Networks Division

Network Planning & Development Branch

PROJECT PLANNING DEFINITION

(Transmission Scope of Work)

Medical Centre – Establishment New Zone Substation

CAPEX Project No:

T0367820, T0368532, T0342732 & N0348860

DM# 8881718 v7

Issued: December 2011

Contents

1 Project Description

The existing Medical Centre (MC) zone substation is a reduced firm capacity substation located in the Western Terminal load area. The substation consists of three 66/6.6kV transformers and two 6.6kV switchboards that currently supplies Sir Charles Gairdner Hospital (SCGH), Hollywood Hospital and other local customers.

SCGH has advised that it will be undergoing major expansion over the next few years as part of the Government's efforts to rationalise the public health system in Western Australia. To meet the forecast increase in demand, additional substation capacity will be required and SCGH will need to uprate its distribution voltage from 6.6kV to 11kV. The QEII hospital load is expected to increase from 12.5MVA to 27.5MVA by 2020 (with an expected load of 23MVA by 2015).

A Long Term Strategic Option Review (DM# 8381133) was undertaken which identified several problematic conditions in the Western Terminal load area in addition to the identified customer-driven requirements. These included insufficient capacity to support forecast load growth, asset age/condition and network reliability issues.

A new zone substation (MCE) is therefore required to provide secure and reliable 11kV supply to SCGH and provide the additional capacity required to meet SCGH's increasing demand for electricity. Although the primary driver is the customer-driven requirements, the establishment of a new zone substation will also concurrently address the load growth and asset replacement issues in the area.

The location of the proposed new 132-66/11kV MCE substation is the land just north of the existing MC substation as shown in Appendix 6.1.

The new MCE substation is required-in-service ("RIS") by 30 June 2014. This date is driven by the requirements of the new Children's Hospital at SCGH.

To cater for the investment drivers in the Medical Centre area for the long term needs, the following three options were investigated to determine the most efficient solution:

- Option 1: 132-66/11kV new substation with two 66MVA transformers energised at 66/11/11kV initially and ultimately converted to 132kV operation in 2018.
- Option 2: 66/11kV new substation with three 33MVA transformers initially and ultimately converted to 132kV operation by 2018 (the 66/11kV transformers will be replaced with equivalent 132/11kV units).
- Option 3: 132-66/11kV new substation with three 33MVA transformers energised at 66/11kV initially and ultimately converted to 132kV operation in 2018.

Option 3 is the recommended option on the grounds of the technical solution it provides, the lower cost of implementing the option and the residual risk that exists once the option has been implemented.

The purpose of this document is to initiate A2 cost estimates for Option 3.

2 Projects

The proposed network reinforcement in the Medical Centre area will comprise of various stages, and the funding streams will be from both capital expenditure (capacity expansion & customer-funded) and operational expenditure (University substation decommissioning costs). As such, the work has been split into four individual components as follows:

2.1 PART A (Project T0367820): Establish New 132-66/11kV Medical Centre (MCE) Zone Substation

This is a customer driven project to facilitate the SCGH hospital upgrade and involves the construction of the new zone substation at Medical Centre (MCE) and the installation of two 132-66/11kV transformers, two 11kV switchboards and associated line works.

2.2 PART B (Project T0368532): Install Third Transformer & Switchboard at 132-66/11kV Medical Centre (MCE)

This is a capacity expansion driven project and involves the installation of the third 132-66/11kV transformer and associated 11kV switchboard at Medical Centre (MCE) to address underlying load growth and asset replacement issues.

2.3 PART C (Project T0367820): Decommission 66/6.6kV Medical Centre (MC) Zone Substation

This is a capacity expansion driven project that covers the decommissioning of the existing 66/6.6kV Medical Centre (MC) zone substation, required to facilitate the establishment of the new 132-66/11kV Medical Centre (MCE) zone substation.

2.4 PART D (Project T0342732): Decommission 66/6.6kV University (U) Zone Substation

This is a non-recurring operational expenditure project that covers the decommissioning of the existing 66/6.6kV University (U) zone substation, following the transfer of its load to the new 132-66/11kV Medical Centre (MCE) zone substation.

3 Staging of Works

3.1 Existing Arrangement

The existing arrangement of the Medical Centre and surrounding substations is as follows:

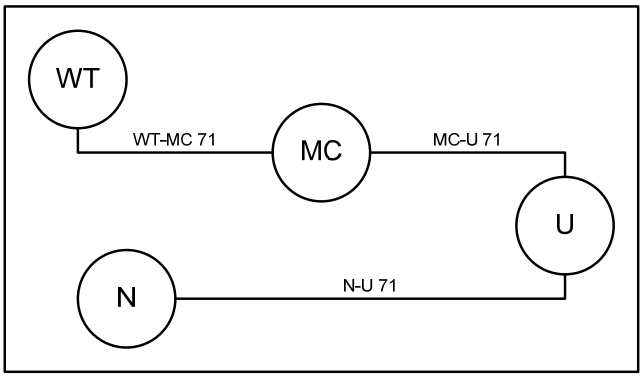


Figure 1: Existing Arrangement

3.2 Establish New Medical Centre Substation

The first stage of the project is to establish the new Medical Centre (MCE) substation adjacent to the existing site (MC) and connect six new 11kV feeders to the QEII hospital, two of which will initially be spare. The MCE substation will be connected to the existing MC by teeing into the existing WT-MC 71 & MC-U 71 lines, forming MCE-WT/MC 71 & MCE-U/MC 71 lines respectively. The new MCE substation is required in service by June 2014.

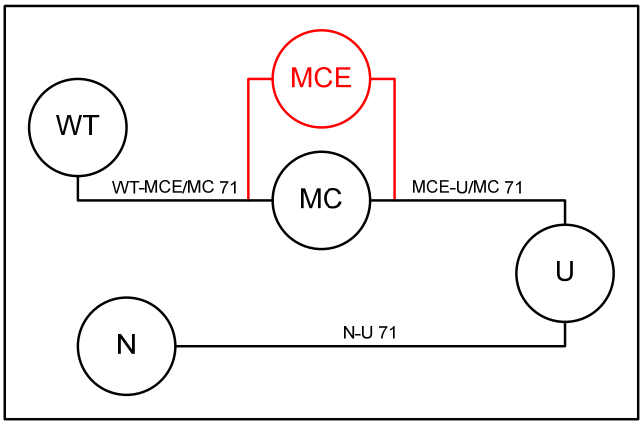


Figure 2: Establish New Medical Centre Substation

3.3 Transfer of Distribution Load

Following the establishment of the new MCE substation in June 2014, the remaining MC feeders and the distribution load at the existing U substation will be progressively transferred over to the new MCE substation commencing July 2014, and is expected to be completed around June 2015 as long as the electrical equipment at SCGH and University of WA are ready for the 11kV conversion.

