Warren Smith & Partners Pty Ltd

INFRASTRUCTURE SERVICES STRATEGY

INCORPORATING STORMWATER MANAGEMENT & WSUD PRINCIPLES

CONCEPT DESIGN REPORT

RALSTON AVENUE, BELROSE

Client: Matthews Civil Pty Ltd

Consultant:
Warren Smith & Partners Pty Limited
Consulting Civil, Hydraulic & Fire Protection Engineers
Level 1, 123 Clarence St
Sydney, NSW 2000
Ph: +61 2 9299 1312 W: www.warrensmith.com.au

E	23rd November 2012	Issue for Client – Matthews Civil Review
D	16th November 2012	Revised Issue for Client – Matthews Civil Review
C	9th October 2012	Issue for Client - Matthews Civil Review
B	28th September 2012	Preliminary Issue for CIS and Planner Review
A	25th September 2012	Preliminary Issue for CIS Review
Rev #	**Date**	**Description of Change**
Prepared by		M. Cahalane
Directed, Reviewed & Approved by		L. Panagopoulos

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Front Page Image Source:- Melbourne Water

1. EXECUTIVE SUMMARY

This Concept Design Report has been prepared by Warren Smith & Partners (WS&P) on behalf of Matthews Civil Pty Ltd to outline a strategy for the provision of infrastructure services to the proposed development site at Ralston Avenue, Belrose.

This work specifically includes the following disciplines:-

- Road Network Strategy;
- Stormwater Management Strategy;
- Water Supply Strategy;
- Sewerage Servicing Strategy;
- Natural Gas Strategy.

The concept design has been undertaken with the incorporation of Best Practice Guidelines to ensure that the highest quality standards are utilised in the development's design. Statutory requirements have been incorporated in the design to ensure that the set regulations of Municipal Councils, State Government and Utility Authorities are met

A road hierarchy has been included in the concept design to maximise road safety, amenity and function. This has resulted in three (3) levels of roads being utilised; Distributor Road, Perimeter Road and Local Street.

Particular emphasis has been placed on stormwater quality to ensure that the surrounding environment is not detrimentally affected by the proposed development. Significant water sensitive urban design measures have been incorporated in the concept design that will assist in reducing runoff volumes and pollution loads discharging from the site. The utilisation of Rainwater Capture and Reuse, On-Site Detention, Stormwater Bio-Retention Systems and Permeable Pavements will result in the development meeting the most stringent Water Quality Targets.

The stormwater system will be designed to ensure that flows will be reduced to a pre-development development rate in-line with Warringah Council's OSD Policy. The utilisation of On-Site Detention in lots and in the parkland/streetscape will be implemented to achieve this.

A preliminary design has been undertaken to service the site with water, sewer and gas. Liaison with the relevant authorities has taken place which has resulted in straightforward connections to existing mains to provide reticulation services to the development.

2. INTRODUCTION

The proposed development is located at Ralston Avenue, Belrose in Sydney's Northern Beaches. Belrose is a suburb situated 19 km north-east of the Sydney Central Business District in the local government area of Warringah Council. The suburb is primarily a residential area with a number of shopping precincts and recreation areas.

The development area is situated in close proximity to Garigal National Park, 1.5 km west of Forest Way. Please refer to Figure 1.1 for site location. The site is predominantly covered with bushland vegetation with an existing road pavement, 10.0m in width, providing access from Ralston Avenue. Reduced Levels (RL) vary from 173m to 160m with the centre of the site generally located at the crest of the hill.

