

# Chapter 3: Project Description

**Project Description**

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### 3. Project Description

This chapter provides details of the projects' proposed wind turbines and associated infrastructure. The proposed infrastructure is listed and dimensions provided. Each of the construction, operational and decommissioning phases are also discussed.

#### 3.1 Wind Farm and Associated Infrastructure

The proposed wind farm site is located approximately 4km east of Keyneton, 6km north west of Cambrai and 8km west of Sedan. The proposed development extends north/south along the escarpment of the Eastern Mount Lofty Ranges for approximately 15 kilometres, inclusive of an approximate "gap" of 6km, forming two distinct clusters of wind turbines. The site consists of cleared grazing land with scattered pockets of remnant vegetation. Native vegetation on site is predominantly located on the lower slopes to the west of the ridgeline. The main land use within the site is sheep grazing.

This Development Application is for a maximum of 42 wind turbines. The proposed turbine layout and project footprint are shown in Figures 1.2 and 1.3.

The components of the proposed wind farm development are listed in Table 3.1. Figures 3.1 to 3.6 illustrate the proposed dimensions, elevations and layouts for the project's key elements.

**Table 3.1: Wind Farm Works and Associated Infrastructure**

Infrastructure	Description	Notes
<b>Project Layout</b>	<ul style="list-style-type: none"> <li>42 turbines, across two clusters the northern cluster of 22, and a southern cluster of 20</li> </ul>	<ul style="list-style-type: none"> <li>Total Site Area: 5,256 hectares, total project footprint. Approx 48 hectares (Approx 0.92% of site area)</li> </ul>
<b>Wind turbines dimensions (maximum)</b>	<ul style="list-style-type: none"> <li>Maximum tip height 145.5m</li> <li>Foundations (approx 6m diameter at surface, 14m sub-surface diameter)</li> </ul>	<ul style="list-style-type: none"> <li>Pacific Hydro is applying for a maximum tip height of 145.5m</li> <li>For the purposes of those assessments that are specific about the turbine configuration the following indicative dimensions have been adopted: <ul style="list-style-type: none"> <li>– Landscape and Visual Assessment / Shadow Flicker Model, 95m hub height, 50.5m blade length = 145.5m tip height)</li> <li>– Noise assessment - based on a RePower MM92 (98m tower, 46.25 metres blades = 144.25m tip height).</li> <li>– In practice, the final turbine</li> </ul> </li> </ul>

Infrastructure	Description	Notes
		<p>selection occurs at the detailed design stage (i.e. well after approval).</p>
<p><b>Hardstands (maximum area)</b></p>	<ul style="list-style-type: none"> <li>Up to a maximum area of 1700m<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Required at each turbine base. Dependant on turbine supplier, the exact size and shape can differ and uniform rectangle hard stands are not always utilised. 1,700m<sup>2</sup> is the maximum hardstand area.</li> </ul>
<p><b>External Electrical Transformers</b></p>	<ul style="list-style-type: none"> <li>Approximate Dimensions <ul style="list-style-type: none"> <li>Length – Approx 4m</li> <li>Width – Approx 2m</li> <li>Height – Approx 2m</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Pacific Hydro typically preferred turbines require an external electrical transformer or 'kiosk' adjacent to the turbine tower base</li> </ul>
<p><b>On-site access tracks</b></p>	<ul style="list-style-type: none"> <li>Main Access tracks – Approx 38.6km</li> <li>Width – between 5m and 10m (not including underground cabling)</li> <li>Secondary access track - Approx 6.2km</li> <li>Width of Secondary Access track – 5m</li> </ul>	<ul style="list-style-type: none"> <li>Where possible access tracks will utilise/improve existing farm tracks. The majority of access tracks (i.e. track surface) will be approx 5m in width, with shoulders adjacent. Wider tracks of up to 10m width will only be necessary on main arterial access tracks onto site in order to facilitate safe passing and two way movement during construction.</li> <li>Track material will be sourced from suitable on-site spoil or from a suitable local quarry.</li> <li>The 33kV cable trench is typically adjacent to the track shoulder.</li> <li>The secondary access track is proposed between the vehicle clusters. Its primary intent is for lighter vehicle transport during operations and it will only be used during construction to the extent required for overhead line construction (i.e. no turbine transport or turbine construction vehicles).</li> </ul>
<p><b>Underground (UG) 33kV cabling</b></p>	<ul style="list-style-type: none"> <li>Length - approximately 42km</li> <li>Depth – minimum 900mm coverage over top of cable, total depth 1.2m</li> <li>Trench width – Minimum 450mm</li> </ul>	<ul style="list-style-type: none"> <li>Underground 33kV cabling collects electricity between turbines. The majority of trench will run immediately adjacent to access</li> </ul>

Infrastructure	Description	Notes
	(for 1 cable and communications fibres), wider for multiple cables.	tracks
<b>Overhead Line (OHL)</b>	<ul style="list-style-type: none"> <li>• Grid Connection will occur on-site (see above)</li> <li>• Approximately 6.1km overhead transmission line will connect the two clusters of turbine (specifically between the main sub-station in the northern cluster and the southern cluster. It is expected the line will consist of 2 circuits (6 conductors) on a single pole line with steel poles approximately 20-25m high.</li> <li>• A short section (approx 690m) of the transmission line connecting the two clusters will be undergrounded (where the transmission line is required to cross under the existing 275kV transmission line and adjacent to Keyneton Estate Road dwellings). This 690m is included in the underground cable estimate of 42km noted above.</li> </ul>	<ul style="list-style-type: none"> <li>• Electricity from turbines in the southern cluster will be collected on 33kV underground cables. Transition structures are required at any overhead to UG (or vice versa) conversion. An OHL / UG transition is proposed at the northern end of the southern cluster adjacent to Pine Hut Road. At this transition point, two steel poles and cable termination structures are proposed.</li> </ul>
<b>Sub-station / Switching Yard: 33kV / 275kV Grid Connection</b>	<ul style="list-style-type: none"> <li>• One permanent 33kV / 275kV grid connection within approximate dimensions of 80m x 285m, including: <ul style="list-style-type: none"> <li>– Substation area of approx 75m x 120m including transformers and switchgear, control building, staff amenities, workshop, storage, etc)</li> <li>– Switching Station (required by the Electricity Utility) of approx. 75m x 165m.</li> <li>– Maximum height of 22.625m (for gantry).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Sub-station is located within the northern cluster, approximately 600-700m north of Angaston – Sedan Road, adjacent to the access track between turbines 18 and 20 and near the existing 275kV transmission line.</li> <li>• Control building (approx 36.1m length x 7.9m width x 6.35m height)</li> </ul>
<b>Meteorological masts</b>	<ul style="list-style-type: none"> <li>• Up to three (3) permanent meteorological masts will be installed to hub height</li> <li>• Up to five (5) temporary meteorological masts of between 80m and 100m height are</li> </ul>	<ul style="list-style-type: none"> <li>• The new temporary masts will be installed approximately 6 months prior to the commencement of construction of turbines and then dismantled / removed to allow turbine construction at those locations. The two (2) existing 50m</li> </ul>

Infrastructure	Description	Notes
	<p>proposed.</p> <p>Note: Two (2) existing 50m masts are currently installed on the site as indicated in Figures 1.2 and 1.3</p>	<p>masts will remain for approximately 6-12 months from the installation of the new temporary masts and will then be dismantled / removed.</p>
<p><b>Three temporary construction compounds</b></p>	<ul style="list-style-type: none"> <li>• Within an area of approximately 50m x 50m, the temporary compounds may include the following:               <ul style="list-style-type: none"> <li>– Site office and staff facilities</li> <li>– Car park</li> <li>– Concrete batching plant (unless batched off-site)</li> <li>– Turbine lay-down / storage areas</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Concrete batching may be on or off site (subject to construction contractor's methodology)</li> <li>• Size of laydown areas determined by the turbine manufacturer's installation methodology</li> </ul>
<p><b>Road Improvements</b></p>	<ul style="list-style-type: none"> <li>• Access to the site for all over-dimensional vehicles will initially be via the Sturt Highway (see Figure10.1):               <ul style="list-style-type: none"> <li>– To the northern half of the site: departing the Sturt Highway approx 20km to the west of Truro onto the defined heavy vehicle route to Sedan (Halfway House Road and then Blanchetown Road) and then right onto Angaston – Sedan Road (also referred to as Sedan Hill Road) and head west to the site</li> <li>– To the southern half of the site: departing the Sturt Highway at Stockwell onto Duck Ponds Rd, then following the defined heavy vehicle route around the west and south of the Angaston township ( Stockwell Road - Crennis Mine Road – Long Gully Road – Hurns Road) and then right onto Angaston – Eden Valley Road, through the Eden Valley township and then onto site along North</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The preferred routes have been identified following consultation with Mid-Murray and Barossa Councils and consultation / site inspection with DPTI; however their use remains subject to their formal consent / approval.</li> <li>• The existing Pine Hut Road passes through the southern cluster. Pine Hut Road will only be used by over-dimensional vehicles exiting the site (thus retracted vehicles) and those crossing from the main access point to turbine 23.</li> <li>• Where possible access points to site will utilise and/or improve existing access points to site.</li> </ul>

Infrastructure	Description	Notes
	<p>Rhine and Med Wrights Road.</p> <ul style="list-style-type: none"> <li>– Provision of new access points to site from Angaston – Sedan Road, Med Wrights Road and Pine Hut Roads respectively.</li> <li>• Some road improvements will be necessary at various points. These included the following: <ul style="list-style-type: none"> <li>– One DPTI road sign at Cambri will need to be sleeved to enable temporary removal for o/d vehicle movements.</li> <li>– Overhead cables will need to be temporarily relocated (majority within the main street of Eden Valley).</li> <li>– Reconstruction of Med Wrights Road from the intersection of Jutland Road to the access point of the Wind Farm – approx one km.</li> <li>– Miscellaneous and minor tree trimming may be required.</li> </ul> </li> </ul>	
<b>Vegetation Removal</b>	<ul style="list-style-type: none"> <li>• Minimum extent of vegetation removal as necessary.</li> </ul>	

### 3.1.1 Wind Farm Footprint

The site covers a total area of 5,256 hectares, of which approximately 48 hectares (0.92% of the total site area) will be used in the final project footprint. Table 3.2 estimates the area of land associated with each of the wind farm components.

