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Studies

Preliminary Investigations: Water and Wastewater Infrastructure

For Sites:

Pacific Highway, Lake Munmorah

Wye Rd, Bushells Ridge (East)

Motorway Link Road

Client:



Local Aboriginal Land Council
DARKINJUNG

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Executive Summary

This report investigates the current availability of water and wastewater infrastructure within the Wyong Shire Council's area of operation needed for the identified sites and provides qualified comments on anticipated servicing costs.

All of the nominated sites have a varied degree of access to water & wastewater infrastructure.

The preferred option for servicing Site 1 – Wye Road, Bushells Ridge East includes the WSC combined option of water and sewer in terms of lowest capital cost and lowest risk with developing future infrastructure. This combined option would cost approximately \$2,010,000 for both water and sewer lead in infrastructure which represents \$5025 per lot.

The preferred option for Site 2 – Pacific Highway, Lake Munmorah includes connecting to existing WSC infrastructure. This results infrastructure costs to be under \$3000 per lot. To achieve this it is recommended that wastewater Option 1B be used in conjunction with the only water option. This option would depend on WSC acceptance of connection to SPS MP10.

The preferred option for servicing Site 3 – Motorway Link Road, Bushells Ridge South includes connecting to WSC infrastructure for both water and sewer. The preferred option for servicing the development range from between 2.8% - 3.9% of revenue for water and servicing range from 4.9% to 7.0% for wastewater.

Further consultation should and will be undertaken with relevant authorities including Wyong Shire and Lake Macquarie City Councils and other approved utility providers.

Final service costs will be influenced by the timing of other developments as services are provided to those developments. Early nomination of Darkinjung LALC proposals will allow for the coordinated deliver of infrastructure throughout the north Wyong Land Release Area.

1.0 Introduction

ADW Johnson has undertaken preliminary investigations into both water and wastewater servicing options for three Darkinjung sites:

- Site 1 – Wyee Road, Bushells Ridge East
- Site 2 – Pacific Highway, Lake Munmorah
- Site 3 – Motorway Link Road, Bushells Ridge South

These sites are shown on Figure 1.

Each site was assessed based on feasibility and connection methods to different public and private water utilities. The utilities investigated include:

- Connecting to Wyong Shire Council's existing infrastructure (or where available proposed infrastructure)
- Connecting to Hunter Water Corporation's existing infrastructure
- Connecting to proposed private infrastructure for adjoining land located at Wyee

All sites investigated are located within Wyong Shire Council's (WSC) area of operations. Therefore these sites are legally obliged to either connect to WSC infrastructure or alternately, they are able to connect to a private utility under the Water Industry Competition Act 2006 (such as Water Factory Company). It is noted that Hunter Water Corporation (HWC) and WSC have an existing arrangement whereby water is shared. In the past the boundary delineating HWC and WSC's areas of operations has been changed to suit proposed development sites.

As such, options to connect to both WSC infrastructure and HWC infrastructure have been investigated, noting that if feasible, HWC options would need to be further discussed with both entities.

Assessment of infrastructure requirements has been based solely on proximity to existing infrastructure for WSC and HWC infrastructure. No assessment of the capacity of the existing infrastructure has been undertaken. Detailed investigations and discussions with HWC and WSC would be required to determine the capacity of the existing systems.

In addition, sizing of infrastructure provided in this report is indicative only and subject to detailed investigation and analysis.

Advice provided is based on preliminary discussions with WSC, Water Factory Company (WFC), for land at Wyee, and a review of the relevant HWC regional water and wastewater strategies.

1.1 DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL

The Darkinjung Local Aboriginal Land Council (LALC) is located on the Central Coast of New South Wales. Covering an area of approximately 1,855km², its boundaries stretch from Catherine Hill Bay to the north, Hawkesbury River to the south, Pacific Ocean to the east and Watagan Mountains to the west.

Darkinjung LALC was created in 1984, under the provisions of the NSW Aboriginal Land Rights Act 1983 (ALRA). The Land Council is a community based organisation and is registered as a public benevolent institution.

A primary function of a Land Council is to acquire land and manage land. Acquisition generally occurs through the lodgment of a Land Claim over certain vacant Crown Land. Since inception, Darkinjung LALC has been successful in securing a portfolio of approximately 3,500 hectares, with undetermined Land Claims over a further 14,000ha – making Darkinjung LALC the largest non-government landowner on the Coast. This land portfolio is expected to grow over the coming years as further claims are determined and is a similar situation with many other Land Council.

In response to the meeting the goals and objectives of a Land Council as prescribed by the ALRA, Darkinjung LALC has recognised the need to establish a LALC Land Strategy.

This Land Strategy would identify development opportunities and also conservation outcomes for Darkinjung owned land across the whole LALC area. The timing for the development of this Land Strategy is important as Darkinjung LALC moves from what has been largely a research and investigation phase (in relation to land matters), now transitioning into a development and delivery phase. In November 2010, the Department of Planning released the Draft North Wyong Shire Structure Plan. The release of this document prompted Darkinjung LALC to undertake urgent review of its land holdings within the Structure Plan area as if most their holdings were identified within future conservation corridors. The Darkinjung LALC review identified a number of parcels as having potential for future residential or employment uses. These areas are:

- Bushells Ridge North and South (Employment land);
- Bushells Ridge East (Residential land);
- RailCorp/Link Road Employment Estate (Employment land);
- Lake Munmorah (Residential land); and
- Halekulani (Residential land).

The above sites were initially selected on the basis of local site knowledge, commercial experience and preliminary findings from ecological investigations. Since 2010 further work has been undertaken to verify initial findings and to validate site selection. This includes ongoing ecological assessment, preliminary traffic, transport and access assessment, economic demand and needs assessment and ongoing planning review.

