When I'm working on a problem, I never think about beauty. I think only how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong.
Richard Buckminster Fuller

Mechanical Engineering
Lighting Design
Sustainable Design
Electrical Engineering

Copenhagen
London
Sydney
Hong Kong
New York

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Consultant Advice Note

Site Power and Communications Infrastructure

Sydney October 16, 2017
Project No. 177127

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Project Name:	Wallacia Golf Course Redevelopment	**Document No**	177127 CAN EO1
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Subject	Site Power and Communications Infrastructure		

1.0 Summary

The Catholic Metropolitan Cemeteries Trust is finalising the purchase of Wallacia Golf Course located 13 Park Road, Wallacia, NSW. The intention of the CMCT is to divide the golf course in half, to allow the Golf Club to remain and operate and develop the other half as a cemetery.

The aim of this consultant advice note is to inform the design team of the available electrical power infrastructure, propose the point of supply to the site and proposed the method of reticulation of power to the buildings that are to be developed on the site.

Also, this report aims to provide information on the available communications infrastructure, propose lead-in to the site and proposed method of reticulation of communications services to the buildings that are to be developed on the site.

1.1 Power

Power is available from the existing Endeavour Energy high voltage overhead power lines that are running along Park Road (Figure 1). The final agreement on the use of this supply is pending approval from Endeavour Energy.

The option exists to be a High Voltage or Low Voltage Power Customer. The proposal is to be a Low Voltage customer with the point of supply at new a pad mount substation at the south-east end of the site, which will be close to the proposed structures requiring power.

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The reticulation of low voltage cables will be underground and will follow the roads to each building. Spare capacity of the site power supply and distribution will allow for future growth.

In terms of Standby Generation, the option exists to limit the extent of backup power to certain loads and buildings. However, the level of redundancy in the form of a diesel generator for the whole site is recommended to be adopted to ensure critical elements of the business remain operational and provide a simple, less complex electrical arrangement. UPS units will Also, be used to support IT and Security systems.

Existing power supplies to the adjacent Golf Club and other adjacent facilities will be retained.

1.2 Communications

Telecommunications service is available from the existing Telstra and NBN-ready underground cabling running along Park Road (Figure 1). The final agreement on the use of these services is pending approval from Telstra and NBN.

According to the website the NBN is only available along Park Road and not within the property at this stage, telco service lead-in will be arranged with the available telco provider, which is Telstra in this instance.

The reticulation of fibre optic and copper telco cables will be underground and will follow the roads to each building. Spare capacity of the site campus distributor and distribution will allow for future growth as well as NBN connection.

There exists a telecommunications tower within the proposed site (Figure 1). There is Also, an existing Telstra right of way from Park Road to the tower. There is an option to retain the tower including the existing right of way. Another option is to modify the tower and easement for the Telstra right of way, which would require coordination with Telstra and other authorities.

Existing communications connections to the adjacent Golf Club and other facilities will be retained.

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2.0 Existing

2.1 Site Information

Shown in Figure 1 is the location of the proposed site and the existing infrastructure available to the development.

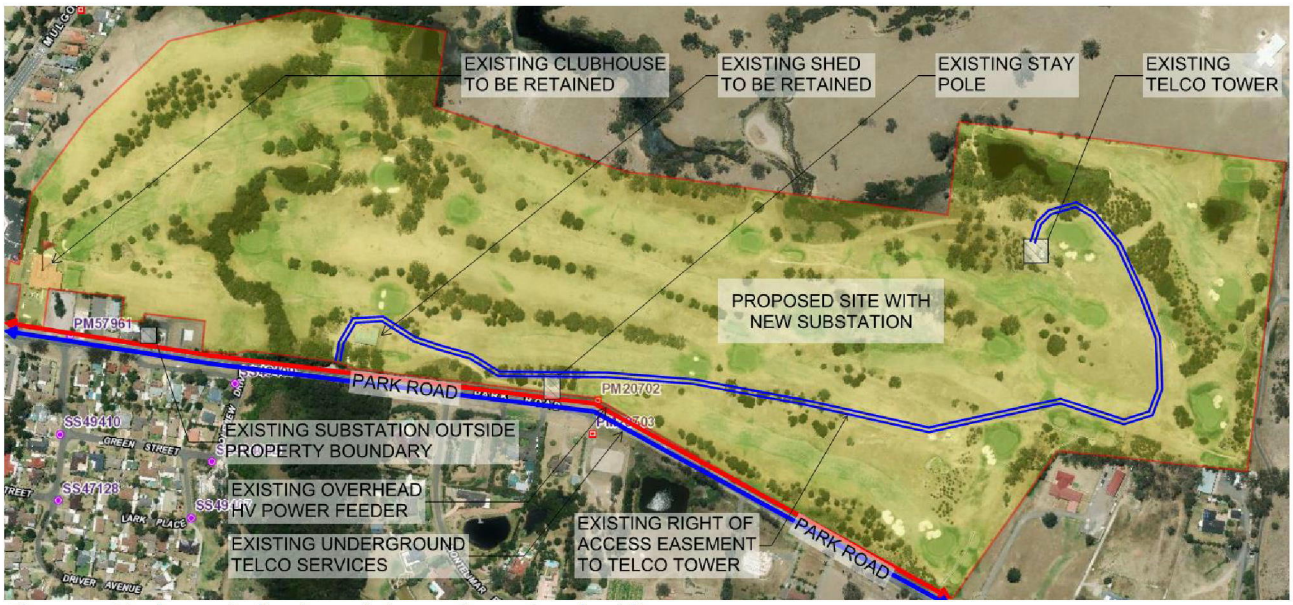

Figure 1 - Site layout indicating existing main overhead cabling

2.2 Existing Infrastructure

Based on the Dial Before You Dig (DBYD) information, there are no underground assets within the property. There do not appear to be overhead cables, either high or low voltage, within the property boundary except only for the stay pole marked on Figure 1 and shown on Figure 2.