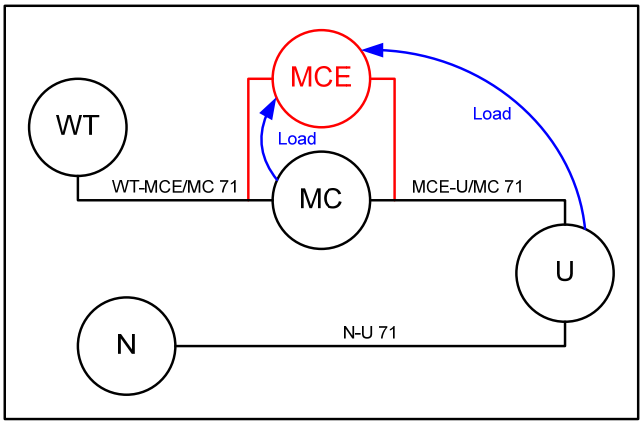


Figure 3: Transfer of Distribution Load

NOTE: The transfer of the U substation distribution load is only possible if the third TX and switchboard (Part B project) has been installed.

3.4 Form WT-MCE 71 Line

Once the existing MC load has been transferred to MCE, the WT-MCE/MC 71 line can be disconnected from the MC substation, forming the WT-MCE 71 line (final arrangement). This stage of work can commence as soon as the distribution load at MC has been offloaded. This may occur before the U distribution load transfer has been completed.

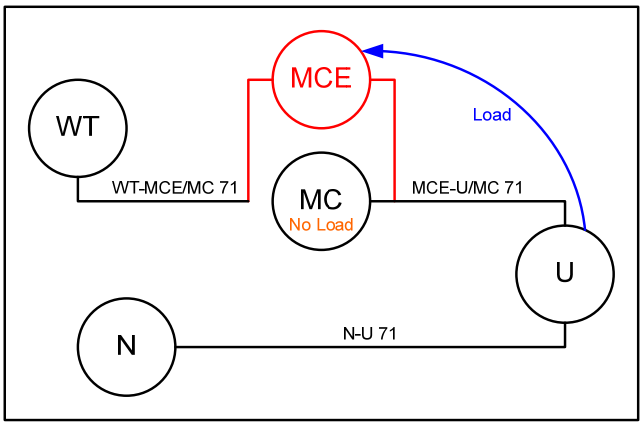


Figure 4: Form WT-MCE 71 Line

3.5 Form the MCE-N 71 Line

Following the transfer of the U substation load to MCE, the MCE-U/MC 71 and N-U 71 lines can be reconfigured to form the new MCE-N 71 line (bypassing the existing U substation). This is expected to take around 6 months to complete, following the transfer of the U distribution load.

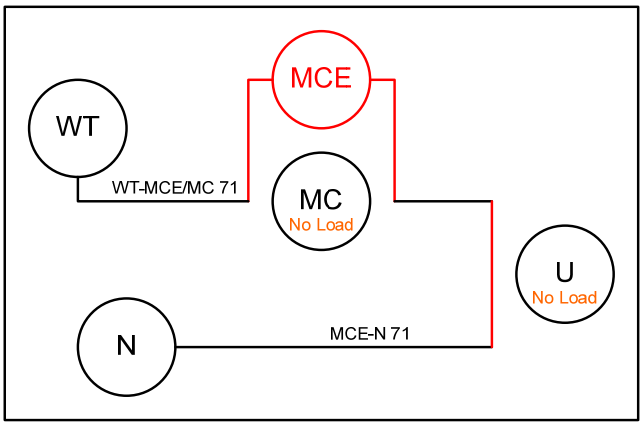


Figure 5: Form the MCE-N 71 Line

There is no system requirement to have an interim stage consisting of the MCE-U 71 & N-U 71 lines (U substation remaining in service) unless the U substation load is not ready for transfer to the MCE substation. However, such an arrangement can be considered if it helps facilitate a more efficient transition to the final MCE-N 71 arrangement. This will be largely based on the practicalities of upgrading the Protection/SCADA/Comms during the transition. The final details are to be clarified with the designers to determine the best approach for this stage.

3.6 Decommissioning MC & U Substations

Following the completion of the MCE-N 71 line, the existing MC & U substations will be decommissioned (i.e. Part C and Part D projects). This is expected to be completed around June 2016, however this is dependent on the customers' plans (both SCGH and UWA) and therefore may change as the project progresses.

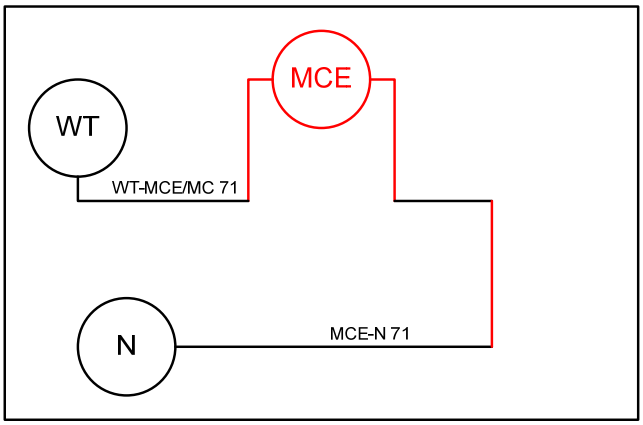


Figure 6: Decommission MC & U Substations

4 Scope

The project covers the design, specification, procurement, contract supervision, construction, installation, project management and commissioning of plant associated with the establishment of the new Medical Centre Zone Substation. It also covers the decommissioning and removal of the existing 66/6.6kV Medical Centre and University zone substations.

The following scope has been grouped based on each of the individual projects. The timing of each of these components is described in Section 3 above.

NOTE: A more detailed breakdown of this scope has been provided by the design community. Refer Appendix 6.6 for these details.

