Our Ref C20012

Contact Paul Broadhurst

Date 14 October 2020

Shire of Collie
87 Throssell Street
Collie WA 6225

River Engineering Pty Ltd
7/9 Griffin Drive, Dunsborough, WA 6281
68 South Terrace, South Perth, WA 6151
ABN 78 146 050 384

T : 08 9430 6789
M : 0439 945 690
E : paul.broadhurst@riverengineering.com.au
W: www.riverengineering.com.au

For the attention of Katya Tripp

Dear Katya,

RE: MINNINUP POOL TOURISM PROJECT – SERVICING REPORT

River Engineering Pty Ltd (River) have been engaged by the Shire of Collie (Client) to investigate the extent of works to be undertaken to provide service connections to the proposed Minninup Pool Camp Grounds and Eco Cabins (site) located within Reserve 23606, R34343 which is zoned Parks and Recreation.

The site investigation took place on the 9 April 2020 and together with Dial Before You Dig information and information provided by the Client and liaison with Services Authorities, the following report was written to identify the possible work that needs to take place.

In September the Client engaged River to do some further investigation to the internal services of the site together with servicing three precincts being the sandy beach, pool and rowing club (precincts).

1 INTRODUCTION

1.1 Purpose

The purpose of this report is to identify and outline the conceptual design of services infrastructure to the proposed Camp Ground and Eco Cabin development located at Minninup Pool Reserve, Minninup Road, Collie together with the sandy beach, pool and rowing club precincts.

1.2 Scope of Report

The scope of this Service Report includes the following:

- Existing site conditions
- Water supply
- Sewer options
- Site power supply
- Power distribution infrastructure

This report is intended to be a high-level conceptual overview of the required services, particularly focused on spatial requirements and infrastructure provisions.

2 SITE

The site is located in Collie, WA, bordered by Mungalup Rd to the north, Minninup Rd to the east, and the Collie River to the south.

The site and precincts locations are shown in Figure 1 below.

Figure 1 Site and Precinct Locations

3 DEVELOPMENT AREA

River have assessed the proposed development within the Camping and Cabins lease area. The following has been used in the preliminary assessment of the required services infrastructure: -

Camp Grounds

- 50 off camping sites (assumed to be powered)
- 8 off motel style units
- 12 off camping bays (assumed to be powered)
- Reception/Manager's residence
- Ablutions block
- Kitchen block

Eco Cabins

- 20-off Cabins (assumed to be powered)

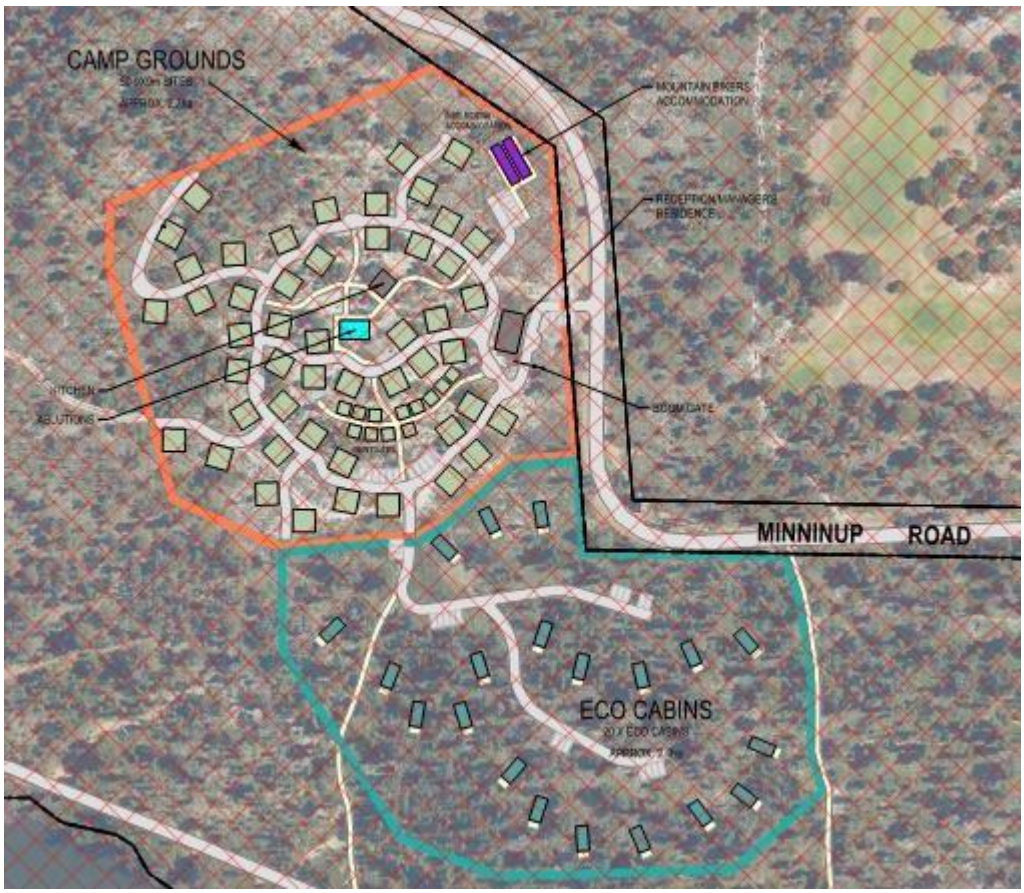


Figure 2 Layout of proposed site

Sandy Beach Precinct

- Toilet Block building water and lighting
- Sewer pump station water and power
- Allowance for two BBQs
- Picnic shelters lighting
- Walkways lighting connecting shelters, picnic tables and the toilet block to the carpark

Pool Precinct

- Toilet Block building water and lighting
- Sewer pump station water and power
- Allowance for four BBQs
- Picnic shelter lighting
- Main walkway lighting connecting shelters, the river and the carpark

Rowing Club Precinct

- Toilet Block building water and lighting
- Allowance for two BBQs
- Existing Rowing Club building (allowance to provide lighting)
- Main walkway lighting connecting shelters, the river and the carpark

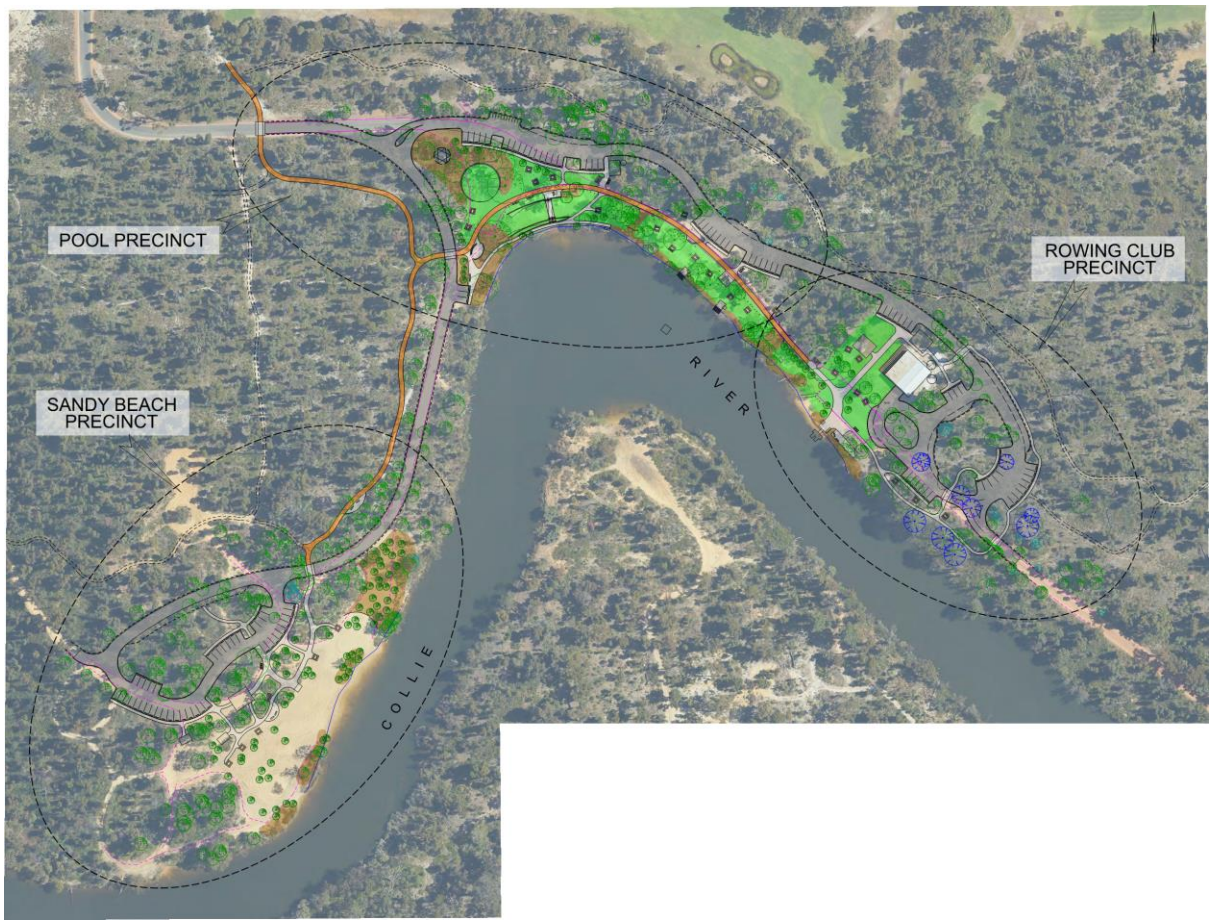


Figure 3 Layout of proposed precincts

4 SERVICING

4.1 Water and Sewer Supply

4.1.1 Current Situation

The site does not have a water and sewer connection.

4.1.2 Water and Sewer Headworks Options

The water demand for the site will determine the not just the water meter size but also the resultant headworks charges for water and sewer. For this project there will be two options investigated based on the size of the water meter.

The flowrates shown in Table 1 below is an estimate of the water demand for the site and precincts erring on the conservative side. The peak flowrate of 3.23 litres/sec (or 193.80 litres/minute) will result in a restricted 50mm water meter which is capable of delivering 180 to 200 litres/min.