The existing power overhead service cables, owned and operated by Endeavour Energy, have been interposed onto Figure 1.

The electric pole will remain on the site. Endeavour Energy have right of way and easements set aside for their assets. To relocate these would be a significant and an inappropriate cost to the client.

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Figure 2 - Existing power stay pole

Also, according to the DBYD information there is an existing telecommunications tower within the proposed site as marked on Figure 1 and shown on Figure 3. The telco tower that Telstra has identified requires access. There is Also, an existing Telstra right of way from Park Road to the tower.

Coordination with Telstra and other authorities is required to modify the existing tower and easement for the Telstra right of way.

Figure 3 - Existing telco tower

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2.3 Documents

The following documents were available at the time of writing this note:

- Wallacia Golf Course Redevelopment Masterplan by Ignite Architects, October 2017
- 171013 DP survey by DS&P, October 2017
- 171013 Arch updated site plans by Ignite Architects, October 2017
- 171012 Arch updated plans for coordination, October 2017

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3.0 Assessment and Recommendations

3.1 Electrical Power

3.1.1 Maximum Demand

The new buildings at Wallacia Memorial Park are distributed on the eastern side of the site as shown in Figure 4. The electrical demand for each building and in turn the entire site has been worked out using the area After Diversity Maximum Demand (ADMD) energy demand method.

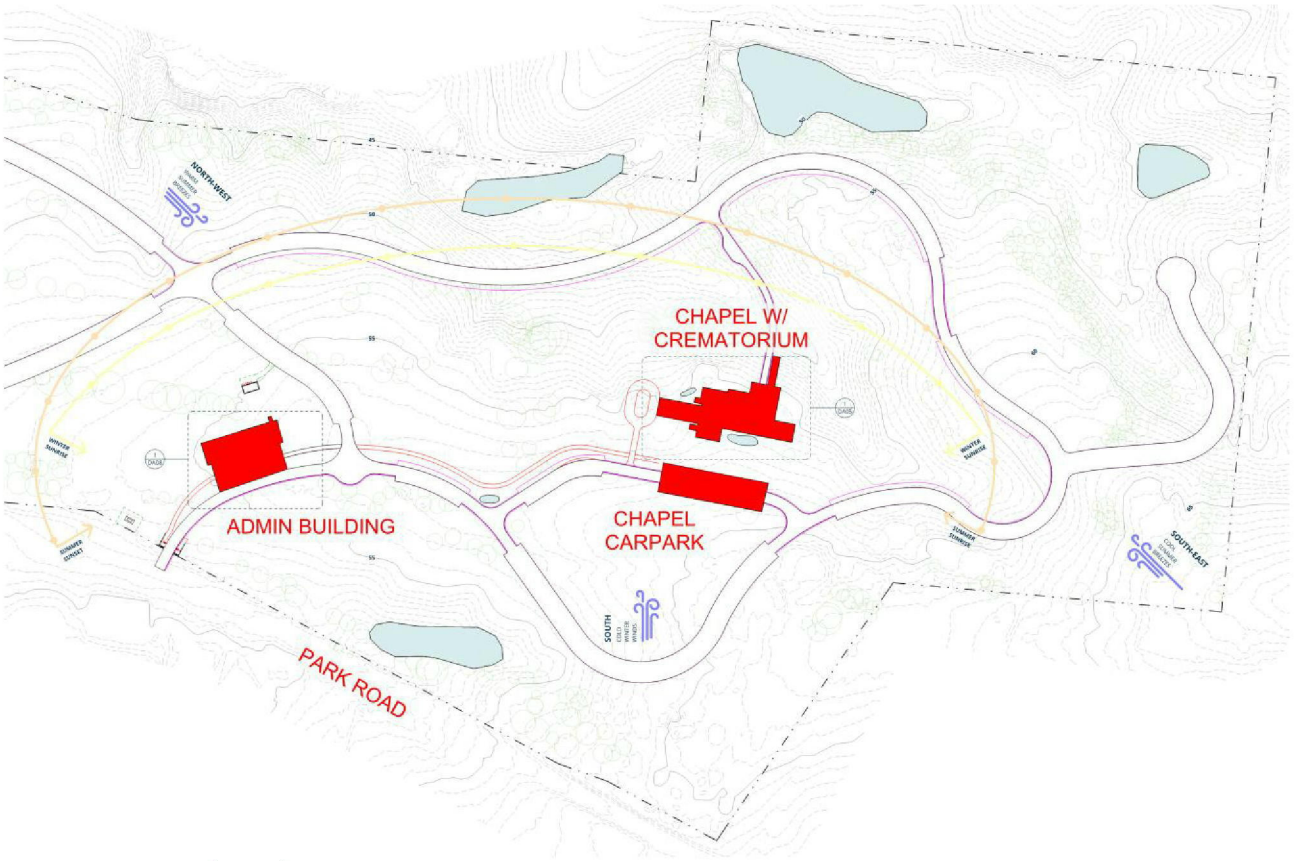

Figure 4 - Proposed site plan

The following table outlines the electrical demand for each building and consequently, the total site demand. The main parts of the loads include air conditioning, pumps, lighting and general power.