Table 3.2: Development Footprint\*

Location	Estimated length (m)	Estimated area (m <sup>2</sup> )
<b>Tower base / foundations</b>	NA	6,468
<b>Main access tracks (and adjacent cabling)</b>	38,621	310,000
<b>Additional Cabling</b>	3,000	3,000
<b>Secondary Access Track</b>	6,205	37,230
<b>Overhead Line</b>	6,057	30,285
<b>UG Cable (connector only)</b>	686	1,372
<b>Hardstands</b>	NA	71,400

Substation / Switching Yard	NA	22,800
<b>Total</b>		<b>482,555</b>

\*Excludes temporary construction compounds

### 3.1.2 Turbines

The wind farm will comprise a maximum of 42 turbines with an estimated capacity of 105MW. The actual turbine model has not yet been selected, as this can only be finalised following planning approval and a commercial competitive tendering process. The final turbine model selected will have a maximum height of 145.5m above ground level.

Each turbine will consist of:

- **Tip Height** - maximum height to tip of 145.5m.
- **Tower** – tapered cylindrical towers.
- **Blades** - three blades

*In order to maximise the turbine models available for selection the tower and blade lengths are not being specified within this application however the total height will be a maximum of 145.5m. For the purposes of those assessments that need to be specific about the turbine configuration the following indicative dimensions have been adopted: (Landscape and Visual Assessment / Shadow Flicker Model, 95m hub height, 50.5m blade length = 145.5m tip height; Noise assessment - based on a RePower MM92 (98m tower, 46.25 metres blades = 144.25m tip height)*

- **Nacelle** – the nacelle is located on top of the tower and generally houses the gearbox, turbine and control systems.
- **Foundation** - Mass concrete foundations and/or rock anchors support the turbines depending on the ground conditions encountered at each turbine location. The foundation will have an above surface footprint of approximately 6m in diameter.
- **Electrical Transformer** – housed at the base of each tower with approximate dimensions of 4m length, 2m width and height.

This application is being made for turbines of a maximum height to tip of 145.5m in order to allow Pacific Hydro to consider a range of manufacturers during the tender process. Indicative turbine dimensions within this total height are shown in Figure 3.1.

#### Tower and Blades

Turbine blades will be made from fibre-reinforced epoxy and the tower made from steel. The turbine colour will be off-white, colour code RAL7035. This is the standard colour used for all wind farms in South Australia.

The turbines are computer controlled to ensure that each turbine faces directly into the wind at all times and will operate in wind speeds between approximately 3 and 24 metres per second. Depending on the model at wind speeds greater than about 20 - 25m/s (72-90 km/per hour), the turbines will shut down for self protection.

#### Turbine Foundation

Each foundation will comprise a reinforced concrete base foundation with underground dimensions of approximately 14m diameter x 3.5m deep. The surface footprint of the turbine foundation will be approximately 6m in diameter once constructed.



An embedded ring or holding down bolts will be cast into the concrete foundation to fix the tower to the foundation. Conduits enabling electrical and communication cable connections will also be cast in the foundations. An indicative turbine foundation cross section drawing for a reinforced concrete base foundation is shown in Figure 3.2.

If rock-anchoring can be used, a drilling rig will enable installation of deep rock anchors at each tower base. This technique significantly reduces water consumption and multiple truck movements by substantially reducing the volume of concrete required. The foundation depth may be reduced to approximately 1-2m and the diameter reduced to 8m if rock anchors can be used. The use and disposal (if any) of excavated material is discussed in Section 3.2.

Turbines are designed to the International Standard IEC61400-1 which includes obligations for lightning protection and seismic loads. Pacific Hydro requires turbine suppliers to provide third party certification of the turbine model's compliance with this International Standard.

### **Transformer**

A transformer will be required at each turbine location in order to step up the electricity from low to medium voltage. The transformer will be housed adjacent to the turbine within a kiosk. The dimensions of an external kiosk are approximately 4m (length) x 2m (width) x 2m (height).

The step-up transformers are enclosed in metal framed kiosks typically painted in green or light brown with a matt finish. Stock fencing as illustrated in Photo 3.1 below may also be provided where required.



**Photo 3.1: Typical external transformer kiosk**

### **3.1.3 Hardstands**

Each turbine will require a hardstand, measuring up to a maximum of 1,700m<sup>2</sup>, to be located directly adjacent to the foundation. The configuration of the hardstand is dependent on the turbine supplier and model. The hardstand provides a stable base from which the crane can lift the turbine

components during erection and any subsequent maintenance. This area will also be used as a hardstand for the turbine sections prior to assembly and erection. Construction of the crane pad will involve stripping of the top soil, and they will be constructed using the same material as the site access tracks and will be retained after construction to facilitate any necessary maintenance or repair.

#### **3.1.4 Access Tracks**

On-site access tracks will be constructed to enable construction and operational vehicles to access each of the turbines. Wherever possible, access tracks will follow existing farm tracks and the existing contours and features of the landscape thus minimising the need for substantive earthworks and maximising the retention of productive land. Wherever possible, the tracks will also be designed to avoid cultural heritage sites. The access tracks will have minimal impacts on any native vegetation. At present the only areas where native vegetation removal is foreseen is to construct new access / egress points along Pine Hut Road. It is intended that the access tracks between clusters and within the site's north-western section will be designed / micro-sited to avoid impacts on native vegetation, in particular large trees.

Approximately 39km of site tracks will be required in order to access the turbines. The tracks will generally be 5m wide with a verge of up to 1m on each side (i.e. 7m total width) and the underground cable route located immediately adjacent. In some locations it will be necessary to increase the width in order to accommodate widening at bends and passing places.

Suitable material for track construction will be sourced either on site or from a local quarry. Track construction will involve the stripping back of the existing track surface and/or overlying top-soil and vegetation to suitable substrate and then surfacing materials laid to the required specification. Excavated topsoils will either be spread alongside tracks and graded to the existing levels or stockpiled for use throughout the site for rehabilitation works. Tracks will incorporate suitable drainage and sediment control measures. An indicative access track cross section is shown in Figure 3.3.

At present, the only areas where native vegetation removal is foreseen is to construct new access / egress points along Pine Hut Road. The majority of the plateau is devoid of native vegetation. In the limited areas of site where access tracks are proposed in areas defined as native vegetation associations access tracks will be designed / micro-sited to avoid native vegetation impacts



**Photo 3.2: Typical access track post construction (from Cape Nelson South Wind Farm)**

### **3.1.5 Underground Cabling**

Approximately 42km of medium voltage reticulation cabling will be installed on site in underground trenches. The underground cable trenches will predominantly run adjacent to access tracks and be located beside the access track wherever possible in order to minimise site disturbance.

The trenches will be excavated to a depth of around 1m using a standard backhoe excavator or specialised cable layer. Following cable laying, the trenches will be backfilled with the original excavated material and the topsoil reinstated.

Turbines in the project's northern cluster will be directly connected to the on-site sub-station by underground cabling. The project's southern cluster will collect the electricity generated by each turbine before transitioning to the 33kV overhead line which will transmit the electricity to the sub-station in the site's north (See Section 3.1.6 below)

### **3.1.6 Transmission Line between Clusters**

Approximately 6.7km transmission line will connect the two clusters of turbine (specifically between the main sub-station in the northern cluster and the southern cluster). This will include approximately 6.1km of overhead line. It is expected the line will consist of 2 circuits (6 conductors) on steel poles approximately 20-25m high. Subject to alignment, site conditions and detailed design parameters, poles would be spaced between 100-250m apart (estimated average spacing of 180m).

A short section (approx 690m) of the transmission line connecting the two clusters will be undergrounded (where the transmission line is required to cross under the existing 275kV transmission line and adjacent to Keyneton Estate Road dwellings). This 690m is included in the underground cable estimate of 42km noted above in Section 3.1.5.

### **3.1.7 Substation / Switching Yard and Control Building**

The underground electrical reticulation system will connect the wind turbines to the on-site substation, where the generated electricity will be collected and transformed to a voltage level suitable for connection to the electricity grid. The proposed substation location is shown on Figures 1.2 and 1.3. The proposed substation location is approximately 600-700m north of Angaston-Sedan Road adjacent to the access track between turbines 18 and 20 and near to the existing 275kV transmission line. This area is within a lower lying area to reduce visibility.

It is anticipated that the substation compound will be a maximum of 80m x 285m and comprise:

- One main transformer and outdoor switchgear for connection to an overhead line and the existing 275kV transmission line that traverses the site.
- One control building to house equipment required for operation and control of the wind farm (approximately 33.7m length x 7.9m width x 6.35m height)
- Gantries at a height of 22.625m will be required to connect the substation to the existing 275kV transmission line
- Lightning protection poles to 21m height
- Workshop, storeroom, staff facilities and small carparking area.

The series of drawings provided as Figures 3.4 and 3.5 are provided to give an indication of the substations layout and elevation

The supporting structures of outdoor equipment installed in a substation have a matt finish in neutral colours such as grey. Some components of the substation such as the gantry and lightning protection mast will retain a galvanised steel finish. External security fences are in mesh galvanised steel. The control building and storage room are in colourbond steel with colours chosen to blend in with the surrounding environment, typically of a muted green tone.