4.1 PART A (Project T0367820): Establish New 132-66/11kV Medical Centre (MCE) Zone Substation

The following work will take place as part of a customer driven project to facilitate the SCGH hospital upgrade. This component of work has a required in service date of 30 June 2014:

- Undertaking requisite site preparation work as required, including surveys of the proposed new substation site, earth works and fencing as required for this stage.
- Construction of the new AIS 132kV-rated busbar for the MCE 132-66/11kV substation. The new AIS 132kV-rated busbar will accommodate two 132kV line circuits and three 132kV transformer circuits as shown in the Appendices.
- Reconfiguration of the existing 66kV WT-MC71 and MC-U71 lines in order to supply 66kV to the new substation (refer Section 3).
- Supply and installation of three single phase surge arrestor and 66kV cable sealing ends at the existing MC substation. Supply and installation of 66kV underground cable from the MC substation to the MCE substation.
- Installation of two new 33MVA, 132-66/11kV MCE transformers and associated transformer bunds as per the Appendices.
- No Rapid Response Spare Transformer (RRST) option is required at MCE.
- Installation of two of Western Power's new, single-busbar, 11kV switchboards as per the Appendices.
- Construction of three switch rooms to accommodate the 11 kV switchboards.
- Construction of one control room to accommodate the SCADA, communications, protection and ancillary secondary equipment.
- Allowance for firewalls between each of the transformers as required.
- Supply and installation of 2 station services transformers.
- Installation of tariff metering equipment for SCGH.
- Installation of two 11kV 5 MVAr capacitor bank sets as shown in Appendices.
- Supply and installation of all associated protection, SCADA and communications facilities, including accommodation for the protection, SCADA and communications equipment and backup batteries.
- Installation of earth grid and lightning masts and associated protection

- Staged conversion of the existing distribution network from 6.6kV to 11kV at Medical Centre substation. This work will be completed under a distribution sponsored project (refer DM# 8395072 for details).
- Installation of transformer noise mitigation and visual screening facilities as necessary.

Note: 132-66/11kV transformers having lower NPC than 66/11kV transformers are opted. Refer DM# 8894089 for the NPC analysis.

4.2 PART B (Project T0368532): Install Third Transformer & Switchboard at 132-66/11kV Medical Centre (MCE)

The following work will take place as part of a capacity expansion driven project to address underlying load growth and asset replacement issues in the Medical Centre area. Currently, this component of work has a required in service date of 30 December 2014:

- Installation of one new 33MVA, 132-66/11kV MCE transformer and associated transformer bund as per the Appendices.
- Installation of one of Western Power's new, single-busbar, 11kV switchboards as per the Appendices.
- Installation of one 11kV 5 MVAr capacitor bank set as shown in Appendices.
- Supply and installation of all associated protection, SCADA and communications facilities, including accommodation for the protection, SCADA and communications equipment and backup batteries.
- Staged conversion of the existing distribution network from 6.6kV to 11kV at University substation. This work will be completed under a distribution sponsored project (refer DM# 8395072 for details).
- Installation of transformer noise mitigation and visual screening facilities as necessary.

4.3 PART C (Project T0367820): Decommission 66/6.6kV Medical Centre (MC) Zone Substation

The following work will take place as part of a capacity expansion project and covers the decommissioning of the existing 66/6.6kV Medical Centre (MC) zone substation. This component of work will commence once all distribution feeders from the existing Medical Centre (MC) substation are cut over to the new Medical Centre (MCE) substation:

- Decommissioning, demolition, and removal of the existing plant and buildings in the 66/6.6kV MC substation and the transmission line entries supplying the decommissioned 66/6.6kV MC substation. This work will follow the transfer of the existing load to the 11kV network.
- Modification of the protection and communications systems of the transmission lines supplying the new 132-66/11kV MCE substation to suit the transmission line rearrangements.
- Rehabilitation of the decommissioned substation site to acceptable standards. The ground/soil conditions of the existing site will need investigating, as this will undoubtedly affect the cost of this part of the works.

- The area for the temporary 66kV cable to MCE substation will be retained until the final conversion to 132kV has been completed (planned for 2018).

4.4 PART D (Project T0342732): Decommission 66/6.6kV University (U) Zone Substation

The following work will take place as part of a non-recurring operational expenditure project that covers the decommissioning of the existing 66/6.6kV University (U) zone substation. This component of work will commence once all distribution feeders from University are cut over to the new Medical Centre (MCE) substation:

- Decommissioning, demolition, and removal of the existing plant and buildings in the 66/6.6kV U substation and the transmission line entries supplying the decommissioned 66/6.6kV U substation. This work will follow the transfer of the existing load to the 11kV network.
- MC-U71 and U-N71 shall be joined together to form a MCE-N71 line at a minimum cost. This includes modification of the protection and communications systems of the transmission lines.
- Rehabilitation of the decommissioned substation site to acceptable standards. The ground/soil conditions of the existing site will need investigating, as this will undoubtedly affect the cost of this part of the works.

4.5 Not Included in the Scope

The following specific items are not included in Western Power's scope of work:

- The installation and commissioning of SCGH's new LV switchboard(s), including the LV cables to supply the switchboard(s).
- All other works, equipment, materials and apparatus that are not expressly or implicitly included in the works described above.
- The distribution feeder connections will be included in the distribution scope of works (Refer DM# 8395072 for details).

4.6 Customer’s Requirements

The following outlines the requirements of the customer:

- The hospital (essential service) requires N-1 supply. Hence the substation must comply with both the Technical Rules (clause 2.5.2.2) and customer requirements.
- The site footprint is not more than 50m wide. [Preferably at most 50m wide x 82m long].
- Intake substations are to be incorporated into the WP 11kV switch rooms.
- Costs associated with the decommissioning of University substation need to be easily separated from the total estimate. The customer should not be charged for any University works.
- The customer’s equipment must be fault rated at 25 kA.
- Supply & routing of communications cabling from customer's site into WPs control building
- Ensure SCADA interface is provided from customer's site into WPs control building
- Six 11 kV feeders are required to meet the customer’s load requirements

5 Additional Project information

5.1 Plant Ratings

Standard plant shall be used where possible. All new primary plant should be designed in accordance with the minimum ratings specified in the Appendix A of the Planning Criteria (DM# 1195855).

The switchgear shall be rated for the standard X/R duty for an 11kV zone substation.

5.2 Project and Operational Responsibilities

The responsibilities of the various roles associated with this project will be defined in the Project Management Plan specific to this project, when it is developed by Transmission Capital Program Management Branch.

5.3 Operational Considerations

The 11 kV A4-A5 and A5-A1 bus couplers will initially be operated normally-open.

The following fault scenarios will cause the bus couplers to change to a normally-closed state:

- A2-A3-A4 busbar fault – close A5-A1 bus coupler
- A1 busbar fault – close A4-A5 bus coupler

The 11kV A1-A2, A2-A3 and A3-A4 bus couplers will be operated normally-closed.