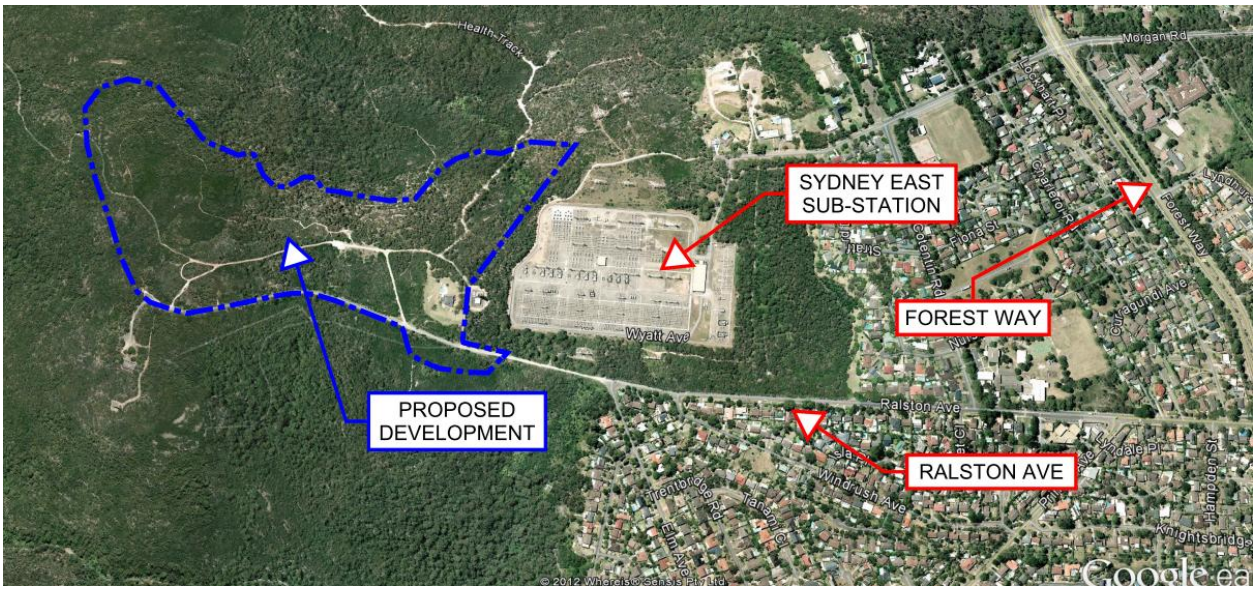

Figure 1.1 Site Location

The concept design report addresses the following disciplines:-

- Road Network Strategy;
- Stormwater Management Strategy;
- Water Supply Strategy;
- Sewerage Servicing Strategy;
- Natural Gas Strategy.

3. STATUTORY REQUIREMENTS

The following statutory requirements have been incorporated into the concept design of the proposed development:-

- AUSPEC 1 – Specification for Engineering Works
- Warringah Council 'On-Site Detention Technical Specification August 2012';
- NSW Government 'Managing Urban Stormwater – Soils and Construction';
- Sydney Metropolitan Catchment Management Authority 'Managing Urban Stormwater; Environmental Targets October 2007';
- Sydney Water;
- Jemena.

4. ROAD NETWORK STRATEGY

A hierarchical road network has been incorporated in the concept design to maximise road safety, amenity and function. The three (3) levels of roads utilised are illustrated in Figure 4.1 and listed as follows:-

- Distributor Road;
- Perimeter Road;
- Local Street.

Figure 4.1 Proposed Road Hierarchy

4.1 DISTRIBUTOR ROAD

The distributor road is the highest order in this development. It carries a high volume of traffic generated from lower order streets. A sketch of the proposed distributor road is illustrated in Figure 4.2.

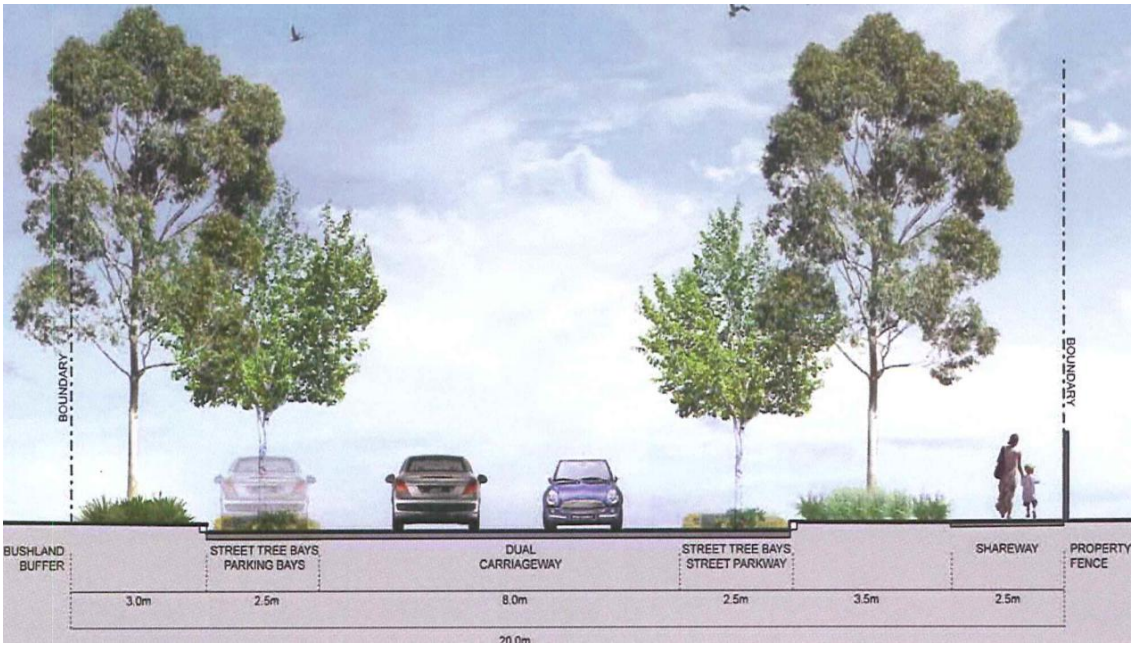

Figure 4.2 Distributor Road

4.2 PERIMETER ROAD

The perimeter road provides a balance between the access and residential amenity requirements of the development. Safety and amenity are dominant in this street but to a lesser degree than in a local street A sketch of the proposed perimeter road is illustrated in Figure 4.3.