The substation will include basic amenity facilities (including toilet and sink) for operational staff.

It is proposed that the screen planting with native species will be undertaken around the majority of the perimeter of the substation / switching yard, to the extent allowed whilst allowing vehicular access to the sub-station and maintaining necessary safety clearances.

The sub-station and switching yard are required to meet all relevant Australian standards with respect lightning protection and seismic loads.

### **3.1.8 Services**

General personnel amenities, comprising of toilets and basins (as required), will be provided on site within the substation control room. It is likely that a septic tank discharging to (depending on the ground conditions) soakaway will be provided. An assessment of the porosity capabilities of the ground would be carried out prior to installation and an application made to Mid Murray Council

in accordance with the requirements of "Information Sheet 24 Guidelines to Installing a Septic Tanks and Holding Tank".

Rainwater is proposed to be collected and tanked within the sub-station for water supply.

The electricity used for general consumption on site (i.e. lights, power outlets, etc) is fed directly from the grid once the substation is energised. A small transformer (auxiliary transformer) located within the compound will step down the voltage to enable general appliance use. Provision for a portable generator may also be provided in case the grid is not available.

### **3.1.9 Meteorological Masts**

The wind farm will include up to three permanent meteorological masts. These will comprise a guyed mast to the same height as the hub of the turbines and will monitor wind speed and direction. These masts are used as a part of the quality assurance program to ensure the proper and efficient operation of the wind generators during their operational life. A typical meteorological mast is shown in Figure 3.6 and Photo 3.3 and the proposed permanent meteorological mast locations are shown in Figures 1.2 and 1.3.

In addition to the permanent masts, five temporary masts of between 80m and 100m height are also proposed to collect additional data during construction. The new temporary masts will be installed approximately 6 months prior to the commencement of construction of turbines and then removed to allow turbine construction at those locations. The two existing 50m masts will remain for approximately 6-12 months from the installation of the new temporary masts and will then be removed.

Meteorological masts are typically made of galvanised steel with stainless steel guy wires.



**Photo 3.3: Indicative Meteorological Mast Appearance**

### **3.1.10 Temporary Construction Compounds**

Up to three temporary construction compounds (approximately 50m x 50m) will be required to accommodate the following facilities:

- Batching plant for concrete production if concrete cannot be sourced practically from a local batching plant.
- Turbine lay-down / storage areas of approximately 50 x 50m each.
- Site offices, staff facilities, car park, and storage areas. Temporary site buildings are typically pre-fabricated off/white colourbond buildings with flat roofs that are fully removable / transportable.
- Within six months of the wind farm becoming fully operational, all site huts, containers, machinery and equipment required for construction will be removed and the lay-down /storage areas reinstated.
- It is proposed that the temporary construction compounds will have perimeter fencing to prevent unauthorised access during the construction phase. This fencing will be removed along with the construction compound at the end of construction.

Concrete will either be sourced from a local batching plant or a temporary batching plant (in accordance with EPA requirements) will be established on site. This will be subject to the civil contractor selected during the project's competitive tendering process and their methodology.

The locations of the temporary construction compounds are shown in Figures 1.2 and 1.3 and example photographs are provided below.



**Photo 3.4: Example Temporary Compound (from Cape Bridgewater Wind Farm)**



Photo 3.5: Site Offices within Temporary Compound (from Cape Bridgewater Wind Farm)



Photo 3.6: Example Batching Plant

The following major raw materials will be required during construction:

- Water will either be sourced on site or tanked in
- Suitable track material will either be sourced on site or from a local quarry

- Concrete (i.e. aggregate, sand, gravel, cement and reinforcement) – for turbine foundations, either batched on site or from an off-site local source. If concrete is batched on site, materials will be sourced locally.

### **Temporary Services**

During construction, the following temporary services are proposed at the compounds:

- Water tank (either rainwater or delivered to site)
- Temporary toilet block and septic tank (i.e. typically a portable or “cartaway” service)
- Power via the local distribution network is preferred; however a diesel generator may be provided if local supply is not available

#### **3.1.11 Security**

All turbines and the proposed substation / switching yard will be located on private property. The entrance(s) to the site will have lockable gates installed and clear signage stating no unauthorised access to the site. No specific security fencing is proposed for turbines and in Pacific Hydro’s experience this has never been necessary as the entrance to each turbine is well secured by locked doors. Low level fencing may be utilised around electrical transformers for stock control, subject to agreements with each respective landowner.

The proposed sub-station / switching yard will have perimeter security fencing (e.g. - cyclone fencing with barbed wire and all access gates locked).

It is also proposed that temporary construction compounds have perimeter security fencing. This fencing will be removed along with the construction compound at the end of construction.

### **3.2 Site Excavations / Excavations**

The main sources of earthworks would arise from:

- Upgrading existing and forming new on-site tracks
- Forming hardstands or working platform areas at turbine sites, lay down areas at suitable locations for storage of wind turbine components and site offices;
- Substation
- Constructing foundations for each turbine

Excavated topsoil and subsurface material will be kept in separate stockpiles and re-used throughout the site wherever possible. Surplus spoil can be used to fill low spots on access tracks to level out road gradients and can be used as a base for hardstands if the material is suitable. Surplus spoil is usually re-used on site as fill or as batters. It is Pacific Hydro’s experience that all excavated material will be used elsewhere on site during construction and it will not be necessary to export any soil off site.



### **3.3 Traffic**

Short term transport movements required during the construction of the wind farm will comprise the following:

- Once only delivery of crane(s) required to erect turbines (if possible)
- Delivery of tower sections, nacelle and blades by extended articulated trucks
- Delivery of raw materials (depending on source) including aggregate, sand, gravel, cement and reinforcement required for the mobile concrete batching plant and the foundations
- Delivery of water for the concrete production (if required) and dust suppression
- Movement of employees to and from the site each day
- Internal site traffic will include the cranes (as above), earthwork plant, electrical delivery equipment and other construction equipment

Predicted traffic volumes are provided in more detail in Chapter 10.

The exact route to site will depend on the turbine supplier's logistic arrangements (e.g. delivery port), however assuming as is probable that turbines will come via Adelaide's port facilities, access to the site for all over-dimensional vehicles will initially be via the Sturt Highway (see Figure 10.1). In order to access the northern part of the site traffic will leave the Sturt Highway approximately 20km to the west of Truro onto the defined heavy vehicle route to Sedan (Halfway House Road and then Blanchetown Road) and then right onto the Angaston – Sedan Road before travelling in a westerly direction onto the site.

To access the southern part of the site, vehicles will exit the Sturt Highway at Stockwell onto Duck Ponds Rd, before following the defined heavy vehicle route around the west and south of Angaston (Stockwell Road - Crennis Mine Road – Long Gully Road – Hurns Road). From here traffic will turn right onto Angaston – Eden Valley Road, through the Eden Valley township and onto site along Rhine Park and Med Wrights Road.

Site access will be via access points on Angaston – Sedan Road, Med Wrights Road and Pine Hut Roads respectively.

The following road improvements will be carried out:

- One DPTI road sign at Cambrai will be sleeved to enable temporary removal for over dimensioned vehicle movements.
- Some overhead cables will be temporarily relocated (primarily within the main street of Eden Valley).
- Reconstruction of Med Wrights Road from the intersection of Jutland Road to the access point of the Wind Farm – approximately one km
- Miscellaneous and minor tree trimming may be required

The preferred routes have been identified following consultation with Mid-Murray and Barossa Councils and consultation / site inspection with Transport SA (DPTI); however their use remains subject to their formal consent / approval. Should the project be approved it is intended that a

detailed TMP be developed in conjunction with and subject to the approval of these authorities (as appropriate to the subject road).

The existing Pine Hut Road passes through the southern cluster. Pine Hut Road will only be used by over-dimensional vehicles exiting the site (thus retracted vehicles) and those crossing from the main access point to turbine 23. Over-dimensional vehicles exiting the site via Pine Hut Road will only travel west to return to the Sturt Highway via the over-dimensional routes outlined above. Where possible access points to site will utilise and/or improve existing access points to site.

A Traffic Management Plan will be developed to manage traffic movements and minimise disruption. School bus times, freight users, farm vehicles, the locations of hospitals, schools and aged care facilities will be taken into consideration within the plan. Traffic management is discussed further in Chapter 10.

During operations the proposed development will have no long term adverse traffic-related environmental implications on traffic amenity or traffic safety.

### **3.4 Grid Connection**

An existing 275kV overhead transmission line traverses the length of the site, generally in a north-south direction along the site's ridgeline. The wind farm will connect directly to this line negating the need for additional overhead line for the grid connection. The electricity produced by the Keyneton Wind Farm will be exported from the metered point of output at the proposed on-site substation, directly into the existing 275kv line.

### **3.5 Wind Farm Development**

The life of the wind farm will proceed in four phases:

- Pre-construction works
- Construction
- Operation
- Decommissioning

Each of these phases is discussed in greater detail below.

#### **3.5.1 Pre-Construction**

In order to survey the geotechnical conditions and inform detailed design, if the project is approved, a geotechnical assessment including soil sampling and associated minor works (i.e. test pitting) will take place at each proposed turbine location.

#### **3.5.2 Construction**

Construction of the wind farm is expected to take approximately 24 months, depending on equipment procurement lead times, and is likely to comprise the following main components:

- Construction plan mobilisation and enabling works including setting up of the temporary construction compounds

- Upgrading/construction of on-site access tracks
- Installation of temporary meteorological masts(which are subsequently removed to allow turbine installation in those locations)
- Construction of turbine foundations and transformer bases
- Underground cable installation
- Construction of substation / switching yard
- Turbine installation and associated pad mounted electrical transformers
- Erection of permanent meteorological masts
- Removal of two (2) existing 50m meteorological masts
- Commissioning of site equipment
- Site restoration and land management

Many of the above operations will be carried out concurrently, though generally in the order identified above.

