Lismore to Mullumbimby Electricity Network Upgrade

Environmental Assessment Report

Annexure Q
Volume 3

for Country Energy

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Annex Q

Suffolk Park Substation and Line Route Selection (FC 25562) Environmental Assessment
(MWH, 2008)

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Suffolk Park Substation and Line Route Selection (FC 25562) Environmental Assessment

December 2008

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Quality Assurance Statement	
Country Energy	**Prepared by:** P Flint - BSc(Tech) PGDip (Env Mgt)
Suffolk Park Substation and Line Route Selection EA	**Reviewed by:** Macnish/Brooks
Project Manager: Paul Flint	**Approved for issue by:** Stuart Macnish - B.Agr.Sc. M.Phil.

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2	08/12/08	Final EA Site 7	P Flint	Macnish/Brooks	S Macnish

MWH Australia Pty Ltd
Suite 4, 60 Nerang Street
Nerang
QLD 4211
Tel: 61-7-5596 9600
Fax: 61-7-5578 4295

Country Energy

Suffolk Park Substation and Line Route Selection EA

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Glossary

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ASCT	Australian Soil and Concrete Testing
ASS	Acid Sulfate Soils
BSC	Byron Shire Council
CE	Country Energy
DBYD	Dial Before You Dig
DECC	Department of Environment and Climate Change (NSW)
DEWHA	Department of Environment, Water, Heritage and the Arts (Federal)
EA	Environmental Assessment
EP&A Act	*Environmental Planning and Assessment Act, 1979*
EMF	Electric and Magnetic Fields (extra low frequency)
EPBC	*Environment and Biodiversity Conservation Act*
GIS	Global Information System
LEP	Local Environmental Plan
LV	Low voltage
kV	Kilovolts
mG	milligauss
NHMRC	National Health and Medical Research Council
NPWS	National Parks and Wildlife Service
PASS	Potential Acid Sulfate Soils
SEPP	State Environmental Protection Policy

1. Executive Summary

Country Energy needs to construct a new 132/11 kV zone substation to provide for future loads in the Byron Bay/Suffolk Park and surrounding areas. The preferred location identified by Country Energy for the substation is in the Skinners Shoot area, near Suffolk Park. The area investigated is predominantly rural land, with remnant vegetation to the west, north and east.

Following an extensive site selection process, a preferred site was chosen to locate the zone substation (described in this document as Site 7). This Environmental Assessment (EA) has been prepared to assess the potential environmental impacts of locating the proposed Suffolk Park 132/11 kV zone substation on Lot 9/588885 at the southern end of Yagers Lane, Skinners Shoot and to define management measures to minimise and/or avoid those impacts.

The major findings of this EA are:

- no significant impacts to flora and fauna, public safety, flooding, heritage or water quality are expected;
- the proposed substation development will not have a significant impact on Matters of National Environmental Significance as described in the *EPBC Act* and therefore does not need to be referred to the Minister of the Department of Environment, Water, Heritage and the Arts (DEWHA);
- noise impacts during operation are manageable and would not exceed the NSW Department of Environment and Climate Change (DECC) environmental criteria;
- noise impacts during some construction components exceed the noise criteria – these will be managed through complying with the Construction Environmental Management Plant (CEMP) and by close consultation with affected residences;
- there would be some short-term disturbance to the local community due to increased traffic movements along Skinners Shoot Road during the construction period. This would be managed through implementing a Traffic Management Plan; and
- there would be some visual impact on the surrounding area from the substation though this would decrease over time as the landscaped vegetation matures.

The location of the substation and access road has in-principle landowner support.

Potential impacts have been identified and appropriate mitigation measures recommended in this EA. These measures are to be implemented in the undertaking of all works associated with the development.

Consequently, this EA demonstrates that no significant adverse environmental impacts are likely to occur as a consequence of undertaking the proposed development. Based on the findings of this EA, Site 7 is a suitable location for the Suffolk Park zone substation.

2. Introduction

Country Energy needs to construct a new 132/11 kV zone substation to provide for future loads in the Byron Bay/Suffolk Park and surrounding area. Options for location are limited by the need to meet network requirements, the ability to link in with the existing 66 kV system and the constraints of establishing an effective 11 kV distribution network close to the population centres of demand to avoid voltage loss.

MWH Australia was commissioned initially to identify suitable substation sites and transmission line corridors (if required) within the Skinners Shoot area. Twelve potential sites were identified and ranked based on environmental, planning and constructability constraints using desk-top processes initially. These rankings were further refined following detailed site inspections, which allowed closer evaluation of key constraints initially identified in the desktop review. Following an extensive site selection process, a site was chosen to locate the zone substation (described in this document as Site 7).

This EA has been prepared as part of the Lismore to Mullumbimby Environmental Assessment Report (EAR) as part of the application under Part 3A of the *Environmental Planning and Assessment Act, 1979*. This EA presents the detailed evaluation of Site 7 following additional field investigations. The evaluation of the other eleven sites included in the initial options study (Suffolk Park – Revised Final RSS Report, April 2008) is included in Appendix M.

2.1 Location

The general location identified by Country Energy for the substation is in the Skinners Shoot area, near Byron Bay (area circled in Figure 2-1). A more detailed aerial view of the general location of Site 7 is provided in Figure 3-1.

Figure 2-1: Area of investigation

2.2 Objectives of this Environmental Assessment

This EA identifies the existing environmental values, potential environmental impacts, and proposed management and control measures associated with construction and operation of a zone substation at Site 7.

To this end, the EA:

- Provides a description of the proposed development;
- Assesses the existing environment, both on and off-site;
- Provides an assessment of the potential impacts during construction and operation of the substation and network connections;
- Identifies measures to be taken to mitigate all adverse environmental impacts;
- Addresses direct and indirect impacts of the Suffolk Park zone substation and network connections; and
- Provides supporting documentation suitable for submission with the Environmental Assessment Report (EAR) to the Director General under Part 3A of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

This EA does not include any strategic or legislative/planning context. Strategic and planning issues, along with project justification, ecologically sustainable development and cumulative impacts, will be covered in the Environmental Assessment Report (EAR) for the Lismore to Mullumbimby Electricity Network upgrade.

3. Description of the Project

3.1 Overview

To cater for future loads in the Byron Bay/Suffolk Park and surrounding area, Country Energy will need to construct and commission a new 132/11 kV zone substation. The new substation will initially be supplied at 66 kV unless load growth stabilises and allows deferment of substation construction until 132 kV supply is available. In either event it will ultimately be a 132 kV zone substation.

The new zone substation must cater for two 132 kV feeders, two 132/11 kV transformers, seven 11 kV distribution feeders (with ducting provision for a future five 11 kV feeders), and an 11 kV capacitor bank as the ultimate development. The project involves the selection and procurement of a substation site of a minimum 130 m by 100 m (including a 15 m vegetation buffer zone and a Council setback of 20 m from the road) and routes for 132 kV dual circuit transmission power lines between the existing 66 kV circuit and the proposed new substation if necessary. The area of investigation and the existing Country Energy network in the area of interest are shown in Figure 3 -1. Site 7 is located some 150 m to the south-east of the former Yagers piggery sheds at the southern end of Yagers Lane.

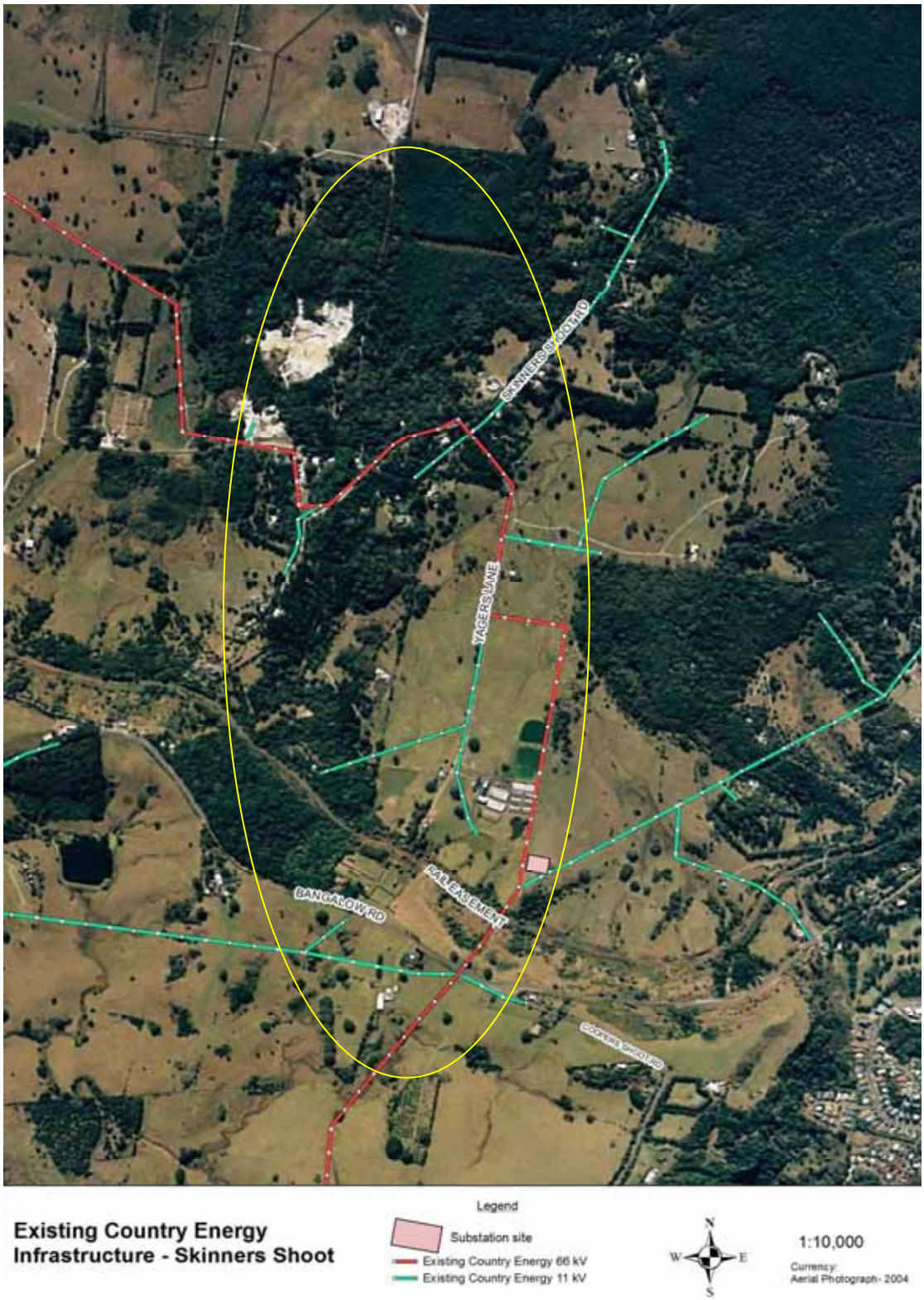

Figure 3-1: Existing Country Energy infrastructure in Skinners Shoot

The following aspects have been considered for selection of a preferred site:

- Proximity to existing Country Energy distribution infrastructure;
- Accessibility for heavy vehicles/equipment;
- Suitability for civil construction and access above 1 in 100 year AEP flood level;
- Adequate perimeter buffer space to allow residential development up to the boundary of the property if required;
- Minimal visual and acoustic impact;
- Minimal potential risk of substation causing environmental contamination;
- Minimal exposure of the substation to airborne contaminants; and
- Availability of water and sewer, and where sewer unavailable, provision of appropriate method of effluent disposal.

3.2 Site Description

The proposed substation at Site 7 is located in a cleared, native pasture paddock on Lot 9/588885, in the south-west corner of the Lot (Figure 3-6). Access to Site 7 will be from Byron Bay via Skinners Shoot Road and Yagers Lane. From the southern end of Yagers Lane, an access road to the site will need to be constructed through the former piggery land. Details of siting for this road will need to conform to proposed development plans for the property, which is currently subject to a series of progressive Development Applications for an eco-village/artists residence(s). The nearest residence, other than those on the property, is located approximately 310 m south-east of the site on Bangalow Road.

The buildings of the former Yagers Piggery are visible in mid-shot to the west of Site 7 in Figure 3-2. The existing Country Energy 66 kV line extends to the north along the eastern boundary of the former piggery. An 11 kV line diverges off the 66 kV just south of Site 7 and heads in a north-easterly direction towards Suffolk Park. See Figure 3-1 for existing Country Energy infrastructure.

The site occupies a low convex crest on a spur ridge facing north-east, draining to deeply incised gullies on both sides. The site slopes at approximately 1:15 (6%) along the ridge crest and steepens to 8-10% towards the gullies. Drainage works will be required to divert stormwater runoff around the site. Only the gully on the western side of the site needs to be crossed to access the site. This will require a pipe or box culvert to provide a suitable vertical geometry for large vehicles and delivery of the transformers on low-loaders. The current ford crossing is not suitable for large vehicles and equipment. Hydraulic design will be needed to ensure adequate capacity is provided to ensure all-weather access as the cross-sectional U-shape of the gully indicates the likely size of flash, short duration flows that are associated with the gully in large storm events.

The existing 66 kV line runs through the right of the photo with an 11 kV distributor in the foreground heading north-east towards Suffolk Park.

The disused Casino-Murwillumbah railway line lies above and to the south of the site. There is no access to the site from the south where the land rises steeply above the site, climbing some 80 m in approximately 280 m to Bangalow Road.

The site is approximately 40 m from the 66 kV line and is underneath an 11 kV line that heads north-east towards Suffolk Park. The 66/132 kV line will enter the substation above ground and then connect back into the 66/132 kV network via an underground cable. The pole on the right in Figure 3-5 will be the last pole before entering the substation.

Figure 3-2: View from Bangalow Road looking north over proposed substation Site 7 (just beyond tree line in mid-shot) to Byron Bay.

Figure 3-3: View looking north-east from Site 7 along existing 11 kV line.

Figure 3-4: Looking north from Site 7.

Figure 3-5: View looking south-west from Site 7 along existing 66 kV line.