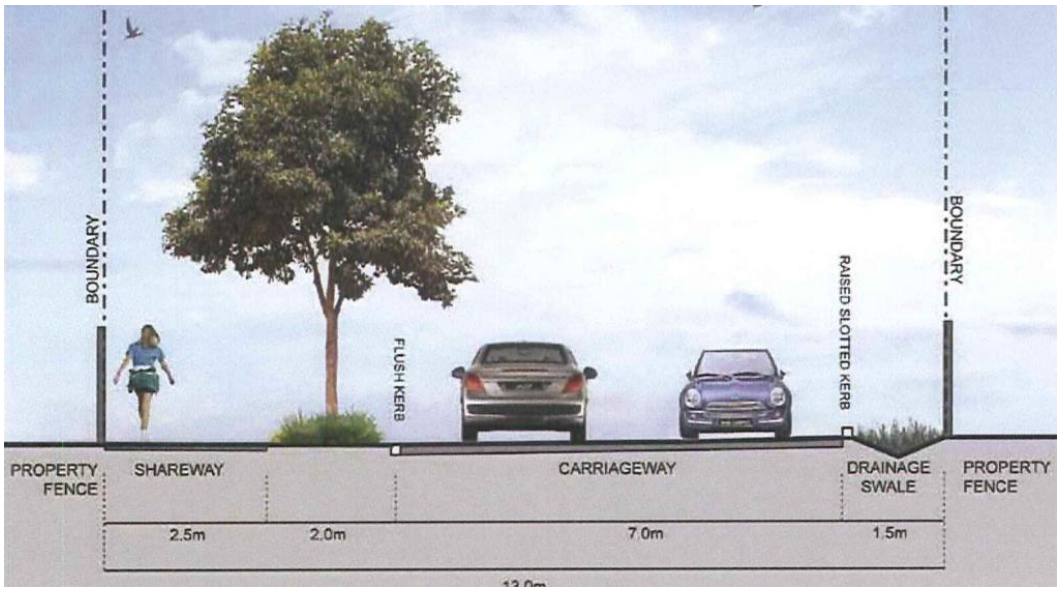

Figure 4.3 Perimeter Road

4.3 LOCAL STREET

The local street is the lowest order road and its primary function is residential space where vehicular traffic is subservient to space, amenity, pedestrians and cyclists. A sketch of the proposed local street is illustrated in Figure 4.4.

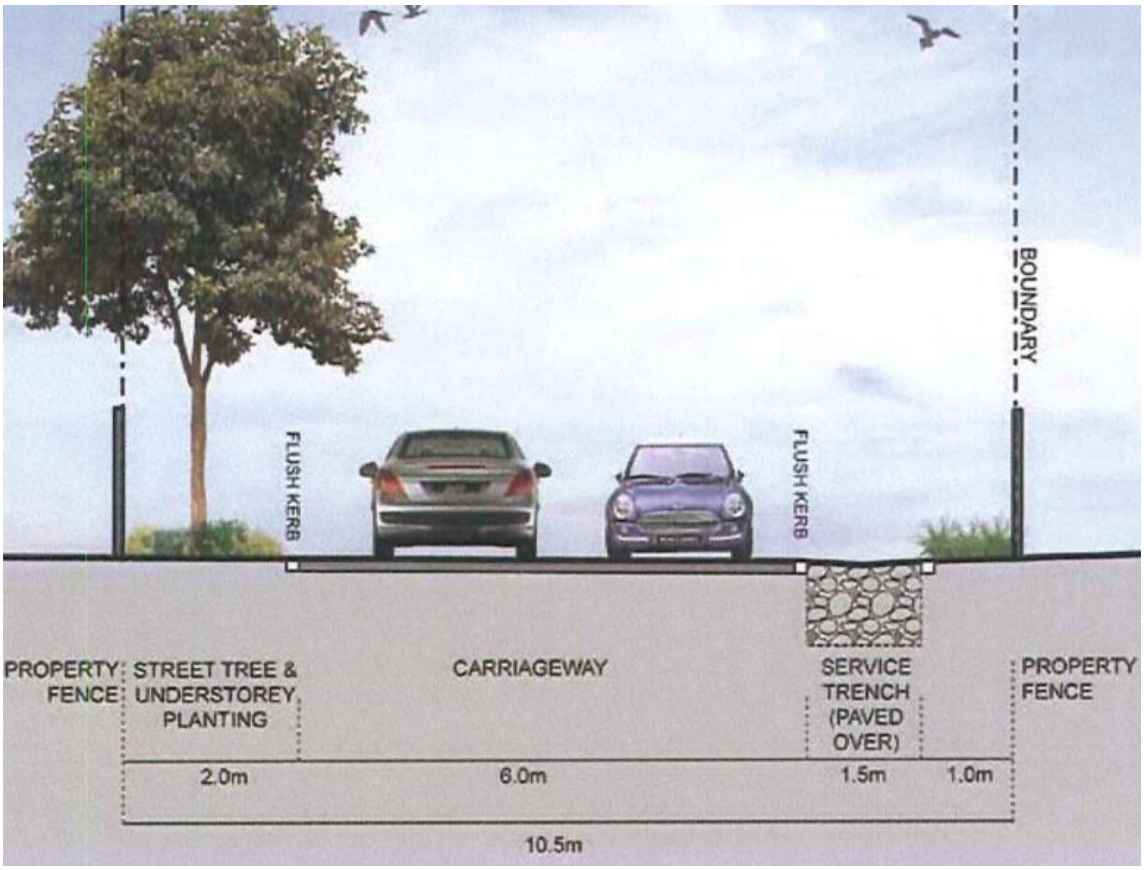

Figure 4.4 Local Street

5. STORMWATER MANAGEMENT STRATEGY

The development of the site from the existing bushland state into low density residential will generally impact on water quality and quantity as follows:-

- Increasing stormwater runoff volumes due to the increase in impervious areas;
- Increasing the concentrated pollutant loads of suspended solids and nutrients.

It is the objective of the development to utilise Best Practice Guidelines in the design of the stormwater system to ensure that there are no adverse impacts on the surrounding environment as a result of the proposed development. This will be achieved through the utilisation of Water Sensitive Urban Design (WSUD) initiatives.