The estimated 24 month construction timeframe can be broadly categorised into four phases as follows:

- Phase 1 – Civil Works, roads, access tracks and foundations (Months 1-10)
- Phase 2 – Electrical Works (Months 11-12)
- Phase 3 – Turbines - Delivery and erection (Months 13-20)
- Phase 4 – Continuing construction and site works (Months 21-24)

It is probable that there will be some overlap between these phases and transition from one phase to the next at different sections of the site will be staggered. For example, at different parts of the site civil works may be continuing whilst wind turbines are being erected. Site restoration of disturbed areas is carried out progressively and as early as practicable (as soon as works are concluded in an area).

### **3.5.3 Operations and Maintenance**

Due to the limited development footprint of the wind farm, the current agricultural land use of cropping and grazing will continue during operations. The site will be accessed in order to carry out day to day management activities as well as routine maintenance and repair. Maintenance activities will be undertaken during normal working (i.e. - hours generally restricted to 7.00am to 6.00pm Monday to Friday, 7.00am to 1.00pm Saturday). These activities will avoid disruption to agricultural activities wherever possible.

The wind farm operations will be supported by a team of one wind farm supervisor and approximately six - eight technicians. Routine maintenance and servicing will be carried out in accordance with the manufacturers maintenance recommendations, typically twice per year in addition to an initial service three months after commissioning. On average, it takes two people up to two days to service each turbine.

Turbine performance is constantly monitored and minor maintenance will be carried out and consumables replaced at regular periods as required. Blade inspections are performed as part of

the scheduled maintenance at least annually. Major gearbox oil changes are likely to be required approximately every five years. In the event of any unexpected events on site, such as failure of a turbine or gearbox, appropriate maintenance works will be carried out immediately. Hardstands adjacent to turbine bases will be retained in the event that maintenance requires the use of a crane.

#### **3.5.4 Decommissioning**

The operational life of the wind farm is expected to be 25-30 years from the date of commissioning. Towards the end of this period a decision will be made as to whether to refurbish, remove or replace the turbines. If refurbishment or replacement were to be chosen, any necessary approvals would be sought. If the wind farm was to be decommissioned, this would necessitate the removal of all the turbine components, transformers, substation and associated buildings. Our expectation is that within 18 months of cessation of the operation of the project, the site shall be decommissioned and returned, as far as practical and in accordance with a Decommissioning Rehabilitation / Environmental Management Plan, to its condition prior to the commencement of construction.

Subject to site rehabilitation methods current at the time and the landowner's future land use plans, the Decommissioning Rehabilitation / Environmental Management Plan will be formulated in accordance with the Development Authorisation requirements. It is expected at this stage that the portions of the site used for the wind farm would be re-instated for agricultural use. Sub-surface concrete foundations would be left in-situ as their removal would cause increased land damage. However, the exposed concrete plinth would be removed to a depth of approximately 1 metre and the entire foundation graded over with soil and either replanted or the vegetation allowed to regenerate naturally. The access tracks may be left on site depending on the requirements of the landowners.

A specific traffic management plan would be prepared prior to decommissioning.

One significant advantage of wind power generation over other forms of energy production is the relative ease of decommissioning and the simple removal of structures from the site. The inherent value of steel ensure that the decommissioning processes pays for itself.

A wind farm can be easily dismantled and the site restored, leaving no visible sign of its existence, and no pollution for future generations. The Keyneton site would be relatively easy to rehabilitate given that the site plateau is relatively flat and does not include extensive or dense areas of native vegetation within close proximity of the project footprint.

### **3.6 Environmental Management and Monitoring Plans**

A series of EMMPs will be developed prior to construction (See Chapter 12). This is an expected condition of planning approval. EMMPs will demonstrate compliance with all legislative and planning requirements as well as Pacific Hydro's Health, Safety and Sustainability Policy (see Attachment 1.1).

A typical EMMP would include the following:

- Pollution Prevention Plan (including stormwater management, sedimentation and erosion prevention)

- Cultural Heritage Management Plan
- Traffic Management Plan
- Native Vegetation Management Plan
- Weed Management Plan
- Fire Management Plan
- Site Rehabilitation Plan
- Decommissioning Plan

The above plans are discussed in more detail below. All activities carried out on site during each of the phases (construction, operation and decommissioning ) of the wind farm life cycle will be carried out with regard to the general environmental duties set out in Part 4, Section 25(1) of the *Environmental Protection Act 1993* and the *Environment Protection (Water Quality) Policy 2003*. Section 25 of the Environmental Protection Act states:

*“A person must not undertake any activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.”*

Mitigation measures which will be adopted during the construction, operation and decommissioning stages are outlined within each environmental assessment chapter (Chapters 6-9). In addition Chapter 12 summarises the mitigation measures to be adopted and also provides greater information with respect to the expected Environmental Management and Monitoring Plans.

A copy of the conditions associated with the planning approval and the approved EMMPs will be incorporated into tender documents and contracts.

# Chapter 3 Figures

**Figures 3.1: Indicative Turbine Dimensions**

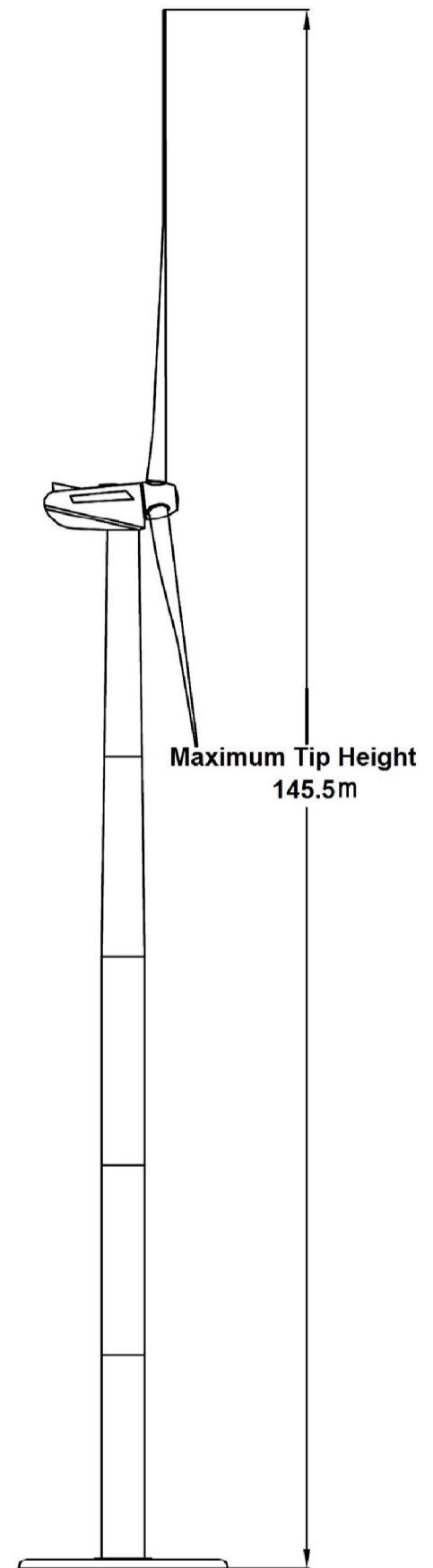
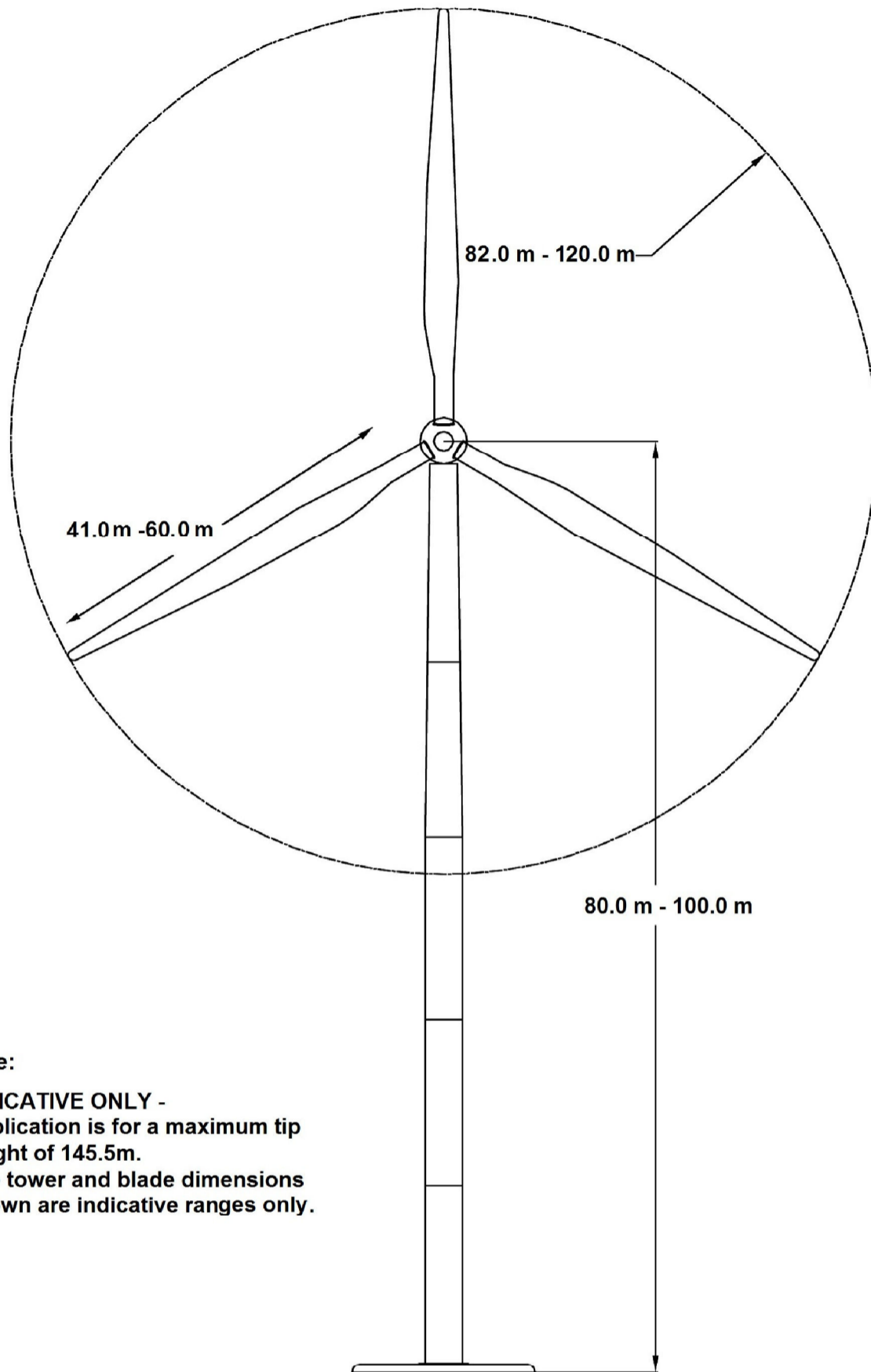
**Figures 3.2: Indicative Turbine Foundations Cross-section**