The design of the substation for both primary and secondary equipment must facilitate the parallel operation of the transformers by simply closing the 11kV bus coupler circuit breakers.

The 11kV feeder loads must be distributed evenly across the transformers, such that the loss of any one transformer does not subsequently overload the remaining transformers.

To improve reliability of supply to customers connected to the A5 switchboard, an auto-close switching scheme will be installed at MCE substation (refer section 5.9 for details).

5.4 Future Expansion

It is envisaged that in 2018/19, the MCE substation will be upgraded from 66kV to 132kV. It is therefore important that the substation designs for this project facilitate the upgrade of this substation to 132kV in the future with minimal interruption of supply. Areas impacted by the 66kV to 132kV transition may include (but are not limited to) 132kV clearances, instrument transformers, voltage regulation design, surge arrestors, protection, SCADA alarms).

It should be noted that variations in the region's load growth and availability of real estate might result in changes to the plans described herein.

5.5 Environmental Considerations

Specific environmental requirements to be included in this project are to be advised by ECA branch (Ben Schneider x6378).

Major environmental issues to be considered are:

- Cable transition poles for the incoming 66kV lines;
- Too many transmission structures during the transition period; and
- Rehabilitation of existing 66/6.6kV MC substation.

It is important that the Project Manager, once appointed, consult with ECA to ensure all environmental and land management issues are identified and resolved as soon as possible to ensure project is completed on time.

5.6 Substation Site Considerations

A distribution corridor of 6m is required for Western Power distribution feeders that exit the substation. The proposed location for this is west of the MCE substation down Caladenia Crescent.

A 1m earth grid corridor is required between the MCE fence line and the proposed earth grid.

An overall 5m temporary corridor is required along the East of MCE and MC for the temporary 66kV underground cable.

A 3m corridor along the South of the MCE substation is required for future 132kV cables.

An additional transmission corridor of 6m is required for Western Power 132kV transmission cables that exit the substation. The proposed location for this is west of the MCE substation down Caladenia Crescent, in parallel with the distribution corridor.

5.7 Proposed Private Parallel Generator (PPG) Connection

[redacted]

5.8 Fault Levels

The maximum forecast fault levels at Medical Centre substation are shown in Table 1 below:

Table 1: Medical Centre Maximum Fault Levels

Busbar	*Year*	*3-Phase Fault Level (kA)*	*1-Phase Fault Level (kA)*
132kV	2014	N/A – Operating at 66kV	N/A – Operating at 66kV
	2021	16.70 kA -79.68 deg (Fault contribution from SPK81 is 8.35 kA 100.32 deg. Fault contribution from SPK82 is 8.35kA 100.32 deg.)	17.33 kA -80.4 deg (Fault contribution from SPK81 is 8.26 kA 100.23 deg. Fault contribution from SPK82 is 8.26 kA 100.23 deg.)
66kV	2014	10.10 kA -82.92 deg (Fault contribution from WT is 6.38 kA 94.85 deg. Fault contribution from U is 3.73 kA 100.90 deg.)	11.07 kA -83.26 deg (Fault contribution from WT is 6.06 kA 95.54 deg. Fault contribution from U is 3.57kA 100.56 deg.)
	2021	N/A – Operating at 132kV	N/A – Operating at 132kV
11kV (no TXs in parallel)	2014	7.78 kA -87.93 deg	1.79 kA -82.91 deg
	2021	8.65 kA -88.33 deg	1.82 kA -82.89 deg
11kV (2 TXs in parallel)	2014	13.60kA -87.29 deg	3.50 kA -82.91 deg
	2021	16.51kA -87.93 deg	3.61 kA -82.87 deg
11kV (3 TXs in parallel)	2014	18.12 kA -86.80 deg	5.14 kA -82.85 deg
	2021	23.68 kA -87.57 deg	5.38 kA -82.85 deg

Note: The above fault levels DO NOT include the effect of the proposed new PPGs. Based on the proposed generator impedance of 10.2% Xd" however, the theoretical maximum current that 1 x gas engine-driven generator could contribute to a fault on the 11kV busbar is 1.363kA (neglecting cable impedance). This can be used as a guide until the exact 11kV PPG arrangements have been confirmed.

Initially, the substation is intended to be operated with all 3 TXs in parallel, such that if any one of the TXs were to fail, the remaining TXs would be able to maintain the load with no loss of supply. However, at some point in the future when fault levels become too high, it is intended to change the operating configuration so that only TX1 and TX2 are run in parallel, with TX3 supplying load separately. The switchboards connected to TX1 and TX2 will therefore need to supply all essential loads (such as the QEII hospital). As part of this transition, an auto-close scheme will need to be implemented (refer Section 5.9 below for details).

By managing the 11kV fault levels operationally, the 11kV switchboards do not need to be rated beyond the standard of 25kA. Distribution Planning however will verify the ratings of all equipment connected downstream of the switchboard.

The Project Manager and Design Manager must ensure that the project meets safety compliance.

5.9 Auto-Close Switching Scheme

As the 11kV 3 phase fault levels approach the maximum rating of 25kA, the operating configuration of the new Medical Centre substation will be changed so that only TX1 and TX2 are run in parallel. When this transition occurs, it is proposed to implement a simple auto-close scheme which will operate as follows:

- Normal configuration: TX1 & TX2 operating in parallel (supplying essential load) and TX3 operating separately (supplying non-essential load).
- Fault on TX1 or TX2: If a fault were to occur on either TX1 or TX2, then by virtue of the parallel arrangement, the remaining TX will be able to accommodate the total load with no loss of supply. Depending on the severity of the fault, TX3 may be able to be manually switched in to maintain 2 transformers in parallel.
- Fault on TX3: If a fault were to occur on TX3, then supply would be lost to all customers connected to its associated switchboard. The auto-close scheme is required to detect this loss of supply and initiate the automatic closing of one of the bus section circuit breakers following a 30 seconds delay. As this substation will be built to the IEC 61850 communication standard for the automation of substations, all necessary communications between circuit breakers and Protection/SCADA equipment will already be established throughout the substation, so the implementation of this scheme should only be a software modification.
- Installation of scheme: Although the requirement for separating the TXs will only occur sometime in the future (around 2021), the auto-close scheme should be installed from the initial in service date (June 2014) and feature an enable/disable function that can be operated by the controllers at East Perth. When the fault levels approach an unacceptable limit, the controllers will simply be able to separate the TXs as previously outlined and enable the auto-close scheme with no further modifications required.
- PPG consideration: The auto-close scheme must consider the operation of the PPG at the QEII hospital. Any potential interlocks will need to be included to ensure that auto-closing does not adversely affect the operation of the PPG. This can occur when more definite details of the 11kV PPG connection and operational arrangements are known.