Please refer to Figure 5.1 for an illustration of the natural, urban and WSUD water balances:-

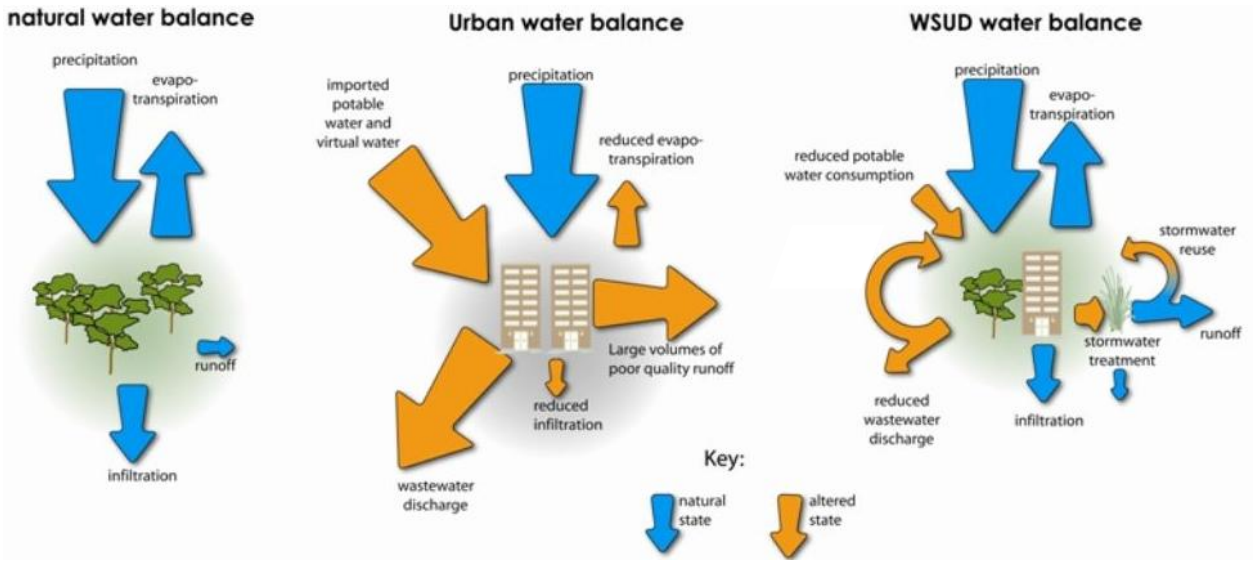

Figure 5.1 Water Balance (Source; Water by Design)

The development is proposing to adopt the measures outlined in Landcom's Water Sensitive Urban Design Policy. This policy has set the standard for WSUD in urban development with a number of projects receiving industry awards for their effectiveness in providing neutral effects to the surrounding ecosystems. Please refer to Table 5.1 for the principles that are proposed to be adopted in this development.

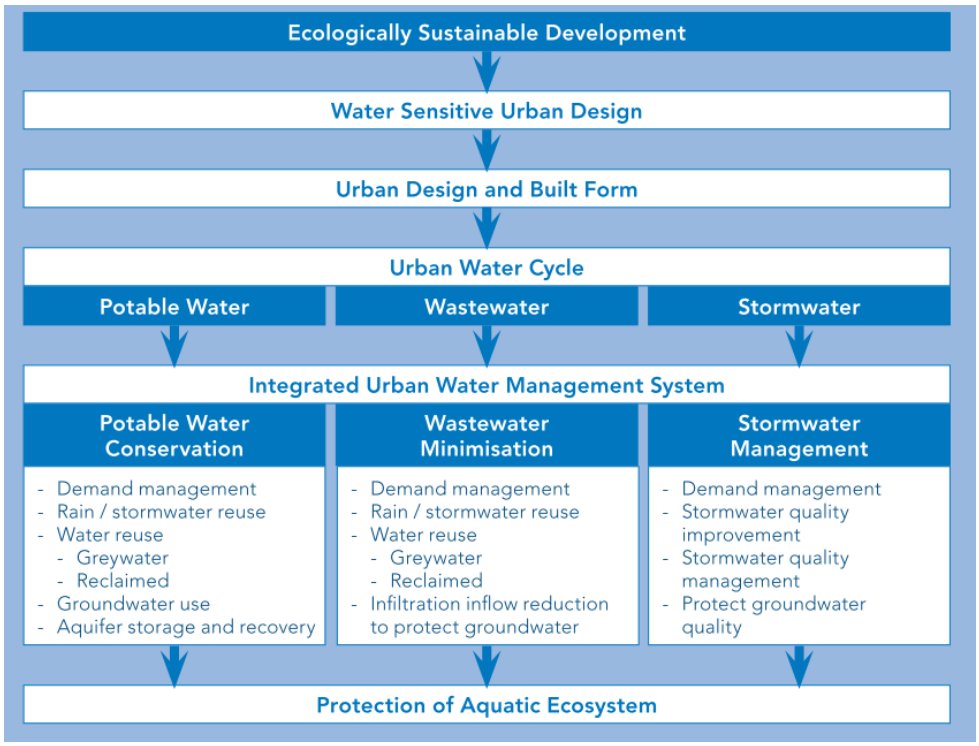

Table 5.1 Landcom's WSUD Framework (Source: Landcom)

The implementation of these principles requires for a number of targets to be met including water conservation, pollution control and flow management. Please refer to Table 5.2 for details of Landcom's WSUD targets. It is proposed that the 'Stretch Targets' will be applied to the development.