3.3 Substation Site Construction

3.3.1 Access Road

The following access route options exist:

Option 1 – via Yagers Lane and the piggery property (Figure 3.6). This route offers the best all-weather access and most likely least cost option for accessing Site 7 from the Skinners Shoot Road route from Byron Bay. It traverses the high ground as far as is possible and will be founded on weathered sandstone for the majority of the route once it enters the property boundary. There is a need to upgrade the horizontal and vertical geometry of Yagers Lane, to widen the Lane and to upgrade the culverts. The road would then be a shared access route through the property and traverse the northern embankment of the southern storage pond. It would be necessary to construct a berm on this embankment to avoid the complex drainage issues associated with the discharge of two drainage lines and a concrete spillway to a common culvert that passes under the former piggery sties where it was used previously for effluent flushing purposes. A culvert of sufficient capacity to take short duration, high velocity flows in severe storm events will be required to cross the gully immediately to the west of the site. The advantage of this option is that the high voltage lines and 11 kV feeders can be installed in conduits in the shoulder of the road, including capacity for future expansion. This will provide for ease of maintenance, remove the need for overhead poles down the eastern boundary of the property and result in a single easement. Maintenance of the access road will be shared by Country Energy and the property owners as it would be a shared road. This option is considered to have least environmental and landholder impacts and provide greater security for maintenance of the substation in all-weather conditions.

Option 2 – via Yagers Lane and then east across Lot 7/8385 and south through Lot 9/588885. This route retains the need for either poles or underground powerlines along the eastern boundary as at present (or further to the east within Lot 9/588885). All-weather access would also be required to service this area. Significant constraints relate to this option such as difficulty of access, wetness, flooding, ASS, the need to import large volumes of fill for road construction, and high maintenance costs. There is insufficient space to install underground powerlines along the fenceline within Lots 7/8385 and 8/8385 as the pond embankments lie immediately adjacent to the fenceline. This would require the conduits to be laid within the embankment leading to a very high risk of dam failure from piping. Additionally, there is no road access along this fenceline and both construction and maintenance would have to undertaken from the neighbouring property. This option is not recommended.

Option 3 – via Lot 9/588885 from Old Bangalow Road. This option requires construction of an all-weather road across the full width of Lot 9/588885 from Old Bangalow Road. This access would have to pass the homestead and traverse a broad, alluvial valley that has high watertables. This would incur considerable disruption to the property and the importation of large volumes of fill to construct the road above flood line. Maintenance costs would be high and there would be significant impacts on the daily lives of the landholders. This could be an issue as most power disruptions occur as a result of storm events and frequently at night. One advantage is that all negotiations would be with the one landholder, but as a corollary, impacts as to future utility of the property would also be greatest, severely constraining future development options and marketability of the property. This option is not recommended.

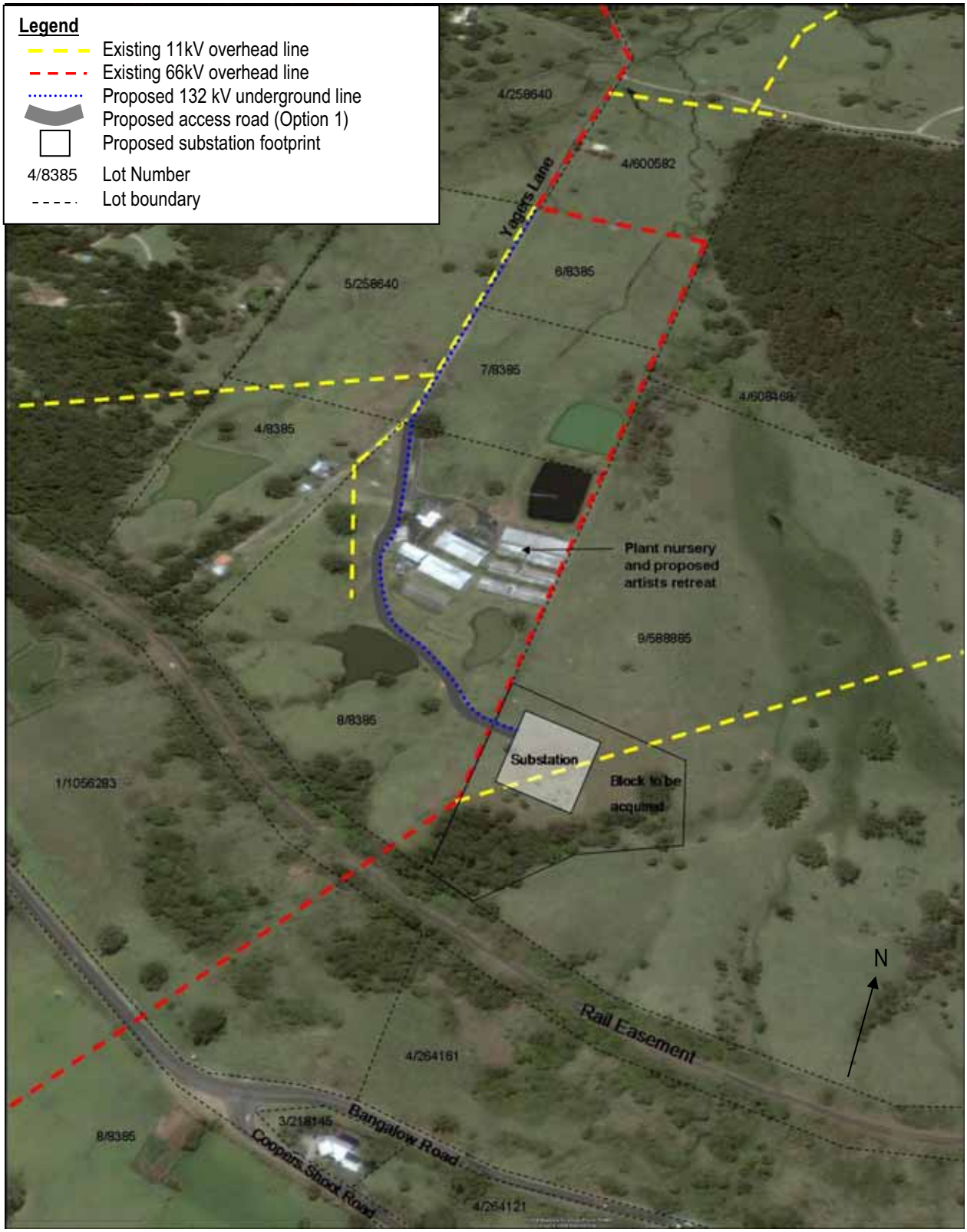

Figure 3-6: Proposed site access (Option 1)

The proposed access road through Lot 8/8385 (shown in Figure 3.6) has been surveyed (Appendix A) and a detailed road design will be undertaken. Upgrades to Skinners Shoot Road and Yagers Lane will be required to allow access for a low-loader carrying a 50 tonne transformer during construction. These road upgrade issues are discussed in more detail in Section 4.13.5.

Emergency 4WD access through Lot 9/588885 via Old Bangalow Road will be arranged in the case of Skinners Shoot Road being flooded. This will not require a formed road.

3.3.2 Substation Compound

The substation compound area will be covered in aggregate or compacted gravel with a two coat bitumen seal in areas with vehicle traffic, such as the access road entrance and vehicle access to control and switch room buildings. The access road will be a minimum of 6 m wide. The remainder of the compound area will be stones. The proposed substation compound area will be surrounded by a 2.4 m high security chain mesh fence with a lockable gate at the access road entrance. The general layout for the proposed substation at Site 7 is included in Appendix B. An example photo of a similar substation is shown in Figure 3-7.

Figure 3-7: Similar substation design at Lennox Head

3.3.3 Electrical Infrastructure

The substation may initially be supplied at 66 kV, but will ultimately be a 132 kV zone substation. Electrical infrastructure within the proposed substation compound area is likely to include:

- two 132 kV feeders;
- two 66/11 kV transformers to be upgraded to 132/11 kV;
- seven 11 kV distribution feeders (with ducting provision for a further five 11 kV feeders);

- an 11 kV capacitor bank as the ultimate development; and
- switchroom and control room buildings.

Country Energy workers will need to visit the site regularly to undertake routine inspections and maintenance. The potential upgrade of the 66 kV transformers to 132 kV may require further work on the site sometime in the future, when electricity demand requires.

3.3.4 Substation Buildings

The substation compound area will contain two buildings, the 11 kV switchroom building and the control room. Both buildings will be constructed of almond colour (sandstone) split face concrete blocks and grey or green doors, downpipes and colourbond roof. Building elevations are included in Appendix B. The approximate planned dimensions of the buildings are:

- 11 kV switchroom building – dimensions approximately 14 m by 5 m and 3- 4 m high; and
- Control building – approximately 16 m by 5 m and 3-4 m high. A rainwater tank will be fitted to the switchroom and control buildings. The runoff collected from the roof areas will be stored in the rainwater tank for re-use onsite. One toilet will be provided in the control building.

3.3.5 Water Supply

The water supply for the site for non-potable uses and landscaping maintenance will be sourced from a rainwater tank fitted to the control and switch room buildings. Potable water is likely to be supplied by a water main from the nearby reservoir at the intersection of Old Bangalow Road and Bangalow Road.

3.3.6 Waste Disposal

The proposed substation would not routinely produce waste products of any significant volume. All putrescible and dry wastes will be placed by users of the site in appropriate containers and regularly removed from the site by approved contractors as part of Byron Council services.

During construction, some vegetation material and general construction waste would be generated. The vegetation material would be mulched and reused on-site for landscaping works. As clearing requirements are minimal, this is not expected to be of significant volume to meet site landscaping requirements and there would be no need to remove excess material from site for disposal elsewhere. General construction waste such as paper, plastics and metal would be exported for recycling or disposal at appropriately licensed facilities following on-site separation. The waste hierarchy of reduce, re-use, recycle will be adopted during construction.

3.3.7 Effluent Disposal

The site is not serviced by sewage infrastructure. Effluent from the toilet facility provided in the control building would be treated and disposed on-site and would consist of a septic tank and evapotranspiration/absorption (ETA) beds or shallow disposal trenches.

One toilet with a hand basin will be provided in the control building for use by employees visiting the substation for maintenance inspections. It is proposed that the amenities be serviced by an on-site effluent disposal system.

The volume of effluent generated by the site is expected to be very low, as visits by Country Energy staff would be infrequent. The Australian Standard (AS/NZS 1547:2000) outlines typical domestic wastewater-flow design allowances. The allowance most similar to the facility use for the site is for non-

resident staff at a hotel/motel, with the typical wastewater flow allowance for being 40 L/day. As the site is to be visited at most approximately once a week, the average daily wastewater flow would be approximately 6 L/day.

The proposed effluent treatment and disposal system will consist of a septic tank and an absorption trench. The septic tank will be selected to meet the estimated volume outlined above and will be installed according to the relevant Council guidelines and Australian Standards. The septic tank will be installed a minimum of 3 m from the nearest structure. This will conform to the performance requirements of other similar facilities in the valley.

The absorption trench will be constructed in accordance with Australian Standard AS/NZS 1547:2000. The absorption trench is surrounded by the buffer distances recommended by Council's Septic Guide. The absorption trench will be located:

- more than 3 m downhill from the site vehicle entry;
- more than 3 m from any pathway;
- more than 6 m downhill and 12 m up-hill from the nearest property boundary;
- approximately 200 m uphill from the nearest tributary of Belongil Creek; and
- more than 250 m from any domestic groundwater bore or well (there are no domestic groundwater bores within 1 km of Site 7).

3.3.8 Landscaping

The proposed substation compound will be surrounded by a minimum buffer zone of approximately 15 to 20 m. The buffer zone will be planned to incorporate a multi-storey vegetation screen to maximise screening effects. The vegetation buffer will involve plants that provide a low risk of fire and prostrate plants and weed matting will be used for ground cover rather than pine bark or mulch. A concept landscape plan is provided in Appendix C.

A minimum 4 m cleared buffer zone on the outside of the fenced area is required for public safety. Landscaping and tree planting works may also be undertaken where appropriate within the site to limit potential visual impacts of the substation.

3.3.9 Network Connection

As the proposed site is located immediately adjacent to the existing 66 kV line, connection to the 66/132 kV network presents minimal issues. The 66/132 kV line would enter the substation above ground and then connect back into the 66/132 kV network via an underground cable. It is anticipated that the underground section will, at the very least, extend from the substation until the point where the 66 kV line intersects Yagers Lane (see Figure 3-6). As described in Section 3.3.1, the recommended access road to the site is through the adjacent former piggery. The underground high voltage lines and 11 kV feeders would be installed in conduits in the shoulder of the road, including capacity for future expansion. The advantage of this option is the existing 66 kV aboveground infrastructure extending along the boundary of the piggery property could be removed, reducing the visual impact in the valley.

The underground cables will be located in PVC ducts with a minimum depth of cover of 900 mm as shown in Figure 3-8.

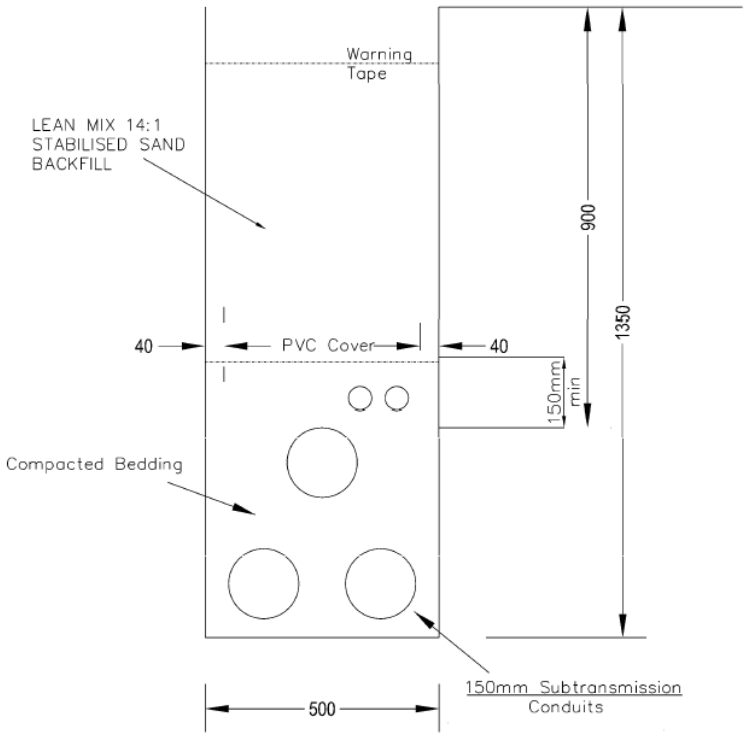

Figure 3-8: Standard Country Energy underground cable diagram

3.3.10 11 kV Distribution

The positioning of the new substation site requires removal of the majority of the overhead 11 kV and low voltage (LV) mains from the property, and these will be replaced with underground cables. Seven 11 kV feeders will be installed and ducting provision will be made for a further five feeders.