**Figures 3.3: Indicative Access Track cross-section**

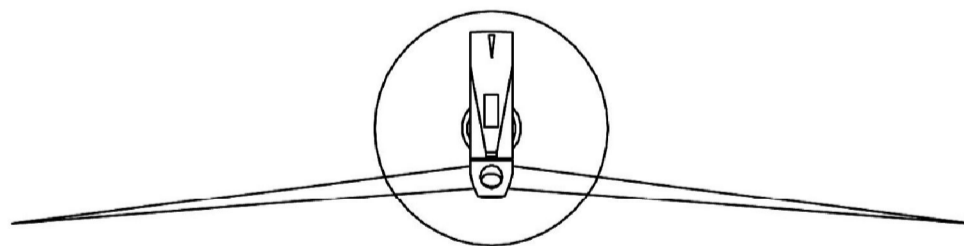
**Figures 3.4: Indicative Substation / Switching Yard Layout**

**Figures 3.5: Indicative Substation / Switching Yard / Control Room Elevations**

**Figures 3.6: Proposed Monitoring Mast Diagram**




**Note:**  
**INDICATIVE ONLY -**  
 Application is for a maximum tip height of 145.5m.  
 The tower and blade dimensions shown are indicative ranges only.




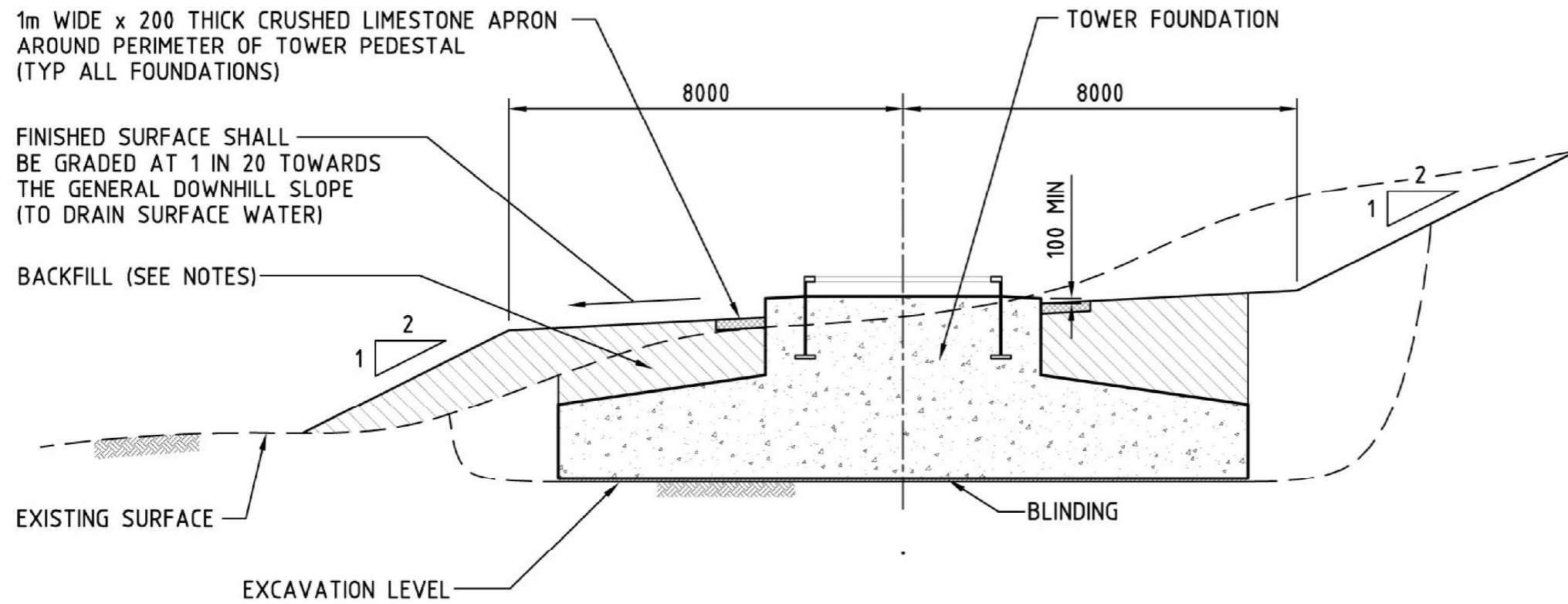
**NOT TO SCALE**

**Note:**  
 INDICATIVE ONLY -  
 Application is for maximum tip height of 145.5m.  
 The tower and blade dimensions shown are indicative ranges only.

PROJECT	Keyneton, South Australia		DATUM
TITLE	Figure 3.1 Indicative Turbine Dimensions	SCALE	A3
	<b>FOR EXTERNAL DISTRIBUTION</b>	DATE	12/06/12
CREATED	A.Liu	DRAWING NO	PH-0884
CLEARED	V.Vandale	REV	A
APPROVED	M.Barnett		

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PROJECT	Keyneton, South Australia		
TITLE	Figure 3.2 Indicative Turbine Foundation Cross Section		
<b>FOR EXTERNAL DISTRIBUTION</b>			
<small>Maps marked "Internal Use Only" contain information that is of a private and confidential nature. These maps may only be distributed to, and viewed by, current Pacific Hydro Employees.</small>	CREATED	A.Liu	
	CLEARED	D.Curtis	
<small>Maps marked "For External Distribution" have been checked and approved for release for information purposes as at the date shown on the map. A Responsible Manager must approve release of these maps on any other date.</small>	APPROVED	M.Barnett	
	DATE	12/06/12	
	SCALE		A3
	DATUM		
	DRAWING NO	PH-0885	REV A
		<small>Level 11, 474 Flinders Street, Melbourne Victoria 3000 Australia Telephone +61 3 8621 6000 Facsimile +61 3 8621 6111 www.pacifichydro.com.au</small>	