5.10 Project Program

Table 2: Project Milestones

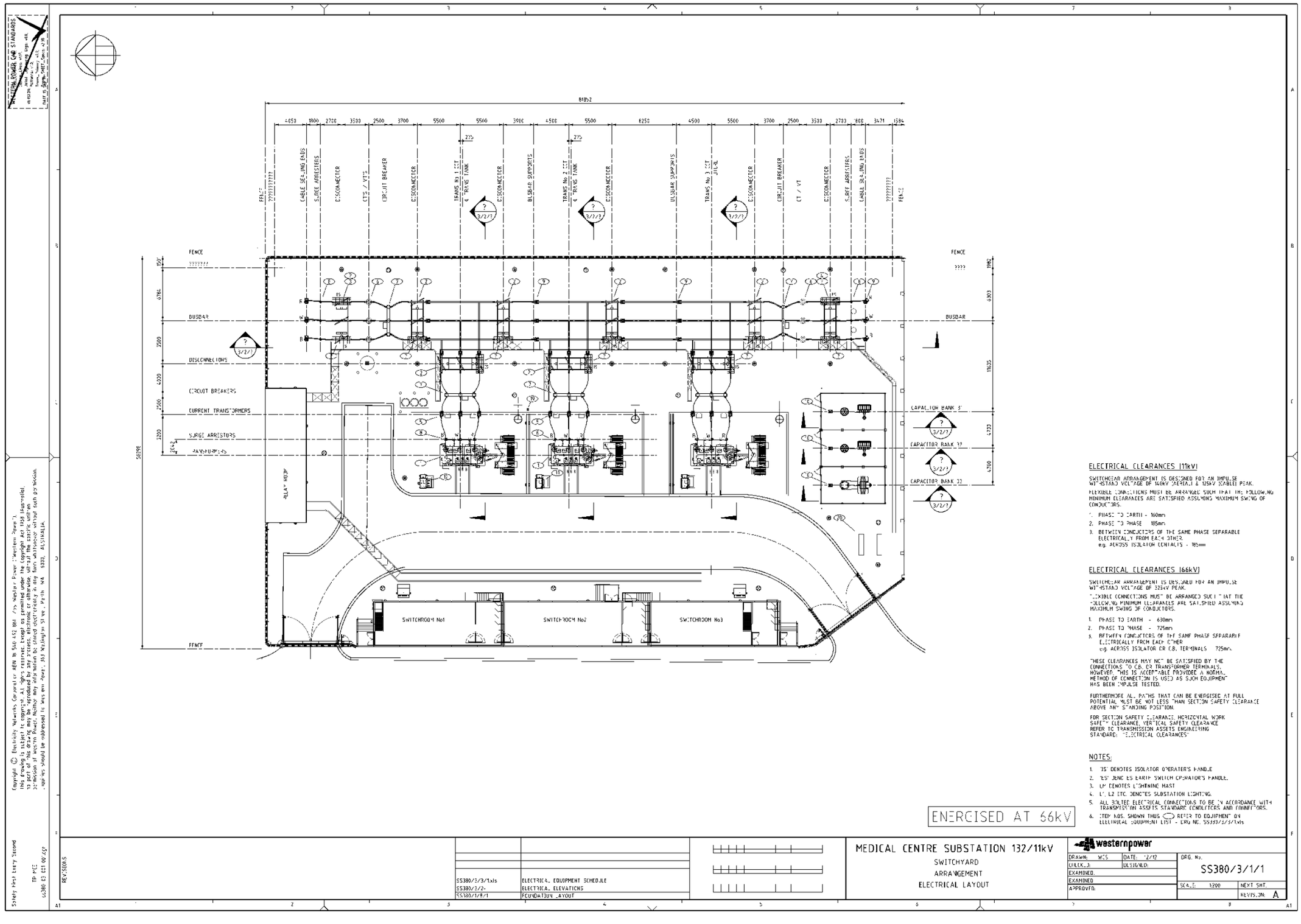
Program	***Milestone***
Detail Estimate	31st July 2012
BC approval date (Board Approved)	25th September 2012
Project start date	1st October 2012
Project Required in Service Date:	30th June 2014

The Work Order number to be used for the A2 estimate is TT025002.

