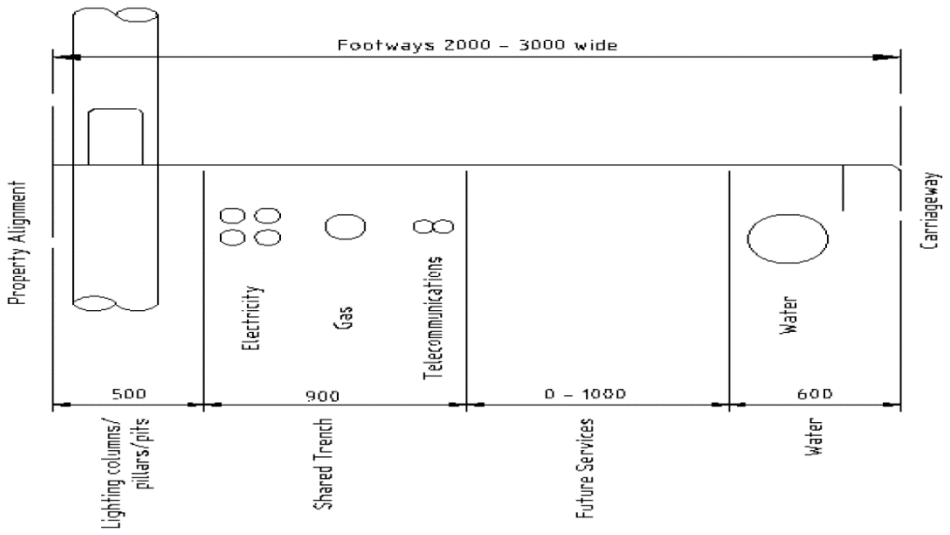
Notes:

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 19: 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 20.

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 20: 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 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. This is to be negotiated with the City of Sydney as a part of any future Development Application.

14.0 Conclusion

The Elizabeth Street, Redfern site has several utilities that pass along the streets by which it is bound. As the site is largely vacant land, only a few utilities run through the site. Previous investigations for the Central to Eveleigh Infrastructure Servicing Strategy (AECOM, 2015) and other utility reports indicate that local amplifications to potable water, wastewater, electrical and gas delivery systems will be required for future development. Upgrades to the local zone substation may also be required subject to confirmation by Ausgrid. Further, existing capacity of gas mains remains to be confirmed by Jemena. An opportunities and constraints map for utilities has been produced below in Figure 21.

Utility constraints that may affect the Site development include:

- Demand calculations provide the following estimated utility demand:
  - Potable Water demand between **150-200 kL/d**
  - Sewer loading between **0.9 – 1.2 L/s**
  - Electrical Demand between **1.9 – 2.5 MVA**
  - Gas demand between **460 - 620 m^3/day**
- Dual 225mm dia. sewer mains running through the site;
- Gas mains and Telstra cables running along most of the boundary of the site;
- A concentration of potable water main, stormwater pipes, gas main, Optus cable and auxiliary electrical cables along the western boundary of the site on Elizabeth Street; and
- Overhead powerlines around the site boundary on Elizabeth Street and Phillip Street which need to be undergrounded.

Opportunities and needs to support the precinct include:

- The site has minimal utility infrastructure as the majority of it is vacant land, which gives an opportunity to plan the services in line with the urban design intent and sustainability outcomes;
- Existing trunk services may have capacity to service the new development without requiring substantial upgrades (local zone substation capacity to be investigated) subject to confirmation through feasibility applications to utility companies; however local amplifications are very likely;
- There may be an opportunity to re-use any redundant electrical utility routes for new infrastructure; and
- Areas such as the Australian Technology Park (ATP) or Green Square Town Centre may enable the sharing of sustainable utility infrastructure and potential recycled water networks.

Future work that is required includes:

- Coordination with the Urban Design team to understand development scenarios and limit the impact on the existing trunk utilities;
- To investigate potential utility amplification to areas of increased density;
- 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;
- Assessment of ESD options to confirm the effects on utility supply and lead-in infrastructure requirements and routes; and
- Further opportunities for alternative utility supply requiring further investigation as part of this ongoing study.

Based on the studies undertaken within this report, the CoS Council Planning Proposal Requirements for Elizabeth Street, Redfern have been satisfied. Appropriate investigations into utilities infrastructure upgrades during the detailed development application process have also been recommended.