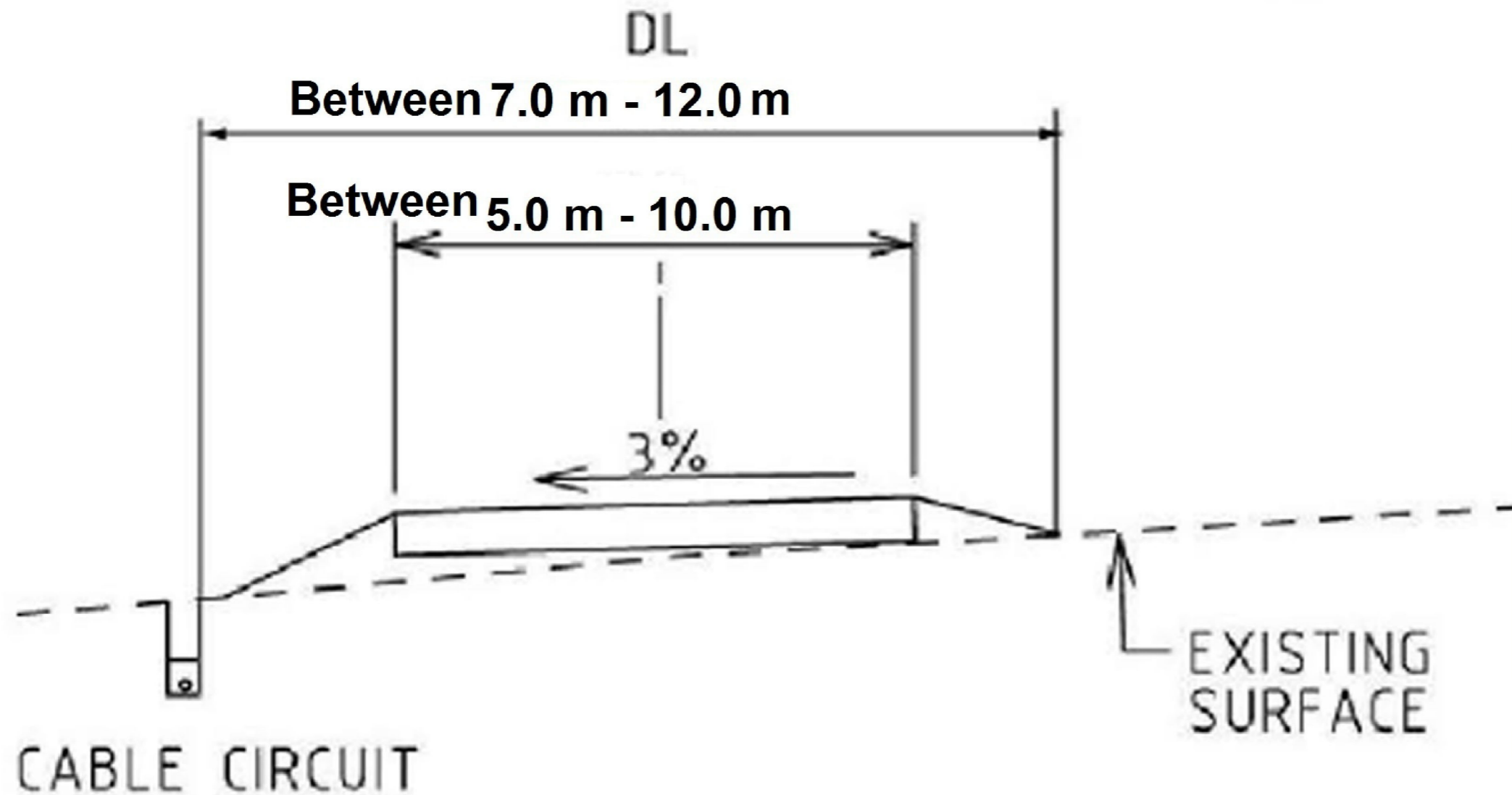


**TYPICAL EXCAVATION FOR NEAR SURFACE FOUNDATION**

**NOT TO SCALE**



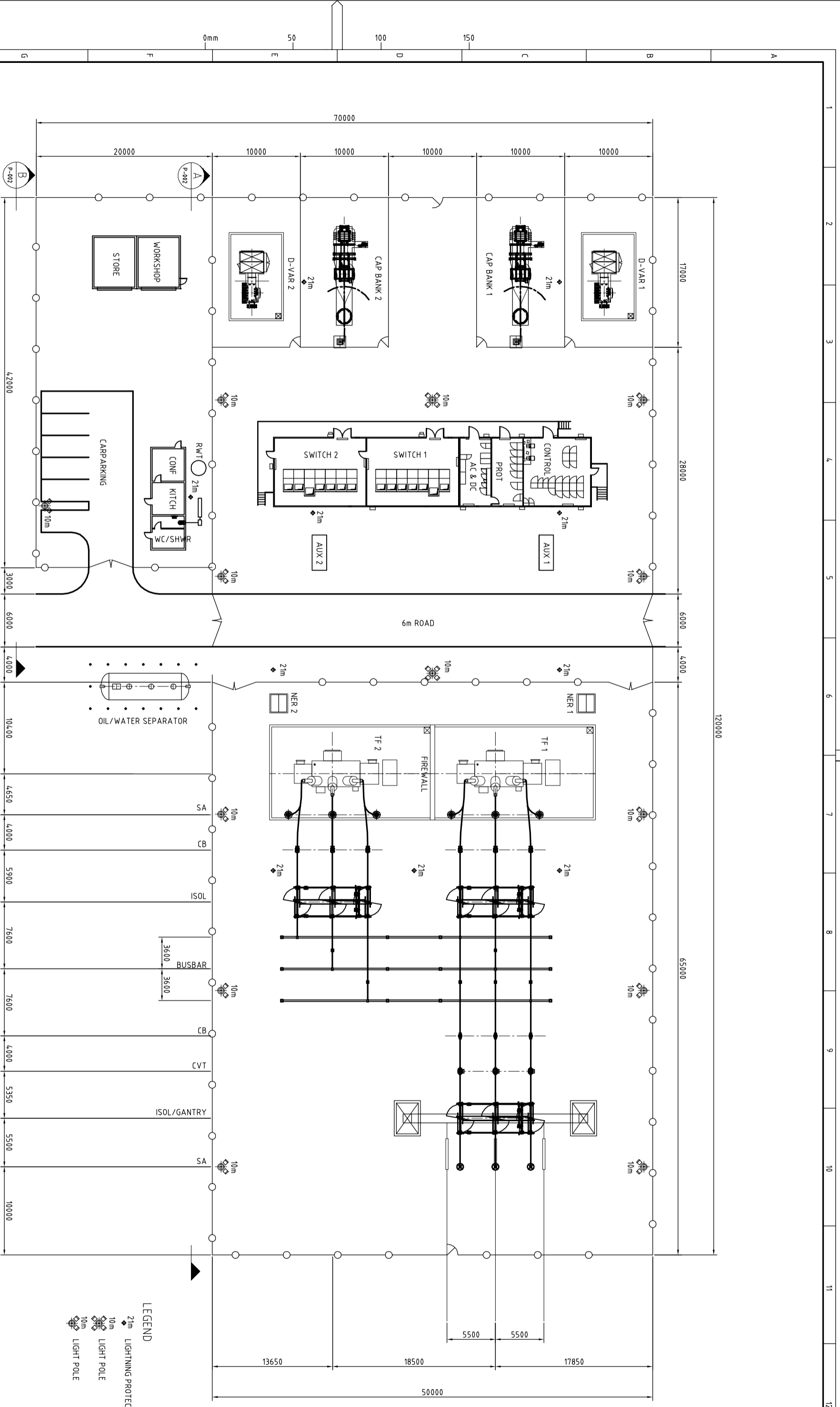
PROJECT	Keyneton, South Australia		
TITLE	Figure 3.3 Access Track Cross Section		
	FOR EXTERNAL DISTRIBUTION		
<small>Maps marked "Internal Use Only" contain information that is of a private and confidential nature. These maps may only be distributed to, and viewed by, current Pacific Hydro Employees.</small>	CREATED	A.Liu	
	CLEARED	D.Curtis	
<small>Maps marked "For External Distribution" have been checked and approved for release for information purposes as at the date shown on the map. A Responsible Manager must approve release of these maps on any other date.</small>	APPROVED	M.Barnett	
	DATE	12/06/12	
	SCALE		A3
	DATUM		
	DRAWING NO	PH-0886	REV A
		<small>Level 11, 474 Flinders Street, Melbourne Victoria 3000 Australia Telephone +61 3 8621 6000 Facsimile +61 3 8621 6111 www.pacifichydro.com.au</small>	



TYPICAL CROSS SECTION  
ACCESS TRACK

**NOT TO SCALE**

\* The majority of access tracks will be approximately 5m in width with shoulders and cabling immediately adjacent.



**PRELIMINARY**

REV	DESCRIPTION	DATE
A	ISSUED FOR DEVELOPMENT APPLICATION	05/04/12
B	MODIFY ORIENTATION	23/04/12

REV	DESCRIPTION	DATE
A	ISSUED FOR DEVELOPMENT APPLICATION	05/04/12
B	MODIFY ORIENTATION	23/04/12

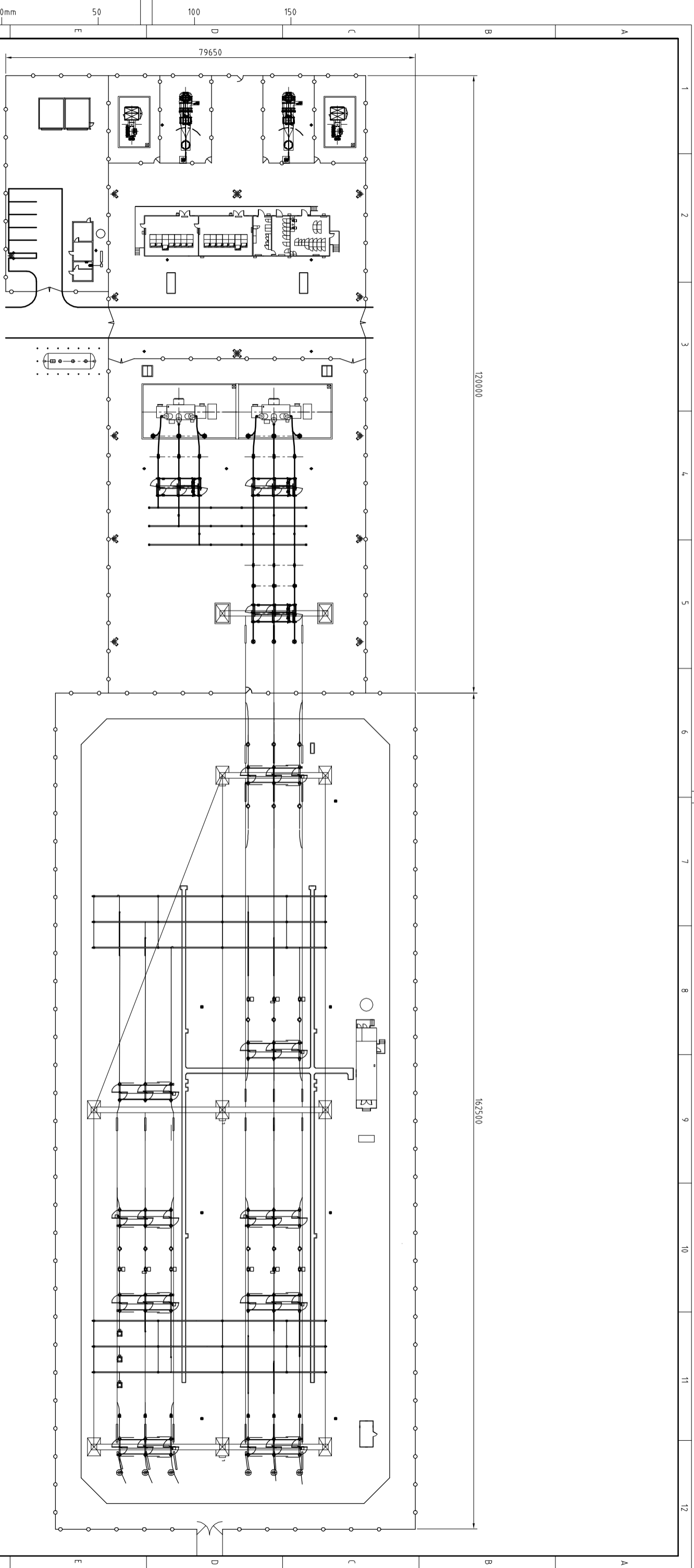
**Figure 3.4**  
Indicative Substation/Switching Yard Layout  
1 of 2