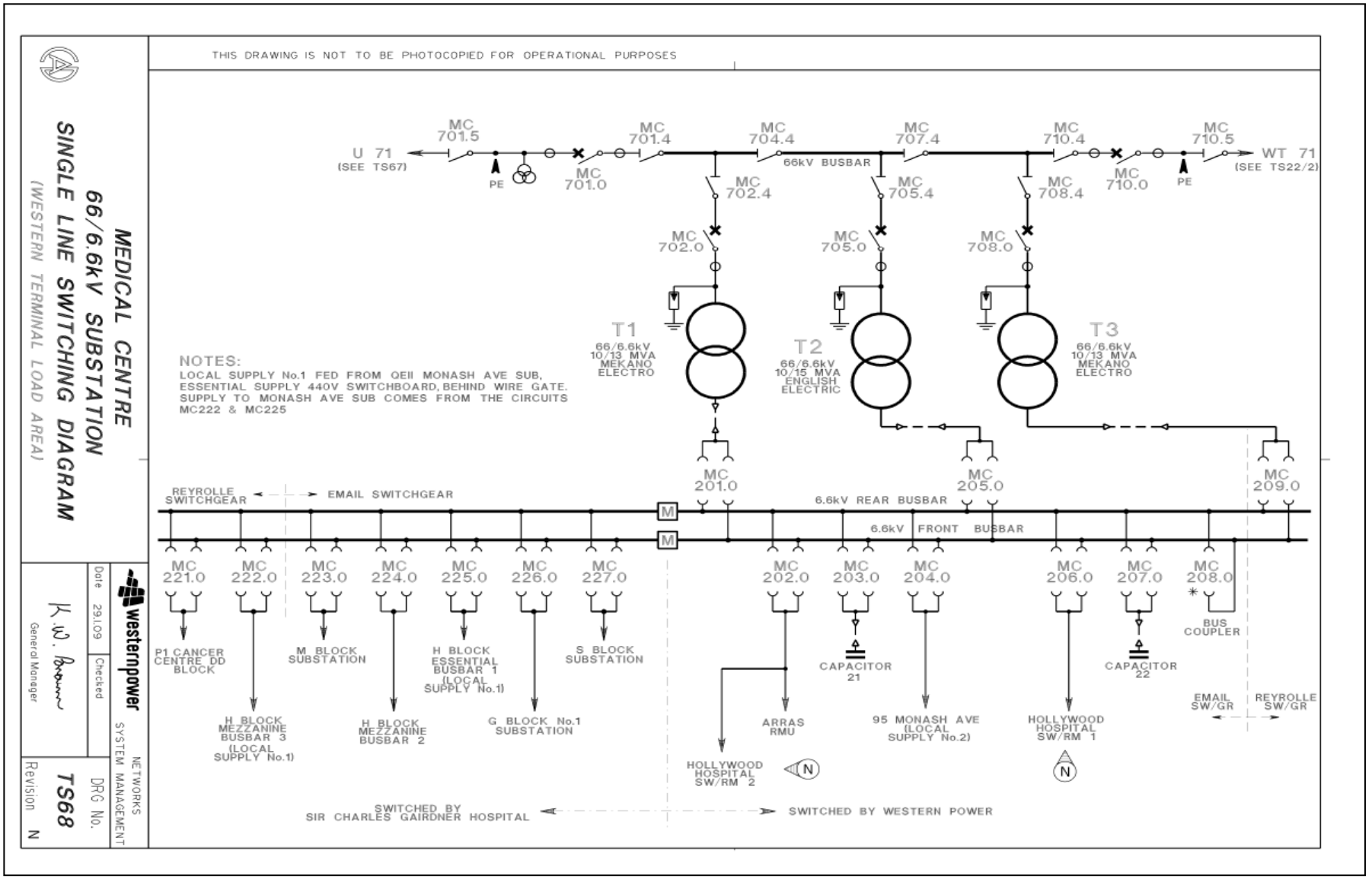
6 Appendix

6.1 Aerial Photo of the Land for Proposed Medical Centre Substation

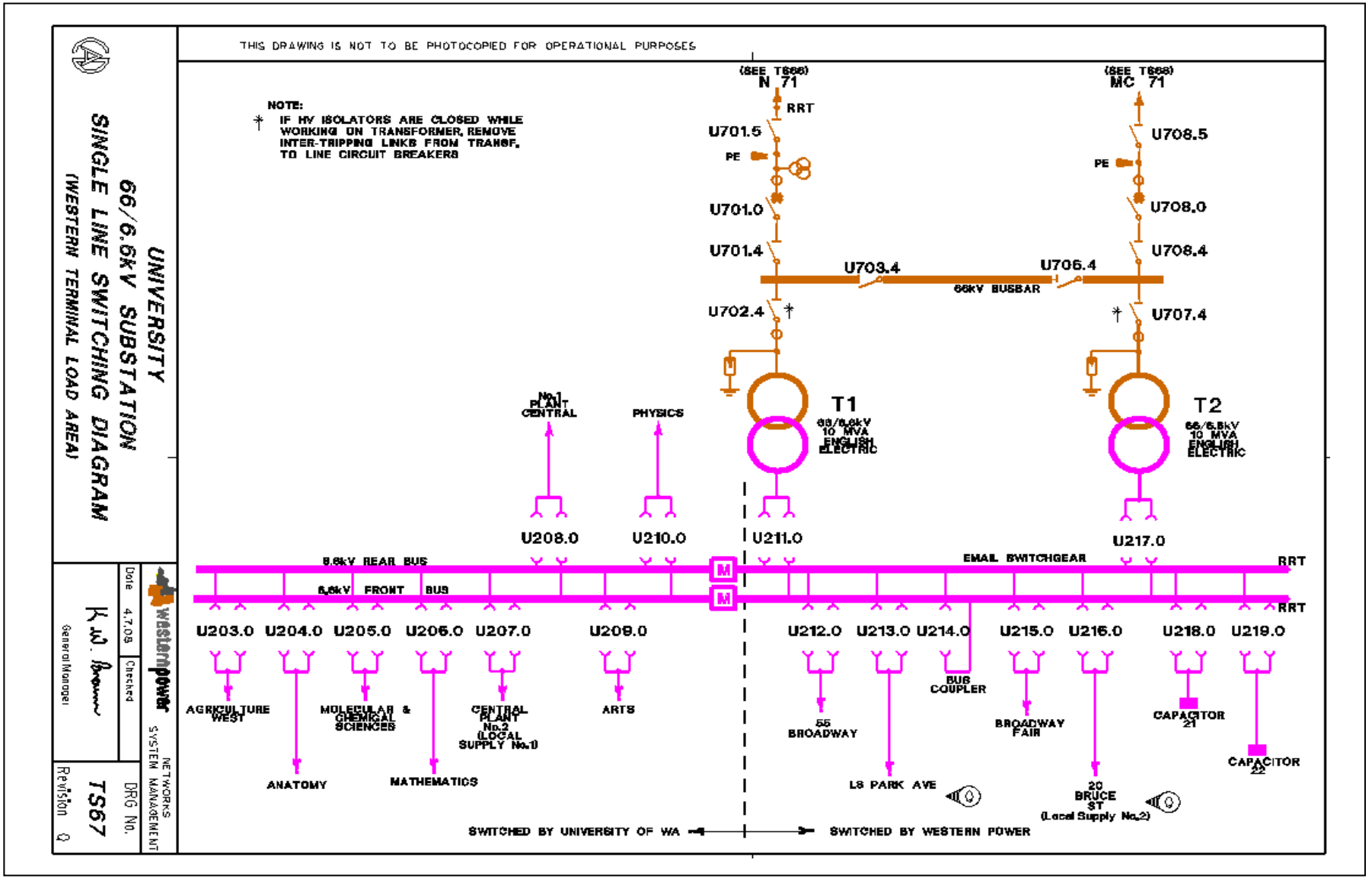
6.2 Proposed Layout for the New Substation at Medical Centre