The proposed layout of these feeders relative to Site 7 is shown in Figure 3-9. The site requires four feeders heading eastwards from the substation site for approximately 400 m. From this location, one feeder traverses north-east to connect to the existing overhead network on the eastern extremity of the property. The remaining three feeders head south with an underbore through the railway easement, onto the Old Bangalow Road reserve, and then onto the intersection with Bangalow Road. At this point, one feeder continues underground south along the west side of the Golf Course to behind Suffolk Park residential area where it connects to an existing padmount substation near Caniaba Crescent. The remaining two feeders head eastward as underground cables along Bangalow Road to Broken Head Road where they connect with the existing overhead network.

To complete the extent of these feeders, an additional underground section for one feeder is required along Bangalow Road between Ironbark Crescent and Cooper Street. The existing OH substation near the corner of Old Bangalow Road and Bangalow Road will be replaced by a small padmount substation and overhead LV mains along Bangalow Road will be replaced with underground LV cable.

There will also be three 11 kV feeders heading west from Site 7. Two of these will be underground to the western boundary of the property where they connect with existing overhead feeders. The third

feeder traverses south west with an underbore of the railway easement and Bangalow Road before joining up with the overhead network heading west.

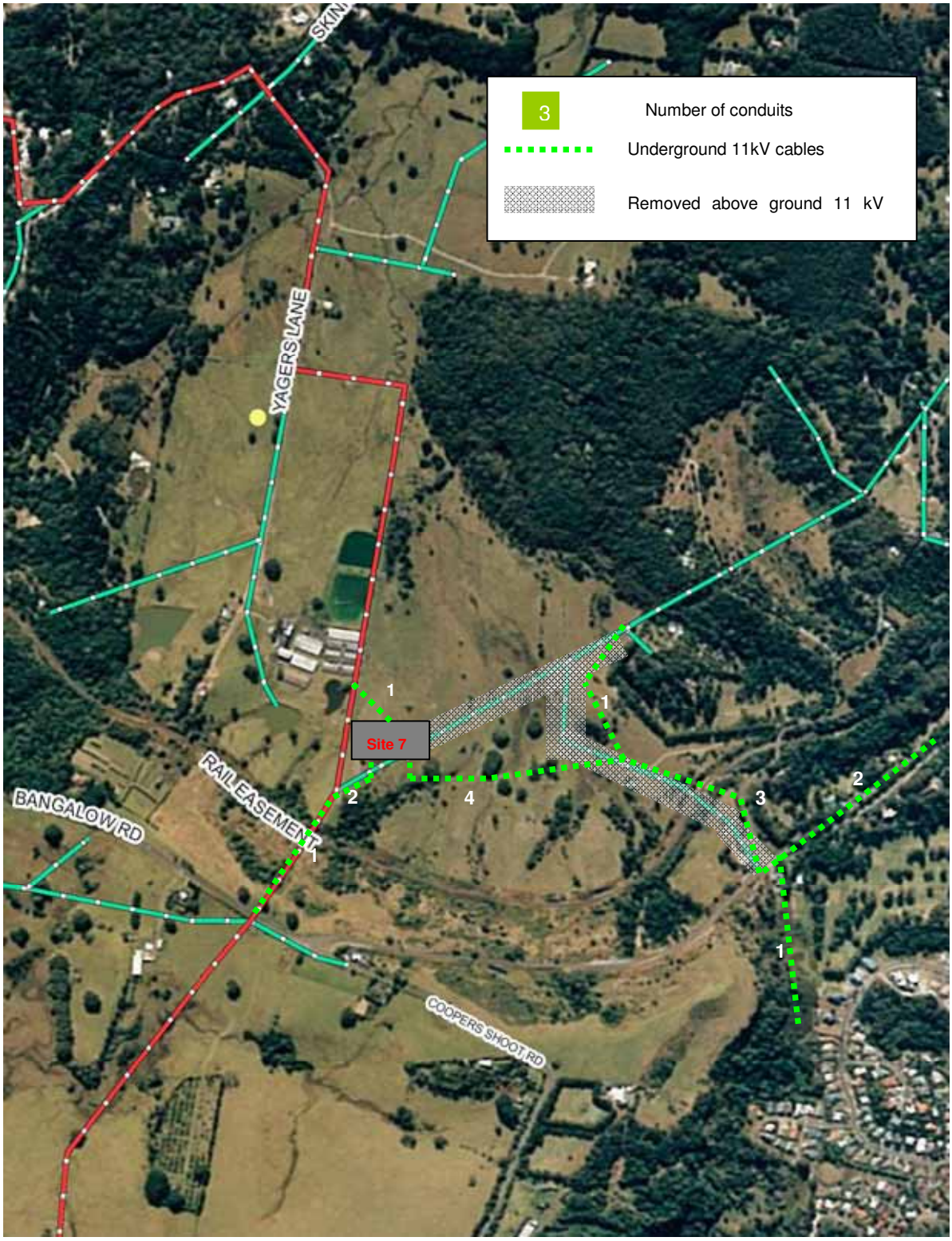

Figure 3-9: Site 7 11 kV feeder layout

4. Existing environment, Impacts and Mitigation

4.1 Climate

Byron Shire receives a mean annual rainfall of between 1700 and 2000 mm over much of the Shire. A comparatively narrow lowland area bounded by a high mountain range to the west together with a reliable annual rainfall results in a rapid runoff response in the coastal streams (Table 4-1). This is clearly reflected in the long-section profiles of the tributary streams of Belongil Creek which are characterised by short (generally less than 250 m) upper sections draining the escarpment below Bangalow Road with long, low gradient mid and lower reaches draining to Cumbebin Swamp. It is likely that the lateral retreat of the upper reaches has almost reached equilibrium due to the headward controls imposed by the railway corridor and Bangalow Road, and the restricted catchment remaining upslope of the site. The implications of this feature is that the runoff from the upper catchment will tend to be rapid but of short duration leading to high velocity flows that will require careful attention to drainage design in site preparation.

There is a marked wet season occurring from December to April, during which over 60% of average annual rainfall occurs. Thunderstorms and cyclonic activity may cause intense rainfall events and resultant flooding during this season. Falls of up to 260 mm in 24 hours are not uncommon (BSC, 2004).

The study area lies within the sub-tropical climate zone. The mountainous topography close to the ocean has a marked effect on rainfall, wind and temperature, modified by the orientation and local landform of the valley in which the two sites are located.

Very warm to hot weather is experienced during the summer months. From December to March, the average temperature is 23°C with a mean maximum of 27.2°C. Cooling sea breezes during these months assist in reducing the number of days of hot humid weather. During the winter months (June to September) temperatures are warm to mild, the average winter temperature being 14°C with a mean minimum of 11.5°C. Such temperatures make this area a popular place to visit during the winter periods (BSC, 2004).

Table 4-1: Byron Bay mean maximum and minimum temperature and rainfall (BoM, 2008)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Temperature														
Mean max temp (°C)	27.5	27.6	26.5	24.5	22.0	19.7	19.3	20.3	22.2	23.3	24.7	26.4	23.7	1974-2007
Mean min temp (°C)	20.8	20.6	19.5	17.2	15.0	12.5	11.7	12.5	14.3	16.1	17.8	19.5	16.5	1974-2007
Rainfall														
Mean rainfall (mm)	165	186	208	183	180	164	106	93	67	103	120	143	1722	1950-2008

4.1.1 Impacts and mitigation measures

The main impact of the climate to this project during both construction and operation will be the wet season from December to April when thunderstorms and cyclonic activity can cause intense rainfall events and resultant flooding. During the construction period, sediment and erosion management will be the greatest risk to avoid impacts on water quality and sedimentation of the lower valley floor.

Heavy and/or sustained rainfall has the potential to cause flooding of Belongil Creek and Cumbebin Swamp. Flooding is not an issue for construction activities but will significantly affect access to Site 7 where flooding could cause access issues in the low-lying areas of Skinners Shoot Road and Yagers Lane.

Construction works involving the major earthworks activities should be timed to occur during the dry season as far as is practicable to avoid erosion risk. Construction works during the drier months may generate minor dust impacts. Site watering will be required to control dust nuisance. As all access roads will be sealed, haul roads will not be an issue except through the former piggery property until sealed if this option is selected.

Cut and fill for site preparation should be designed to be spoil-neutral so there will be no need to manage the disposal or stockpiling of spoil for any length of time. Specifications are incorporated in the Construction EMP for temporary management if required.

Mitigation can be achieved for both erosion and dust issues by following measures outlines in Country Energy's CEM7022.07 Environment Operations Manual: Land Use procedure and using industry best practice guidelines.

4.2 Geology

The basement rocks of Byron Shire are comprised of Neranleigh-Fernvale metasediments (Pzn) from the Brisbane Metamorphic Series. These rocks are of Palaeozoic age (500-250 million years ago) and consist of metamorphosed siltstones, mudstones, shales, sandstones and conglomerates. The basement metasediments are exposed in a number of localities along the coast including Cape Byron and Broken Head, and can also be seen at the base of the coastal escarpment. The regional geology of the area is shown in Figure 4-1. Care should be taken with the interpretation of lithological boundaries in Figure 4-1 as scale of mapping does not accord with field observations.

The basement rocks are overlain in part by Mesozoic sediments (R-Jb) of the Bundamba Group formed by erosion during the Triassic, Jurassic and Cretaceous periods (210-135 million years ago). These sediments, consisting of conglomerates, sandstones, siltstones, shale and carboniferous shale can be seen in the cliffs behind Byron Hills Estate to the west of Suffolk Park. Within these sediments are layers of what are known locally as 'hailstone gravels', which are beds of small rounded, mainly white quartz alluvial gravel (5-20 mm) in a sandy/clayey matrix. These were laid down as river and lacustrine deposits within the unit as supported by the shape and size-sorted gravels that occur. These gravels were intercepted at Site 7 in the geotechnical investigatory drilling. They act as zones of subsurface water flow and, where intercepted in embankments as part of site establishment, will need to be drained to avoid seepage problems on site. Site 7 is located on the R-Jb unit or within colluvial/landslip sandy deposits derived from the R-Jb sediments that overlie the metamorphic rocks of the Neranleigh-Fernvale at or near the contact zone.

The Mesozoic sediments are in turn overlain by Mt Warning Volcanics. These volcanics consist of a sequence of lava flows from Mt Warning, with the Lismore Basalt (Tlb) being present on the area of

interest. It is estimated that the first flow occurred about 23-21 million years ago and produced an olivine-rich, low viscosity basalt known as the Lismore Basalt. This lies at the crest of the ridges to the south of the valley and sits above the Bangalow Road.

Following the cessation of volcanic activity, differential uplift and erosion occurred, causing faster water movement and incision of creek and river systems which persist to this day. Fluctuations in sea levels during the Quaternary period caused alluvial deposition of sequences of fluvial and marine sediments. This combined with high sea levels brought eroded materials into the valleys creating the coastal plain (BSC, 2004). These are expressed in the valley as the Qa unit in Figure 4-1 and comprise alluvial sands and clays and river gravels. Due to their elevation and history of development, these sediments are associated often with acid sulphate soil materials and often contain high watertables such as are expressed in Cumbebin Swamp further downstream and in the lower valley floor of Belongil Creek in the area of investigation.

The major geological units of the site are set out in Table 4-2 and illustrated in Figure 4-1.

Figure 4-1: Regional geology 1:250,000 showing the location of Sites 7

Table 4-2 : Major geological units of the area surrounding Site 7

Unit Symbol	Unit Name	Location in Relation to Site	Description	Characterised by:
Qa	Quaternary Alluvium	Valley floor along Belongil Creek and into Cumbebin Swamp	River gravels, alluvium, sand and clay	Wet, flood prone, low-lying, low gradient
Tlb	Lismore Basalt from the Lamington Volcanics (Mt Warning Central Complex)	Along Hayters Hill ridge crest	Basalt (agglomerate, bole)	Hard, high areas, ridgetops, good constructability
R-Jb	Bundamba Group	Site itself and mid to upper slopes of Hayters Hill to the south and along the Skinners Shoot Road ridgeline.	Triassic sandstone, siltstone, claystone, conglomerate	Moderate to steep slopes, erodible
Pzn	Neranleigh-Fernvale Group	Basement rock underlying R-Jb at the site	Metamorphics (greywacke, slate, phyllite, quartzite)	Steep slopes, erodible

Source: Tweed Heads, 1:250,000 Geological Series Sheet SH 56-3, NSW Department of Mines, 1972

4.2.1 Impacts and mitigation measures

The most likely impact is slope instability as a consequence of the location of the site at or just below the contact between the softer, weathered sediments of the Bundamba Group and the overlying Lismore Basalts. Undercutting of the sediments is a risk due to overland flow or over-steepening of the cut face beyond the natural angle of repose of the exposed sediments. Bedding within the Bundamba Group sediments is also a trigger for collapse of these slopes, particularly where there are beds that are more permeable than others and are associated with seepage. Hailstone gravel layers are present as surface materials at Site 7.

Hailstone gravel layers are associated with throughflow and seepage at Site 7. Stabilisation of embankment faces and intercept drains will be required.

Mitigation measures for management of the rock types and differential weathering at the sites should focus on minimising excavation depth, reduction in batter slopes as far as is practicable, and interception of seepage flows upslope of the sites and installation of bypass flow measures. Additional geotechnical investigations may be required for the selected site to better assess the extent of the risk.