This 50mm water meter subsequently results in a headwork charge of nine (9) Single Residential Equivalent (SRE) water costs and twenty five (25) SRE wastewater costs. At the moment the water SRE is $2,469 and the wastewater SRE is $3,110 resulting in a headworks cost as follows;

(9 x $2,469) + (25 x $3,110) = $99,971 headworks charge for a 50mm water meter.

Alternatively, there is an option for reducing the water meter size down to 40mm which will capable of delivering 80 to 102 litres/min. In order to achieve this reduced flowrate, the peak factor (currently shown as 5.5 time the average flow in Table 1 below) will need to be reduced to 2.9 times the average flow. This can be achieved by providing a water storage tank on the site together with a booster pump which will buffer the peak flowrate.

This 40mm water meter subsequently results in a headwork charge of four (4) SRE water costs and six (6) SRE wastewater costs. Based on the current headworks costs this will result in the following;

(4 x $2,469) + (6 x $3,110) = $28,536 headworks charge for a 40mm water meter.

The cost estimate for water and sewer will be combined and provide the following options;

- Option 1 – 50mm water meter
- Option 2 – 40mm water meter

4.1.3 Water Demand

Table 1 below is an estimate of the water demand for the site and precincts. The peak flowrate of 3.23 litres/sec is based on a peak factor of 5.5 times the average daily flowrate of 0.59 litres/sec resulting in a 50mm water meter.

This peak factor can be reduced to 2.9 times the average daily flowrate giving a peak flowrate of 1.70 litres/sec which will enable the water meter to be reduced to 40mm, however, additional infrastructure will be required to achieve this reduction.

Item	Description	Quantity	Persons/Unit	Flow/Person (litres/day)	Amount (litres/day)
1	Caravan bays	50	3	170	25,500
2	Eco-cabins	20	4	170	13,600
3	Motel style units	8	2	170	2,720
4	Camping bay	12	3	170	5,100
5	Managers residence	1	4	200	800
6	Office	1	4	30	120
7	Sandy Beach Precinct Toilet	1	103	10	1,030
8	Pool Precinct Toilet	1	107	10	1,070
9	Rowing Club Precinct Toilet	1	83	10	830
		Total Daily Flowrate (litres/day)			50,770
		Total Daily Flowrate (litres/sec)			0.59
		Peak Factor			5.50
		Peak Flowrate (litres/sec)			3.23
	Notes				
a	The above figures are based on a 100% occupancy rate.				
b	Precinct toilet persons based on 2.5 persons per car park bay and 1.5 person per motorbike bay.				

Table 1 Water Demand (50mm Connection)

4.1.4 Connection Point

The Water Corporation has advised that the preferred connection point to the Water Corporations water reticulation system shall be the existing water reticulation pipe at the intersection of Mungalup Road and Atkinson Street South (refer to Figure 4 below).

There will be a requirement to install approximately 1,000m of DN100 PVC water pipe and it is recommended that this pipe should run on the northern side of Mungalup Road so there will only be two road crossings being Mungalup Road and Atkinson Street South (refer to Figure 4 below).

The Water Corporation has also advised that the pressure at the proposed water meter will be in the range of 80 to 89m head due to the site contour. It is recommended that a pressure reducing valve is installed at the site to reduce this pressure down to <60m head and subsequently reduce the impact to appliances such as hot water systems, dishwashers, etc.

Figure 4 – Water Alignment

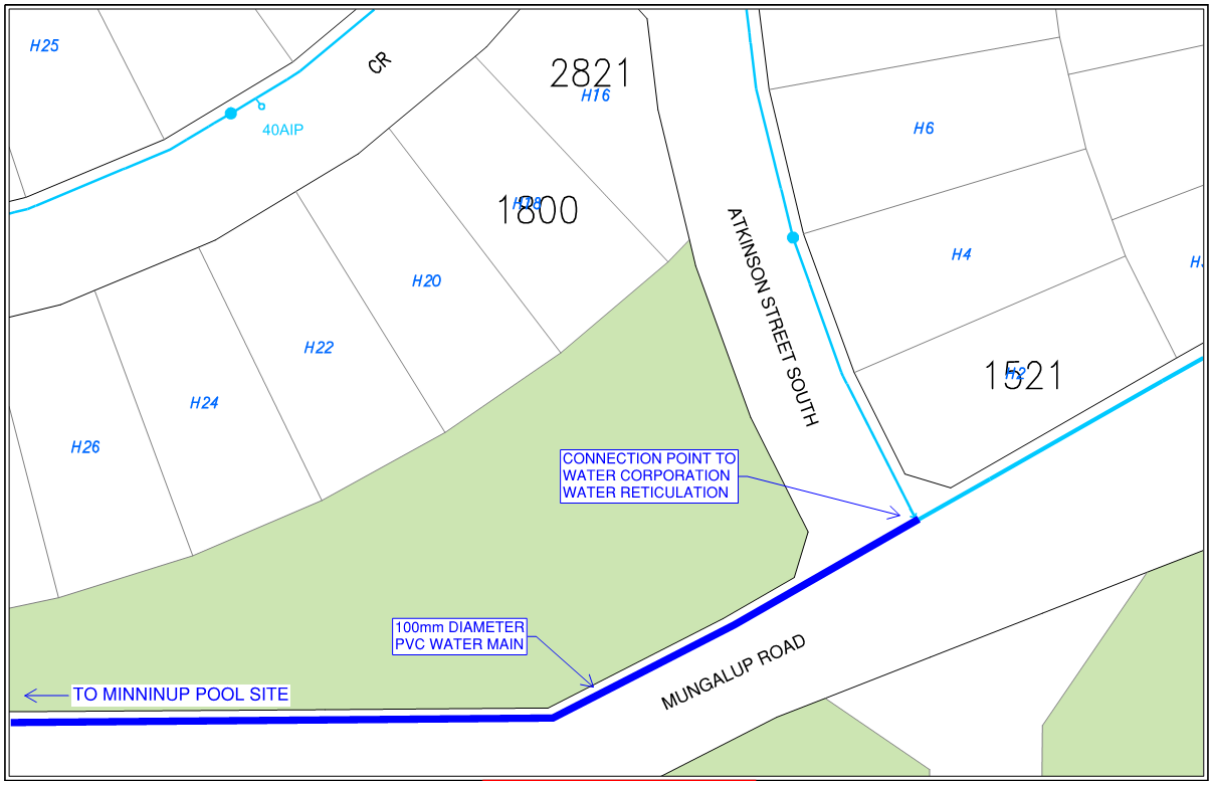


Figure 5 Water Connection Point

4.1.5 Wastewater Flowrate

The flowrates shown in Table 2 below is an estimate of the wastewater flowrates for the site and precincts. The flowrates have been taken from the Department of Health Supplement to Regulation 29 and Schedule 9 – Wastewater system loading rates.

Item	Description	Quantity	Persons/Unit	Flow/Person (litres/day)	Flow/Dwelling (litres/day)	Amount (litres/day)
1	Caravan bays	50	3	140		21,000
2	Eco-cabins	20			564	11,280
3	Motel style units	8	2	140		2,240
4	Camping bay	12	2.5	140		4,200
5	Managers residence	1			761	761
6	Office	1	4	30		120
7	Sandy Beach Precinct Toilet	1	103	10		1,030
8	Pool Precinct Toilet	1	107	10		1,070
9	Rowing Club Precinct Toilet	1	83	10		830
			Total Daily Flowrate (litres/day)			42,531
			Total Daily Flowrate (litres/sec)			0.49
			Peak Factor			4.00
			Peak Flowrate (litres/sec)			1.97
	Notes					
a	The above figures are based on a 100% occupancy rate.					
b	Precinct toilet persons based on 2.5 persons per car park bay and 1.5 person per motorbike bay.					
c	The peak factor is less than the water peak factor due to storage within the system which will					
	buffer the peak factor.					

Table 2 Wastewater Flowrates

4.1.6 Sewer Disposal Options

Due to the proximity of the site to the Collie River it is not recommended to install a septic tank or an Aerobic Treatment Unit (ATU) as the area for disposal of final effluent falls within the river flood area which will subsequently contaminate the river. This could be achieved by placing fill around the disposal area, however, to achieve this there will then be a need to place a considerable amount of clean fill on the site and a pump station will then be required to pump the sewage up to the septic tank or ATU making this option high in capital cost, high in operational cost and still pose a risk to the environment.

The only feasible option is to install a private pump station and pressure main which shall run to the Water Corporations sewerage network in Collie.

The Water Corporation have confirmed that the private pump station can discharge in access chamber 0663 which is located in the Public Open Space (POS) behind house 18 Telfer Crescent (refer to Figure 6 for the pressure main connection point).

It should be noted that the Water Corporation will not allow a flowrate above 2.5 litres/sec into this access chamber. Even at the 2.5 litres/sec the Water Corporations system modelling falls slightly outside the design standard depth of flow in the downstream DN150 pipework from access chamber 0663. This depth of flow will not result in the pipe flowing full and the Water Corporation has agreed that this will be acceptable in this case.

The pressure main from the private pump station shall be a DN63 in order for the scouring velocities within the pipe to be achieved. The length of the pressure main will be approximately 1,200m in order for the pump station to be located within the centre of the Camp Ground and Eco Cabins to reduce the lengths of internal gravity sewer within the site which subsequently reduces the depth of the sewer (refer to Figure 7 below).

During the detailed design phase of this system the connection point into the Water Corporation's access chamber will need to consider a boundary trap to the two existing junctions. The pump station design will also need to consider flood levels and the possibility of flotation so a structural engineer will need to be involved to ensure the pump station has sufficient ballast.