The adoption of these upper limit targets will allow the development to apply Best Practice Principles. This includes providing a 75% reduction in potable water consumption, significantly reducing suspended solid and nutrient loads, and maintaining flows to pre-development 'green field' rates. Linked to flow management is the stream erosion index which also requires for pre-development rates to be maintained.

OBJECTIVE		BASELINE AND PERFORMANCE TARGET	STRETCH TARGET
1	WSUD Strategy	(a) 100% of projects to have project-specific WSUD strategies.	
2	Water Conservation	Combination of water efficiency and reuse options – % reduction on base case.	
		(a) Single dwelling, no reticulated supply available: Baseline 40 % Performance 50+ % Stretch 65 %	
		(b) Single dwelling, reticulated supply available: Baseline 50 % Performance 65 % Stretch 75+ %	
		(c) Apartment, no reticulated supply available: Baseline 40 % Performance 50 % Stretch 60+ %	
3	Pollution Control	(a) 45% reduction in the mean annual load of Total Nitrogen (TN). (b) 65% reduction in the mean annual load of Total Phosphorus (TP). (c) 85% reduction in the mean annual load of Total Suspended Solids (TSS).	(a) 65% reduction in the mean annual load of Total Nitrogen (TN). (b) 85% reduction in the mean annual load of Total Phosphorus (TP). (c) 90% reduction in the mean annual load of Total Suspended Solids (TSS).
4	Flow Management	Maintain 1.5 year ARI peak discharge to pre-development magnitude Stream Erosion Index = 2.0	Maintain 1.5 year ARI peak discharge to pre-development magnitude Stream Erosion Index = 1.0

Table 5.2 Landcom's WSUD Targets (Source: Landcom)

In order to achieve the above principles and targets, it is proposed that the following WSUD initiatives be incorporated into the development to achieve the water quality and quantity goals:-

- Rainwater capture and reuse in WC flushing, laundry and irrigation;
- On-Site Detention;
- Stormwater treatment systems including Bio-Retention Tree Pits and Swales;
- Utilisation of permeable pavements in the road network.

The proposed water cycle for the development is illustrated in Figure 5.2.

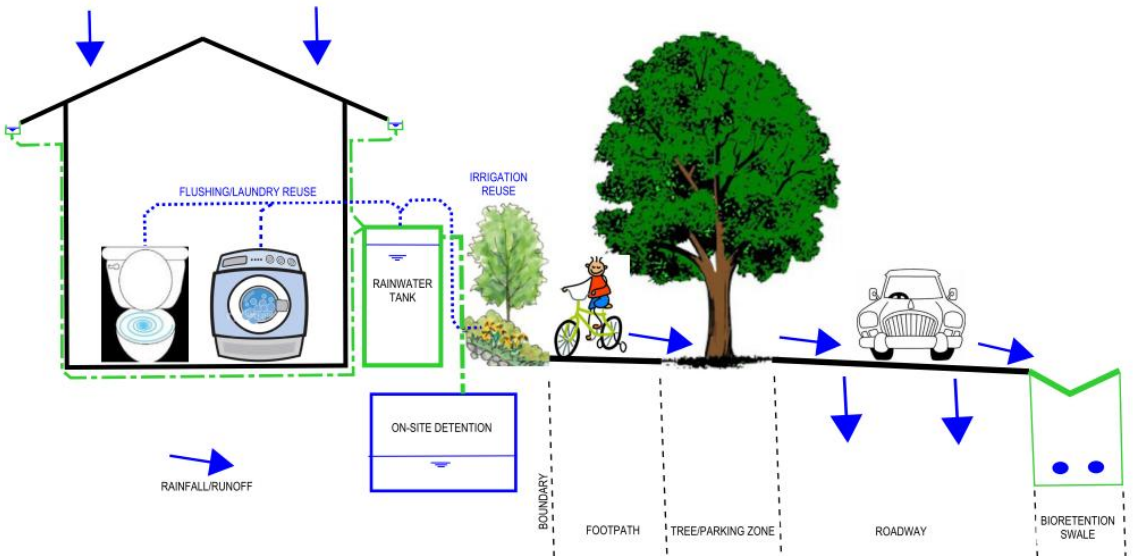

Figure 5.2 Proposed Water Cycle

5.1 STORMWATER QUALITY

Managing urban stormwater to minimise environmental impacts on the health of waterways is one aspect of an integrated approach to stormwater management. Other aspects include minimising flooding and the reuse of stormwater. Please refer to Figure 5.3 for a comprehensive list of the factors involved.