4.3 Topography and Geomorphology

The area surrounding the two sites is dominated in the south by the ridgeline of Hayters Hill which is a remnant of the Lismore Basalt flow. The ridge is aligned generally east/west with Bangalow Road sited on or just below the crest before it descends to the coastal plain further to the east. This is the highest point at around 100 m AHD. Hayters Hill ridge slopes steeply (greater than 20%) down to the north and north-east forming an arc subtended by the sediments of the Bundamba Group on which the disused Casino-Murwillumbah Railway line is located at or just below the contact between the two lithological units.

Steep gullies have formed at approximately 100 m intervals along the lower escarpment of Hayters Hill, initiating at this lithological break. These drainage lines are steep in the upper reaches and initially V-shaped before becoming U-shaped where their gradient changes at the base of the scarp and sediments drop out on the valley floor. Below this profile change, the drainage becomes diffuse and

indistinct, flowing mainly as overland flow and seepage in unconsolidated sediments across the valley floor. These gullies are tributaries of a small creek system, Belongil Creek, which flows north-east to discharge into Cumbebin Swamp, which ultimately drains to Byron Bay. The depth of the mixed alluvium in the valley floor is unknown but is known to be associated with a high watertable and poor drainage. Skinners Shoot Road, from which Site 7 will be accessed, follows a gently sloping ridgeline to the north-west of Site 7 and defines the northern extent of the Belongil Creek catchment. The southern end of Yagers Lane (around the disused piggery) is at approximately 20 m AHD. The valley floor from the entrance to the property lies below 10 m AHD. The spur on which Site 7 lies is between 32 and 36 m AHD with about a 10 m fall to the eastern extent of the proposed footprint of the site (Figure 4-2).

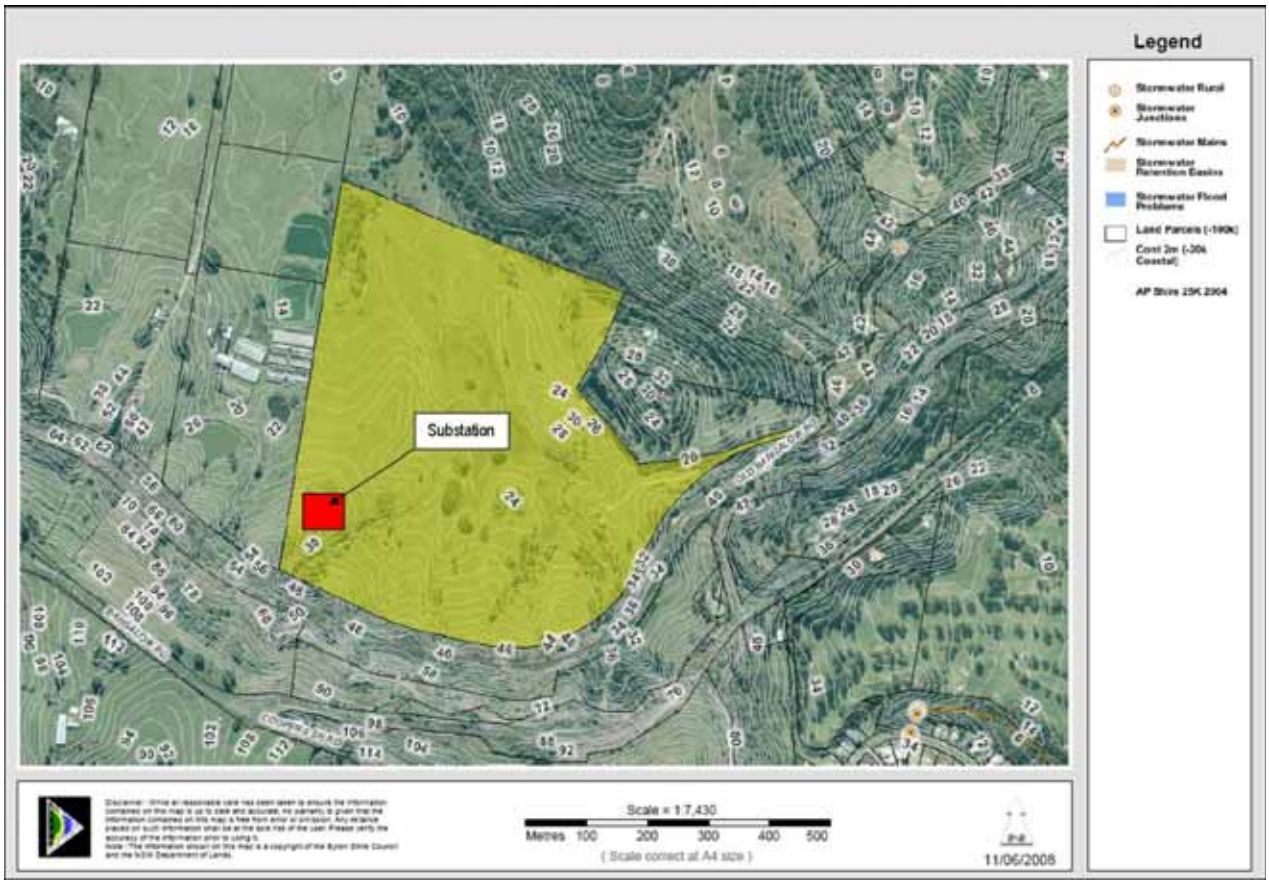

Figure 4-2: Topography of the valley surrounding Site 7

4.3.1 Impacts and mitigation measures

This site is located on the crest of a spur ridge and will be built on fill extending towards the east. The site sits below the railway line and runoff from this and the hillslope above is largely directed to gullies situated either side of the spur ridge. No specific impacts are anticipated for this site.

Mitigation measures would be lessened by design of the substation on multi-levels to minimise cut and fill sections and reduce the extent of batter stabilisation required.

4.4 Soils

No detailed soil survey was undertaken for the site. Reconnaissance survey though indicated that Site 7 was predominantly brown to reddish brown and grey brown, sandy clays (mainly Chromosols and Dermosols) and moderately deep to deep sands (Podosols). Some soils had significant amounts of small rounded (5-20 mm) white quartz, alluvial gravels consistent with the locally recognised hailstone gravels of soils formed on the Bundamba Group sediments.

Hydrosols also occur in the valley floor below the dams to the north of Site 7 in the area where feeders may need to be established or undergrounded. These sites are very wet and have a positive watertable for much of the year. They may be associated with ASS materials in this zone.

Profile development in the landslip deposits is inconclusive and best still fits with a Chromosol and/or Dermosol classification, suggesting that these landforms are presently comparatively stable. It is not known from the investigations undertaken to date though, whether the landslips pre-date or post-date clearing of the area. It is likely though that removal of the dense sub-coastal rainforest and wet sclerophyll forest vegetation that formerly occurred in these upper slope sites (remnants of which still remain around the escarpment) would have made the slopes more susceptible to landslip. Historical records show that much of these upper slope areas was cleared by the late 1800s/early 1900s and used for banana production through until the war years. It is, therefore, highly probable that the landslips may be of more recent origin and reflect agricultural use of the area.

Provided adequate attention is paid to drainage and design of stabilisation of any cut faces and batter slopes on fill sections, soils on the slopes are not likely to present any unmanageable problems for construction. It will be necessary to implement an effective sediment and erosion control plan during construction and to ensure appropriate rehabilitation and revegetation occur.

Soil resistivity

Earthing system design is aided by soil structure that exhibits conductive properties in the deeper soil layers allowing fault current to be drawn away from the surface when returning to its source. Soil resistivity results (Appendix D) indicate that Site 7 has more conductive lower layers although each of these layers is quite resistive overall. This site is suitable from an earthing perspective as the lower layer appears to be a better conductive medium. Nevertheless, considerable area may need to be secured for auxiliary earthing such as counterpoising if required on a solidly earthed system. Usually the distribution phase to earth fault level is the limiting design parameter which can be alleviated by neutral earthing reactors if site area is insufficient.

4.4.1 Impacts and mitigation measures

The following general mitigation measures apply and relate mainly to the construction phase:

- minimise clearing and disturbance to the actual construction site as far as is practicable;
- prepare a site specific sediment and erosion control plan once final design is determined and ensure regular inspection for maintenance and to check performance;
- establish groundcover as soon as practicable in disturbed areas to prevent sediment generation;
- reduce slope length exposed to runoff and minimise batters on stockpiles;
- provide silt fencing constructed according to IEAust Guidelines and regularly maintain by removing sediment and relocating to account for construction activities;
- provide stable drains to manage concentrated flows and their discharge points into gullies/creeks;

- construction should be undertaken in accordance with a site-specific erosion and sediment control plan and follow Country Energy's 'CEM7022.07 - Environmental Operations Manual: Land Use' and 'CEM7022.06 - Environmental Operations Manual: Waste."
- all works should be undertaken in accordance with the soil and water management standards detailed in the NSW Department of Housing, Managing Urban Stormwater – Soils and Construction (1998) manual; and
- prepare an appropriate revegetation and landscaping plan.

4.5 Acid Sulfate Soils

The Byron Shire LEP Acid Sulfate Soils (ASS) Planning Map indicates the northern and north-eastern portions of the investigation area contain Class 2, 3 and 5 ASS (Figure 4-3). The ASS class refers to whether development consent is required for earthworks in that area. Class 1 is broadly areas of highest ASS risk with Class 5 being lower risk but still requiring development consent in some circumstances. ASS typically occur in low-lying coastal areas, generally below 5 m AHD. Developments involving excavation or lowering of the watertable may result in the oxidation of sulfur (predominantly in the form of pyrite) contained within these soils and the subsequent generation of acid discharge from the exposed soil or spoil that must be disposed of following construction. The resultant discharge may find its way into the groundwater or stormwater and eventually into natural aquatic environments. The acidic run-off may lower the pH of the receiving water system, increase the concentration of metals and reduce the natural buffering capacity of the receiving waters.

The proposed substation site is located higher up the Belongil Creek valley above the ASS zone with Site 7 being above 28 m AHD. ASS investigation results (Appendix D) from the substation site and between the southern storage dams (on proposed access road) indicated that the soil at the site generally consists of non-reactive sand and gravely sand. The watertable was found to exist from 1.9 m below the ground surface. Soil from the site was found to have a net acidity below the ASSMAC action criteria and can be classified as Non-PASS/AASS. Non-PASS/AASS are not considered to present an environmental hazard.

Though no investigations were undertaken in the valley floor to the north of the piggery property, it is likely that ASS will be found here. The Byron Bay LEP mapping identifies the potential for ASS in this area as can be seen in the small 'finger' of Class 5 mapped area across Yagers Lane in (Figure 4-3). This area corresponds with the culvert drains under Yagers Lane. These culverts will need to be replaced as part of the road upgrade works. The presence of ASS will need to be verified before road upgrade works are undertaken in this area.

Any road strengthening or repair works through the low-lying Cumbebin Swamp will be in Class 2 ASS land. Any potential works are considered minor. Works will only occur within the existing road reserve (i.e. on non-ASS imported road material) and will not involve any excavation below natural ground surface. Nevertheless, should road works be required mitigation measures to prevent accidental exposure or transport of ASS due to road works will be put in place.

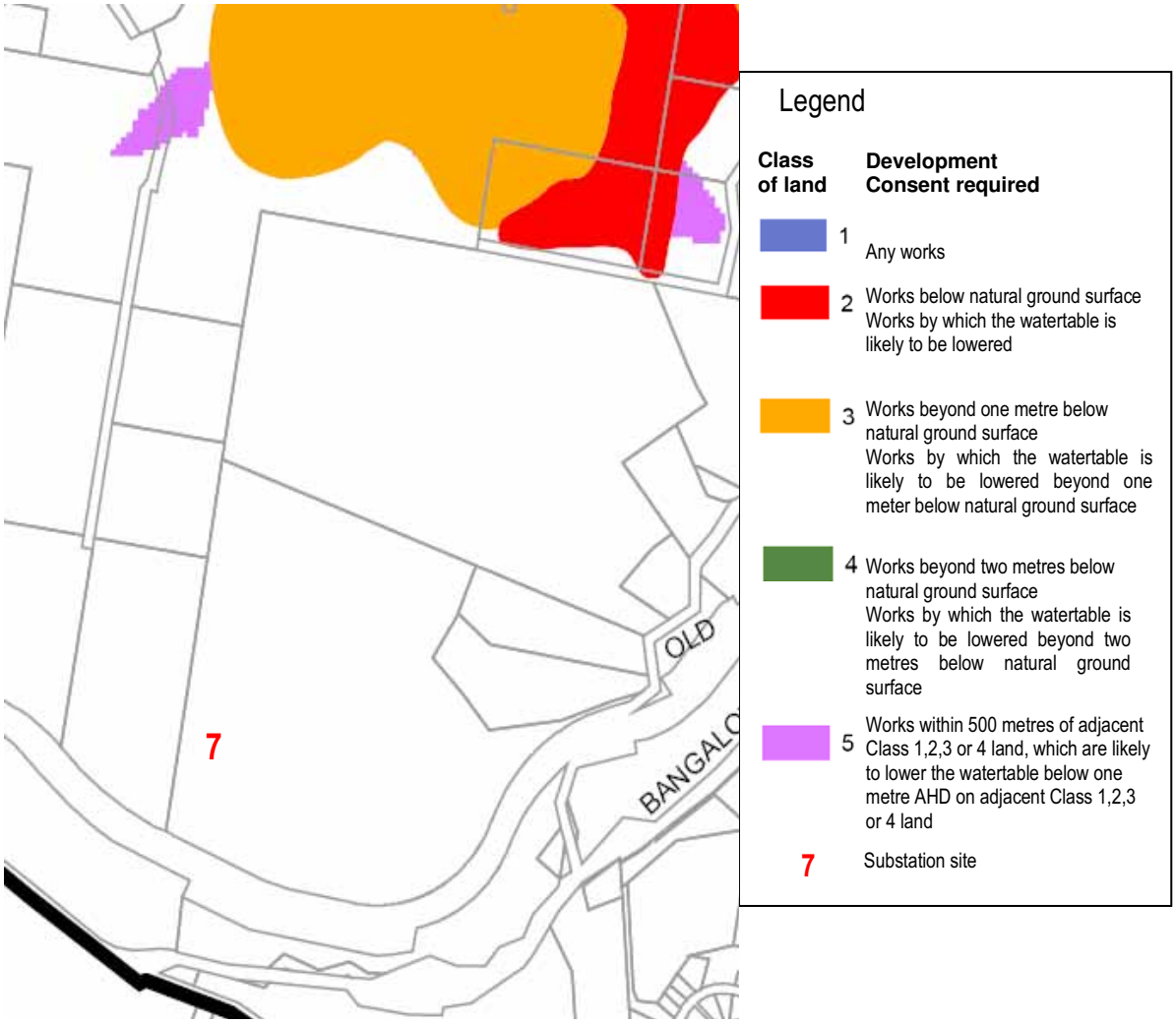

Figure 4-3: ASS mapping (from Byron LEP Map 13)

4.5.1 Impacts and mitigation measures

The following principles are in accordance with the Acid Sulfate Soil Management Advisory Committee (ASSMAC) Management Guidelines (1998) and are the fundamental strategies that underpin the management of ASS.