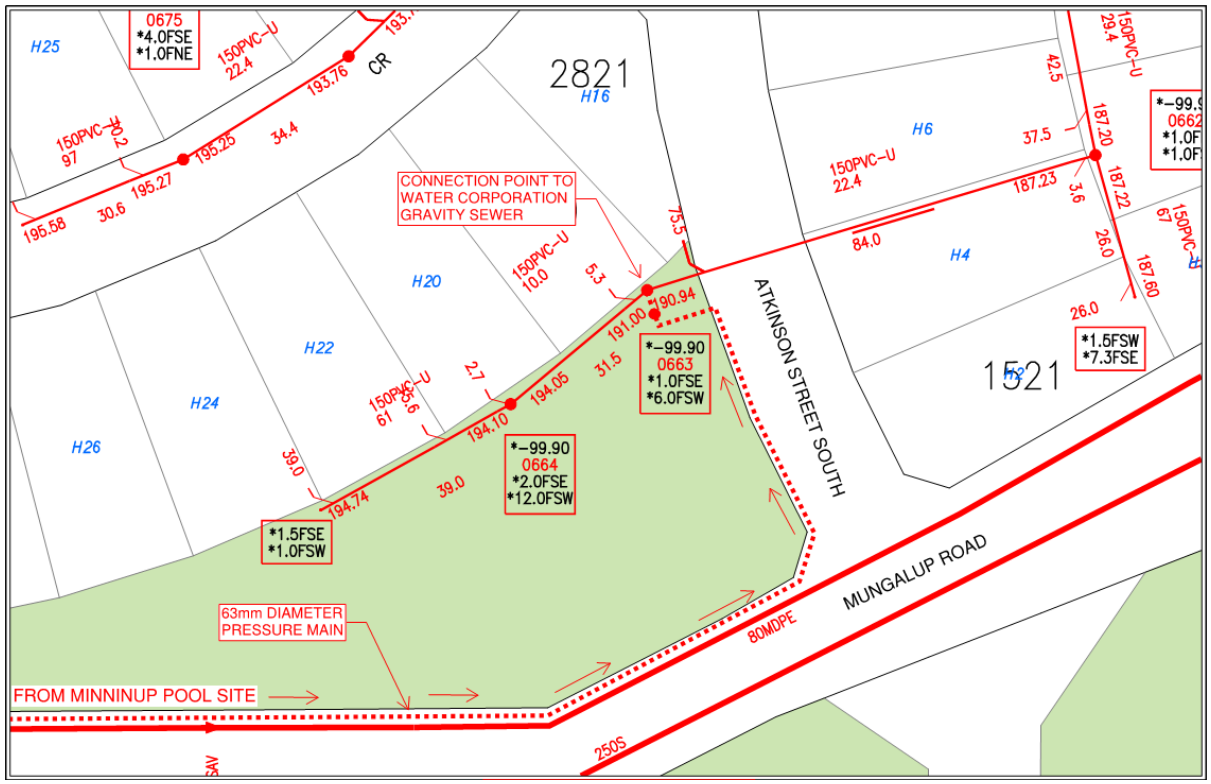


Figure 6 Pressure Main Connection Point

Figure 7 Proposed sewer Pressure Main Alignment

4.1.7 Internal Sewer

The internal sewer for the site shall run by gravity to the main sewer pumping station which will subsequently pump the wastewater to the Water Corporation sewerage network as previously mentioned within this report (refer to figure 8 below).

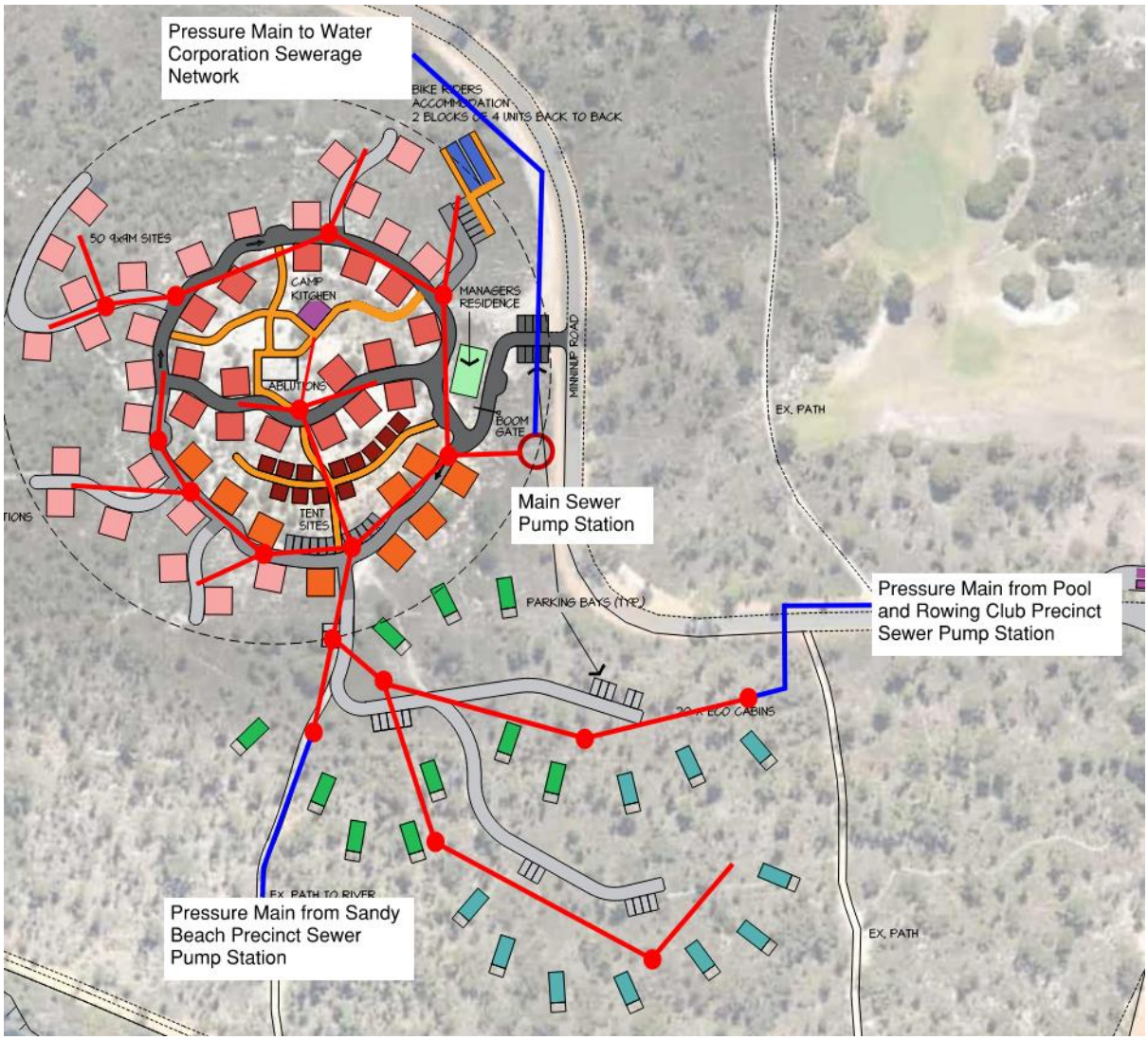


Figure 8 Site Internal Sewer Network

If it is decided to connect the precincts to the sewer network the only option to achieve this is by satellite sewer pump stations within the precincts. A gravity sewer system from the precincts was considered, however, in order to achieve a sewer gradient of 1 in 60 would mean that the sewer network within the site would have to be lowered by almost 6m. The resultant construction cost would be too high especially when dewatering has been allowed for within such a deep internal sewer network.

The sandy beach precinct will require its own dedicated sewer pump station whereas the pool and rowing club precincts can share a sewer pump station (refer to figure 9 below).

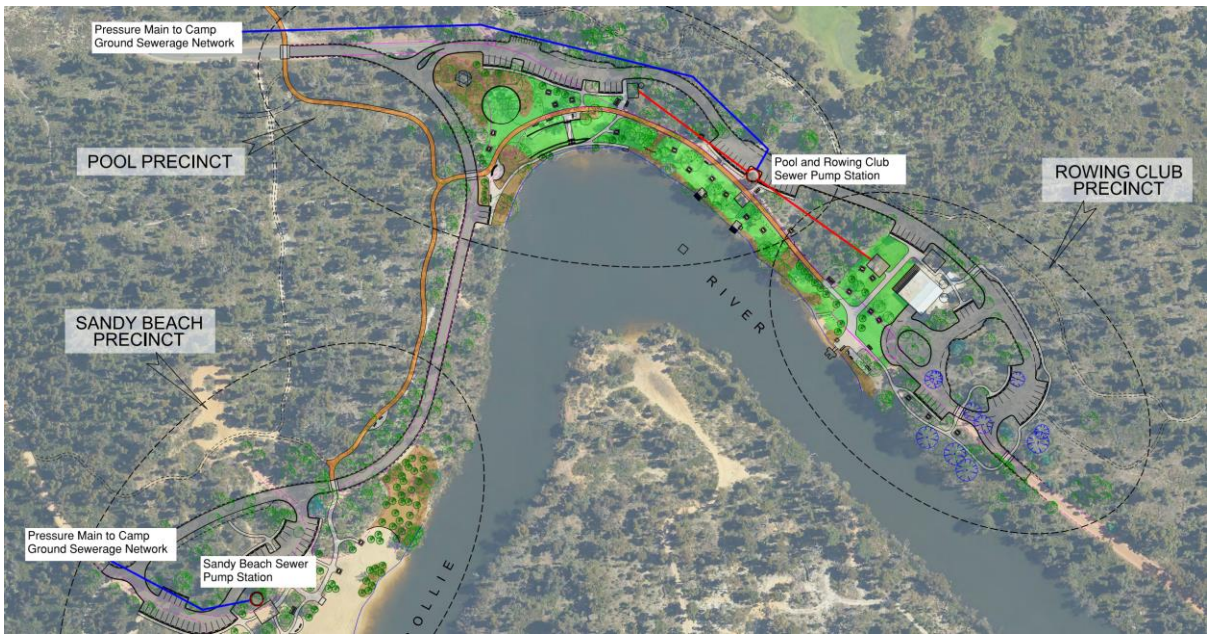


Figure 9 Precinct Sewer Systems

4.2 Power and Communications Supply

4.2.1 Maximum Site Demand

A preliminary assessment of the Camp Ground and Eco cabin maximum demand has been undertaken, based upon AS3000 and AS3001 as follows: -

- Assume 1-off 15 Amp socket-outlet for light-duty loads to each proposed tent site (12-off in total).
- Assume 1-off 15 Amp socket outlet for heavy-duty loads including air-conditioning to each proposed camping site (50-off in total).
- Assume 1-off 15 Amp socket-outlet for light-duty loads to each proposed Eco cabin (20-off in total).