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Preliminary Electrical Maximum Demand

Project Name: Wallacia Golf Course Redevelopment

Instructions

1. Enter room name and VA/m^2 estimate according to AS3000 according to the rooms function
2. Enter the area for each room and the spread sheet will do the rest
3. To enter more rooms simply add more lines within the table and copy down the formula

Job Number	177127
Date	4/10/2017
Revison	2
Author	DR
Checked	MH

Room Name	VA/m^2	Area (m^2)	Total kVA
			0
Chapel - Ground Level	120	1305.7	156.684
Chapel - Basement Level (Crematorium)	110	1271	139.81
Carpark	10	1455.4	14.554
Admin Office	120	250.7	30.084
Admin Carpark	10	183.2	1.832
			0
	TOTALS	**4466**	**342.964**
	Current Per Phase (A) - LV		**477.13339**

The assessed area from the drawings have been used in the calculations. While the electrical maximum demand calculation is based on the Australian and New Zealand Standard AS/NZS3000 at 500 Amp it may be lower when installed and measured. However, a 500 Amp supply in theory does not provide any spare capacity. Thus, an application for a larger load is recommended.

3.1.2 Incoming Power Service

General

Power supply to a site is provisioned from a local supply Authority. In this case Endeavour Energy. The property can choose to be a low voltage or high voltage customer. The decision is based on the load required and the size of the site, which may mean buildings at great distances from each other.

High voltage customers generally have a higher maximum demand but Also, cover a large area. Examples include hospitals, universities or industrial processing plants.

Low voltage customers range from small single loads up to larger developments. Examples include street lights, houses, apartments, schools and office buildings.

For this site, it has been assumed that a low voltage arrangement will be implemented.

There are two options for the location of the Pad Mount Substation as shown in Figure 5.

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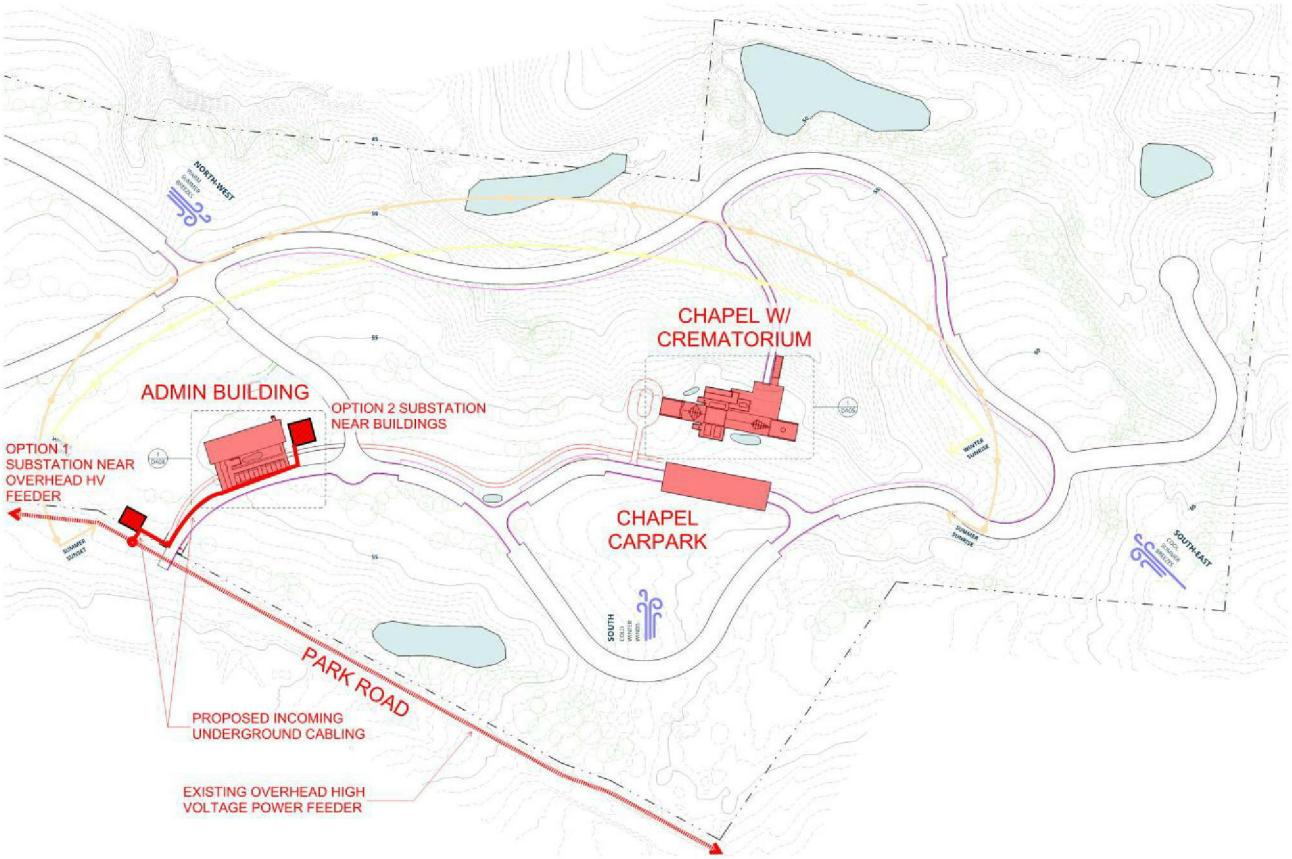