Avoidance
This is the soundest strategy and the proposed works should always attempt to modify work practices in order to avoid unnecessarily exposing or disturbing ASS. The proposed works should also avoid activities that result in the fluctuation of the groundwater, in particular the lowering of groundwater where possible.

Minimisation
Appropriate handling techniques and treatment of excavated soil are to be used to minimise and or prevent the disturbance of ASS. Furthermore, earthworks activities should be managed to minimise or mitigate the potential of ASS to impact on the surrounding environment.

Neutralisation
Sufficient neutralising agent should be incorporated into excavated soils in order to neutralise acid that is generated over time due to the gradual oxidation of ASS. Neutralising agent should also be applied to acidified water run-off and any remaining water *in situ* (within the pore spaces of the material being excavated) that has become acidified.

If required, the management and remediation of the excavated soil for road upgrade works will be achieved using a combination of the management strategies outlined above.

There are no ASS issues associated with the substation site. The road upgrade near the northern end of Yagers Lane may intersect ASS material (Figure 4-3). This upgrade will include replacing the culvert crossing (2 x 600 mm diameter RC pipes) in Class 5 ASS zone. Geotechnical drilling in areas of likely ASS along Yagers Lane will be required to determine level of ASS and therefore treatment required.

The impact of earthworks on potential areas of ASS can be mitigated through:

- Implementation of an ASS Management Plan based on the results of the geotechnical investigation;
- full compliance with the ASSMAC guidelines (1998); and
- following Country Energy Procedure CEM7022.07 - Environmental Operations Manual: Land Use.

4.6 Contaminated Land

No dip sites have been identified within the nominated buffer zone at Site 7. Two current or former dip sites have been identified though in the valley, which may require remediation if construction occurs nearby. One dip site located in the valley floor near the intersection of Skinners Shoot Road and Yagers Lane may be within the specified management buffer zone if works are required here for either road construction or for placement of poles or underground cabling.

A former dip site located at the intersection of Bangalow Road and Coopers Shoot Road will not impact on the substation site.

SEPP 55 - Remediation of Land sets policy guidelines for the remediation of contaminated land should there be any need for management of contaminated lands at the selected substation site and for associated works.

4.6.1 Impacts and mitigation measures

No impacts are anticipated at the site from contaminated land matters, except potentially with any upgrading of Yagers Lane that may involve work near the former dip mentioned above.

Mitigation measures include:
- adequate investigations to determine the extent and nature of any contamination; and
- full compliance with SEPP 55 Contaminated Land Guidelines if required.

4.7 Surface Water

This site is situated on the crest of a convex spur ridge that will be modified by excavation to yield a level site on a cut and fill base. Presently the site receives minimal run-on water with all local runoff

being directed to the two steep sided gullies that flank the spur ridge. The base of the creeks is more than 10 m lower than the current crest of the ridge at the proposed site and will not impact on the site as overbank flooding even in extreme storm events, even if the cut and fill excavation halves the elevation difference to approximately 5 m relief.

There is, however, a potential for surface runoff, particularly during more severe runoff events to affect the access via the piggery to Site 7. The gully on the western side of the proposed site has a broad, flat-bottomed cross-section showing evidence of considerable deposition of sediments from the overlying slopes that have deposited where the gully changes gradient significantly. These features provide clear evidence that these gullies regularly carry heavy sediment loads in rapid/short duration runoff events.

A further issue in this area associated with the access relates to its probable location on the berm of the southern-most storage pond from the former piggery. Stormwater management associated with the former piggery at this point redirected flows from the aforementioned gully to the east and the overflow of the pond to a central pipe culvert that flows under the piggery buildings. This flow was used for flushing of the effluent from the sties to the lower pond system. Careful design will be required in this location to ensure that all stormwater is adequately managed up to an agreed design event to avoid damage to property and access during severe storm events when a site visit may be required.

North of Site 7 on both sides of Yagers Lane and outside the piggery property is within the 1 in 100 year AEP flood extent zone (Willing and Partners, 2000). High watertables were observed on properties traversed by Yagers Lane in areas mapped as Qa (Quaternary Alluvium). Even though this is outside the area identified as flood prone land (subject to AEP 1 in 100 year event), the area is still subject to seasonal inundation within the upper part of the Belongil Creek catchment. Numerous tributaries and gullies from the steep upper slopes feed Belongil Creek. During large rain events Cumbebin Swamp may become inundated making access to Yagers Lane via Skinners Shoot Road difficult to impossible at times. There is a need to upgrade the culverts in this area and widen the road pavement for access to the site, particularly for the movement of the large transformers.

The substation site lies well above the 1 in 100 year AEP flood margin. Consideration will need to be given to installation of poles and/or any underground cabling lower in the flood-prone valley in terms of both construction and maintenance needs.

A stormwater management plan will need to be developed once final design of the substation site is complete for incorporation into the civil works at the site and the safe management of runoff from the site to the gullies.

4.7.1 Impacts and mitigation measures

The main impacts at this site will be due to surface runon and runoff from the spur ridge above and the site itself. There is a risk of erosion during construction but implementation of an appropriate stormwater management plan will avoid continuing risk. It will be important to ensure safe disposal into the gully to the east to avoid erosion of the bank at any overfall. Surface water will also affect access to the site if access is via the piggery due to the need to cross a gully that is subject to short duration, high velocity flows in large storm events. Flooding will also be an issue along Skinners Shoot Road and Yagers Lane in terms of maintaining all-weather access for maintenance operations in particular.

Mitigation measures include:

- implementation of an effective stormwater management plan and incorporation of this into the construction design, rather than treating it as a retro-fit solution following construction;

- stormwater runoff will be managed in association with the sediment and erosion control plan;
  - all runoff from the construction area is to be directed through sediment fences;
  - stockpiles will be located away from drainage lines;
- drainage from the sealed vehicle movement areas should be directed through an appropriate water quality treatment device e.g. oil/water separator, prior to release;
- discharge points for the site runoff to these gullies will be downstream of their incised sections and into the spread flow zones;
- point source discharge should not be contemplated. Rather, a system of dispersing flow to avoid erosion at the discharge point will be required;
- locating the transformers on concrete slabs with concrete bunding sufficient to prevent spillage escaping from the contained area;
- each bunded area should drain to an underground storage tank with equal or greater capacity than the transformer's oil reservoir;
- any oil collected in the underground storage tanks should be pumped out immediately by a suitably licensed contractor;
- minimising vegetation clearing and site disturbance;
- storage of fuels and chemical away from drainage lines and within bunded areas;
- ensuring that no refuelling or servicing of machinery and equipment occurs in areas likely to yield runoff so that the risk of entrainment of hydrocarbons is minimised; and
- arranging for emergency 4WD access through Lot 9/588885 via Old Bangalow Road in the case of Skinners Shoot Road being flooded out.

4.8 Groundwater

No watertables were intercepted during investigations of Site 7. Nevertheless, as a bed of hailstone gravel was detected near the crest of the spur ridge, it is possible that there may be periods of seasonal subsurface seepage from the overlying ridge at this site. Interception of such flows would present few problems for management as part of the site stormwater management plan.

It is possible that there may be a near surface watertable near the extreme east of the site associated with the discharge of the gully where it transitions to open flow conditions. This would need to be investigated once a detailed location of the footprint of the site is determined.

There would be issues associated with groundwater with respect to any undergrounding of cables and positioning of poles with the feeders heading north and across the valley floor by whatever route is selected beyond the northern-most storage pond. The 11 kV lines to be undergrounded to the east of the site (Figure 3-9) will likely intercept groundwater.

4.8.1 Impacts and mitigation measures

There are no impacts of significance anticipated from groundwater at Site 7 though there may be minor subsurface seepage associated with the hailstone gravel layer to be managed. This can only be determined with further geotechnical investigations on site.

There may be significant groundwater issues though depending on the means of conveying power back to the network at Yagers Lane. This is particularly so if the cable is to be laid underground northwards within Lot 9/588885 to the northern storage pond.

Additional geotechnical data to determine the extent, depth and exact nature of the groundwater flows may be required for the underground cable section as trench excavation will likely intercept groundwater. Any underground cable in the valley floor though will face significant groundwater

conditions, some of which may be acid where ASS are encountered. Construction measures will be necessary for installation and the selection of appropriate cable will be needed.

Mitigation measures include:

- additional geotechnical investigation to be undertaken prior to excavation along the underground cable route to determine depth and extent of groundwater;
- dewatering procedures to be in place where excavation likely to intercept groundwater table; and
- implementing an ASS Management Plan based on the geotechnical investigation, including dewatering procedures.

4.9 Land use and land tenure

The project area is located within the Byron Shire Local Government Area (LGA). The predominant land use surrounding the site is grazing with some residential and rural residential properties. There are approximately thirty residential properties along Skinners Shoot Road that may be affected by construction activities at Site 7.

To the west of the existing 66 kV line at the southern end of Yagers Lane is the disused Yagers Piggery. The piggery has been decommissioned but all infrastructure remains in place. A development approval for a plant nursery has been granted for this site, which will utilise some of the existing buildings. The owners plan to create an artist's retreat and conduct a range of other activities on the site, including the construction of eco-retreat housing. The site is being developed in stages and other Development Applications are pending the decision on the location of the proposed substation.

There are no other commercial or industrial land uses in close proximity to the site. There is potential for some of the more elevated sections up to the disused railway to be developed in the future into residential blocks though this is not currently allowable under the existing Byron Shire planning scheme.

Historical records indicate that the valley in general was initially cleared in the late 1800s to early 1900s, mainly for dairying. Prior to this the upper slopes were dominated by sub-coastal rainforest and wet sclerophyll forest, with *Melaleuca* spp, forest in the wet valley floors (similar to the Cumbebin Swamp at present). For a period, these upper slopes were subsequently used for banana production for many years. There is some indication that the steep slopes were subject to considerable erosion during this phase.

Following the cessation of banana production, the piggery was constructed post-war and the remainder of the valley reverted to cattle grazing.

4.9.1 Impacts and mitigation measures

Construction of a substation at this location will require acquisition of a minimum area approximately 130 x 100 m to include the buffer zone for vegetative screening. This will remove a significant area of productive pasture land on a cleared ridge from access to grazing. Easements will also be required for installation of either underground or overhead powerlines. An access easement may also be required to allow for times when access not possible from the adjacent property to the west due to flooding of the road through Cumbebin Swamp. Access from the east within Lot 9/588885 is not recommended as the primary route due to the significant environmental impacts, effects on streamflows and the difficulty of obtaining all-weather access at reasonable cost.

In-principle agreement has been reached with both affected landholders for the location of the substation and for the powerlines to be undergrounded alongside the upgraded access road through the former piggery.

Mitigation measures include:

- continue close consultation with affected landholders to facilitate mutually beneficial outcomes;
- making timely decisions and ensure affected landholders are kept informed so that they can make decisions on their development; and
- if possible, locate substation in area to minimise impact on future potential of the property to the landholder.

4.10 Flora

4.10.1 Overview

Vegetation mapping from the Byron Shire Council Local Environmental Study (LES) identifies a number of different vegetation communities in the investigation area. The northern portion of the area is characterised by *Eucalyptus pilularis* (blackbutt), *E robusta* (swamp mahogany), *E grandis* (flooded gum) and *Melaleuca quinquinervia* (teatree), all predominantly swampy/wet ground trees.

The elevated areas towards the southern end of Skinners Shoot Road are identified as primarily rainforest. This includes the Hayters Hill Nature Reserve in the south-western corner of the investigation area. The eastern side of the area has a patch of teatree and blackbutt. To the east is described as Coast Banksia and rainforest. The centre of the investigation area (around Yagers Lane) is predominantly farmland used for grazing.

A more detailed fauna and flora survey of the site was undertaken in June 2008 to assist in final site selection. The study concentrated on the area between Site 7 and the water reservoir on the corner of Bangalow Road and Old Bangalow Road to the east. In October 2008 the vegetation in the gully to the south of the substation site was assessed separately following determination that some of this vegetation would require removal to allow a 15 m minimum clearance from the incoming 66/132 kV line. The findings of all surveys and assessments are presented below.

4.10.2 Background Data

Searches of relevant databases (Atlas of NSW Wildlife database and EPBC Online Protected Matters Search Tool database – Appendix E) for the proposed disturbance areas and surrounding landscape identified a total of 34 flora species listed as Endangered or Vulnerable under the provisions of the New South Wales *Threatened Species Conservation Act* 1995 (TSC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC). All threatened species were targeted in the subsequent field inspection. Based on habitat characteristics present within the disturbance zones, most of the threatened species identified from the searches are not likely to occur. Those species likely to occur are discussed below. Additionally, other than minor clearing associated with relocation of power to the site, no clearing is required at Site 7. The site as shown in Figures 3-2 and 3-5 is cleared and consists primarily of grass and bracken fern cover.

The area includes several polygons that have been mapped by Byron Shire Council as containing vegetation of high conservation significance (Figure 4-4). The disturbance area identified in Figure 4-4

was part of a previous site selection that is no longer relevant. The proposed site has been cleared so the survey focused on the units mapped by the Byron Shire Council.

Figure 4-4: Areas mapped by BSC as Significant Vegetation

- ***Recorded Flora***

A total of 108 flora species were identified from the proposed disturbance areas (Appendix F). This consisted of 62 (57%) native species and 46 (43%) exotic species.