The estimated maximum demand load is shown below in Table 3.

Load Type	Comment	Formula	Estimated Load (Amps)	
Socket outlets for tent sites (light duty loads)	6 Amps per point	= (6 x 12)/3	24	Amps three phase
Socket outlets for Eco cabins (light duty loads)	36 Amps plus 4 Amps for the 7th and each successive point	= (36 + (4 x 14))/3	31	Amps three phase
Socket outlets for camping sites (heavy duty loads)	60 Amps plus 6 Amps for the 7th and each successive point	=(60 + (6 x 43))/3	106	Amps three phase
Reception/Manager's residence	Modular building		32	Amps three phase
Ablutions block	6-off 3.6kW hot water units		52.5	Amps three phase
Mountain biker's accommodation	Modular building		15	Amps three phase
Camp kitchen	Modular building		45	Amps three phase
Total			**306**	**Amps three phase**

Table 3 Estimated Maximum Site Power Demand Load

4.2.2 Maximum Precinct Demand

A preliminary assessment of the precinct maximum demand has been undertaken, based upon AS3000 as follows: -

- Assume 1-off 15 Amp socket-outlet for each electric barbeque (8 in total).
- Assume single phase 2 Amp supply to each Ablution block, to service LED lighting only (no hot water).
- Assume external 50W LED pole lights spaced at a maximum of 30m apart to external walkways, for compliance with AS1158.3.1 Category PP3.
- Assume two (2) 40W LED luminaires to each picnic shelter.

The estimated maximum demand load is shown below, with single phase loads balanced across the three phases.

Load Type	Comment	Formula	Estimated Load (Amps)	
Pool Precinct				
Barbeques	15 per point	= 15+(15x75%)	26	Amps three phase
Toilet block building (lighting only)	10 fittings x 40W each	= 40Wx10	2	Amps single phase
Picnic shelter	2 fittings x 40W each	= 40Wx2	0.4	Amps single phase
Walkway lighting	10 post top fittings x 50W each	= 50Wx10	2.5	Amps single phase
Sandy Beach Precinct				
Barbeques	15 per point	= 15	15	Amps three phase
Toilet block building (lighting only)	10 fittings x 40W each	= 40Wx10	2	Amps single phase
Picnic shelters	4 fittings x 40W each	= 40Wx4	0.8	Amps single phase
Walkway lighting	9 post top fittings x 50W each	= 50Wx9	2	Amps single phase
Rowing Club Precinct				
Barbeques	15 per point	= 15	15	Amps three phase
Toilet block building (lighting only)	10 fittings x 40W each	= 40Wx10	2	Amps single phase
Rowing Club Building	10W/m2	= 10W/m2 x 384	5.0	Amps three phase
Walkway lighting	9 post top fittings x 50W each	= 50Wx9	2	Amps single phase
Total			**45**	**Amps three phase**

Table 4 Estimated Maximum Precinct Power Demand Load

4.2.3 Existing Site Western Power Infrastructure

Western Power transmission (33kV – 330kV) and distribution (1kV – 33kV) aerial power cabling reticulates across the Crown land, adjacent to an existing access road, as indicated below on Figure 10 and Image 1.

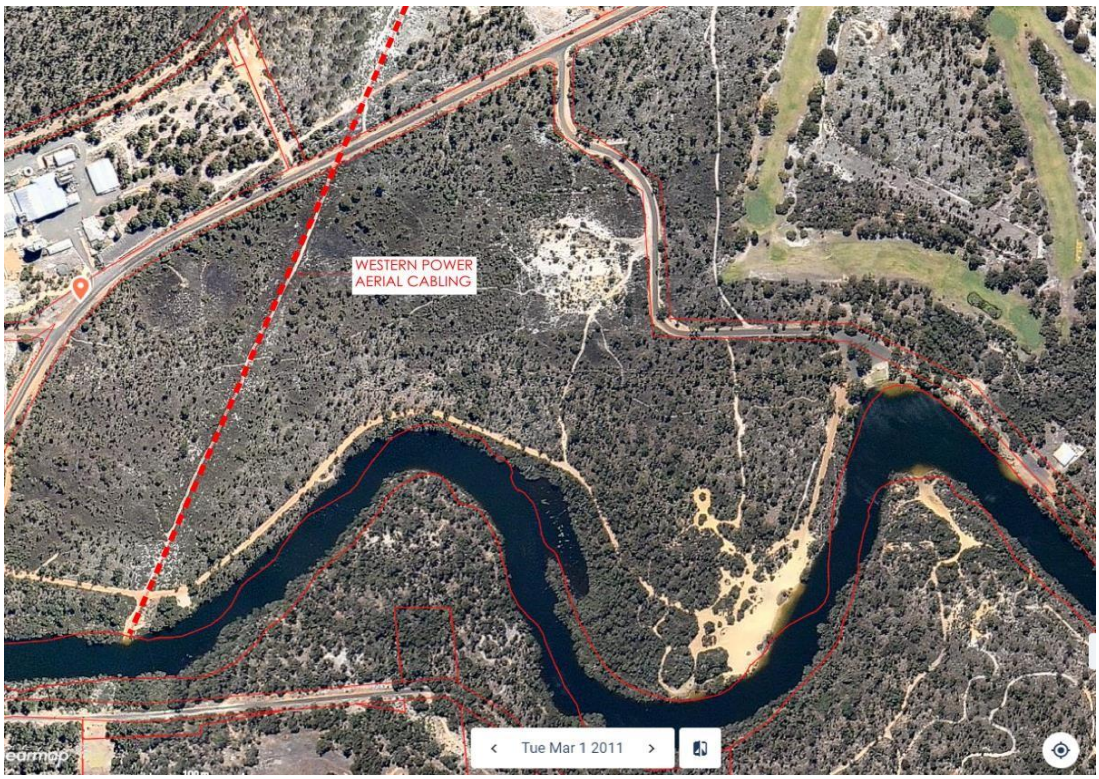


Figure 10 Western Power Aerial Cabling

Image 1: Existing Western Power Aerial Cabling

Based upon visual inspection and Dial Before You Dig drawings, there do not appear to be any existing Western Power points of supply (either pillars or substations) within the site.

4.2.4 Existing Site Power Distribution Infrastructure

The area of crown land indicated above does not contain any existing power distribution infrastructure.

4.2.5 Existing Telecommunications

Existing telecommunications conduits and pits reticulate down Minninup Road, and terminate at a network authority telecommunications pit, located adjacent to the proposed Day Use area. These services are indicated in the Dial Before You Dig information depicted below.

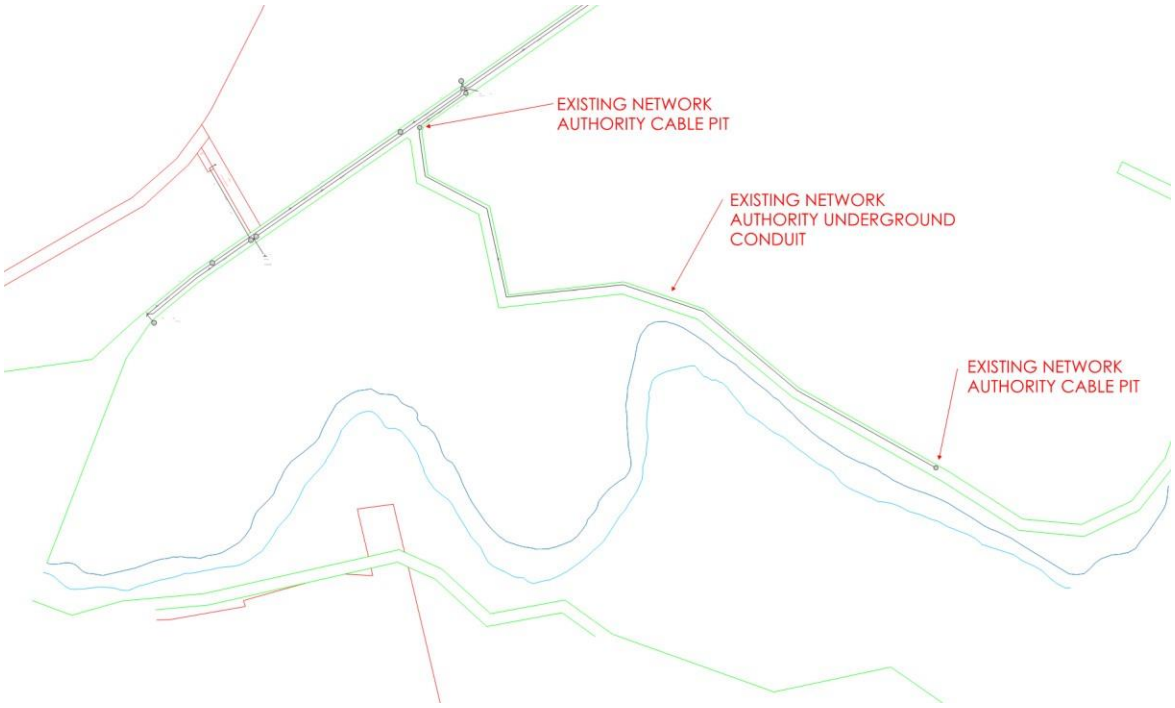


Figure 11 Existing Telecommunication Supply

4.2.6 Existing Site Communications Infrastructure

The area of crown land indicated above does not contain any existing Customer communications infrastructure.

4.3 PROPOSED ELECTRICAL SERVICES

4.3.1 Gazetted Roads

The area of crown land containing the proposed development areas appears to be bordered by two gazetted roads, being Mungalup Road to the north, and Minninup Road to the east.