1.2 BACKGROUND ON WATER UTILITIES

WSC's process is that the initial developer will typically construct the infrastructure required to service the site, with the value of the works nominated in the Developer Service Plan (DSP) used to offset the water and sewerage contributions payable. Developers undertaking works at a later date will connect to the new infrastructure and pay WSC developer contributions. It should be noted that credits and reimbursements apply only to the infrastructure identified explicitly in a DSP.

Advice from Council is that for large scale infrastructure projects Council will construct the infrastructure and collect developer contributions as developers connect to the infrastructure. Whilst this is the advice of Council, our experience is that generally Council do not forward fund infrastructure due to cash flow constraints and expects the lead developers to fund and construct

under “works in kind” agreement. Additional assessment of existing gravity main capacity etc by Council will require the payment of an assessment fee.

WFC is an Australian owned private water utility which operates under the Water Industry Competition Act (WIC Act) to provide recycled water, water and wastewater services to residential and commercial homes in high rise and land release developments.

1.3 LIMITATIONS OF COST ESTIMATES

Cost estimates provided are preliminary only with approximately 30% contingency built in. Further detailed investigations and liaison with water authorities would be required to refine costs.

Internal servicing requirements have not been examined as part of this report. Internal water and wastewater infrastructure may consist of reservoirs, booster water pumping stations, water and sewer mains and wastewater pumping stations.

Costs presented in this report are for new local lead-in I infrastructure to service each site. Unless otherwise stated, cost estimates do not consider any upgrades required to the existing regional water and wastewater systems which may be required as a result of connection of these sites.

Water cost estimates assume supply of water via one water main only. Water authorities have “security of supply” licence requirements which can sometimes mean duplicate water mains are required. This is particularly the case in Hunter Water’s area of operations. As such, this is likely to increase the cost of Hunter Water water mains from what has been presented in this report.

WFC infrastructure consists of water, sewer and recycled water infrastructure. The provision of recycled water infrastructure (in the form of a third pipeline) has not been priced in this report, however this may be required and would need to be considered for future costings. In addition, WFC have a facility with a wastewater treatment works (WWTW) and a water reservoir. No costings associated with contributions to this facility have been priced in this report. Any contribution requirements for this facility would need to be determined in consultation with WFC.

It should be noted that costs/lot presented in this report for each option is indicative only and is based on the number of lots assumed for each site.

2.0 Site 1 Wye Road Bushells Ridge East Site

Site 1, referred to as Bushells Ridge East Site is approximately 40ha in size, located near Doyalson. It slopes north-west to the Sydney/Newcastle Railway Line. The site is bounded to the West by the Sydney/Newcastle Railway Line, Gosford Road to the North and Wye Road to the South East. The site concept plan has the potential to yield approximately 400 residential lots (Equivalent Tenements (ET)) which is equivalent to approximately 35L/s in sewer loads.

2.1 EXISTING INFRASTRUCTURE

The Bushells Ridge East Site is situated within WSC's area of operations, however it is also within the vicinity of HWC assets and the proposed Water Factory Company infrastructure. Existing WSC and HWC infrastructure is illustrated on Figure 1.

The nearest water infrastructure is located approximately 600m north of the site. A HWC water booster station and DN375 water main is located near the intersection of Wye Road and Murrawal Road. Existing HWC wastewater infrastructure is located approximately 6km north of the site, being Wye 1 Wastewater Pumping Station (WWPS).

WSC's assets include Charmhaven WWTW located approximately 3.1km south of the site and Mannering Park WWTW located 5.7km north-east of the site. This site is outside the boundaries of any existing Council development servicing plans (DSP) and therefore there has been no assessment of Council's strategy to service the site.

WFC proposed infrastructure is located approximately 1km north-west of Site 1 and will include water reservoir(s) and a WWTW to service the proposed development. It is anticipated that the Wye WFC Facility will be constructed within the next 3 years and will be able to service the proposed development.

2.2 SERVICING OPTIONS

2.2.1 WATER

There are three options for connecting water to the Bushells Ridge East site. Refer to Figure 2 for route options.

These options and preliminary cost estimates for each option are shown in Table 1 following.

Table 1 Bushells Ridge East Water Options

Option	Option Description	Preliminary Cost Estimate	Cost Per Lot (based on 400 lots)
1	Connection of approximately 1500m of DN200 watermain to the proposed WSC network	\$720,000	\$1,800
2	Connection of approximately 1400m of DN150 watermain to the proposed Wye WFC facility	\$660,000	\$1,650
3	Connection of approximately 1200m of DN200 watermain to HWC existing network	\$460,000 [^]	\$1,150

[^] Cost allows for duplicate mains to meet HWC security of supply requirements

The above cost estimates have been determined using HWC estimating rates. It is noted that these rates are generally conservative with approximately 30% contingency included in the overall cost. A detailed analysis has not been undertaken.

Option 1

Option 1 would involve connecting the proposed site to WSC existing infrastructure. On inspection of the existing infrastructure, the nearest watermain is located along Roper Road at Blue Haven, approximately 1.5km away and involves crossing the Doyalson Motorlink Road.

WSC have informed ADW Johnson that Council is proposing to construct a DN750 watermain approximately 500m south of the proposed development. It is currently unknown when the proposed watermain will be designed and constructed. Therefore, this option has been excluded at this time but would be an alternative when the infrastructure becomes available.

It is noted Site 1 is outside the boundaries of any Council Development Servicing Plans (DSP's) and no future allocation has been made for this development to connect. The next stage would be to liaise with WSC to confirm development loads and obtain servicing advice.

Option 2

Option 2 would involve connecting the Bushells Ridge East site to the proposed Wye WFC Facility to be located near the intersection of Wye Road and Hue Hue Road (Refer to Figure 1). This option would involve constructing approximately 1400m of DN150 watermain to connect to the existing system.

WFC have indicated that this site could connect to their Wye Facility.