Hydrology: • Frequency, magnitude and duration of events (ie ecological disturbance) • Predictability of flow • Stability of flow • Influence of groundwater	**Hydraulics:** • Water velocity • Water depth • Turbulence • Stream-bed shear forces	**Water quality:** • Suspended particles • Nutrients • Ionic composition and concentration • Dissolved oxygen/biochemical oxygen demand • toxicants
Geomorphology: • Catchment geology • Position in catchment • Channel characteristics • Macro-habitat (pool, riffle run etc)	**In-stream habitat:** • Particle size of benthos • Organic content of benthos • Large woody debris • Vegetation (eg macrophytes)	**Biological:** • Reproduction • Migration • Competition • Predation
Sediment quality: • Particle mineralogy/adsorption capacity • Carbon content • Redox potential/dissolved oxygen • toxicants	**Riparian habitat:** • Food supply (leaf litter) • Habitat supply (large woody debris) • Channel form and stability • Microclimate (canopy and channel light, temperature, humidity and wind speed)	**Continuity and barriers:** • Proximity to other ecosystems • Barriers to movement (eg physical)

Table 5.3 Factors Affecting Ecosystem Characteristics (Source; Engineers Australia)

The following Best Practice Guidelines will be incorporated into the design in order to mitigate against an adverse effect on the surrounding environment due to the development:-

- 90% reduction in the average annual gross pollutant load;
- 85% reduction in the average annual Suspended Solids load;
- 65% reduction in the average annual total Phosphorus load;
- 45% reduction in the average annual total Nitrogen load.

The development will be modelled to demonstrate the performance of the stormwater treatment system utilising a program called MUSIC (Model for Urban Stormwater Improvements Conceptualisation). MUSIC can model the proposed stormwater treatment devices and estimate their respective performance against the performance targets of the project. A preliminary model has been set up which demonstrates that the measure outlined previously results in best practice targets being exceeded as is illustrated in Table 5.4.

Connection	Sources	Residual Load	Reduction (%)	Best Practice Reduction (%)
Flow (ML/yr)	108.00	107.00	0.9	-
Total Suspended Solids (kg/yr)	20000	898	95.5	85.0
Total Phosphorous (kg/yr)	42.80	8.54	80.0	65.0
Total Nitrogen (kg/yr)	293.0	144.0	50.9	45.0
Gross Pollutants (kg/yr)	2360.0	0.0	100.0	90.0

Table 5.4 MUSIC Model Results

5.2 STORMWATER QUANTITY

The development involves the clearing of a proportion of the existing vegetated landscape and replacing it with an urban landscape. This will result in an increase in the volume of runoff emanating from the site as well speeding up the movement of stormwater.

It is proposed that in accordance with 'AUSPEC 1; D5 Stormwater Drainage Design' that the following design parameters will be adopted for the proposed development:-

- Minor Drainage System designed to contain the 1 in 5 Year ARI Storm;
- Major Drainage System designed to contain the 1 in 100 Year ARI Storm;
- Maximum depth of water during a stormwater event to be 0.2m;
- Maximum velocity depth product during a stormwater event to be 0.4;

On-Site Detention (OSD) will be provided in accordance with Warringah Council's 'On-site Stormwater Detention Technical Specification, September 2007' namely:-

- Post-development runoff to be restricted to State of Nature flow rates for the 1 in 5, 20 and 100 Year ARI Storms;
- OSD Tanks to be designed to contain the 1 in 5 Year ARI Storm if the overland flow path does not pass through downstream properties;
- OSD Tanks to be designed to contain the 1 in 100 Year ARI Storm if the overland flow path does pass through downstream properties;
- Pipe flow from the site is not to exceed the 1 in 5 Year ARI State of Nature flow rate.

A preliminary DRAINS model has been set up to model the pre and post development catchments. Pre-development results are summarised in Table 5.5 and will be utilised in the hydraulic modelling of the post-development catchment to ensure that flow rates do not exceed the aforementioned Council requirements.

5 Year			20 Year			100 Year		
Piped	Overland	Total	Piped	Overland	Total	Piped	Overland	Total
-	3.380	**3.380**	-	5.340	**5.340**	-	7.400	**7.400**

Table 5.5 Pre-Development Flow Rates

The development of each sub-divided lot will include the installation of a rainwater and OSD tank. Additional OSD will be required to be provided for the road network. It is expected that this storage will be incorporated into the Bio-Retention Swale system.

Preliminary modelling of the OSD system has suggested that the Permissible Site Discharge (PSD) for each lot cannot exceed 20.59 L/sec/ha. This PSD rate will be required to be confirmed upon more detailed modelling.

Rainwater tanks will be designed in accordance with BASIX requirements. A preliminary BASIX Sustainability Report has been undertaken for an individual lot. Commitments that are proposed to provide for a water sustainable development include:-

- Indigenous or low water species in landscaped areas;
- Water efficient fixtures including showerheads, toilets and tapware;
- Rainwater Tanks;
- Stormwater Tanks.

It is anticipated that parts of the sub-division will be completed prior to the construction of the residences, and associated rainwater and OSD Tanks on each lot. This initial 'early works' development will include the road network, services and the level grading of lots, with no impervious works undertaken within each lot. It is expected that the staging of these works will not have a detrimental effect on stormwater runoff from the development. This will be achieved due to the lack of a house and driveway on each lot resulting in a 100% pervious surface, within the lot, in the interim solution.

6. WATER AND SEWER NETWORK

Sydney Water has provided advice on the requirements for servicing the proposed development. Please refer to Schedule 2 for the Sydney Water Feasibility Letter which details the specific requirements. In summary, the existing infrastructure in Ralston and Wyatt Avenue possesses adequate capacity to service the development with a minor amplification required for the watermain. This represents a significant bonus to the existing infrastructure with minimal works required external to the development. This will result in:-

- Minimal disturbance to existing customers and existing infrastructure;
- Minimal impact on the capacity of existing trunk sewer infrastructure in the general area;
- Minimal impact on the capacity of existing trunk sewer and water infrastructure in the area;
- The requirements stipulated represent typical requirements in relation to servicing.