The following restrictions apply to Western Power points of supply, when the lot is bordered by a gazetted road; -

- A District substation, which has low voltage and high voltage connections to the street network, must be located within 30m of the street fronting property boundary.
- A sole use substation, which has only high voltage, but no low voltage, connections to the street network, may be further than 30m from the street fronting property boundary, however if this is the case then Western Power switchgear must be placed contiguous with the street fronting property boundary, with a high voltage cable provided by Western Power between the switchgear and the sole use substation.

4.3.2 Proposed Site Power Supply

The estimated maximum demand of the site (220kVA / 306 Amps three phase) and precincts (32kVA / 45 Amps three phase) requires a low voltage point of supply to be provided relatively close to the camping ground and a separate low voltage point of supply to be provided relatively close to the precincts areas, to minimise the losses inherent in cabling a large low voltage load over a long distance, i.e. volt drop and impedance. The low voltage conductor circuit lengths will be required to be kept as short as possible.

In order to provide a low voltage power supply, the following options have been considered.

Option 1 – Western Power Sole Use Substation

For a customer load which is located a long distance (more than 30m) into the customer's site, Western Power may provide a Sole Use Substation. This is a substation which is completely dedicated to the customer's site, and does not have outgoing low voltage street feeds like a District Type Substation arrangement.

The main components of the installation are indicated on Figure 12 below, and summarised as follows:

- Western Power high voltage switchgear (indicated in yellow) will be required to be positioned adjacent to the Western Power distribution power lines.
- Underground high voltage cabling (indicated in green) will be required to be provided from the Western Power high voltage switchgear, to the Western Power sole use substation.
- A Western Power sole use substation (indicated in orange) will be required to be provided near to the site.
- A Site Main Switchboard (SMSB) (indicated in blue) containing authority master metering, will be required to be provided contiguous with the substation.

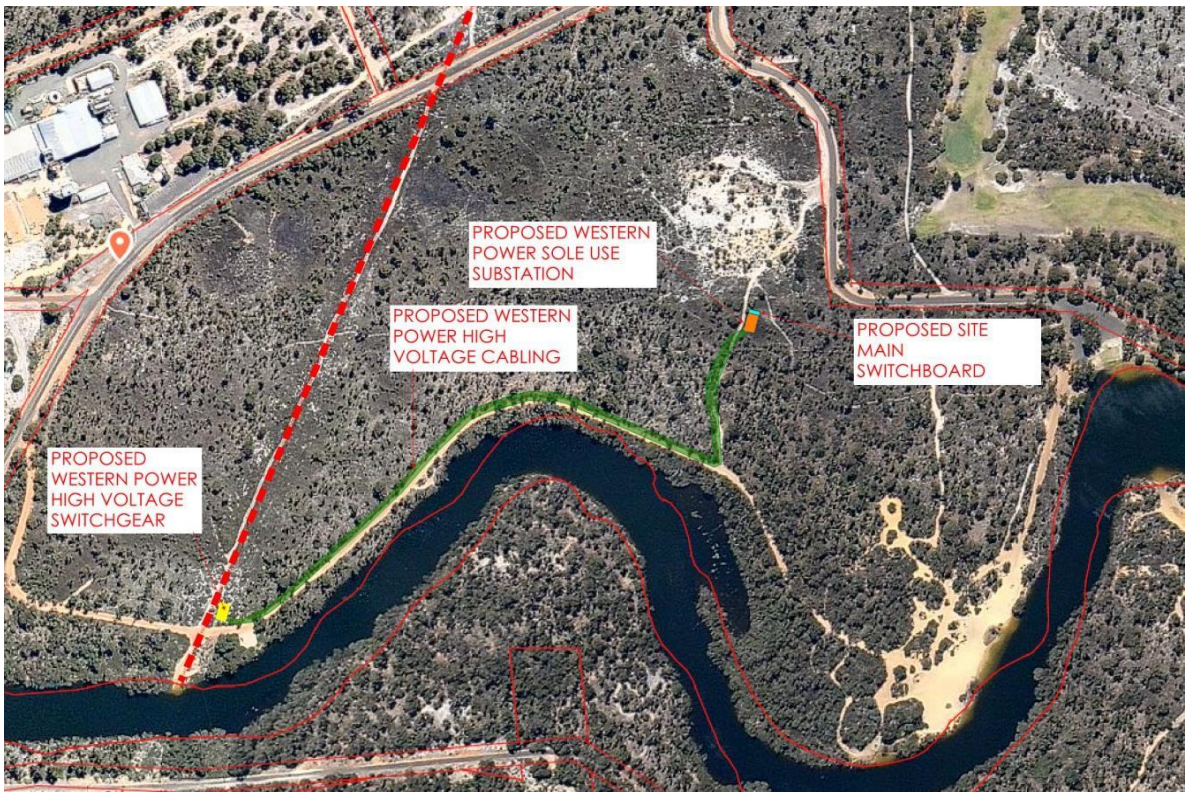


Figure 12 Western Power Sole Use Substation Option

In order to facilitate the Western Power cabling along the route shown in green, the Customer will be required to provide 150mm diameter conduit, buried at a depth of 750mm underground to the top of the conduit, with cable pulling pits positioned every 60-70m.

The Spatial requirements for each of the above components are further described below.

High Voltage Switchgear

The Western Power high voltage switchgear requires 1m deep clear and level sand pad to be prepared, measuring 4500mm x 3000mm. The site requires access from the roadway, and the substation site will be required to be protected from vehicles via non-metallic bollards.

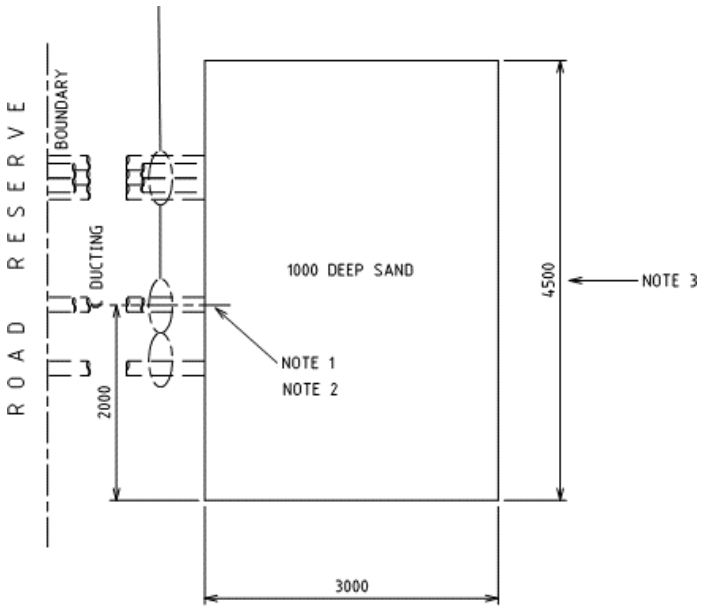


Figure 13 Western Power High Voltage Switchgear

Sole Use Substation

The Western Power sole use substation requires 1m deep clear and level sand pad to be prepared, measuring 3600mm x 3600mm. The site requires access from the roadway, and the substation site will be required to be protected from vehicles via non-metallic bollards.

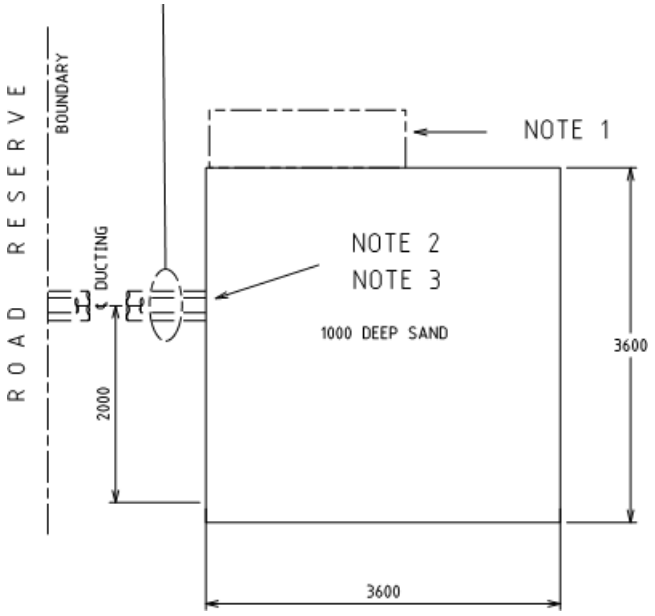


Figure 14 Western Power Sole Use Substation

Note 1 – the Site Main Switchboard must be located contiguous with the substation.

The substation must be located clear of the following services: -

- The fire risk zone associated with a substation, to protect the transformer from fire risk, is 6m, therefore no building may be positioned any closer than 6m from a substation.
- No fire hydrant may be positioned within 10m of a substation.

- No telecommunications pit may be positioned within 15m of a substation.
- The substation footprint must be clear of all other services, including but not limited to any underground water, sewer or gas piping.

The advantages of Option 1 are as follows: -

- Installation and ongoing maintenance of the high voltage installation will be undertaken by Western Power. The customer will be required to prepare the substation sites, and provide the underground conduits for the high voltage cabling. This means that maintenance and replacement costs for the infrastructure are borne by Western Power.
- Low voltage power supply can be provided from the Site Main Switchboard to service the site and in future also to the Floating Safari Tents.
- Low voltage circuit lengths are minimised, thus reducing installation costs.

The disadvantages of Option 1 are as follows: -

- The infrastructure will be limited in terms of extension, for example for the proposed precincts. While low voltage will be available at the site, the limitations on low voltage cabling means that future extension of power will be limited to areas within a few hundred metres of the substation location. As the proposed precincts are located hundreds of metres from the site, extending low voltage supplies over this distance is not feasible.
- Headworks costs associated with the works are likely to be very high, given the extensive scope of works required to be undertaken by Western Power, i.e. the high voltage cabling works.

Precincts Areas

Under Option 1, a separate low voltage supply is required to service the precincts areas, due to the large distance between the site and precinct areas.