DLALC would need to liaise with WFC to ensure this facility is ready in time for site 1 to connect. Connecting to the WFC facility would also involve crossing the existing Sydney/Newcastle Railway Line.

Option 3

Option 3 would involve connecting the Bushells Ridge East site to HWC existing infrastructure. A water booster pumping station is located near the intersection of Wyee Road and Murrawal Road (refer to Figure 1), with the nearest High Level Tank (HLT) located off Summerhayes Road (Wyee HLT).

This option would involve constructing approximately 600m of DN150 watermain to connect to the existing system. An additional 600m of watermain will be required to be constructed as HWC standards require security of supply for all water connections. This option would therefore involve a total of 1200m of watermain to be constructed.

Formal liaison with HWC would be required to validate that capacity exists within this system when development loadings are calculated based on site utilisation (i.e. 400 residential lots equivalent to 400ET).

As the subject site falls within WSC area of operations, liaison with WSC would be required in the first instance and WSC would need to discuss this option further with HWC.

2.2.2 WASTEWATER

There are three options for connecting wastewater to the Bushells Ridge East site, refer to Figure 2 for alignment locations.

Descriptions and preliminary cost estimates for each option are shown in the Table 2 below and do not include internal sewer reticulation for the site.

Table 2 Bushells Ridge East Wastewater Options

Option	Option Description	Preliminary Cost Estimate	Cost Per Lot (based on 400 lots)
1A	Connecting to the existing WSC Charmhaven WWTW directly by construction of a WWPS and 3.8km of DN200 sewer rising main.	\$3,100,000	\$7,750
1B	Connecting to the proposed SPS C21 by construction of a WWPS and 1.4km of DN200 sewer rising main.	\$1,290,000	\$3,225
2	Connecting to the existing HWC network at Wyee by construction of a WWPS and 6km of DN200 sewer rising main	\$4,950,000	\$12,375
3	Connecting to the Wyee Water Factory Company Site (approximately 2km away)	\$2,020,000 [^]	\$5,050

^ Cost includes cost of a WWPS and rising main only. Actual costs will include a recycled water main from the proposed site to the WFC facility and contribution to the cost of WFC's facility (includes a WWTW and water reservoir)

Option 1

Option 1A would involve connecting the proposed site to Charmhaven WWTW direct by a WWPS and approximately 3.8km of sewer rising main.

Option 1B would involve connecting to the planned regional WWPS named SPS C21, by constructing approximately 1.4km of gravity sewer. Due to the slope of the site, it may be possible for the entire site to drain via gravity to SPS C21 and then pump to the Charmhaven WWTW. If this scenario was proven to be possible, it would eliminate the need for a WWPS to service the site, significantly reducing capital costs. It is to be noted that Table 2 cost estimates for Option 1B include a WWPS to service the proposed site.

Both Option 1A and Option 1B would require consultation and approval from WSC as they would need to determine if the Charmhaven WWTW has capacity to receive the development flows. Consultation would also be required for part of Option 1B as this option may need to upgrade the proposed SPS C21 to cater for additional development flows. Currently SPS C21 is designed to service a total of 3282 ET or approximately 260L/s (to cater for existing and future flows)

Preliminary discussions with WSC have indicated that connection to SPS C21 is a feasible option. It is noted that SPS C21 size and logistics are currently being determined by WSC, and it is expected that SPS C21 will be constructed within the next 3 years.

Connection to Mannering Park WWTW was briefly investigated, but due to the relative distance (5.8km) between Site 1 and the WWTW it was discarded due to high capital cost and potential environmental issues (i.e. crossing Mannering Lake).

Option 2

Option 2 would involve connecting the proposed site to existing HWC infrastructure located at Wye Point (refer to Figure 1). Wye 1 WWPS is located off Short Street, Wye Point and is approximately 6km north of the site. Option 2 would involve building a WWPS and 6km of sewer rising main at Bushells Ridge East Site to service the proposed residential lots.

Flows from the proposed development would be approximately 35L/s. Wye 1 WWPS has a current duty of 58L/s and an estimated total capacity of 66L/s. Therefore the development could connect to Wye1 WWPS if the pumping station was to be upgraded by the developer.

Option 2 requires the development to construct significant amount of capital works to service their site, including the possible upgrading of an existing WWPS. Also, as the site is located approximately 6km away from HWC assets, the lead-in infrastructure to connect to the existing system would be significant compared to the other options. Option 2 would also involve crossing Wye Road and Summerhayes Road, as well as Wye Creek and Cobra Creek.

Option 3

Option 3 would involve connecting the proposed site to the Wye WFC site, located approximately 2km north-west of Site 1. Constraints for Option 3 would involve crossing the Sydney/Newcastle Railway line and relying on WFC to incorporate the proposed development flows to the water factory site.

2.3 SUMMARY

All options for connecting the Wye Road Bushells Ridge East development to water infrastructure are considered viable.

The WSC combined option of water and sewer is likely to be the most cost effective means of servicing the development in terms of lowest capital cost and lowest risk with developing future infrastructure. This combined option would cost approximately \$2,010,000 for both water and sewer lead in infrastructure which represents \$5025 per lot.

It is recommended consultation with WSC and WFC be undertaken to further refine costs and determine the most cost effective option for providing wastewater services to the site as capacities within the existing system are not confirmed and the proposed infrastructure timing will depend on funding. The timing of infrastructure delivery to Wye WFC facility must be considered in any cost assessment.

3.0 Site 2 Pacific Highway, Lake Munmorah

Site 2, referred to as Lake Munmorah Site, is approximately 68ha in size, located at Lake Munmorah. The site slopes downhill towards Chain Valley Bay. It is bounded to the north by Chain Valley Bay Creek, to the East by bush land and Kanangra Drive, to the South by the Pacific Highway and the West by residential lots and Carters Road. The site concept plan provides for approximately 600 residential lots which is equivalent to approximately 51L/s in wastewater loads.