**CONSOLIDATED POWER PROJECTS**  
AUSTRALIA Pty Ltd  
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PROJECT	KEYNETON WIND FARM
TITLE	KEYNETON WIND FARM PROPOSED 275/33kV SUBSTATION
SCALE	1:200
DRAWING NO.	10160-P-001
SHT	-
REV	B

DO NOT SCALE DRAWINGS FOR WORKING DIMENSIONS



KEYNETON SUBSTATION

275kV SWITCHING STATION

REFERENCE DRAWING:  
ELEVATION 10160-P-005

**PRELIMINARY**

REV	DESCRIPTION	BY	CHKD	DATE	REFERENCE DRAWING	DRAWING NO.
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	DETAIL OF REVISION					

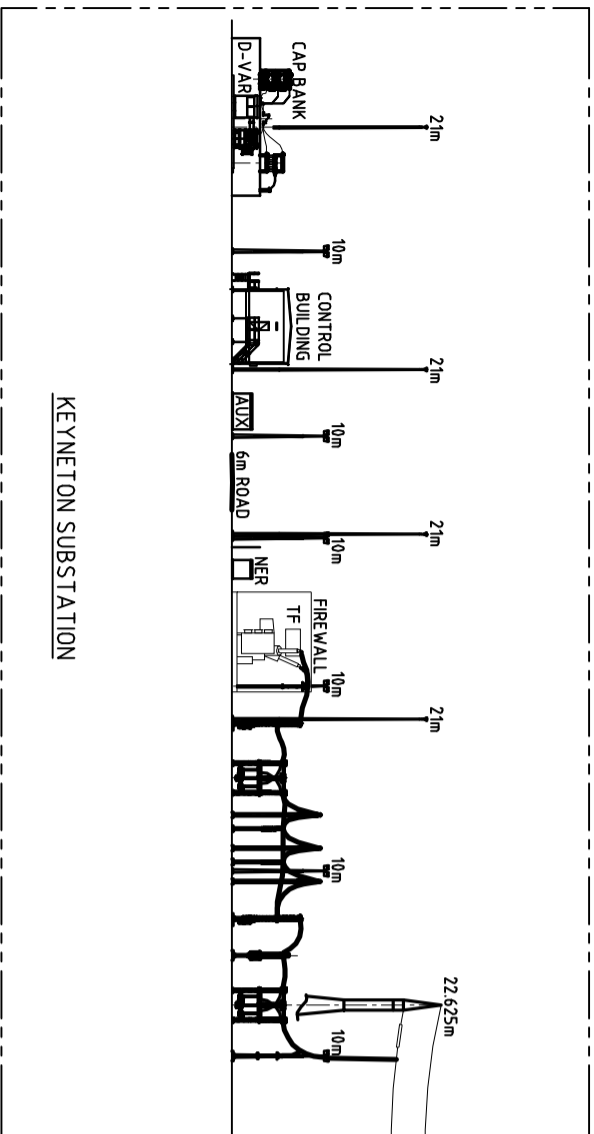
**Figure 3.4**  
Indicative Substation/Switching Yard Layout  
2 of 2

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DRAWN	S. ROBERTS	PROJECT	KEYNETON WIND FARM
CHECKED	J. WARR	TITLE	KEYNETON WIND FARM PROPOSED OVERALL SITE LAYOUT - PLAN VIEW
APPROVED	A. KLEYVANS	SCALE	N/S
CPRA PROJECT NO.	23/04/12	DRAWING NO.	10160-P-004
	10/60	SHT	-
		REV	A

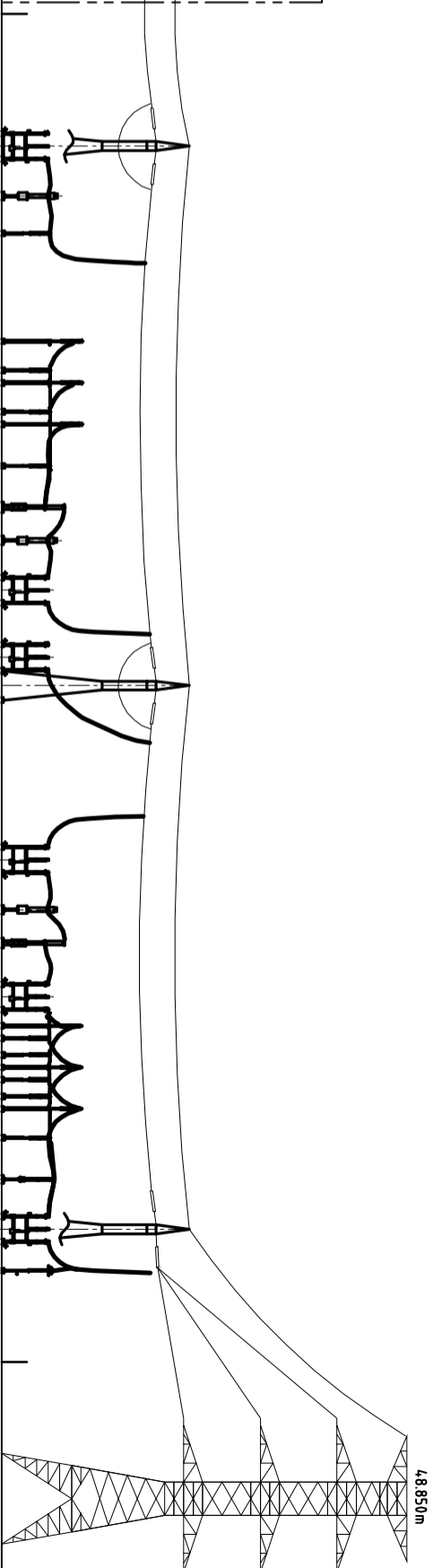
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ENLARGED DETAIL SEE : DWG 10160-P-002

KEYNETON SUBSTATION

275kV SWITCHING STATION



EXISTING ROBERTSTOWN - TUNGKILLO 275kV TOWER

REFERENCE DRAWING:  
PLAN VIEW 10160-P-004

PRELIMINARY

REV	ISSUED FOR DEVELOPMENT APPLICATION	SPR	JM	24/04/12
1	DETAIL OF REVISION			
2				
3				

REV	REFERENCE DRAWING	DRAWING NO.
1		
2		
3		

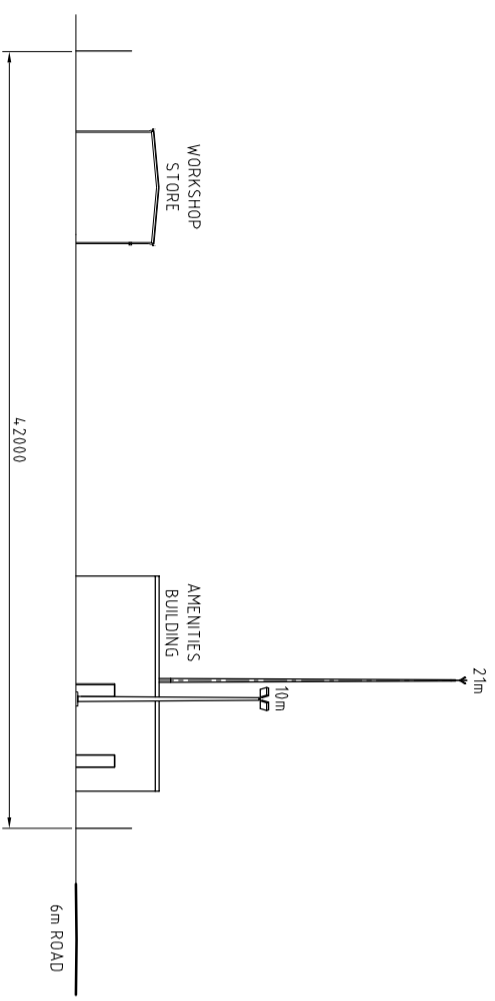
**Figure 3.5**  
Indicative Substation/Switching Yard/Control Room Elevations  
1 of 2

**CONSOLIDATED POWER PROJECTS AUSTRALIA Pty Ltd**  
205 HAUDEK STREET  
ADELDAIDE SA 5000  
AUSTRALIA  
ASN: 18 079 411 219

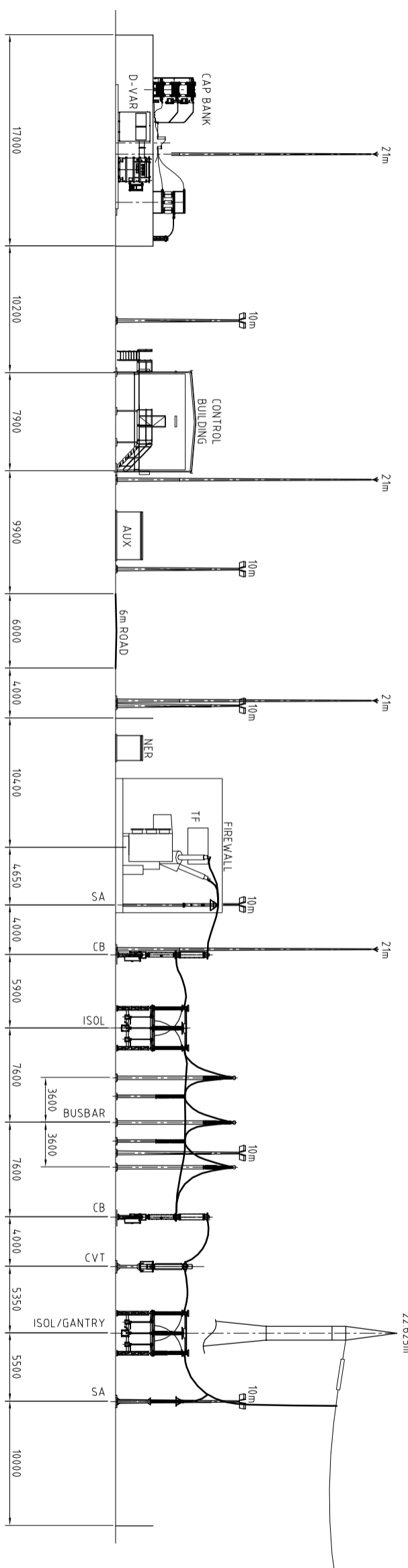
Telephone: +61 8 8291 7800  
Facsimile: +61 8 8291 7801  
Email: admin@cpower.com.au