Given that a gazetted road (Minninup Road) runs directly past the proposed pool precinct area, it may be possible to request Western Power to extend their power distribution network via aerial or underground high voltage cabling, to service a Western Power District substation at the proposed pool precinct area. A District substation is a substation which is not completely dedicated to the customer's site, and has outgoing low voltage street feeds which Western Power can utilise for street lighting or other neighbouring sites

This would require a separate application to be submitted to Western Power for a District Substation to be located near the pool precinct area, to service all three precincts. Western Power would be required to extend their power distribution network down Minninup Rd either via aerial or underground cabling. A district substation is one which is not dedicated to the customer, and Western Power can utilise the excess low voltage capacity on the transformer for street lighting or neighbouring property supplies.

The main components of the installation are indicated in figure 15, and summarised as follows: -

- A Western Power district substation (indicated in orange) will be required to be provided near to the pool precinct.
- A Site Main Switchboard (SMSB) (indicated in blue) containing authority master metering, will be required to be provided adjacent to the substation.

- Distribution boards (indicated in green) would be required to be provided near each remote precinct, for local lighting and power supplies.

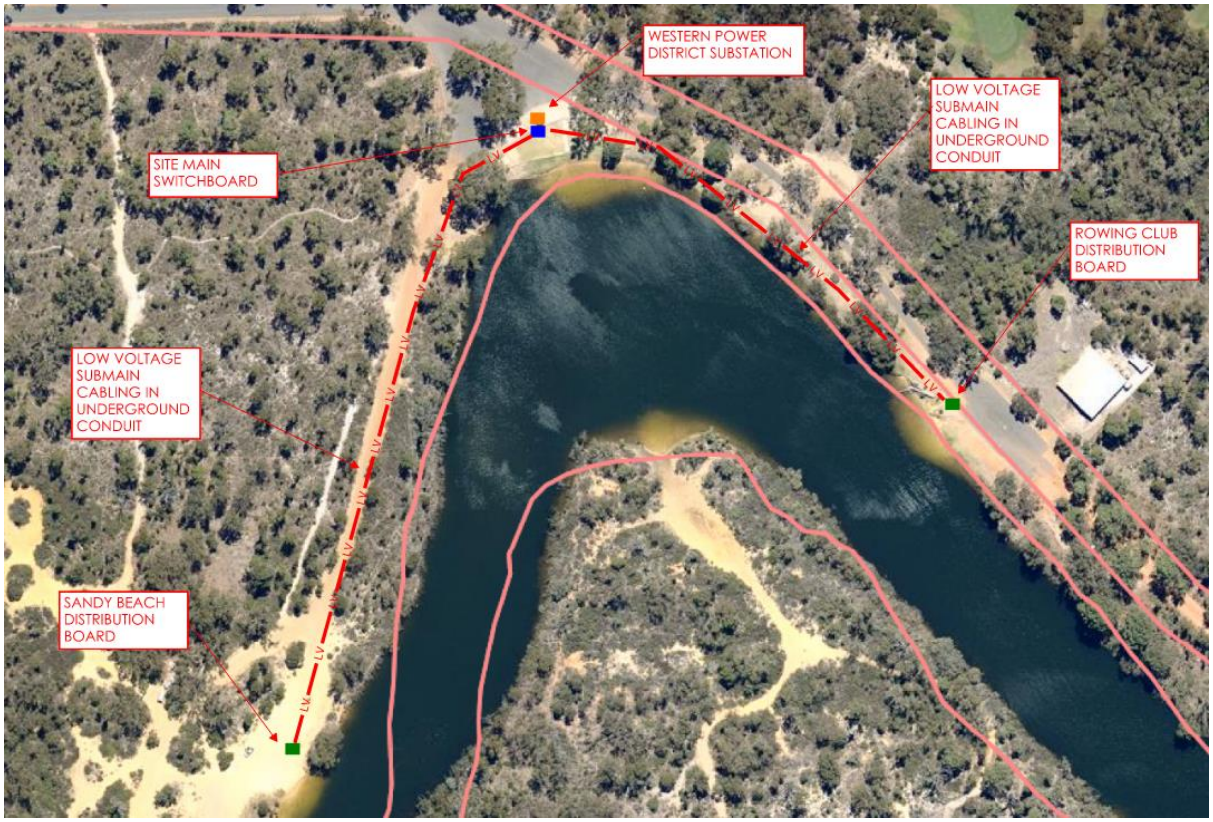


Figure 15 Precinct Main Electrical Components

The provision of an additional Western Power substation to the lot would cause the lot to have Multiple Points of Electrical Supply (MPOS). This would require notification to be provided to Landgate, and Zone Diagrams developed and housed in each main switchboard, noting the existence of the multiple points of supply.

The Spatial requirements for each of the above components are further described below.

District Substation

The Western Power District substation requires 1m deep clear and level sand pad to be prepared, measuring 4000mm x 3700mm. The site requires access from the roadway, and the substation site will be required to be protected from vehicles via non-metallic bollards.

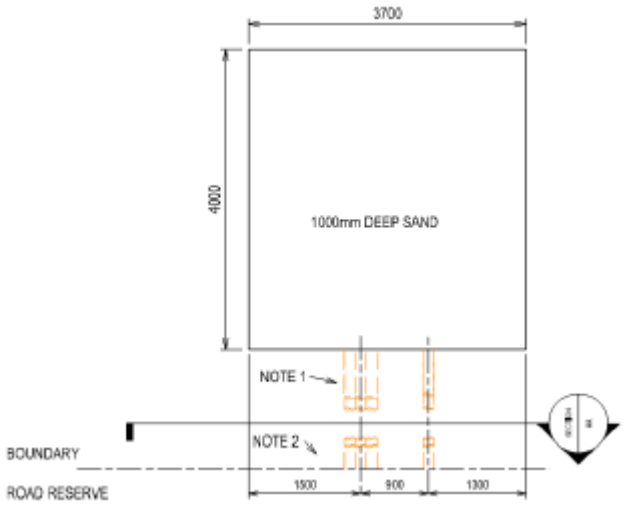


Figure 16 Western Power District Substation

The substation must be located clear of the following services: -

- The fire risk zone associated with a substation, to protect the transformer from fire risk, is 6m, therefore no building may be positioned any closer than 6m from a substation.
- No fire hydrant may be positioned within 10m of a substation.
- No telecommunications pit may be positioned within 15m of a substation.
- The substation footprint must be clear of all other services, including but not limited to any underground water, sewer or gas piping.

The costs associated with a Western Power supply adjacent to the pool precinct are likely to be very high, as the customer will bear the majority of the cost for Western Power's network extension down Minninup Road.

Option 2 – Customer Owned Substation

For a customer site which requires a high voltage supply, Western Power will provide a High Voltage Substation point of connection and high voltage metering unit only.

The main components of the installation are indicated on Figure 17 below, as follows: -

- Western Power high voltage switchgear and metering unit (indicated in yellow) will be required to be positioned adjacent to the Western Power distribution power lines.
- Customer Owned underground high voltage cabling (indicated in green) will be required to be provided from the Western Power high voltage switchgear, to the Customer Owned High Voltage Switchgear.
- Customer Owned High Voltage Switchgear (indicated in pink) will be required to be provided in order to facilitate extension of the high voltage network to the precincts.
- Customer owned underground high voltage cabling (indicated in red) will be required to be provided from the Customer Owned High Voltage Switchgear to the Customer Owned Substation.
- A Customer Owned substation (indicated in orange) will be required to be provided near to the site and precincts.

- A Site Main Switchboard (SMSB) (indicated in blue) will be required to be provided contiguous with each substation.

Figure 17 Customer Owned Substation

The Spatial requirements for each for the above components are further described below.

<u>High voltage substation</u>

The Western Power high voltage substation requires 1m deep clear and level sand pad to be prepared, measuring 5500mm x 6200mm. The site requires access from the roadway, and the substation site will be required to be protected from vehicles via non-metallic bollards.

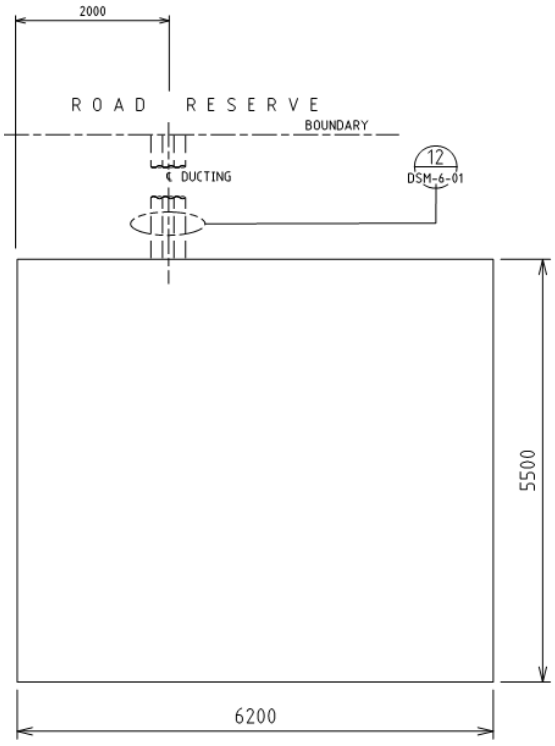


Figure 18 Western Power High Voltage Substation

Customer Owned High Voltage Switchgear

The Customer owned high voltage switchgear requires 1m deep clear and level sand pad to be prepared, measuring 4500mm x 3000mm. The site requires access from the roadway, and the substation site will be required to be protected from vehicles via non-metallic bollards.