- ***Protected Flora***

One (1) individual of a single species listed as Endangered under the provisions of the EPBC and the TSC Act was recorded in the remnant forest to the south-west of the water reservoir, namely the Green-Leaved Rose Walnut *Endiandra muelleri*. A discussion of this species is provided below.

Green-leaved Rose Walnut - *Endiandra muelleri*
Status: Endangered (EPBC Act, TSC Act).

One (1) individual of this species was observed growing with closed forest within the south-eastern portion of the study area (-28.674105S 153.593816E – GDA 94 Datum). The current habitat was degraded by infestations of Camphor Laurel, Small-leaved Privet, Slash Pine and Lantana, although native species were present also within the canopy.

This species is a tree growing to 30 m in height, with buttressed roots and brown bark that often forms rounded plates. Leaves are usually 6–12 cm long and 3–5 cm wide, moderately glossy, brown or green when dried. The midrib is warty on the lower leaf surface. Small domatia are sometimes present and petioles approximate 5–10 mm in length. Flowers approximate 2 mm in length and are yellowish in colour (Harden 2008).

The Green-leaved Rose Walnut is distributed along the east coast of Australia, from the Allyne River in New South Wales, northward to Innisfail in Northern Queensland. It often occurs in warm tropical and sub-tropical rainforest on poorer soils and in littoral rainforest on sands (Harden 2008).

- ***Declared Pest Flora Species***

A total of 46 exotic flora species were observed in the surrounding area but none within the proposed construction area of the substation. Of these species, seven (7) have been declared as noxious under the provisions of the New South Wales *Noxious Weeds Act 1993* (NWA). These species include: Mistflower *Ageratina riparia* (Class 4); Groundsel Bush *Baccharis halimifolia* (Class 3); Bitou Bush *Chrysanthemoides monilifera* (Class 4); Camphor Laurel *Cinnamomum camphora* (Class 4); Fountain Grass *Pennisetum setaceum* (Class 4); Giant Rats-tail Grass *Sporobolus pyramidalis* (Class 3) and Lantana *Lantana camara* (Class 4).

Vegetation assessment immediately adjacent to Substation site

A site inspection was undertaken of Site 7 in October 2008 to assess the potential impacts of removal of vegetation to allow the realignment of the 66 kV line to the proposed substation. The gully line behind the site contains a dense vegetation community that consists of a range of both native and introduced species. The following key species were identified during the inspection:

Botanical name	Common name
Cinnamomum camphora	Camphor laurel
Pinus elliottii	Slash pine
Cupaniopsis anarcardiodes	Tuckeroo
Elaeocarpis obovatus	Hard quandong or Smell of the bush
Neolitsea dealbata	White bolly gum
Jagera pseudorhus	Foambark
Mallotus discolour	White kamala
Flindersia schottiana	Cudgerie
Diospyros fasciculosa	Grey ebony
Cryptocaria triplenervis var pubens	Hairy three-veined cryptocaria
Ficus watkinsiana	Strangler fig
Lantana camara	Lantana

The main large species that are of concern to the powerline relocation are camphor laurel and slash pine. None of the other trees was greater than 3 m high and many are pioneer or understorey species that will not threaten the powerlines.

The remainder of the area is grassed and is regularly grazed and kept low. A patch of *Pteridium esculentum* (Bracken fern) lies within 15 m to the north of the proposed line but will be removed for substation construction.

None of the trees recorded are scheduled species of conservation value. They do, nevertheless, provide good ground cover and confer stability on the steeply sloping banks of the gully. The canopy is very dense and there is no ground cover other than a deep leaf litter layer under the trees.

4.10.3 Impacts and mitigation measures

A single species (i.e. Green-leaved Rose Walnut) listed as Endangered under the provisions of the TSC Act and the EPBC was observed growing along a drainage line near the water reservoir. However, under the current proposal, the area that currently provides habitat for this species will remain undisturbed. In addition, it is likely that any control of exotic species (e.g. Camphor Laurel and Lantana)

will benefit this species and its habitat. The impact of the proposed development on this species has been assessed using criteria in Section 5A of the EP and A Act 1979 (assessment of significance). No significant impact was identified (see Appendix G). Therefore, it is not considered that referral to the Department of the Environment, Water, Heritage and the Arts (DEWHA) or the State authorities will be required as part of the approval process.

It is expected that the proposed works will have no disturbance upon areas mapped as High Conservation Value by Byron Shire Council, and will be restricted to the removal of exotic species (e.g. Camphor Laurel) in the gully to the south of the site.

Several exotic species (i.e. Mistflower - Class 4; Groundsel – Class 3; Bitou Bush – Class 4; Camphor Laurel – Class 4; Fountain Grass – Class 4; Giant Rats-tail Grass – Class 3 and Lantana – Class 4) have been declared as noxious under the provisions of the NWA. It is a legal requirement that landholders keep their lands free of Class 3 weeds by continually suppressing and destroying observed infestations, while Class 4 species must be controlled in a manner that is consistent with the management plans that have been published by the local control authority. It is therefore recommended that noxious weeds be controlled in a manner consistent with their listing under the provisions of the NWA.

Some overhanging vegetation along Skinners Shoot Road and Yagers Lane will require trimming/lopping to allow a low-loader transporter carrying the transformers to access the site. This trimming will prevent damage to vegetation from vehicle strike. Trimming will be undertaken under the supervision of an experienced arborist to ensure no long-term damage to the vegetation.

Removal strategy for vegetation adjacent to substation

There are two options for removal of the existing vegetation within the required buffer zone of 15 m proposed:

1. Clear fell and mulch all removed vegetation on site. The mulch could then be spread over the exposed ground and allow pioneer low-growing species to recolonise.
2. Remove trees to ground level and poison to prevent regrowth using an environmentally acceptable spray to avoid impacts on aquatic species downvalley in the wetland to the north. The trees should then be mulched and the mulch spread under the remaining canopy rather than over the cleared area. The cleared area should be grassed to provide stability and ease of management of the area under the powerline. This reduces the risk of large storm events moving the mulch and depositing it in the gully, leading to erosion and impacts on streamflow.

Option 2 is preferred as it is less likely to lead to long-term maintenance problems.

Recommendations

Clear the vegetation that lies within 15 m of the centre line of the new alignment. Mulch and stockpile initially. This will allow a degree of composting and consequent reduction in viability of entrapped seed material. This mulch should then be evenly spread under the remaining canopy along the steep slopes above the gully and allowed to settle. The area from which the trees have been removed should then be grassed, preferably using turf gained from the stripping of the substation site to avoid the introduction of weed species not already present. This will also provide a uniform pasture for continued grazing of the area outside the fenced substation site. The tree stumps should be ground down to ground level and poisoned to avoid regrowth under the powerlines.

4.11 Fauna

4.11.1 Terrestrial Vertebrates

Searches of relevant databases for the proposed site and surrounding landscape identified a total of 60 vertebrates listed as Endangered or Vulnerable under the provisions of the TSC Act and/or EPBC. However, a large number of these are aquatic or pelagic species, whereas only terrestrial species were considered in the subsequent field inspection. Based on habitat characteristics present within the disturbance zones, not all threatened species identified from the searches are likely to occur. Those species likely to occur are discussed below while a brief discussion of species not considered likely to occur is provided in Appendix H.

In addition, a large number of migratory species has been recorded in databases, although many are marine or estuarine/mudflat inhabitants. Migratory species recorded from the proposed impact area, or those considered likely to occur, are discussed in the Migratory Species section below.

- ***Recorded Terrestrial Vertebrates***

A total of 45 terrestrial vertebrate species has been identified from the proposed disturbance areas including three species of amphibian, one reptile, 36 birds and five mammals (Appendix H). Abundant species included Common Eastern Froglet *Crinia signifera*, Little Wattlebird *Anthochaera chrysoptera*, White-cheeked Honeyeater *Phylidonyris Niger*, Brown Honeyeater *Lichmera indistincta*, Silvereye, Figbird, Grey Fantail *Rhipidura fuliginosa*, Willy Wagtail *Rhipidura leucophrys*, Australian Magpie *Gymnorhina tibicen,* Scarlet Honeyeater *Myzomela sanguinolenta*, Lewin's Honeyeater *Meliphaga lewinii* and Welcome Swallow *Hirundo ariel*.

Most vertebrates recorded are considered common and abundant within the local area, although one identified species is listed as Vulnerable under the TSC Act and EPBC. This species, and other threatened species known or considered likely to occur, are discussed below.

- ***Threatened Vertebrates Recorded or Considered Likely to Occur***

The field inspection identified three species listed as Vulnerable under the TSC Act and/or EPBC as present within the area. The locations of where these species were recorded are indicated in Figure 4-5. In addition to these species, three species not recorded are considered likely to occur based on habitat assessment and local records. These species are listed in Table 4-3.

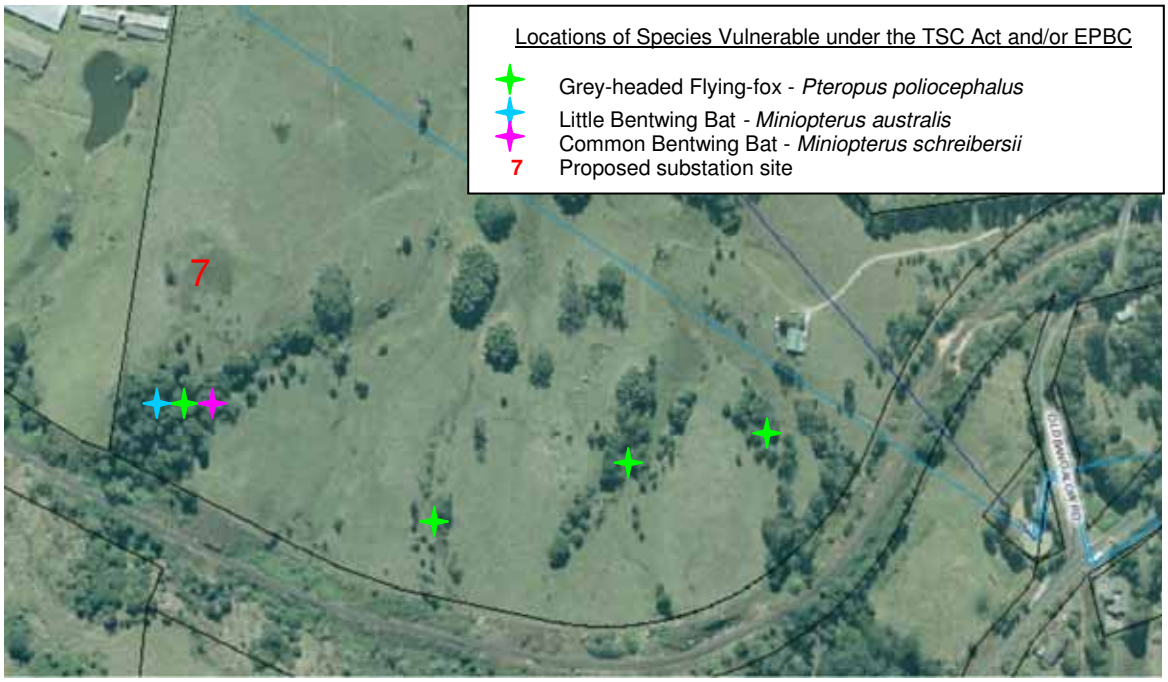

Figure 4-5: Recorded Threatened Vertebrates

Table 4-3 : Threatened vertebrates recorded or likely to occur

Group *Scientific Name*	Common Name	Status TSC	 EPBC	Likely Occurrence
BIRDS				
Monarcha leucotis	White-eared Monarch	V		Possible
MAMMALS				
Syconycteris australis	Common Blossom bat	V		Expected
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Known
Miniopterus australis	Little Bentwing Bat	V		Known
Miniopterus schreibersii	Common Bentwing bat	V		Known

White-eared Monarch - *Monarcha leucotis*

Status: Vulnerable (TSC Act).

White-eared Monarchs are a summer migratory species to central eastern Australia. They have not been recorded within the proposed disturbance areas, although the species has been recorded less than 1 km away. The species is known to inhabit coastal and near-coastal mesic forests and particularly ecotones between dense and open vegetation such as rainforest edges and occasionally regrowth (Higgins et al., 2006). Good habitat for the species occurs within rainforest near Skinners Shoot.

Habitat within the study area is restricted to two vegetated gullies, to the south of Site 7 and west of the water reservoir. While these gullies provide good structural habitat, they are dominated by exotic Camphor Laurel Cinnamomum camphora which is less regularly used by the White-eared Monarchs. Accordingly, while it is possible that the species may use this vegetation, it seems unlikely that any resident birds inhabit the area during summer months.

Common Blossom Bat - *Syconycteris australis*

Status: Vulnerable (TSC Act).

No Common Blossom Bats have been recorded within the study area. However, the species has been recorded approximately 3 km to the east and suitable foraging resources are abundant. Furthermore, ideal roosting habitat occurs less than 1 km to the west in rainforest associated with Skinners Shoot. The species is therefore expected to occur.

Common Blossom Bats occur in small colonies within areas of suitable habitat. As its common name suggests, they feed predominantly on nectar and blossom. Hence they are regularly located foraging and feeding within coastal heathlands and forests where banksias are common. However the species has also been recorded taking quantities of fruit (Law 2001) and may therefore seasonally or occasionally utilise resources in rainforests. Banksia integrifolia flowers all-year-round and abundant large trees are likely to provide a stable and abundant dietary resource. In addition, fruiting bodies, particularly Syzygium and Ficus, could provide additional resources.

Radio-tracking of the species has shown that individuals have a strong fidelity to feeding areas, which extend in size to around 13 ha (Law 1993). The maximum distance any individual was recorded commuting from a roost to a foraging location was 4 km, although the average distance moved was 0.8 km in winter and 1.4 km in summer (Law 1993).

Eastern Blossom Bats roost within the sub-canopy of the rainforest. Multiple roost locations are used throughout the individual's home range and each roost is rarely used more than one night in succession (Law 1993). Rainforest at Skinners Shoot is in close proximity to the study area and provides typical roosting habitat for the species. While there is some rainforest type vegetation associated with the two gullies this may not be extensive enough to provide roosting habitat in itself.