6.1 WATER SUPPLY STRATEGY

An existing DN100 Sydney Water watermain is located at the junction of Ralston and Elm Avenue. A new connection will be made from this main to service the proposed development. Please refer to Figure 6.1 for details of the existing infrastructure and to Schedule 2 for the Sydney Water Feasibility Letter.

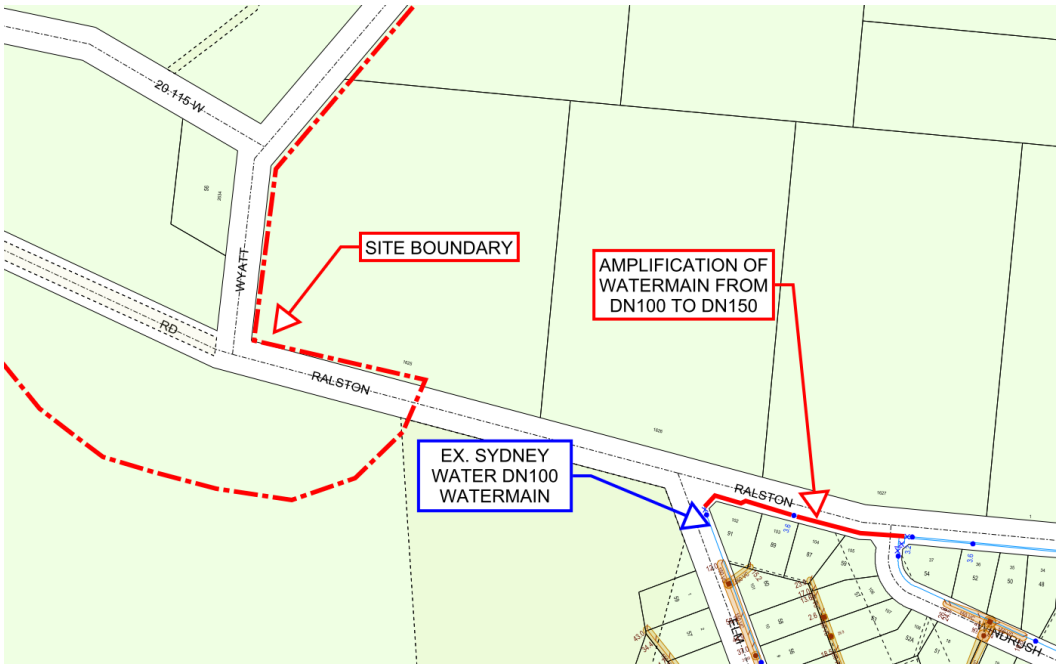

Figure 6.1 Existing Sydney Water Watermain Location (*Source; Sydney Water Hydra Data Base*)

A minor amplification of the existing watermain has been identified by Sydney Water in their Feasibility Letter dated 20th June 2012. The amplification consists of the upgrading of the existing DN100 to a DN150 service for approximately 130m between Elm and Windrush Avenue.
The proposed watermain servicing the development will have the following characteristics:-

- DN100 Watermain;
- Hydrants typically at 60 m centres;
- Stop Valves typically at 300m centres;
- Hydrant and Stop Valves at each take-off.

The design of the watermain has been undertaken with Best Practice Guidelines and in accordance with the Water Supply Code of Australia WSA 03 -- 2002-2.2. The code requires pipe sizes of DN100 for low to medium residential zones to ensure adequate flow rates and residual pressures including a contribution to basic fire fighting capabilities. All assets will be designed for a nominal asset life of at least 100 years without rehabilitation.

6.2 SEWER SERVICING STRATEGY

An existing DN150 vitrified clay Sydney Water sewer is located at the junction of Ralston and Elm Avenue. A new connection will be made from this main to service the proposed development. Please refer to Figure 6.2 for details of the existing infrastructure.