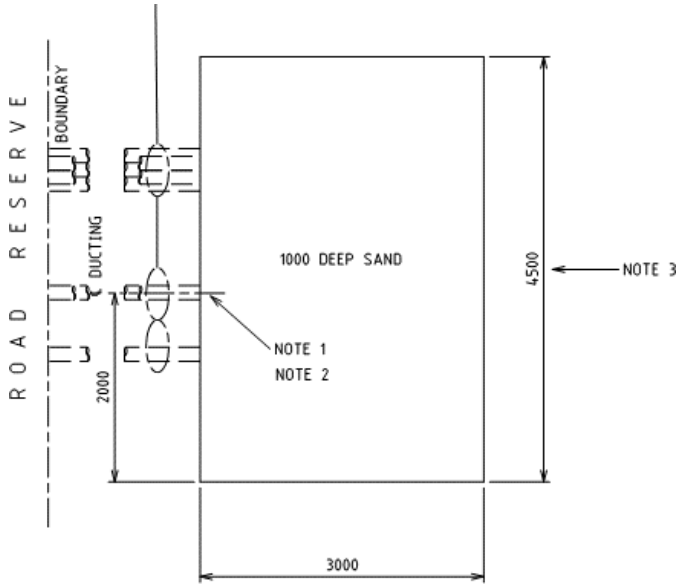


Figure 19 Customer Owned High Voltage Substation

Customer Owned Substation

The Customer owned substation (one to service the site and one to service the precincts) require a clear site to be prepared, measuring a minimum of 3600mm x 3600mm. The site requires access from the roadway, and the substation sites will be required to be protected from vehicles via non-metallic bollards. The substations will be required to be designed to contain the oil from the transformer and prevent spillage to the surrounding land.

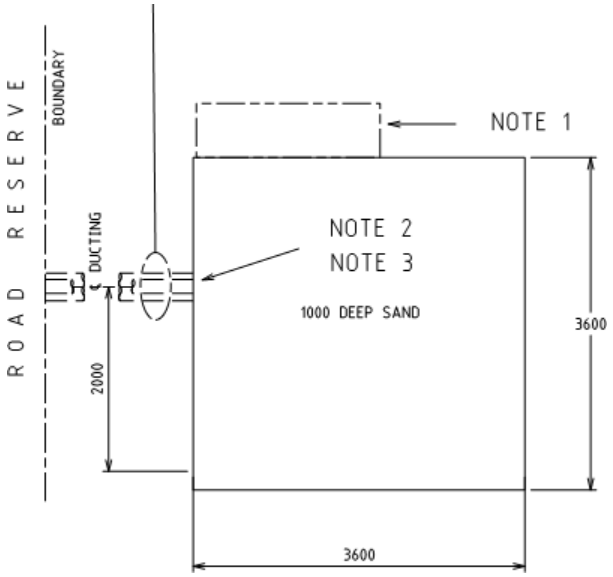


Figure 20 Customer Owned Substation

Note 1 – the customer's Site Main Switchboard is required to be positioned contiguous with each substation.

The advantages of Option 2 are as follows: -

- Headworks costs may be reduced compared to Option 1, as Western Power are not required to provide and maintain the same quantity of infrastructure. (Note this will be required to be confirmed by Western Power through a Feasibility Study process). In particular Option 2 does not require separate headworks costs for the site and precinct areas, as both areas are proposed to be serviced via the customer's high voltage network.
- By providing high voltage switchgear as shown above in pink, the infrastructure will be able to be extended to the precinct areas by provision of additional high voltage cabling. As high voltage cabling can reticulate over large distances with minimal losses, the network can be extended many hundreds of meters to support further development.
- The low voltage circuit lengths are minimised, thus reducing installation costs.

The disadvantages of Option 2 are as follows: -

- The customer is responsible for supply, installation and ongoing maintenance of the privately owned switchgear, high voltage cabling and two transformers.
- Preparation of the substation sites for the Customer owned transformers will be more extensive than Option 1, as the Customer is required to ensure that any oil leakage is fully contained, and does not contaminate the surrounding area.

Option 3 – Western Power District Substation

Given that a gazetted road (Minninup Road) runs directly past the proposed site and pool precinct, it may be possible to request Western Power to extend their power distribution network via aerial or underground high voltage cabling, to service a Western Power District substation at each separate site. A District substation is a substation which is not completely dedicated to the customer's site, and has outgoing low voltage street feeds which Western Power can utilise for street lighting or other neighbouring sites.

The main components of the installation are indicated on the diagram below, and summarised as follows: -

- Two Western Power District substations (indicated in yellow) will be required to be provided near to the Camping Ground and Day use areas.
- Site Main Switchboards (SMSB) (indicated in blue) containing authority master metering, will be required to be provided contiguous with each substation.

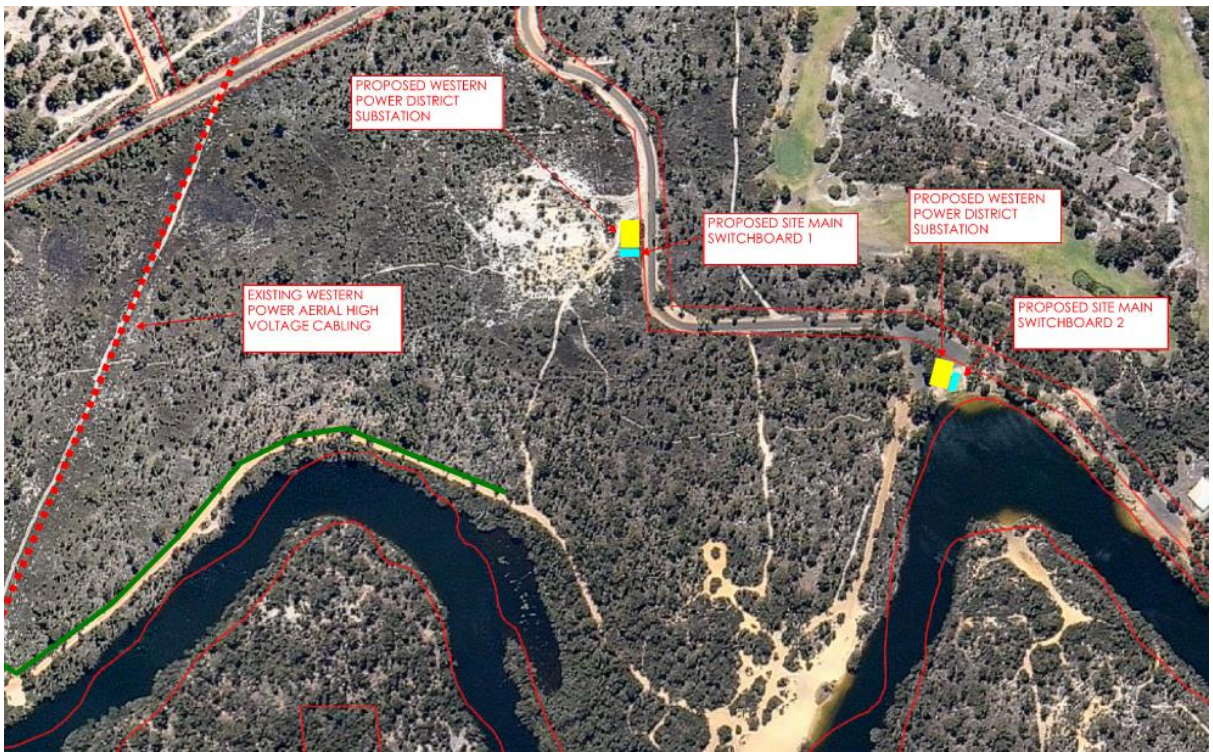


Figure 21 Western Power District Substation

The provision of two Western Power substations to the lot would cause the lot to have Multiple Points of Electrical Supply (MPOS). This would require notification to be provided to Landgate, and Zone Diagrams developed and housed in each main switchboard, noting the existence of the multiple points of supply.

The Spatial requirements for each of the above components are further described below.

District Substation

The Western Power District substation requires 1m deep clear and level sand pad to be prepared, measuring 4000mm x 3700mm. The site requires access from the roadway, and the substation site will be required to be protected from vehicles via non-metallic bollards.

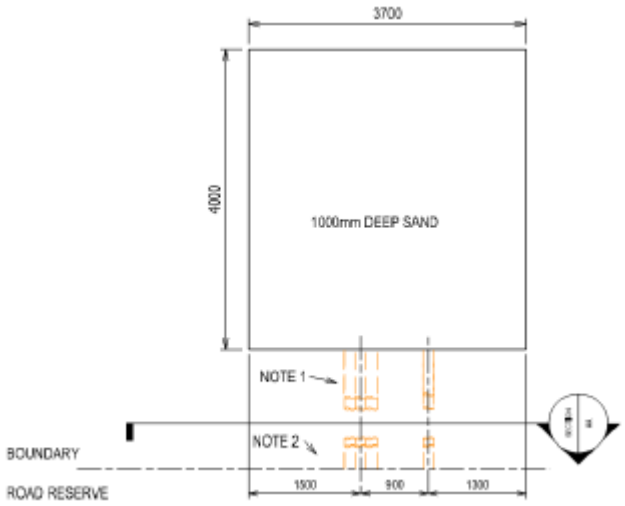


Figure 22 Western Power District Substation

The substation must be located clear of the following services: -

- The fire risk zone associated with a substation, to protect the transformer from fire risk, is 6m, therefore no building may be positioned any closer than 6m from a substation.
- No fire hydrant may be positioned within 10m of a substation.
- No telecommunications pit may be positioned within 15m of a substation.
- The substation footprint must be clear of all other services, including but not limited to any underground water, sewer or gas piping.

The advantages of Option 3 are as follows: -

- The customer is not responsible for provision or ongoing maintenance of the high voltage installation.
- Substations can be provided close to where the main load sources are location.
- The low voltage circuit lengths are minimised, thus reducing installation costs.
- The works for both sites could be undertaken as one package of works by Western Power.

The disadvantages of Option 3 are as follows: -

- Western Power headworks for extension of their high voltage network down Minninup Road are likely to be very high, compared with Options 1 and 2, as the customer will bear the majority of the cost for Western Power's network extension.

4.3.3 Site Main Switchboard

A new ground mounted free standing Site Main Switchboard (SMSB) will be required for both the site and the precinct areas, contiguous with the low voltage point of supply for the respective areas.

The SMSB will contain master metering equipment, and will provide power supply via underground submain cabling to low voltage distribution boards throughout the camping area development.

4.3.4 Standby Power Supply

Standby power supply provided by diesel generator is not deemed necessary.