3.1 EXISTING INFRASTRUCTURE

The Lake Munmorah Site is located in the vicinity of HWC and WSC infrastructure. It is located in WSC's area of operations. The nearest HWC water and wastewater infrastructure is located approximately 5km north at Nords Wharf, refer to Figure 3.

WSC's wastewater assets include Mannering Park WWTW located 2.5km north-west and Charmhaven WWTW located approximately 10km south-west of the site. WSC water assets include Kanangra Reservoir located off Kanangra Drive, approximately 650m east of the site, a 375mm trunk main running parallel to the Pacific Highway which skirts the proposed Crangan Bay development site. WSC No.10 water pumping station (WPS) is located approximately 4km west of the development, located at the intersection of the Pacific Highway and Ruttleys Road, west of the development.

The proposed development is outside the boundaries of any WSC existing servicing plans and therefore there has been no assessment of WSC strategy to service the proposed site. Existing properties in the area (such as Lake Munmorah Public School, located in Carters Road) are serviced by private pump stations that pump to WSC SPS MP10. WSC have advised that SPS MP10 will not have capacity for this site following the construction of an additional high school which is DA approved. Therefore new infrastructure will be required in that area.

WFC is unlikely to be a servicing option unless there are additional developments proposed nearby. WFC generally require a minimum of 1000 lots to be proposed before they will consider constructing a new facility and servicing the site. Site 2 is too remote to connect to the proposed Wye WFC Facility.

3.2 SERVICING OPTIONS

3.2.1 WATER

There is only one feasible option for connecting water to the Lake Munmorah site. Refer to Figure 3 for route options. A description and a preliminary cost estimate is shown in Table 3.

Table 3 Crangan Bay Site Water Options

Option Description	Preliminary Cost Estimate	Cost Per Lot (based on 600 lots)
Connecting to the existing WSC network via a DN200 watermain approximately 650m in length	\$250,000	\$417

This option would involve constructing a new DN200 water main which connects to Kanangra Reservoir. It is noted that there is an existing DN375 water main located along the Pacific Highway, though WSC policies will not allow a direct connection to occur into this main for security of supply reasons.

This connection will depend with Kanangra Reservoir has spare capacity. Consultation with WSC will be required to determine capacity constraints.

3.2.2 WASTEWATER

There are two options for connecting wastewater to the Lake Munmorah site, refer to Figure 3 for detailed routes

These options and preliminary cost estimates for each option are shown in the Table 4 below and do not include internal sewer reticulation for the site.

Table 4 Crangan Bay Wastewater Options

Option	Option Description	Preliminary Cost Estimate	Cost Per Lot (based on 600 lots)e
1A	Connecting to WSC existing network and discharging to Mannering Park WWTW via a WWPS and 3.2km of DN250 sewer rising main.	\$2,390,000	\$4,883
1B	Connecting to the existing SPS M10 and upgrading to receive flows from development, it would also involve constructing 1.4km of DN250 sewer rising main	\$1,440,000	\$2,400
2	Connecting to HWC existing network at Nords Wharf via a WWPS and 5km of sewer rising main plus upgrades to the existing HWC system.	Over \$10 million	>\$16,700

All options include a WWPS to service the proposed development.

Option 1A

Option 1A would involve constructing a WWPS to service the proposed development and approximately 3.2km of sewer rising main to connect into Mannering Park WWTW located north-west of the development. WSC have indicated that Mannering Park WWTW may be able to accept development flows.

Option 1B

Option 1B would involve constructing WWPS to service the proposed development and approximately 1.4km of sewer rising main to connect into SPS MP10 located south-west of the development. WSC have indicated that SPS MP10 is at capacity and will not be able to accept new flows. This option will also involve upgrading the existing pump station to allow the proposed development to connect. This option will require Council's permission to upgrade and discharge to SPS MP10. As the condition of SPS MP10 is unknown and the size of the pump station is unknown, \$200,000 was allowed for in the cost estimate. The cost estimate may be significantly more as there are many unknown factors which have not been factored into this cost estimate.

Option 2

Option 2 would involve constructing a WWPS to service the development and approximately 8km of sewer rising main to connect into Nords Wharf 1 WWPS, and upgrade to Nords Wharf 1 WWPS, Nords Wharf 2 WWPS, Cams Wharf 1 WWPS, Swansea South WWPS and Swansea 3A WWPS and associated rising mains. An 8km rising main would also need to be constructed to pump flows from the development to Nords Wharf 1 WWPS.

Due to the significant costs associated with this option, no further consideration has been given to it.

3.3 SUMMARY

The total cost of connecting this site to water and wastewater infrastructure is likely to be under \$3000 per lot. To achieve this it is recommended that wastewater Option 1B be used in conjunction with the water option. This option would depend on WSC acceptance of connection to SPS MP10.

Consultation with WSC would be required to confirm the connection point for water and to determine the most feasible wastewater connection point. Following consultation with WSC, further refinement of costs could be undertaken.

4.0 Site 3 Motorway Link Road, Bushells Ridge South

Site 3, referred to as Bushells Ridge South Site, is approximately 33ha in size, located at Wallarah. The site slopes downhill south-east towards the Sydney/Newcastle Railway Line. It is bounded by Motorway Link Road to the North of the site, the Sydney/Newcastle Railway Line to the South East of the site and Wallarah Creek to the South of the Site. The site has a potential net developable area (NDA) of 28.8ha to be used for industrial purposes. Preliminary advice indicates that industrial land in this area could potentially sell from \$70m² to \$100m². Preferred option for water servicing range from between 2.8% - 3.9% of revenue for water with potential to decrease this to 1.7% - 2.4% should WSC construct the proposed watermain. The preferred option for wastewater servicing range from 4.9% to 7.0% These ranges of industrial land prices, along with a NDA of 28.8ha, used to benchmark the cost of infrastructure as a percentage of retail value.