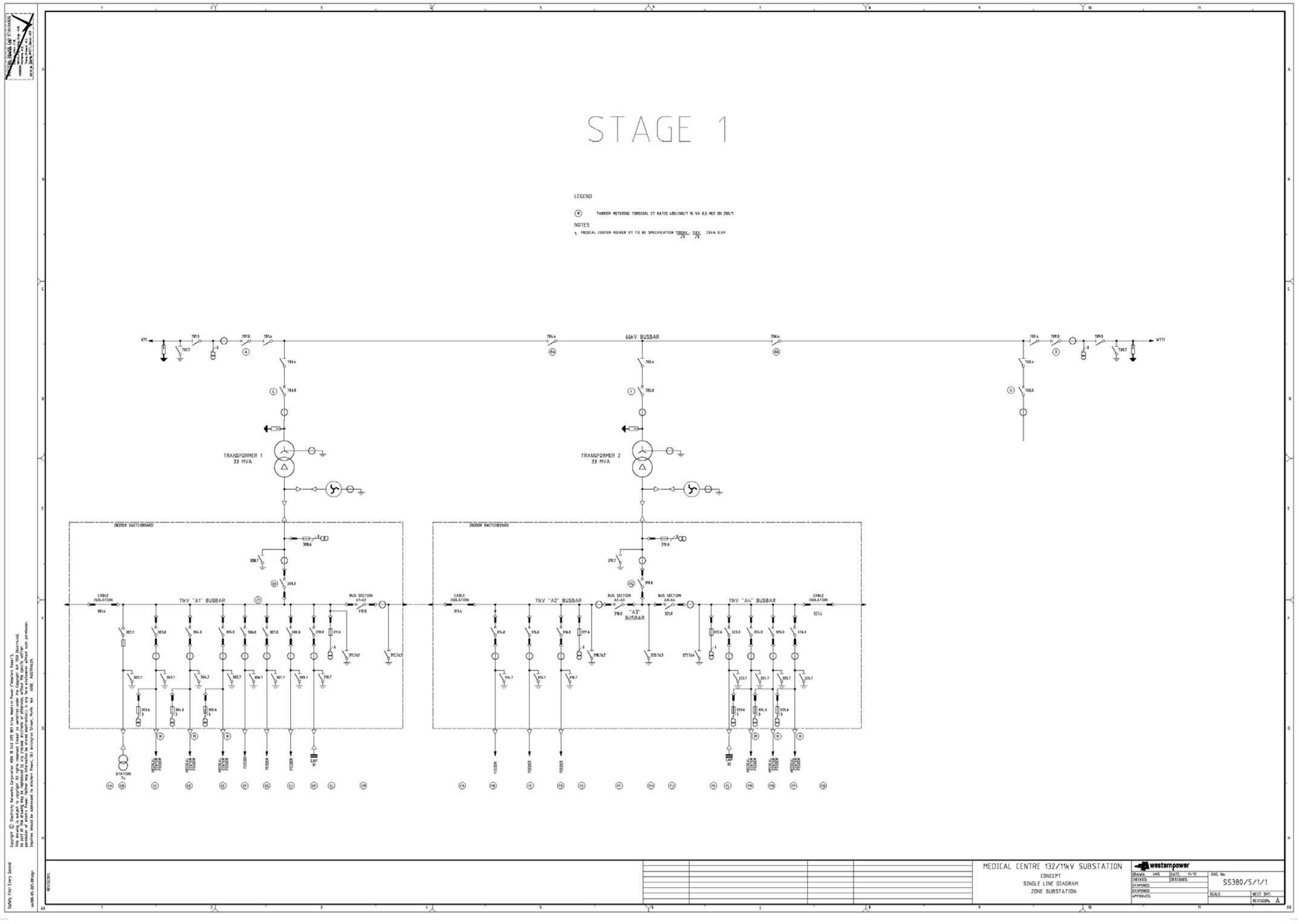
6.3 Single Line Drawing of the Existing Medical Centre 66/6.6kV Substation