Figure 5 - Proposed Incoming Service Options

In Option 1 the substation is located near the overhead high voltage feeder. The advantage of this is that it works well architecturally since the substation is not in the middle of the site. The disadvantage is that the substation is far from the buildings that it serves, which means longer cabling required. This in turn translates to higher costs.

In Option 2 the substation is located adjacent to the administration building. Although this arrangement is not visually beneficial for the overall masterplan, it benefits the site's power supply infrastructure in 2 ways. First shorter cables and conduits are required to run from the substation to the buildings. Second with the shorter cabling costs are reduced.

Proposed

For Wallacia Memorial Park, the main source of supply will come from the existing Overhead High Voltage feeder running though the site parallel to Park Road.

It is proposed that the 500 kVA pad mount substation be placed adjacent to the administration building (Option 2) as shown in Figure 5 to minimise costs or at the street (Option 1).

The final arrangement is subject to Endeavour Energy's approval.

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3.1.3 Reticulation / Underground v Overhead

General

Submain cables are cables, which supply power from a power source to an electrical load such as buildings, electrical switchboards, mechanical switchboards, hydraulic plant and lifts.

The site buildings are connected by a network of roads as shown in Figure 6
The option exists to run overhead cabling or underground cabling.

Standards

Cabling will be provided in accordance with the following standards

- AS/NZS 3000 – Wiring Rules;
- AS/NZS 3008 – Electrical Installations – Selection of Cables.

Proposed

Cables for the supply of power to the buildings will be reticulated via underground conduits.

These can be shared in a trench with other services such as communications and water with appropriate separation.

The reticulation of the cables will follow the path of the road to allow ease of locating and sharing with other services. Figure 6 shows the reticulation of power cables in red. The cables will be placed adjacent to the road to enable access to cables if required without the disturbing the road.

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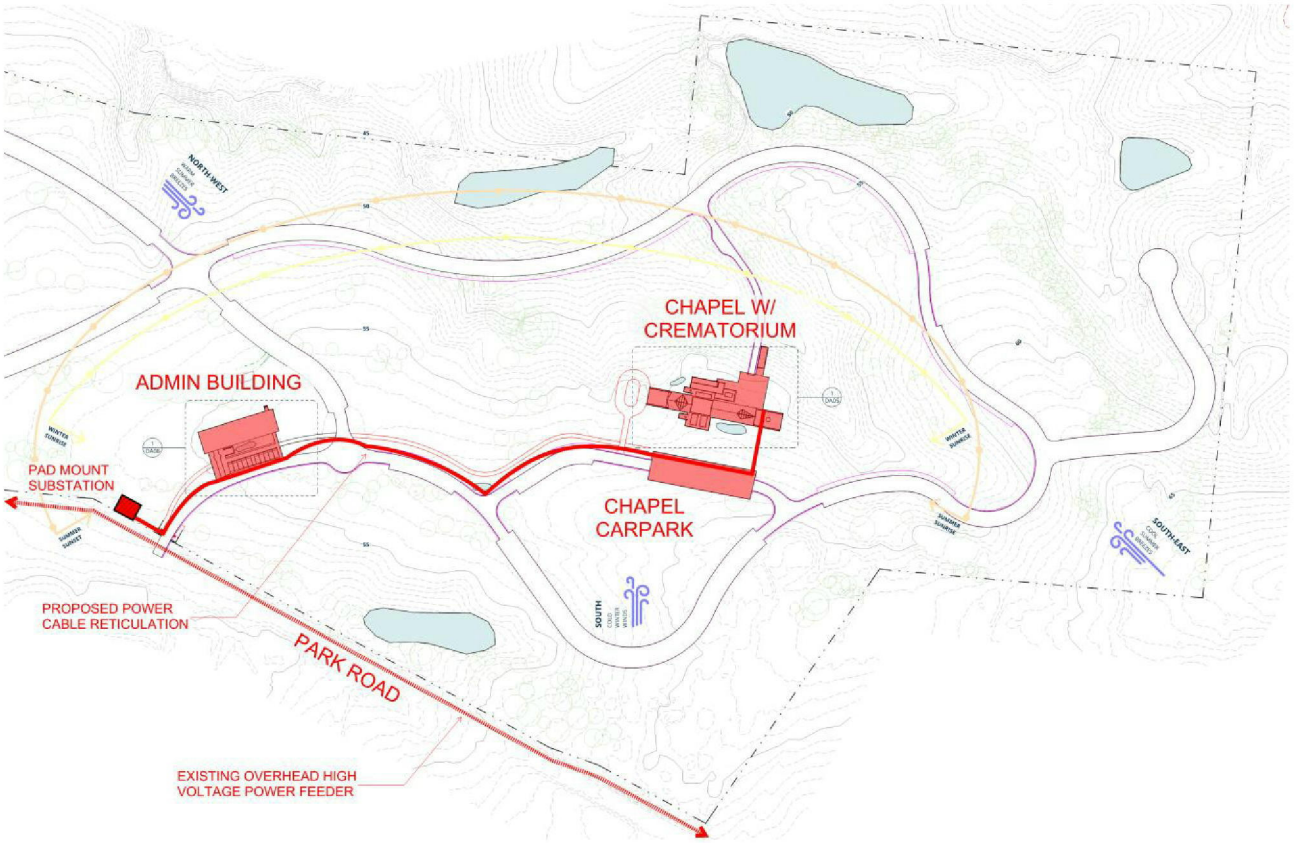