4.1 EXISTING INFRASTRUCTURE

The Bushells Ridge South Site is located in the vicinity of existing infrastructure.

WSC's wastewater assets include Charmhaven WWTW located approximately 500m south of the site. The nearest existing water infrastructure is located approximately 2.2km east of the development including a DN525 watermain.

Currently WSC are proposing to construct water and wastewater infrastructure in the area. These assets include:

- A new reservoir at Kiar Ridge and DN750 watermain linking to the existing DN750 watermain.
- A new WWPS (SPS C22) servicing approximately 890 ET and rising main to Charmhaven WWTW
- A new WWPS (SPS C21) servicing approximately 3282 ET and parallel rising main to Charmhaven WWTW.

Council has indicated that this infrastructure may be constructed within the next 5 years and developers will pay the respective developer service charges depending on development size and loads.

The infrastructure shown on WSC's developer service plans (Refer to Figure 4) provides the general strategy to service land to the north of the F3 link road. On inspection of this plan the likely outcome for this site would be a new WWPS pumping direct to Charmhaven WWTW. An alternative to minimise costs associated with rail/creek crossings and inlet works connections could be to interconnect with the proposed rising man for Sewer Pumping Station (SPS) C22 with the main and pumps sized accordingly.

The nearest HWC water infrastructure is located approximately 3km north of the proposed development, at the Wyee Booster Station and DN375 watermain (refer to Figure 2).

The nearest HWC existing wastewater infrastructure is located approximately 9km north of the proposed site and is considered to be too remote to connect to as it requires crossing the existing railway and two creek crossings.

WFC's Wye facility is located 3.5km north of the development and has indicated that they have capacity to receive the development flows for wastewater and provide water services.

4.2 SERVICING OPTIONS

4.2.1 WATER

There are three options for connecting water to the Bushells Ridge Road site.

These options and preliminary cost estimates for each option are shown in the Table 5 below and do not include internal reticulation for the site:

Table 5 Bushells Ridge Road Water Options

Option	Option Description	Preliminary Cost Estimate	% of revenue value (m ²)
1A	Connecting to WSC proposed DN750 watermain by constructing approximately 1km of DN250 watermain.	\$480,000 ¹	1.7% - 2.4%
1B	Connecting to WSC existing DN525 watermain by constructing approximately 1600m of DN250 watermain.	\$800,000	2.8% - 3.9%
2	Connecting to the proposed Wye WFC Facility by constructing approximately 3.5km of DN250 watermain.	\$1,190,000	4.1% - 5.9%
3	Connecting to HWC existing network at Wye by constructing approximately 3km of DN250 watermain.	\$1,05,000 [^]	3.6% - 5.2%

¹ Cost allows for a single water main only. Does not allow for duplicate mains to meet HWC security of supply requirements

Option 1A

Option 1A would involve connecting to WSC proposed water infrastructure or dependent on the proposed WSC infrastructure to be built. As detailed in Section 4.1, WSC are proposing to build a new reservoir and DN750 watermain which will be approximately 1000m north of the proposed development. It would be possible for the proposed development to build approximately 1km of watermain and connect to the DN750 water main. This option would be the preferred option if the proposed infrastructure is available.

Option 1B

If the proposed development was to be constructed before the WSC water infrastructure was built, the nearest watermain is located along Roper Road at Blue Haven, approximately 1,600m away and involves crossing the Sydney/Newcastle Railway Line and Spring Creek and would increase the capital cost to construct the watermain.

It is noted Site 3 is outside the boundaries of any Council Development Servicing Plans (DSP's) and no future allocation has been made for this development to connect. The next stage would be to liaise with WSC to confirm development loads and obtain servicing advice.

Option 2

Option 2 would involve construction approximately 3.5km of watermain to connect to the proposed Wye WFC located near the intersection of Wye Road and Hue Hue Road (Refer to Figure 2). Constraints with this option would be similar to the Bushells Ridge East Site.

Option 3

Option 3 would involve connecting to HWC existing infrastructure. A water booster station and DN375 watermain is located near the intersection of Wye Road and Murrawal Road (refer to Figure 1), with the nearest Reservoir located off Summerhayes Road.

This option would involve constructing 3km of water pipeline to connect to the system and liaising with HWC to determine the preferred arrangement. It would also involve crossing the Doyalson Motorlink Road and some creek crossings.

4.2.2 WASTEWATER

There are two options for connecting wastewater to the Bushells Ridge South site.

These options and preliminary cost estimates for each option are shown in the Table 6 below and do not include internal sewer reticulation for the site.

Table 6 Bushells Ridge Road Wastewater Options

Option	Option Description	Preliminary Cost Estimate	% of revenue value (m ²)
1	Connecting to WSC existing infrastructure at Charmhaven WWTW by constructing a WWPS and 1km of DN200 sewer rising main.	\$1,420,000	4.9% - 7.0%
2	Connecting to the Wye WFC Facility by constructing approximately 4.3km of DN200 sewer rising main.	\$2,920,000 [^]	10% - 14%

[^]Cost includes cost of a WWPS and rising main only. Actual costs will include a recycled water main from the proposed site to the WFC facility and a contribution to the cost of WFC's facility (includes a WWTW and water reservoir)

Option 1

Option 1 would involve WSC building a WWPS and 1km of rising main pumping to Charmhaven WWTW. This would involve crossing the Sydney/Newcastle Railway Line and Wallarah Creek. Council have indicated to minimise costs associated with rail/creek crossing and inlet work connects, for the proposed development to interconnect with the proposed SPS C22 rising main which pumps to Charmhaven WWTW. This alternative option would still involve constructing a

WWPS but then the length of rising main would be reduced by 800m, depending on the WWPS location (reducing costs by approximately \$285,000), decreasing capital expenditure. WSC would collect developer contributions as developers (such as Darkinjung) connect to the new infrastructure. The Darkinjung development flows for this site would be approximately 29L/s.