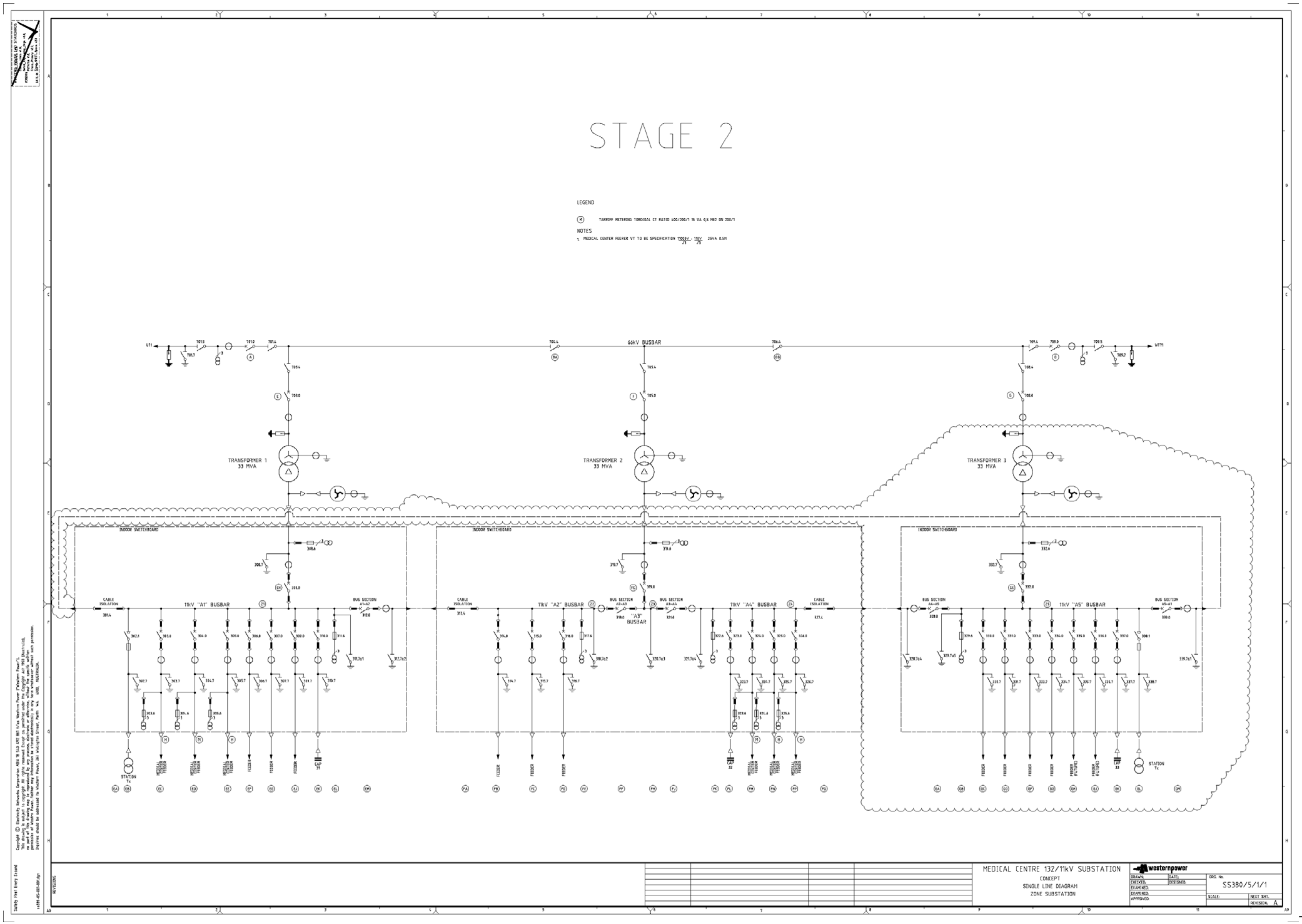


6.4 Single Line Drawing of the Existing University 66/6.6kV Substation



6.5 Medical Centre Substation Proposed Single Line Diagram




STAGE 2
LEGEND
(M) TARRIFF METERING TOROIDAL CT RATIO 400/300/1 15 VA 0,5 ME2 ON 300/1
NOTES
1. MEDICAL CENTER FEERER VT TO BE SPECIFICATION 11000V/√3 : 110V/√3 25VA 0.5M
66kV BUSBAR
TRANSFORMER 1
33 MVA
TRANSFORMER 2
33 MVA
TRANSFORMER 3
33 MVA
INDOOR SWITCHBOARD
11kV "A1" BUSBAR
11kV "A2" BUSBAR
"A3" BUSBAR
11kV "A4" BUSBAR
11kV "A5" BUSBAR
CABLE ISOLATION
BUS SECTION
STATION Tx
FEEDER
CAP
MEDICAL CENTRE 132/11kV SUBSTATION
CONCEPT
SINGLE LINE DIAGRAM
ZONE SUBSTATION
westernpower
DRAWN: DATE:
CHECKED: DESIGNED:
EXAMINED:
EXAMINED:
APPROVED:
DRG. No. SS380/5/1/1
SCALE:
NEXT SHT.
REVISION: A

6.6 Detailed Breakdown of Scope from the Design Community

Site preparation works

There will be a requirement to install a temporary fence around the perimeter of the site to keep it secure prior to construction the actual security fence. This temporary fence will be approximately 2m outside of the boundary so this will make it 54m x 84m in dimension.

The actual fencing used for the site will be standard 2.5m palisade + 0.5m palisade topping for North, West and East Walls.

Allowance for two entries: gates will include a vehicle and personal gate.

A solid 3m tilt panel wall will be on the South wall with a 0.5m palisade topping.

All palisade and solid wall will be painted.

Solid wall sections will require a non-sacrificial anti-graffiti coating.

Earth works

Existing car park surface will be removed; existing drainage in the car park will be removed and reinstated such that it can continue operation.

The site is flat. Assume a 500mm cut and backfill with clean fill. Based on Geotech information; Geotech report - DM# 9060841

Switch rooms

Type: Tilt panel

Dimensions: 15.1m x 7.315, 17.662m x 7.315, 15.1m x 7.315

Cable basement entry

Construction type: Concrete - prefabricated offsite and transported to site for assembly.

(This is 2 panels wide - typical 5.24m width is 1.5 panels wide)

Control/relay room

Type: Tilt panel

Dimensions: 17.18m x 5.24

Basement entry for secondary cables with computer flooring

Construction type: Concrete - prefabricated offsite and transported to site for assembly

Allowance of fire walls

7m firewalls made from Durasteel between (T1 & T2), and between (T2 & T3)

Fire wall: Duralsteel; the attached details are only for acoustic barrier; no details for duralsteel fire wall are available yet. However, for estimate, the fire wall frame shown in SS136/2/A/28/3 with slight modification & duralsteel panels with secondary support need and strip footing shown in SS136/1/A/34/3 can be used.

AcousticBarrierFrame &Footing.pdf

Station service transformers

2 station transformers must be considered.

Transformer bunds

Concrete bunds with a typical 3 tiered concrete oil-water separator.

Tariff metering

Tariff metering is located in the control room building.

Lighting & lightning masts

Lightning masts: 15m (fixed type) / Quantity = 11

Lighting masts: 4m / Quantity = 8

Lights: 1500 W / Quantity = 24 (2 per mast + 2 per building)

Noise mitigation

No noise mitigation is required.

Visual screening

Solid 3m tall prefab panel + 0.5m tall topping wall on the southern side of the substation, buildings on the west side of the sub to be incorporated into the palisade fencing. Palisade fencing is to be painted with a two-part epoxy - pale green (if that makes any difference to cost).

Solid wall sections will require a non-sacrificial anti-graffiti coating.

Layout & cable route

Refer to the easement layout below:

Medical Centre Easement Layouts.pc

Separation of the costs into regulated and unregulated

Regulated costs must be separated from unregulated costs.

Temporary protection panel

Temporary protection panel installation at Nedlands and Protection cubicle at Western Terminal is required.

Cable trench layout

As per the layout given below

WE-9091433vR.DRF

Cable size details

As per the PPD (DM # 8881718), there will be two three phase 66kV underground cable circuits installed with the following lengths:

- 144m between MC-U 71 existing overhead line termination at MC substation to new MCE Substation Cable termination structure

- 91m between WT-MC 71 existing overhead line termination at MC substation to new MCE Substation Cable termination structure.

The cable termination structure with foundation will be design, procure, supply and install by substation including surge arresters at both ends of the cable circuits.

The Lines will provide cable termination at circuit ends and the cable sheath earthing accessories and materials. The 66kV cable along the new zone substation shall be in 3 x 75m ducts.

Quantity of materials is shown in table below:

Item	Description	Quantity
1	66kV 800mm^2 Cu XLPE	840 metres
2	Earth Cable 240mm^2 Cu XLPE (1kV, 25kA/1 sec)	320 metres
3	Earth Sheath Cable 240mm^2 Cu (15kV, 1 core)	12 metres
4	Heat Shrink Termination and fittings	6
5	Porcelain Termination and fittings	6
6	Link Box (1 Ph)	6
7	SVL Link Box (1 Ph)	6
8	Cable Cleats	12
9	Ducts (OD: 160 mm, ID: 155 mm)	3 x 75 metres
10	Identification plate – WT-MCE	54

Soil remediation

Remediation of the existing Medical Centre and University substation site will be to the commercial Department of Environment and Conservation classification. The remediation costs will be part of the ECA estimate.