Figure 6 - Electrical power reticulation layout

3.1.4 Future Provisions

General

It is anticipated that the site will build future buildings or infrastructure requiring addition power. Substantial costs can result if these future services are not provisioned for.

Proposed

It is proposed to provide spare conduits along the proposed reticulation route to enable space for any submain cables required for the supply of power to future building or infrastructure on site.

It is Also, proposed to provide spare capacity on all switchboards to allow additional circuits to be installed where required. The submain cables will Also, be required to provide spare capacity if a building requires additional power for new equipment.

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3.1.5 Redundancy - Standby Generation

General

Various levels of redundancy can be added to the supply of power. The importance of a constant or uninterrupted supply of power will dictate the level of redundancy required.

The introduction of redundancy to a system can mitigate or reduce the probability of the loss of power from several factors. These can include:

- Outages from electricity distributor from causes such as weather, spikes, vehicles, bushfires or animals.
- Failure of electrical equipment on site due to overloading, degradation, low quality or other causes.

Apart from Un-interrupted Power Supply (UPS) for IT and security, one form of redundancy is to introduce an additional supply form another source. This may be in the form of a permanent back-up generator. Or if extra down time can be allowed for some time, an option to connect a portable generator may be possible.

Adding redundancy will improve the reliability and availability of the power supply.

The extent of standby generation can vary. It is noted however that the size of the maximum demand is not significant and that the cost difference for a larger generator to support the complete load could be considered. The simpler electrical installation downstream in this case would have no need for load shedding devices and split chassis switchboards. Thus, making the installation less complex.

Proposed

It is proposed to provide standby power to the crematorium located in the chapel basement level (Figure 8). This will allow minimum disturbance to the occupant who do not need any additional disruptions at sensitive time. It will be in the form of a diesel generator within a weatherproof and acoustically treated enclosure located near building. Upon a recent site visit to Rookwood Cemetery, an existing facility, it was apparent that the generator provided back up power to the chapel and catafalque to minimise disturbance during a service.

In addition to the standby power to the chapel, a manual changeover device and connection facility will be provided at the main switchboard to allow a portable generator to be connected and power the entire site (Figure 8). Considering that the power required for the entire site of Wallacia Memorial Park, the cost of providing back up power to the entire site compared to a few areas is insignificant.

It is proposed to provide UPS with batteries to all Security and communications equipment to ensure that the equipment is not effected by intermittent power supply. Intermitted power can cause communications to fail or cause errors. The duration of supply for equipment in the event of the failure or power supply will be 20 minutes. At, which time the proposed standby generator would truly be in operation in the event of a power failure.

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3.1.6 Distribution Topologies

General

A standard or common method of distributing power to each building would be to have a centrally located main switchboard and submain cables running to each building (Figure 7). This is known as a star configuration. The cables would run the reticulation path as outlined in Figure 6. However, there will be instances where multiple cables are running parallel to each other along a path. This is considered wasteful use of copper and costs.

An alternative to the star configuration is to minimise the 'doubling up' of cables running along a given route (Figure 8). This solution is known as a tree configuration. The distribution of cables essentially 'branches' out to each building. This is achieved by a common cable running along the reticulation layout shown in Figure 6 with 'tap-off' at the Chapel ground level. While the size of cables will increase, the overall quantity of copper used in the site is reduced. This solution will half the cost of cable than of the standard method.