Option 2

Option 2 would involve constructing 4.3km of sewer rising main and a WWPS connecting the proposed site to the Wyee WFC Facility to be located near the intersection of Wyee Road and Hue Hue Road (Refer to Figure 2). Constraints with this option include the risk of the development being constructed before WFC is equipped to process wastewater loads from the development. It would also involve crossing the Doyalson Motorlink Road.

4.3 SUMMARY

The cost of providing the preferred lead-in water infrastructure to service the site using Option 1A (1.7% to 2.4% of revenue per m²) and Option 1B (2.8% to 3.9% of revenue per m²) is considered viable. Should the site be developed prior to the proposed infrastructure being constructed under Option 1A, connection to the existing assets under Option 1B scenario will enable the development to proceed.

The cost of connection of wastewater infrastructure to service the site is only viable under Option 1, that is, direct connection to Charmhaven WWTW through a WWPS and rising main. This could be further reduced if SPS C22 is constructed by WSC or if WSC allows construction (in part) of this infrastructure to be included in this alignment with reimbursements through the DSP.

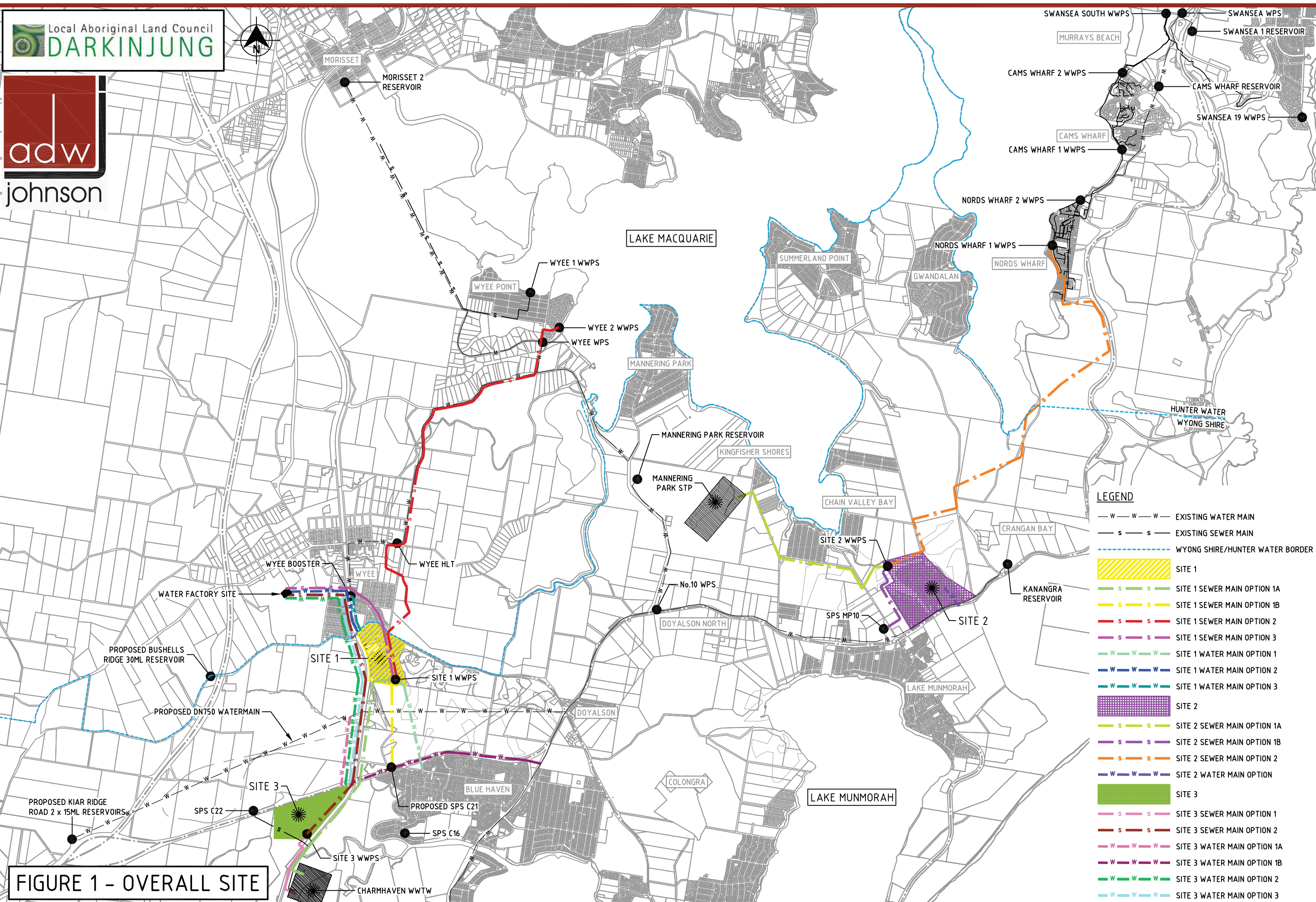
Under best case scenario, the combined water and sewage connection cost represents 6.6% of revenue based on \$100/m² retail value. The worst case scenario using the options detailed above represents approximately 10% of revenue based on \$70/m² retail value. The worst case assumption will still enable the site to be developed in the context of delivering viable water and sewage services to the site.