Grey-headed Flying-fox - *Pteropus poliocephalus*

Status: Vulnerable (EPBC) and Vulnerable (TSC Act).

Grey-headed Flying-foxes were commonly observed within the study area foraging on flowering Banksia trees. Due to the abundance of the species, not all observations were recorded. Rather, details in Figure 4.5 are provided to indicate that the species occurs throughout the study area wherever suitable foraging resources are located. They are also common outside of the study area and were observed at several locations feeding on Banksias and fruiting Ficus.

Grey-headed Flying-foxes occupy a similar niche to Black Flying-foxes and there may be competition between the two species. The two species regularly roost communally, and forage on similar dietary items.

Little Bentwing Bat - *Miniopterus australis*

Status: Vulnerable (TSC Act).

Little Bentwing Bats inhabit a variety of vegetation types ranging from rainforests to dry sclerophyll forest, Melaleuca swamps and coastal forests (Churchill 1998). While it prefers forested areas, it may be readily recorded in open or fragmented areas, particularly along ecotones. The species was recorded during one night's ANABAT detection undertaken near vegetation associated with the gully to the south of Site 7. They are expected to be more widely distributed within the study area than current records indicate.

Little Bentwing Bats roost primarily in caves (Dwyer 1968) but may also use tree hollows (Schultz 1997). However, the species depends upon specific nursery sites to rear its young. These maternity caves are often shared with Common Bentwing Bats Miniopterus schreibersii and the two gather in such large numbers that they raise the ambient air temperature to as much as 39°C (Churchill 1998). No caves or maternal roost sites were located within the study area, although several large culverts beneath the

disused railway are similar to other locations where the species has been located. However, inspection failed to locate any bats in these structures. It is possible that they may be used seasonally.

Common Bentwing Bat - *Miniopterus schreibersii*

Status: Vulnerable (TSC Act).

Common Bentwing Bats have considerable niche overlap with Little Bentwing Bats, inhabiting similar vegetation types and often utilising the same roosts and maternity caves. However, evidence suggests that they may be more tolerant of fragmentation and open habitats than Little Bentwing Bats (Law et al., 1999). The species was recorded during a single night's ANABAT detection near vegetation associated with the gully to the south of Site 7. However, the species traverses considerable distances through landscape mosaics (Dwyer 1969) and is likely to be more widely distributed than current records indicate.

- ***Migratory Species***

A large number of vertebrate species listed as Migratory under the EPBC are recorded in local databases. However, a large portion of these species are marine or restricted to marine associated habitats (e.g. estuaries and mudflats).

Field investigations identified two Migratory species present - Rainbow Bee-eaters *Merops ornatus* and Cattle Egrets *Ardea ibis*. Rainbow Bee-eaters inhabit a variety of habitat types including open pastures and woodlands, while Cattle Egrets are abundant in pasture, particularly those with cattle or horses. Both species are abundant within the local area and likely to occur in many areas outside of the study area.

Several other species of migratory bird may or are likely to occur due to the presence of suitable habitat. These species include Black-faced Monarch *Monarcha melanopsis*, Rufous Fantail *Rhipidura rufifrons*, White-throated Needletail *Hirundapus caudacutus* and Fork-tailed Swift *Apus pacificus*.

Black-faced Monarchs and Rufous Fantails are likely to be restricted to the two rainforest gullies located to the south of Site 7 and the water reservoir respectively. They are abundant within mesic habitat within the region.

White-throated Needletails and Fork-tailed Swifts are aerial foragers that rarely alight. They may occur over any terrestrial habitat including urbanisation and agricultural land.

- ***Exotic Species***

One exotic vertebrate species has been recorded within the study area, the Cane Toad *Bufo marinus*. Other common exotic species such as Black Rat *Rattus rattus*, House Mouse *Mus musculus*, Rabbit *Orycholagus cuniculus*, Brown Hare *lepus capensis*, Feral Cat *Felis catus*, Red Fox *Vulpes vulpes* and Domestic Dog *Canis lupus* are also likely to occur. There was little evidence of pig damage within the pastures or native vegetation.

4.11.2 Terrestrial Vertebrate Habitat Values

- ***Habitat Types***

Fauna communities are comprised of a range of species that inhabit different niches within a habitat. While some species are generalists and able to effectively compete in a variety of niches, other species are specialists and are found only in habitats that meet specific requirements. It is the presence or

absence of these specialist species that is generally the most obvious difference between fauna communities.

Habitat, therefore, plays a significant factor in determining the composition of a fauna community. Generally, two factors are important: habitat structure and resource availability.

Habitat structure refers to the abundance and complexity of the vegetation and debris. Habitats with abundant shrubs, thick ground cover and dense sub-canopy and canopy are vertically complex and provide abundant shelter sites, particularly for bird species. Horizontal complexity refers to the presence of ground plant species, open areas, fallen timber, rock crevices etc that provide sheltering opportunity for terrestrial species. Habitats with higher vertical and horizontal complexity will generally have higher species diversity.

In addition, the availability and types of resources affect the number and type of vertebrate species inhabiting an area. Those habitats with abundant resources may be inhabited by more species, even if they compete, while the presence of a preferred dietary item will facilitate the presence of a particular species (e.g. fruiting bodies for fruit-doves).

Vegetation within the study area can be divided into two basic vertebrate habitat types. Each of these habitats will support different vertebrate communities, although native habitats will support more specialist species, and hence be more valuable than artificial habitats. The two habitat types are detailed in Table 4-4.

Gully lines within the study area provide some habitat for aquatic and semi-aquatic vertebrates. However, these gullies have been highly disturbed by cattle, even in areas of native vegetation. As a result, the edges of ponds are significantly modified and lack vegetation and refugia required for many frog species. Those frogs that are present within these areas (e.g. *Crinia signifera*, *Limnodynastes peronii*) are tolerant of adverse water quality and habitat modification.

There is no known koala habitat identified in the Draft LEP area though the NPWS Atlas identifies some records of Koalas within 5 km of the study area (see Figure 4.6).

4.11.3 Potential Corridors

Wildlife corridors allow both plants and animals to disperse, migrate or move from one area of habitat to another. They are, therefore, important to local and regional biodiversity.

Two factors can influence the importance of a corridor. Firstly, the intrinsic value of the corridor relates to the quality of vegetation and habitat within the corridor. Corridors that are wide and have excellent habitat have more value than narrow, poor quality corridors. Secondly, the corridor may have high significance if it connects two areas of important remnant vegetation, even if the corridor itself does not have good habitat.

Habitat within the study area is small in extent and highly fragmented. Larger areas of habitat occur to the west, around Skinners Shoot Road, as well as east off Bangalow and Old Bangalow Roads. Movement opportunities between these two areas are unlikely to include the study area due to the dominance of open pasture that offers few movement opportunities for terrestrial vertebrates. These areas are likely to be only traversed by highly mobile species such as birds and bats.

In contrast, regrowth vegetation between the old railway and Bangalow Rd provides some shelter. It is likely that most species will move through this vegetation to access areas of vegetation to the east and

west. This strip of vegetation is mapped by the Byron Shire Council as corridor vegetation but will remain unaffected by proposed activities.

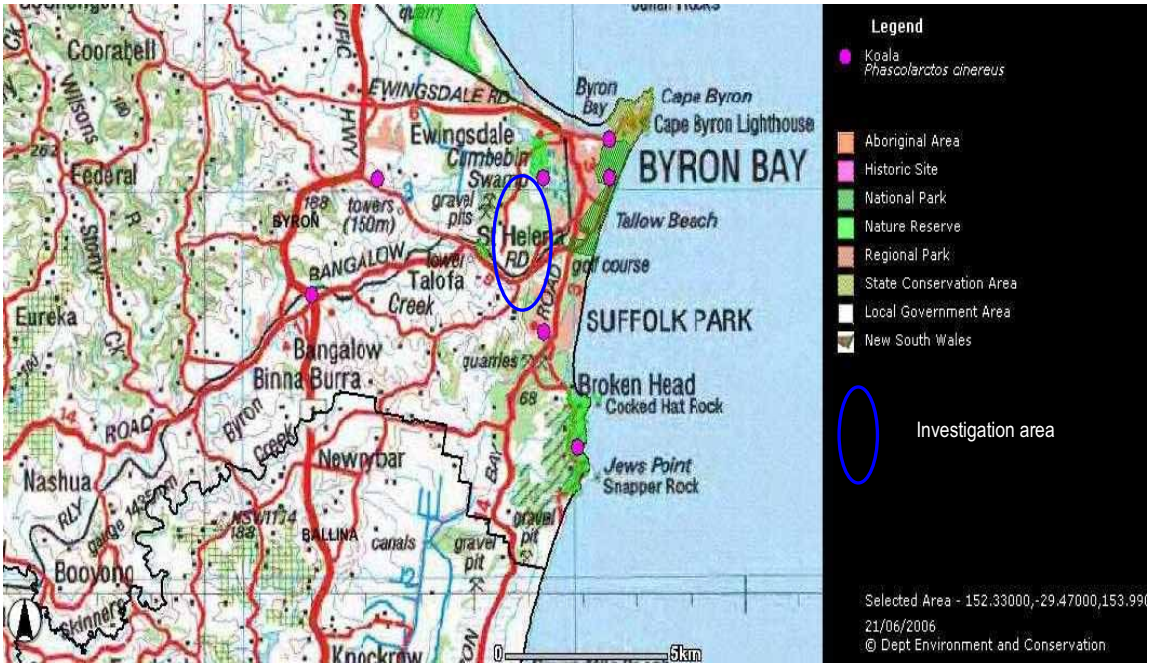

Figure 4-6: Koala records, DECC NSW Atlas

4.11.4 Impacts and mitigation measures

- **Threatened Vertebrate Species** - Three species listed under the TSC Act or EPBC have been recorded within the study area and an additional three species are considered likely to occur. Impacts on these species are likely to be minor and localised, particularly as minimal vegetation clearance is expected for the construction of the substation at Site 7.This clearing will be restricted to the margins of the vegetation to the south of the site and is mainly the removal of exotic pines and camphor laurel. The vegetation that provides habitat and corridor functionaility in the gully will not be disturbed

  Grey-headed Flying-foxes and Black Flying-foxes are known to perish on overhead powerlines through electrocution, which appears to kill disproportionately high numbers of lactating females (Duncan *et al.,* 1999). As it is proposed to underground approximately 1 km of currently overhead line, the risk of electrocution will be diminished in the valley.

  The impact of the development on these species has been assessed using criteria in Section 5A of the EP and A Act 1979 (Assessment of Significance). For all six species known or likely to occur, no significant impact was identified (see Appendix G). An assessment of matters of National Environmental Significance (NES) was also undertaken for the Grey-headed Flying Fox which is listed under the EPBC Act. The assessment was undertaken in accordance with the relevant significant impact criteria, as defined in the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines. This assessment is provided in Appendix G, and shows that matters of NES will not be significantly impacted by the proposed development, and therefore a Referral to the Commonwealth Minister for the Environment will not be required.

Table 4-4 : Terrestrial vertebrate habitat description

Habitat description	Photographic representation	Representative species	Potential threatened species
Mesic Vegetation Restricted to two gullies to the east of Site 7 and west of the water reservoir. These habitats have little vegetation within the groundcover, which consists predominantly of moist leaf litter. Shrubs and mid-storey species are abundant, often forming thick clumps in locations where light penetrates through the canopy. The canopy itself is thick and dense. Exotic Camphor Laurel dominates the canopy of the gully to the east of Site 7. *Banksia integrifolia* is abundant in these communities, particularly along the edges of the vegetation patch		Golden Whistler, *Lampropholis delicata*, Little Shrike-thrush, White-headed Pigeon, Figbird, Little Wattlebird, White-cheeked Honeyeater, Brown Honeyeater	Grey-headed Flying Fox, Little Bentwing Bat, Common Bentwing Bat, Black Flying-fox, White-eared Monarch, Common Blossom Bat
Pasture Grassland Dominated by exotic grasses and weeds, this habitat type has little vertical or horizontal habitat structure. Without a canopy or shrub layer, bird diversity is significantly reduced. Without terrestrial sheltering and refugia, terrestrial vertebrate abundance and diversity is considerably reduced. The occasional and scattered *Banksia integrifolia* provides foraging resources for nectivorous species.		Australian Magpie, Pied Butcherbird, *Crinia signifera* (in moist areas), Australian Pipit, Australian White Ibis, Cattle Egret	Occasional *B. integrifolia* provides foraging habitat for Grey-headed Flying Fox

While the proposed activities are not likely to impact threatened vertebrate populations or habitat, the development presents an opportunity to increase habitat values for these species. This may be most readily achieved by revegetation in disturbance areas not required for future cattle grazing. In such areas, revegetation should include the use of native flowering species, particularly *B. integrifolia* as these will provide long-term foraging opportunities for Grey-headed Flying-foxes, Black Flying-foxes and Blossom Bats.

- **Terrestrial Vertebrate Habitats** - Limited vertebrate habitat values are associated with the open pasture land. Those areas of vegetation that do remain are restricted to gully lines near Site 7 and west of the water reservoir. The construction of the substation will be restricted to cleared land. Some vegetation will require removal for the incoming 66/132 kV line. Nevertheless, the main large species that are of concern to the powerline relocation are camphor laurel and slash pine. None of the other trees were greater than 3 m high and many are pioneer or understorey species that will not threaten the powerlines. None of the trees recorded are scheduled species of conservation value. Accordingly, no significant impacts on existing terrestrial vertebrate habitats are expected.

  While the proposed activities are not likely to impact habitat values, the project provides an opportunity to improve values where consistent with final land use strategies. In particular, those areas not required for further grazing may be rehabilitated using native species. Exotic weed species should also be the subject of control strategies and include weeds within the nearby rail corridor to prevent their spread into nearby habitats and improve corridor values.

- **Potential Movement Corridors** - The study area is highly fragmented and provides no contiguous habitat connections between larger areas of habitat either within the study area or local area. Therefore, the proposed activities will not impact existing values.