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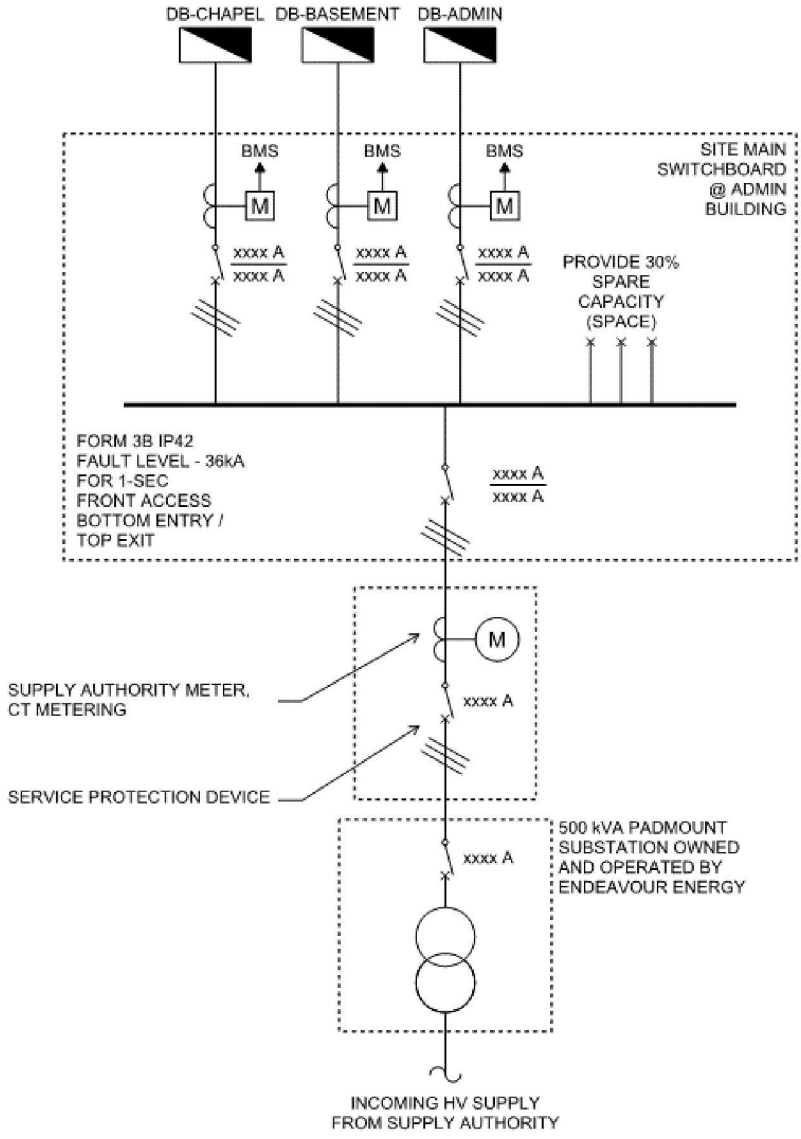

Figure 7 - Single line diagram of Star configuration

Proposed

The proposed distribution for the site will employ the tree configuration as per Figure 8. This will reduce the amount of copper and cost required to power the site.

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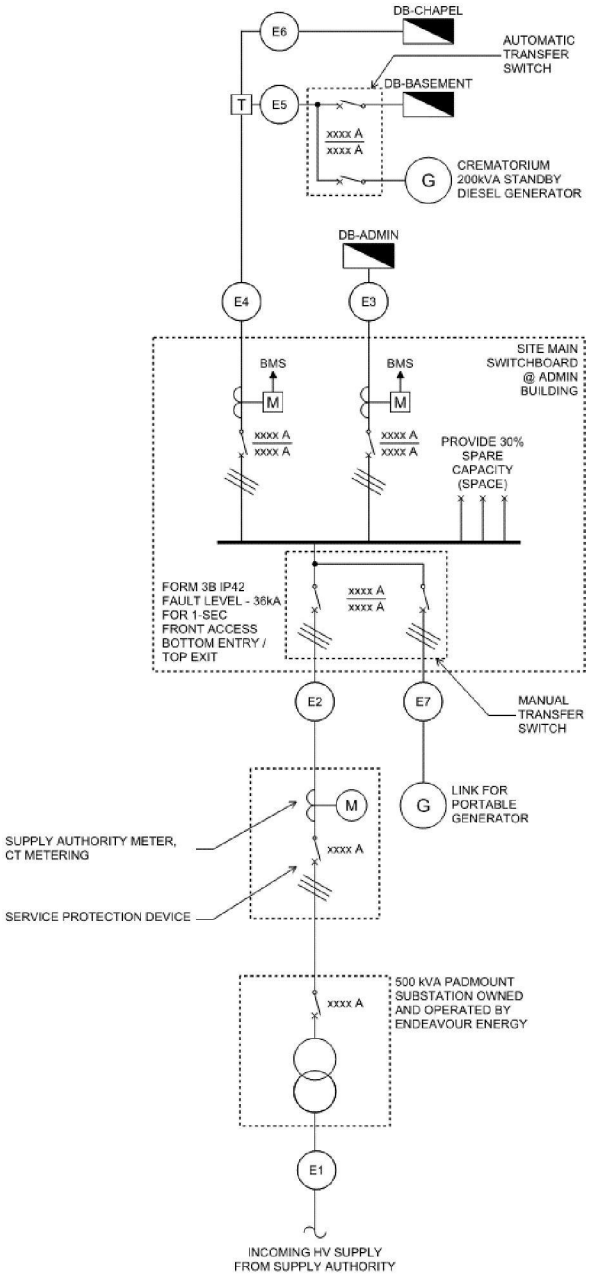

Figure 8 - Single line diagram of Tree configuration with Standby Generator

3.2 Communications

General

Communications services relate to the passive IT equipment to permit the connectivity of various systems such as local networks, WiFi, audio visual, fire, security and telephones. Active equipment is typically provided within a communications rack with various cables running from the racks on reticulation systems to items of equipment in the field. The services are supported and

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controlled by active IT equipment. The diagram in Figure 9 outlines the passive and active components of a communications system.