Appendix 1

REPORT FIGURES



Plotted By: jaysonm Plot Date: 21/05/13 - 15:57 Cad File: N:\238532 Darkinjung\DWG\Water & Sewer Design\ISSUE 11_04_13\CAD\Figure_1 - Overall Site.dwg



LEGEND

— W — W — W —	EXISTING WATER MAIN
— S — S — S —	EXISTING SEWER MAIN
---	WYONG SHIRE/HUNTER WATER BORDER
[Yellow Hatched Box]	SITE 1
[Green Dashed Line]	SITE 1 SEWER MAIN OPTION 1A
[Yellow Dashed Line]	SITE 1 SEWER MAIN OPTION 1B
[Red Dashed Line]	SITE 1 SEWER MAIN OPTION 2
[Pink Dashed Line]	SITE 1 SEWER MAIN OPTION 3
[Light Green Dashed Line]	SITE 1 WATER MAIN OPTION 1
[Blue Dashed Line]	SITE 1 WATER MAIN OPTION 2
[Teal Dashed Line]	SITE 1 WATER MAIN OPTION 3
[Purple Hatched Box]	SITE 2
[Light Green Dashed Line]	SITE 2 SEWER MAIN OPTION 1A
[Purple Dashed Line]	SITE 2 SEWER MAIN OPTION 1B
[Orange Dashed Line]	SITE 2 SEWER MAIN OPTION 2
[Blue Dashed Line]	SITE 2 WATER MAIN OPTION
[Green Hatched Box]	SITE 3
[Pink Dashed Line]	SITE 3 SEWER MAIN OPTION 1
[Red Dashed Line]	SITE 3 SEWER MAIN OPTION 2
[Light Green Dashed Line]	SITE 3 WATER MAIN OPTION 1A
[Purple Dashed Line]	SITE 3 WATER MAIN OPTION 1B
[Green Dashed Line]	SITE 3 WATER MAIN OPTION 2
[Teal Dashed Line]	SITE 3 WATER MAIN OPTION 3

FIGURE 1 - OVERALL SITE



Plotted By: jaysonn Plot Date: 21/05/13 - 15:58 Cad File: N:\238532 Darkinjung\DWG\Water & Sewer Design\ISSUE 11_04_13\CAD\FIGURES 2 & 3 - SITES 1, 2 & 32.dwg