4.4 EXTRA LOW VOLTAGE SERVICES

4.4.1 Telecommunications Service Provider Space

In order to allow for telecommunications services, space for service provider equipment will be required to be allowed. This is recommended to be within the Reception/Manager's Residence close to Minninup Road. A space measuring 900mm wide x 500mm deep is recommended to be allowed.

From the Manager's Residence, underground NBN and Telstra-compliant conduits will be required to be provided out to the site boundary adjacent Minninup Road.

This will ensure the development is future proofed for communications.

Figure 23 Proposed Communications

Communications services via fixed copper or optic fibre cabling are not deemed necessary for the precinct areas.

4.5 Gas

There is no reticulated gas infrastructure available within the area.

5 COST ESTIMATES

5.1 Water and Sewer

5.1.1 Option 1 – 50mm Water Meter & Sewer Pumping Station

Cost Estimate		
Item	Description	Estimated Costs
1	**Consultancy Fees**	
1.1	Survey	$10,000.00
1.2	Geotechnical Investigation	$15,000.00
1.3	Civil engineering, design drawings and documentation, obtain construction prices and contract administration through the construction period	$70,000.00
1.4	Structural engineer for pump station wet well	$10,000.00
	Sub-Total	**$105,000.00**
2	**External Water and Sewer Construction Costs**	
2.1	Water Reticulation (approx. 1,000m)	$240,000.00
2.2	Main Sewer Pump Station and Pressure Main (approx. 1,200m)	$280,000.00
	Sub-Total	**$520,000.00**
3	**Internal Water Construction Costs**	
3.1	Water Reticulation to the site	$140,000.00
3.2	Water Reticulation to the Pool and Rowing Club Precincts	$60,000.00
3.3	Water Reticulation to the Sandy Beach Precinct	$50,000.00
	Sub-Total	**$250,000.00**
4	**Internal Sewer Construction Costs**	
4.1	Sewer Reticulation to the site	$280,000.00
4.2	Sewer Reticulation to the Pool and Rowing Club Precincts	$90,000.00
4.3	Sewer Reticulation to the Sandy Beach Precinct	$60,000.00
	Sub-Total	**$430,000.00**
5	**Contingency**	
5.1	Construction Cost Contingency (10%)	$120,000.00
	Sub-Total	**$120,000.00**
6	**Other Fees**	
6.1	Water and sewer headworks	$100,000.00
	Sub-Total	**$100,000.00**
	Grand Total (excl GST)	**$1,525,000.00**

5.1.2 Option 2 – 40mm Water Meter & Sewer Pumping Station

Cost Estimate		
Item	Description	Estimated Costs
1	**Consultancy Fees**	
1.1	Survey	$10,000.00
1.2	Geotechnical Investigation	$15,000.00
1.3	Civil engineering, design drawings and documentation, obtain construction prices and contract administration through the construction period	$75,000.00
1.4	Structural engineer for pump station wet well	$10,000.00
	Sub-Total	**$110,000.00**
2	**Water and Sewer Construction Costs**	
2.1	Water Reticulation (approx. 1,000m)	$240,000.00
2.2	Water Storage Tank and Booster Set	$50,000.00
2.3	Main Sewer Pump Station and Pressure Main (approx. 1,200m)	$280,000.00
	Sub-Total	**$570,000.00**
3	**Internal Water Construction Costs**	
3.1	Water Reticulation to the site	$140,000.00
3.2	Water Reticulation to the Pool and Rowing Club Precincts	$60,000.00
3.3	Water Reticulation to the Sandy Beach Precinct	$50,000.00
	Sub-Total	**$250,000.00**
4	**Internal Sewer Construction Costs**	
4.1	Sewer Reticulation to the site	$280,000.00
4.2	Sewer Reticulation to the Pool and Rowing Club Precincts	$90,000.00
4.3	Sewer Reticulation to the Sandy Beach Precinct	$60,000.00
	Sub-Total	**$430,000.00**
5	**Contingency**	
5.1	Construction Cost Contingency (10%)	$125,000.00
	Sub-Total	**$125,000.00**
6	**Other Fees**	
6.1	Water and sewer headworks	$29,000.00
	Sub-Total	**$29,000.00**
	Grand Total (excl GST)	**$1,514,000.00**

5.2 Power and Communications

5.2.1 Option 1 – Western Power Sole Use Substation

Cost Estimate		
Item	Description	Estimated Costs
1	**Consultancy Fees**	
1.1	Electrical and communication consultant	$15,000.00
	Sub-Total	**$15,000.00**
2	**Power and Communications Construction Costs - Site**	
2.1	Provision of conduits (660m) and cable pits for underground high voltage cabling including trenching	$78,000.00
2.2	Builders work for preparation of substation sites	$5,000.00
2.3	Provision of main site switchboard	$40,000.00
2.4	Western Power charges for infrastructure – provision of underground high voltage cabling (660m)	$56,000.00
	Sub-Total	**$179,000.00**
3	**Power Construction Costs - Precincts**	
3.1	Western Power charges for infrastructure to the precinct – provision of underground high voltage cabling, trenching, conduits and pits (850m)	$173,000.00
3.2	Builders work for preparation of substation sites	$3,000.00
3.3	Provision of main site switchboard and power to pool precinct	$40,000.00
3.4	Extension of low voltage power supply to the Sandy Beach Area including trenching, conduit, cable pits, cabling and distribution board.	$56,000.00
3.5	Extension of low voltage power supply to the Rowing Club area including trenching, conduit, cable pits, cabling and distribution board.	$49,000.00
	Sub-Total	**$321,000.00**
4	**Other Fees**	
4.1	Western Power headworks - site – based on kVA charge site	$98,000.00
4.2	Western Power headworks - precincts – based on kVA charge	$15,000.00
	Sub-Total	**$113,000.00**
	Grand Total (excl GST)	**$628,000.00**

5.2.2 Option 2 – High Voltage Supply

Cost Estimate		
Item	Description	Estimated Costs
1	**Consultancy Fees**	
1.1	Electrical and communication consultant	$25,000.00
	Sub-Total	**$25,000.00**
2	**Power and Communications Construction Costs**	
2.1	Provision of conduits (660m) and cable pits for underground high voltage cabling including trenching	$78,000.00
2.2	Provision of underground high voltage cabling (660m)	$56,000.00
2.3	Builders work for preparation of substation sites	$10,000.00
2.4	Provision of HV switchgear	$60,000.00
2.5	Provision of HV/LV transformer	$35,000.00
2.6	Provision of main site switchboard	$40,000.00
2.7	High voltage submission to Western Power	$12,000.00
	Sub-Total	**$291,000.00**
3	**Power Construction Costs - Precincts**	
3.1	Provision of conduits (540m) and cable pits for underground high voltage cabling including trenching.	$64,000.00
3.2	Provision of underground high voltage cabling (540m).	$46,000.00
3.3	Builders work for preparation of substation sites	$3,000.00
3.4	Provision of HV/LV transformer	$35,000.00
3.5	Provision of site main switchboard and power to pool precinct	$40,000.00
3.6	Extension of low voltage power supply to the Sandy Beach Area including trenching, conduit, cable pits, cabling and distribution board.	$56,000.00
3.7	Extension of low voltage power supply to the Rowing Club area including trenching, conduit, cable pits, cabling and distribution board.	$49,000.00
	Sub-Total	**$293,000.00**
4	**Other Fees**	
4.1	Western Power headworks - site	$50,000.00
	Sub-Total	**$50,000.00**
	Grand Total (excl GST)	**$659,000.00**

5.2.3 Option 3 – Western Power District Substations

Cost Estimate		
Item	Description	Estimated Costs
1	**Consultancy Fees**	
1.1	Electrical and communication consultant	$15,000.00
	Sub-Total	**$15,000.00**
2	**Power and Communications Construction Costs - Site**	
2.1	Builders work for preparation of substation sites	$3,000.00
2.2	Provision of main site switchboard	$40,000.00
2.3	Western Power charges for infrastructure to the site – provision of underground high voltage cabling, trenching, conduits and pits (510m)	$104,000.00
	Sub-Total	**$147,000.00**
3	**Power Construction Costs - Precincts**	
3.2	Builders work for preparation of substation sites	$3,000.00
3.3	Provision of main site switchboard and power to pool precinct	$40,000.00
3.4	Western Power charges for infrastructure to the precinct – provision of underground high voltage cabling, trenching, conduits and pits (340m)	$70,000.00
	Extension of low voltage power supply to the Sandy Beach Area including trenching, conduit, cable pits, cabling and distribution board.	$56,000.00
3.5	Extension of low voltage power supply to the Rowing Club area including trenching, conduit, cable pits, cabling and distribution board.	$49,000.00
	Sub-Total	**$218,000.00**
4	**Other Fees**	
4.1	Western Power headworks - site – based on kVA charge site	$98,000.00
4.2	Western Power headworks - precincts – based on kVA charge	$15,000.00
	Sub-Total	**$113,000.00**
	Grand Total (excl GST)	**$493,000.00**

5.3 Exclusions

The estimated costs listed above exclude: -

- GST.
- Escalation.
- Internal servicing to buildings and development costs.
- Environmental costs.

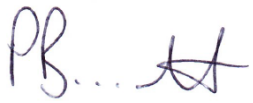
- The cost estimates do not include for all the low voltage power supplies from the SMSB to the campgrounds.
- The cost estimates do not include distribution boards and submain cabling within the campgrounds.
- The cost estimates do not include external lighting.
- The costs above do not include Western Power application ($495), Design Fee ($3,000 - $7,000) and Feasibility Study ($3,000 - $5,000) costs, which will be equally applicable to all Options above.

5.4 Clarifications

- Indicative Western Power headworks costs are based on published Western Power rates (https://westernpower.com.au/industry/distribution-low-voltage-connection- scheme-dlvcs/). Final costs will need to be confirmed by Western Power through a Feasibility Study process. Due to the extensive works to be undertaken by Western Power, final charges may be higher than the published rates, particularly where extensive network extensions are required. It is strongly recommended that a Feasibility Study is submitted to Western Power to determine the estimated headworks for each Option.

If you require further discussion on this project please do not hesitate to contact me.

Yours Faithfully



Paul Broadhurst
Project Director
for **River Engineering Pty Ltd**