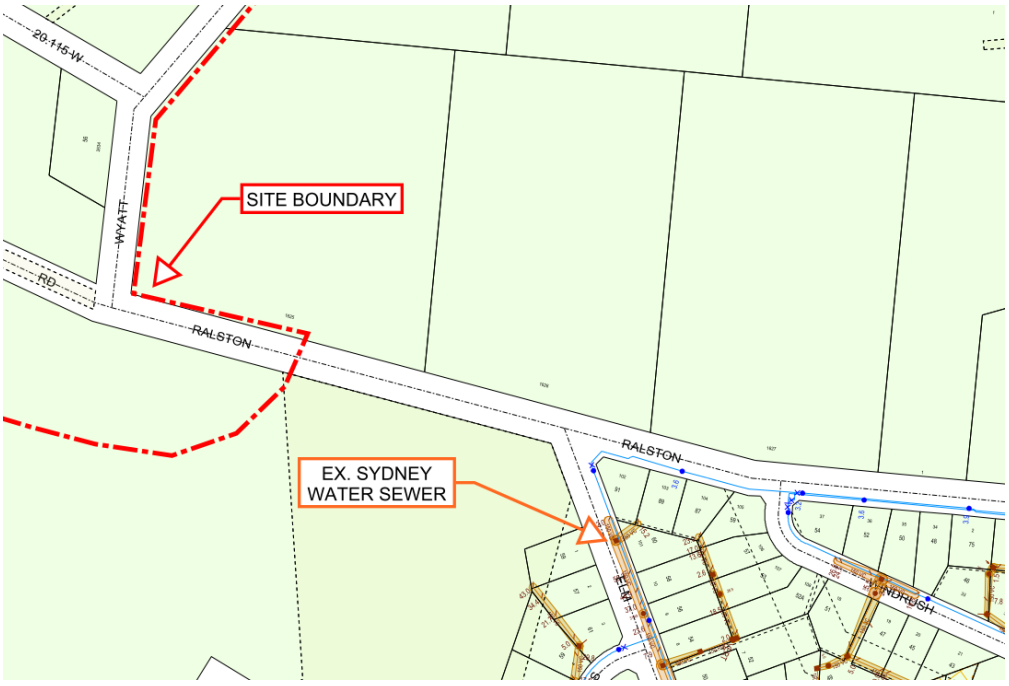

Figure 6.2 Existing Sydney Water Sewer Location (*Source; Sydney Water Hydra Data Base*)

Existing site RLs suggest that a series of pumping stations will be required to be incorporated in the sewer design to reticulate sewerage to the Sydney Water Sewer. This requirement will be further developed upon detailed site and road RL design.

The design of the sewer has been undertaken with Best Practice Guidelines and in accordance with the Sewerage Code of Australia WSA 02 -- 2002-2.2. The code requires pipe sizes of DN150 for reticulation sewers servicing residential lots with a maximum equivalent population of 600. Absolute minimum grades for reticulation of 0.59% will be applied to DN150 sewers. All assets will be designed for a nominal asset life of at least 100 years without rehabilitation.

7. NATURAL GAS SERVICING STRATEGY

There is an existing Jemena service reticulating to the locality. Jemena has advised that there is enough capacity to support the proposed development. Supply will have to be extended from the corner of Ralston Avenue and Elm Avenue with the use of shared trenching convention once inside the development.

Please refer to Figure 7.1 which illustrates the proposed natural gas infrastructure proposed for the development.

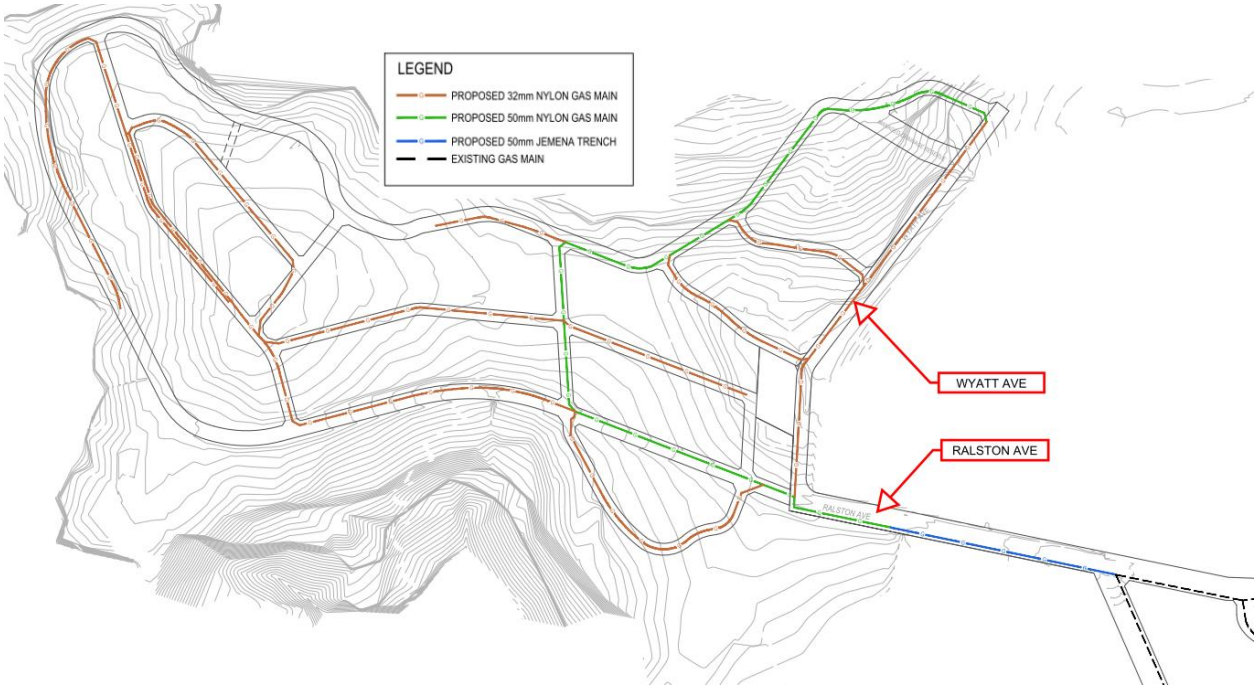

Figure 7.1 Proposed Jemena Gas Main Works

SCHEDULE 1 –CONCEPT DESIGN DRAWINGS

DRAWINGS	
NUMBER	TITLE
SK-01	ROAD NETWORK PLAN
SK-02	STORMWATER MANAGEMENT CONCEPT PLAN
SK-03	WATER SUPPLY CONCEPT PLAN
SK-04	SEWER CONCEPT PLAN
SK-05	GAS SUPPLY CONCEPT PLAN

SCHEDULE 2 –REFERENCE DOCUMENTS

- Sydney Water Feasibility Letter dated 20th June 2012;