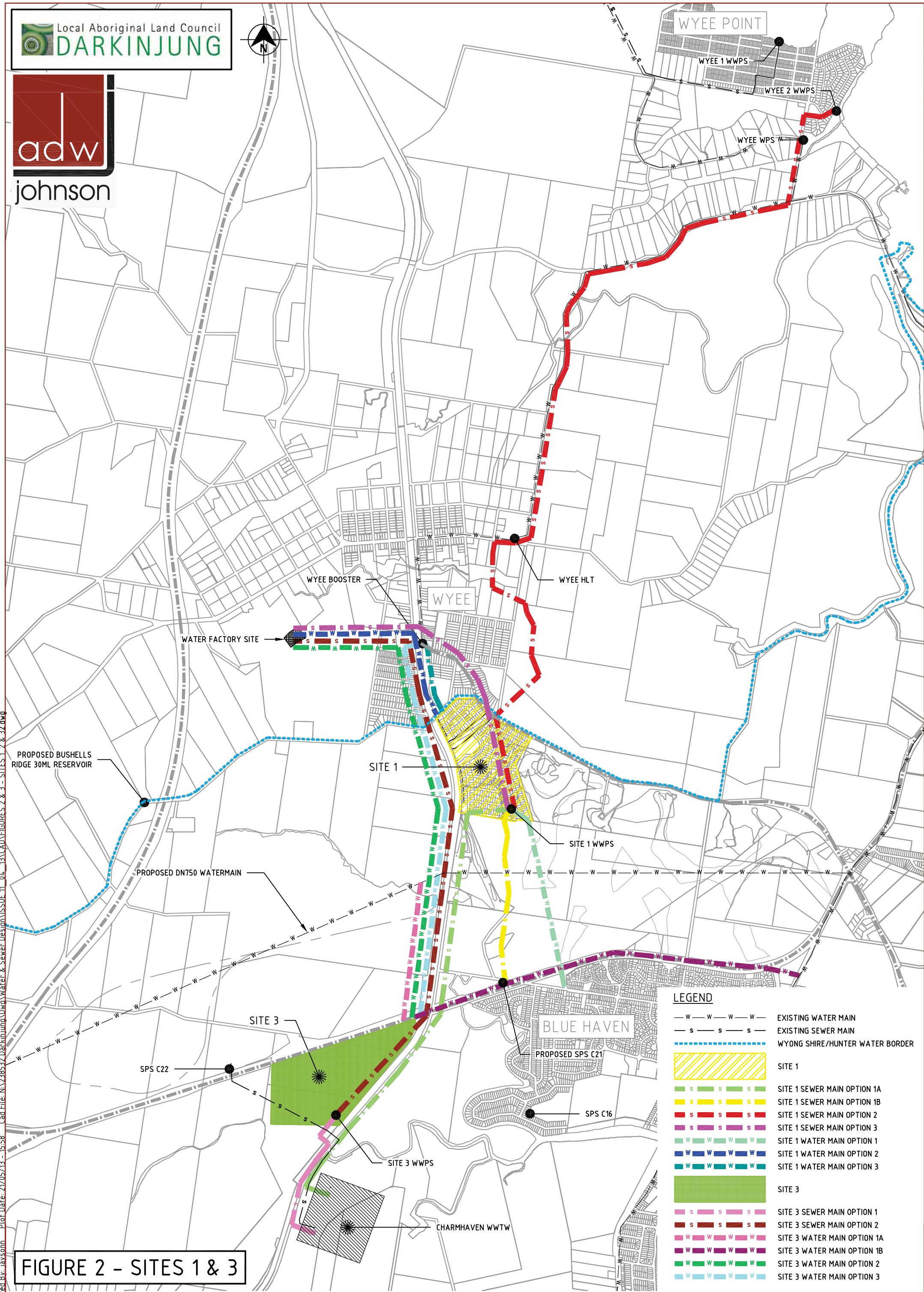


FIGURE 2 - SITES 1 & 3



LAKE MACQUARIE

MANNERING PARK

SUMMERLAND POINT

GWANDALAN

NORDS WHARF 1 WWPS

NORDS WHARF

NORDS WHARF 2 WWPS

HUNTER WATER
WYONG SHIRE

MANNERING PARK RESERVOIR

KINGFISHER SHORES

MANNERING PARK STP

CHAIN VALLEY BAY

SITE 2 WWPS

CRANGAN BAY

KANANGRA RESERVOIR

No.10 WPS

DOYALSON NORTH

SPS MP10

SITE 2

FIGURE 3 - SITE 2

LEGEND

- w — w — w — w — EXISTING WATER MAIN
- s — s — s — s — EXISTING SEWER MAIN
- WYONG SHIRE/HUNTER WATER BORDER
- [Purple Grid Pattern] SITE 2
- s — s — s — s — SITE 2 SEWER MAIN OPTION 1A
- s — s — s — s — SITE 2 SEWER MAIN OPTION 1B
- s — s — s — s — SITE 2 SEWER MAIN OPTION 2
- w — w — w — w — SITE 2 WATER MAIN OPTION

Plotted By: jayson Plot Date: 21/05/13 - 16:00 Cad File: N:\238532 Darkinjung\Water & Sewer Design\ISSUE 11_04_13\CAD\FIGURES 2 & 3 - SITES 1, 2 & 3.dwg

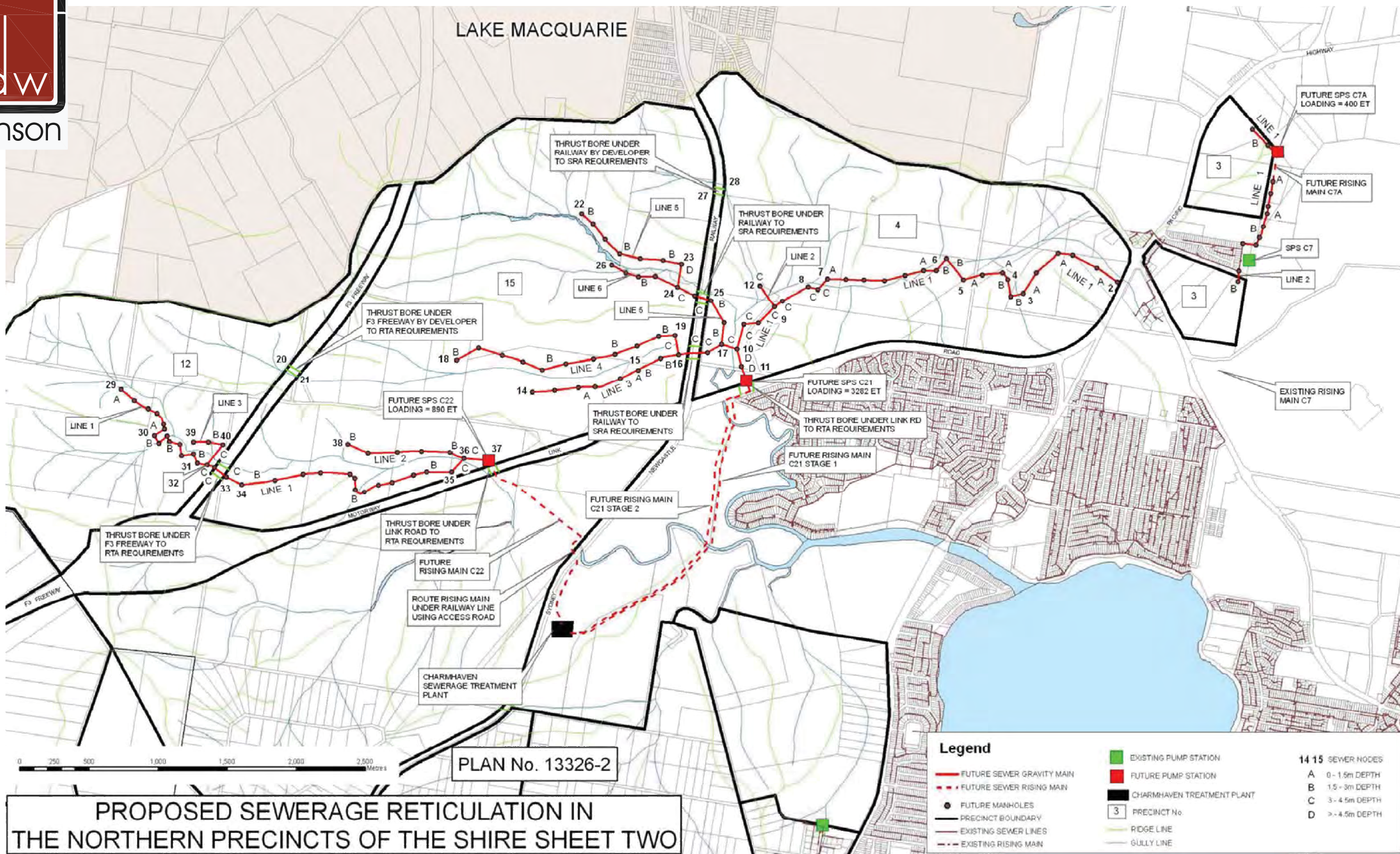


FIGURE 4 - WSC PROPOSED WASTE WATER INFRASTRUCTURE

Plotted By: jaysonm Plot Date: 23/05/13 - 09:34 Cad File: N:\238532_Darkinjung\Drawings\Water & Sewer Design\ISSUE 11_04_13\CAD\Figure 4 - WSC Proposed Waste Water Infrastructure.dwg