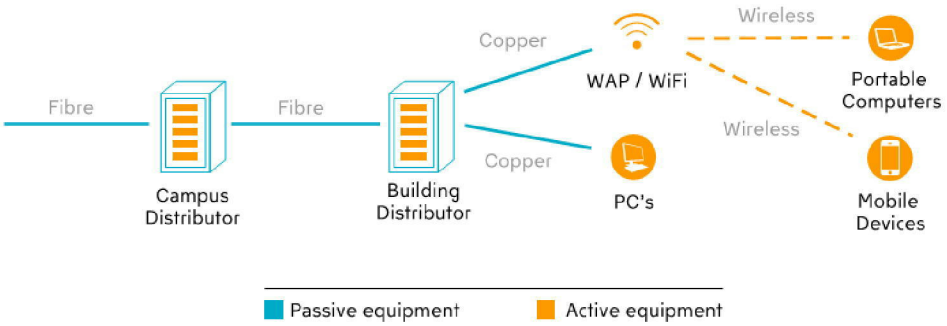

Figure 9 - Communications infrastructure

The aim of the proposed communications services is to allow connectivity, capability and reliability of all required active equipment. The active equipment is to be provided by the client. The services will Also, cater for future possible services.

Standards

System will be provided in accordance with the following standards:

- AS/CA S009 – Installation Requirements for Customer Cabling – Wiring Rules;
- AS/NZS 3080 – Information Technology – Generic cabling for customer premises;
- Relevant NBN standards and guidelines available in their website.

Proposed

A new campus distributor is to be located at the administration building. The campus distributor shall be served via a fibre lead-in cable reticulated to the building in underground conduit from Park Road as shown in Figure 10.

A building distribution rack is to be provided in each building and connected to the campus distributor by fibre optic cables.

All new communication outlets shall be serviced by Cat6A cabling.

Wi-Fi access points will be provided to all buildings to allow coverage to the internal and external areas of each building. The client is to confirm the extent of Wi-Fi coverage to the entire site.

It is anticipated that a Voice over IP (VOIP) will be used for the telephone system. The design will allow for connection of these services.

Help points will be provided to all accessible toilets with integration into the sites communication system to enable quick assistance if required.

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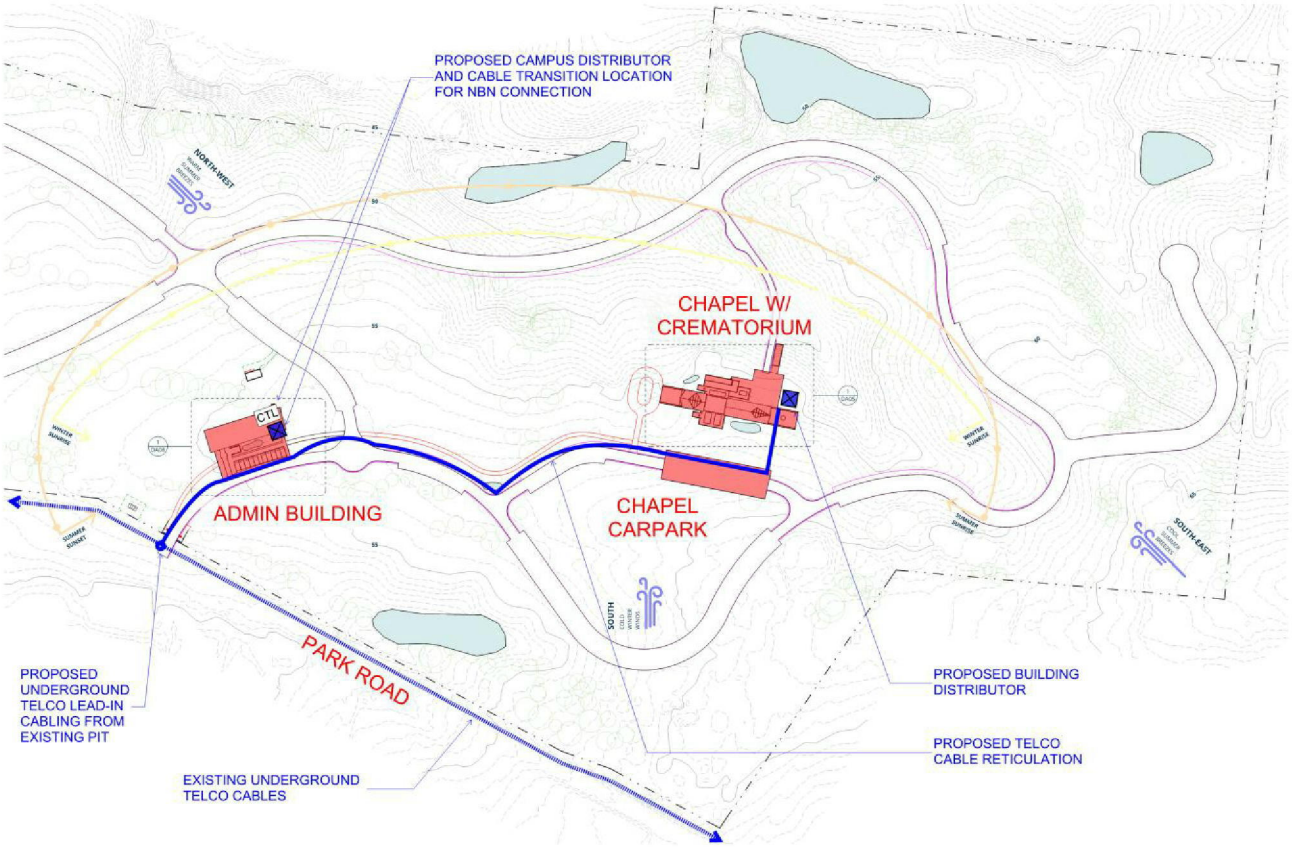