DRAWN	S. ROBERTS	PROJECT	KEYNETON WIND FARM
CHECKED	J. WAAR	TITLE	KEYNETON WIND FARM PROPOSED OVERALL SITE LAYOUT - ELEVATION
APPROVED	A. KILLYMANS	SCALE	A1
CPRA PROJECT NO.	10160	DRAWING NO.	10160-P-005
		SHT	-
		REV	A

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DETAIL B  
P-001



LEGEND  
 21m LIGHTNING PROTECTION  
 10m LIGHT POLE

DETAIL A  
P-007

PRELIMINARY

REV	DESCRIPTION	DATE	BY	CHKD
A	ISSUED FOR DEVELOPMENT APPLICATION	05/04/12	JM	JM
B	ADDED EXTRA VIEWS	24/04/12	JM	JM

REV	DESCRIPTION	DATE	BY	CHKD
A	ISSUED FOR DEVELOPMENT APPLICATION	05/04/12	JM	JM

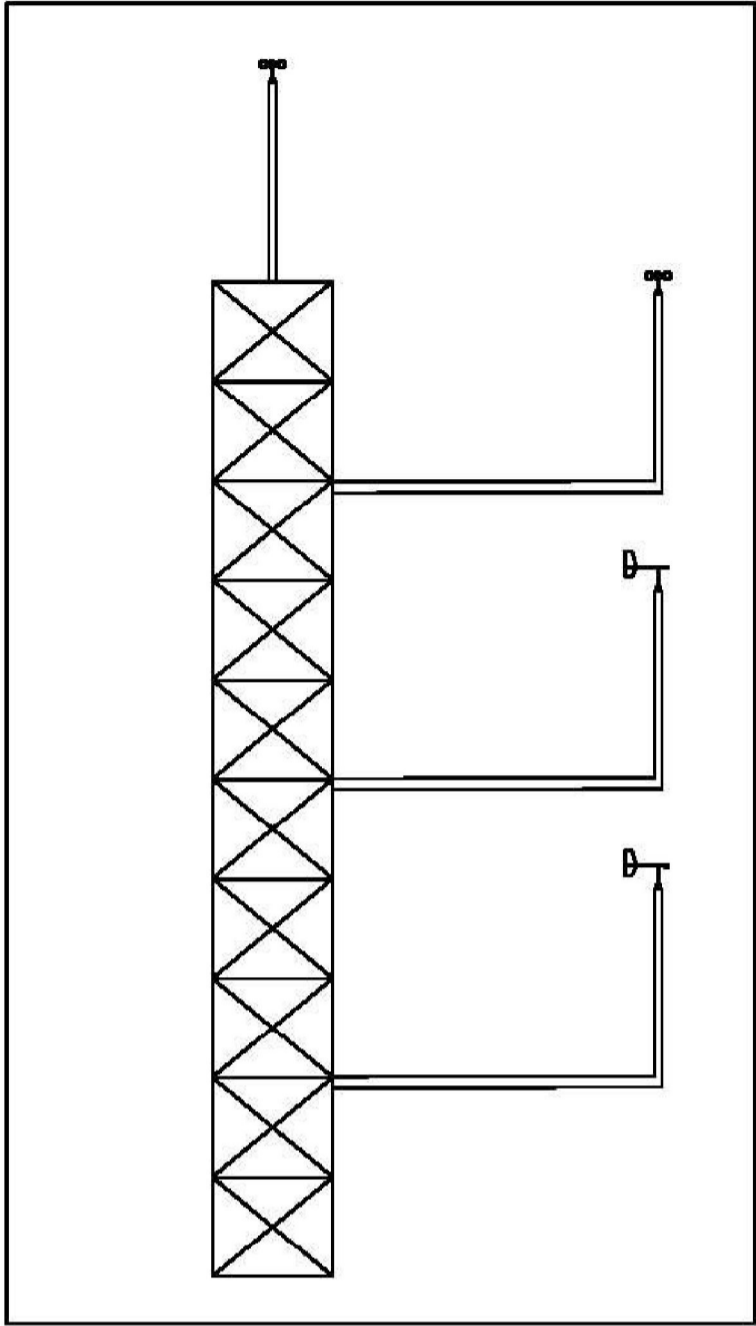
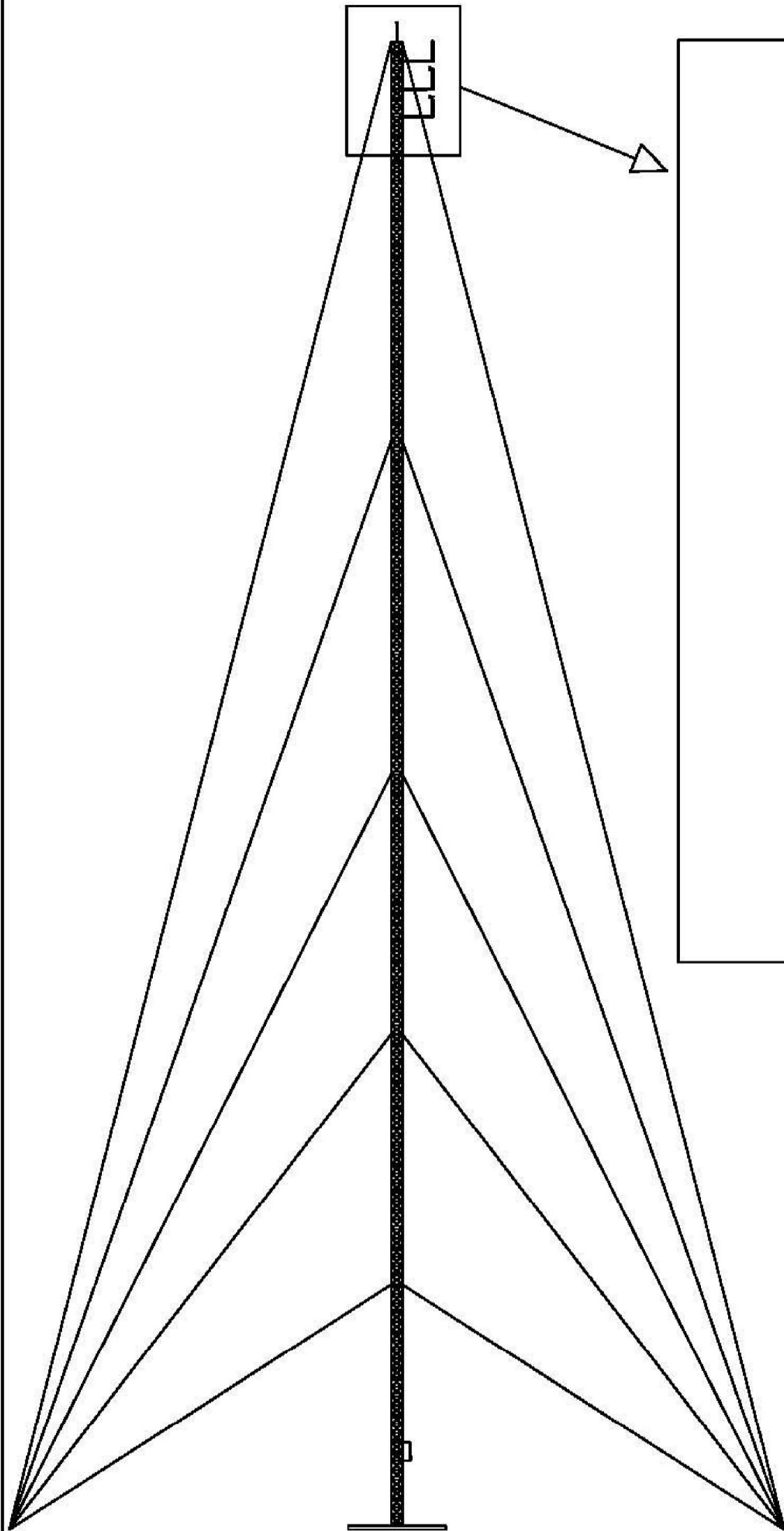
Indicative Substation/Switching Yard/Control Room Elevations  
 2 of 2

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PROJECT	TITLE	SCALE	DRAWING NO.	SHT.	REV.
KEYNETON WIND FARM	KEYNETON WIND FARM PROPOSED 275/33KV SUBSTATION - SECTIONS	1:200	A1	-	B

# Proposed Permanent Measurement Mast



**TO HUB HEIGHT  
Indicative: between  
80 m - 100 m**

	PROJECT	Keyneton, South Australia	DATUM	
	TITLE	Figure 3.6 Proposed Monitoring Mast Diagram FOR EXTERNAL DISTRIBUTION	SCALE	A3
			DATE	12/06/12
			DRAWING NO	PH-0888
	CREATED	A.Liu	APPROVED	M.Barnett
	CLEARED	V.Vandale		
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