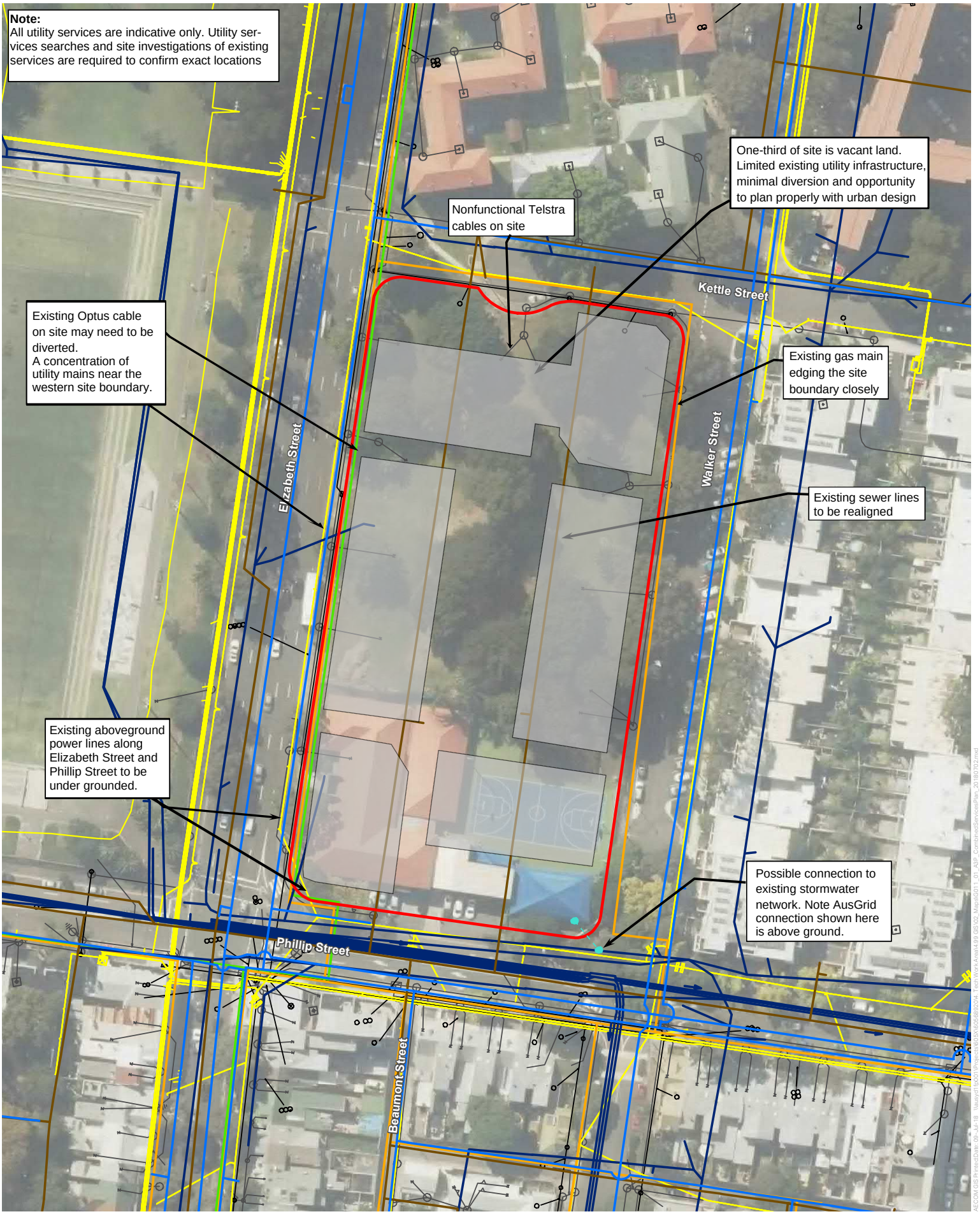


FIGURE 21 - **OPPORTUNITIES** & **CONSTRAINTS** - UTILITIES

Note: Refer to Figure 14 of Stormwater Strategy Report - Stage 1

AECOM

0 5 10 20 m

KEY

Site boundary
Water main
Sewer main
Stormwater main
Electrical cable
Gas main
Optus cable
Telstra main cable
Telstra cable

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