Figure 10 - Communications cable reticulation

3.2.1 National Broadband Network (NBN)

General

NBN is available along Park Road although not within the vicinity via the NBN broadband access network. According the rollout map shown in Figure 11 NBN is planned to be available in the area by the first half of 2019. Until then the telco service lead-in will be arranged with the available telco provider, which is Telstra in this instance.

Proposed

It is proposed to have the lead-in telco service come off the existing Telstra pit via existing underground telco services running along Park Road as shown in Figure 11. Also, space has been allowed for the NBN equipment to facilitate smooth transition in the future.

The final arrangement is subject to Telstra and/or NBN's approval.

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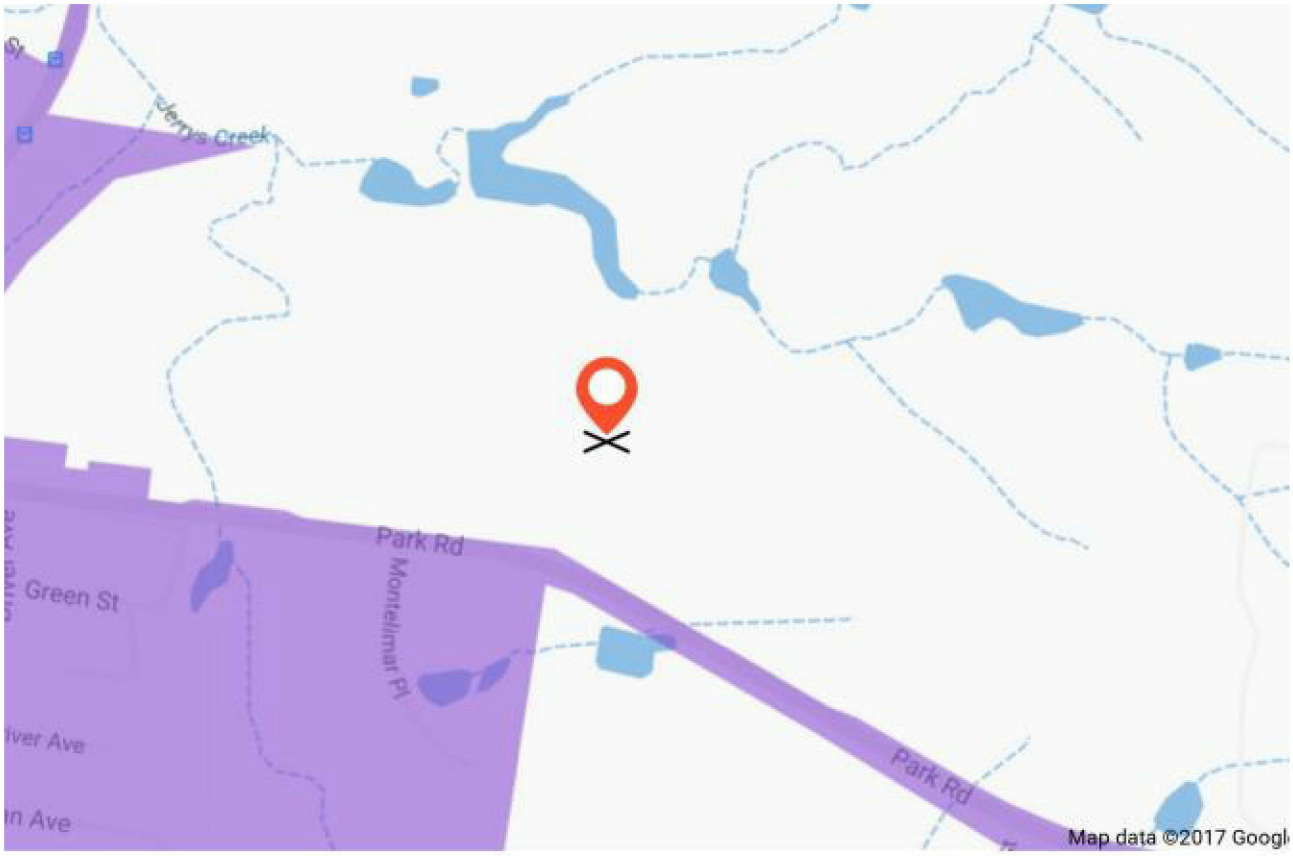

✓ Service available
✓ Other fibre provider
✓ Build commenced

WALLACIA GOLF COURSE LOT 412 13 PARK RD WALLACIA NSW 2745 Australia

Planned | Fixed Wireless

Planned availability: **Jan-Jun 2019***

Figure 11 - NBN service availability