  Byron Shire Council GIS mapping indicates that vegetation in the adjacent rail land is corridor vegetation. Weed control strategies should be developed prior to construction to ensure that weeds are not introduced into this area either directly or indirectly. Furthermore, weed control strategies within this land should be investigated to improve the ecological function of this area.

4.12 Local Community and Socio-economic Setting

Cape Byron is Australia's most easterly point, 153° 39´ east, located on the north coast of New South Wales. With its numerous beaches, unspoilt hinterland, and relaxed lifestyle, Byron Bay is a popular tourist destination. Byron Bay is located just off the Pacific Highway, 800 km north of Sydney and 175 km south of Brisbane.

Statistics from the 2006 Census show:

- There were 28,766 residents in Byron Shire, with around 9,000 living in the town of Byron Bay.
- 33.7% of occupied dwellings were fully owned, 29.8% were rented and 25.4% were being purchased.
- The age distribution was:
  - 0 – 14 years (19.4%)
  - 15 – 24 years (11.5%)
  - 25 – 54 years (44.7%)

  - 55 – 64 years (12.2%)
  - 65 years and over (12.1%)
- The labour force included:
  - 44.1 % employed full-time
  - 40.9 % employed part-time
  - 8.8 % unemployed
- the most common occupations were professionals 21.5%, managers 14.9%, technicians and trades workers 14.5%, labourers 11.8% and community and personal service workers 10.7% (http://www.censusdata.abs.gov.au/)

Positive impacts from the proposed development include a better security of power supply in the region and capacity for future growth without the need for further electricity corridor acquisition. Construction of the substation is likely to provide short term employment opportunities in the Shire.

□ Agriculture

The NSW North Coast region supports a wide range of agricultural activities, from intensive horticulture to broadacre cropping and grazing. Approximately 1 in 12 working people on the North Coast is employed in agriculture, and agriculture is the third largest source of income in the Byron Shire after tourism. Agriculture contributes approximately $110 million to the Shire's economy, particularly in the meat, milk, sugar and macadamia industries.

A number of agricultural industries in the region have been established for many years, such as bananas, dairying, vegetables and sugar cane. Agriculture is a dynamic industry, and market forces and other factors have opened the way for new enterprises such as coffee, macadamias, stonefruit and organic produce (Byron Shire Sustainable Agriculture Strategy— *A Greenprint for a Sustainable Future*). The substation site will only occupy a small area of viable agricultural land.

□ Community Consultation

The area of likely impact is Skinners Shoot Road and the residents along the road and in the valley either side of Yagers Lane.

The substation is located on a single property, namely Lot 9/588885. Access to Site 7 and a number of the feeder sections for both 132 and 11 kV lines will be located on Lot 8/8385 and Yagers Lane as access is provided through the piggery property.

Country Energy has maintained close communication with key affected landholders throughout the site selection process. The issues raised by landholders have been considered in the site selection process. In-principle support for the substation site has been obtained from both the key landholders.

No discussions have been undertaken with the broader community in Byron Bay township or along Skinners Shoot Road at this stage. The proposal or a new substation in the Suffolk Park area has been included in media releases from the Lismore to Mullumbimby 132 kV Ring project and in newsletters to potentially affected landholders.

Consultation has been undertaken with sections of Byron Shire Council with respect to environmental, town planning and road maintenance matters. Feedback from the Council indicated that sections of the Skinners

Shoot Road community have expressed a desire for the road to be upgraded as it is currently considered by Byron Shire Council to be below design standards for traffic volumes using the road. Country Energy does not intend to upgrade the entire road to this design standard. Only those sections of the road that are inadequate to allow construction traffic access will be upgraded. Country Energy will repair to the existing state any damage caused by construction traffic. Yagers Lane will require widening and replacement of two culverts. It is expected that there will also be community members against any road upgrade. Further liaison with Byron Shire Council roads section will be required to determine what level of works would be most appropriate.

4.12.1 Impacts and mitigation measures

The majority of the impacts on the community will be associated with increased traffic movements during the construction phase. This will include temporary road closures for escort of oversize equipment and low-loader delivery of the 50 tonne transformers. These will be only short-term impacts.

There will be a decrease in visual amenity of the valley from the construction of a substation. This can be mitigated to some extent by carefully planned landscaping using endemic species to mask the site as far as is both practicable and safe from an operational point of view. This landscaping will be most effective for viewlines within the valley.

Mitigation measures include:

- advising the affected community well in advance of any upcoming major works, especially those requiring road closures;
- repairing Skinners Shoot Road and Yagers Lane to their pre-existing state should any damage from construction traffic occur;
- unless advised in advance, construction to be limited to:
  - Monday to Friday, 7:00am to 6:00pm;
  - Saturday, 8:00am to 1:00pm; and
  - no construction on Sundays or public holidays; and
- following the Landscape Plan to help reduce visual impacts.

4.13 Existing Infrastructure

4.13.1 Country Energy Infrastructure

Existing Country Energy infrastructure is shown in Figure 3-1. There is currently a 66 kV Country Energy overhead line running north-south through the centre of the Belongil Creek valley immediately to the west of Site 7. This 66 kV line extends from Bangalow Road in the south, runs adjacent to the former Yagers Piggery along its eastern boundary fenceline, before joining Yagers Lane and following it to Skinners Shoot Road. The line then follows Skinners Shoot Road to the south-west before heading off to the north-west.

On the northern side of the railway track, upslope of the piggery at Site 7, an 11 kV line branches off the 66 kV to the north-east to service residences in the Suffolk Park area. This line branches off to the south-east up to the water reservoir on the intersection of Bangalow Road and Old Bangalow Road. An 11 kV line

branches off the 66 kV where it meets Yagers Lane and runs south to service the former piggery and surrounding residences.

The owners of the former piggery have expressed a concern about the future impact of the series of feeder lines that will be installed and their impact on the visual amenity of the valley as they are in the process of seeking development approval for an eco-village and artists retreat on the property. They have requested that the lines currently running down the eastern boundary be placed underground and have offered no contest to an easement for an access road through their property to service Site 7. This provides Country Energy with the opportunity to develop an all-weather access to the site and to also install underground conduits for the current and future cabling needs of the substation. A description of the new network to be installed is provided in Section 3 of this report.

There are distinct advantages with respect to this approach for the following reasons:

- The current overhead 66 kV lines run down the eastern boundary and follow the northern boundary of the property westwards to Yagers Lane. There is no road access to these poles and the area in the northern section at the bend is subject to persistent high watertables;
- It is not possible to install underground lines along the present pole alignment as these would need to pass through the eastern embankment of the dam. There is no access to this area for an excavator and installation of cables in a dam embankment would seriously threaten the dam integrity and present a high risk of piping and subsequent dam failure;
- North of the dam, the cable would need to be laid in a saturated zone, and access for maintenance would be difficult unless a high cost, all-weather access track was also constructed to service the area; and
- Only a single easement for both the powerlines and access road would be required with agreement to be reached with a landholder who has expressed interest in cooperation for mutual benefit and shared input to maintenance costs of the access road.

Impacts and mitigation measures.

The major impacts with use of this site depend on which option is chosen with respect to access to the site. If the access is via Yagers Lane and the piggery, then impacts will be minimal as all infrastructure can be installed in a single easement along the road and dealings be restricted to a single landholder. This route will provide all-weather access for construction, operation and maintenance of the substation and all underground cabling. It permits the removal of the overhead high voltage lines down the eastern boundary and eliminates the need for all weather access to be provided in this area under difficult ground conditions. Access to Site 7 via Lot 9/588885 is not recommended due to the difficulties of providing all-weather access across the flood-out area of Belongil Creek tributaries and the need for multiple gully crossings. Access could be gained from this side with minimal impact to allow for those times when flooding in Cumbebin Swamp cuts the main route from Byron Bay. This would not be used for regular access.

There would be severe environmental and construction risk associated with any move to underground the high voltage lines along the eastern boundary of the piggery property, and maintenance would require considerable cost in providing access across the high watertable area north of the storage lagoon. A possible alternative to this location is to underground or overhead the high voltage and feeders running generally northwards within Lot 9/588885 (approximately 30 m to the east of the existing 66 kV line) before diverging north-west back to Yagers Lane. This would mean, however, that this landholder would be severely impacted in terms of future utility of the property as there would be loss of land for the substation

site, an easement for access to the substation, and multiple easements for installation of both 11 and 132 kV lines, thus restricting potential for future development of the farm.

In summary, the least environmental and visual impacts would be associated with obtaining a single, multipurpose easement through the piggery to access Site 7, with installation of the cabling underground within the easement. Access to Site 7 via Lot 9/588885 is not recommended for environmental and constructability reasons except to permit emergency back-up access.

4.13.2 Telecommunications

A Dial Before You Dig (DBYD) search identified Telstra cables located along all roads connecting to residences within the Skinners Shoot valley. A Telstra cable extends from the southern end of Yagers Lane to service the old piggery and other houses on the property. There are no services identified near to the proposed Site 7.

Exact location of these cables will be required prior to any installation of underground cabling, power poles or other construction activities (see infrastructure location maps in Appendix J).

Impacts and mitigation measures.

There will be a need to locate and potentially relocate telecommunications cables to avoid impacts. Impacts can be avoided by DBYD searches and negotiations with the service provider during the detailed design phase.

4.13.3 Water

A water reservoir is located at the corner of Old Bangalow Road and Bangalow Road. This forms part of the potable water distribution network belonging to Byron Bay Council and services the Suffolk Park area and Skinners Shoot Road area. Two water distribution mains extend from the reservoir in a north-western direction. One main heads under the former piggery sheds and then follows Yagers Lane north while the other main passes either under or just to the immediate north of the northern-most storage pond on the former piggery and then heads west (see infrastructure location maps in Appendix J).

Impacts and mitigation measures.

The exact location of the water mains will need to be determined prior to trench excavation for the underground cable and construction of the access road. The water main may require relocation or the route of the underground cable may need to be adjusted slightly.

Mitigation measures will depend on final design of the underground cable and access road and the needs of Byron Council with respect to their water distribution network operations.

4.13.4 Rail

The disused Casino-Murwillumbah railway line runs around the head of the valley below Bangalow Road and the northern slopes of Hayters Hill. Australian Rail Track Corporation (ARTC) intends to re-establish the line to operational status at some future time. Construction and operation of the proposed substation

site would not impact on the current or future use of the railway. The 11 kV feeders would be underbored and also not impact on the track or rail embankment.

The rail lies above Site 7. Thus, drainage coordination from the site and the railway line will need to be considered in site design.

Impacts and mitigation measures.

No impacts.

4.13.5 Roads

Public road access to the site from Byron Bay is via Yagers Lane, off Skinners Shoot Road. Byron Bay becomes very busy in the peak holiday season and during special events when roads can become congested. Skinners Shoot Road is a rural road heading approximately south-west from Byron Bay. It is currently in poor but serviceable condition, and is considered substandard for the current volume of daily traffic movements. It is sealed for part of its length with the remainder gravelled. The sealed section is less than 4.0 m wide for most of its length. Horizontal and vertical geometry have been assessed by experienced carriers as suitable to marginal for access by low-loaders carrying 50 tonne transformers.

There will be significant impacts on Skinners Shoot Road and Yagers Lane. These will both require upgrades to carry the heavy and oversize loads. The condition of Skinners Shoot Road and Yagers Lane has been investigated and recommendations made as to the extent of road upgrade needed (Appendix A). Country Energy intends to upgrade the sections of the road that are inadequate to allow construction traffic access. Country Energy will repair to the pre-existing state any damage caused by construction traffic.

The requirements for transport of the transformers are set out in Table 4-5.

Table 4-5 : Transporter dimensions

Transporter	Dimensions (approx)
Length of float	22 m
Width of float	3.5 m
Weight of transformer	approx 50 tonne
Height from ground	300 mm
Height to top of transformer	4.7 m
Turning radius - outside	19 m
- inside	12.5 m

The first 1 km of Skinners Shoot Road from the Arts Factory, including the section through the Cumbebin Swamp, lies within SEPP 14 wetland. Some work on Skinners Shoot Road through this area may be required. At the very least, sections of this road will require repair following construction traffic damage. This work would include minor works at a level considered similar to road maintenance. Some vegetation overhangs the road and this will need to be trimmed to conform to the dimensions shown in Table 4-5. No vegetation will be removed with only trimming of overhead branches required to minimise potential damage to vegetation from vehicle strike. The shoulders of the road through the SEPP 14 area may require strengthening in some parts; however the road will not require widening beyond its current width through this

section. Shoulder strengthening would likely involve compacting gravel on the non-paved areas. There are no major bends in this section of road.

Further south, outside of the SEPP 14 wetland, Skinners Shoot Road starts to rise with increasing bends. These bends present issues for the low loader as the rear wheels on the inside of the bend tend to 'cut' the corners. Works in this area would involve reconstruction of sections of the road to provide better alignment mostly in terms of crossfalls where pavement super elevation exceeds 3%. There will also be improvements to areas of pavement along the road formation to cater for the vehicle turning templates (variable widening).

Yagers Lane intersects Skinners Shoot Road and services approximately twelve properties. This road is in poor condition and of insufficient width for a low-loader. There is a need for considerable roadworks involving widening, pavement strengthening, and installation of additional culvert capacity on Yagers Lane. The current road condition would not support the weight of equipment to be delivered to site and the culverts do not have sufficient cover to resist fracturing under load. Horizontal geometry is inadequate for wide loads and the road shoulders need strengthening and widening. The intersection of Yagers Lane and Skinners Shoot Road requires modification to permit turning of the 22 m long low-loaders required to deliver the large transformers.

Further problems also exist at the Byron Bay end at the roundabout in the town (intersection of Lawson Street and Shirley Street), where difficulties arise with negotiability of the tight turning conditions at this point. Initial discussions with Byron Shire Council officers identified the need for engineering plans under Section 138 of the *Roads Act 1993* and a Traffic Control Plan (TCP) before any road works commence. Further liaison will be required with Council prior to any road improvements.

Impacts and mitigation measures.

Mitigation measures include:

- implementing a Traffic Control Plan during the construction phase. Traffic management strategies should include:
  - measures to avoid movements of heavy vehicles and equipment during peak hour traffic periods;
  - appropriate traffic calming measures will be used during construction. This is likely to involve temporary warning signs and limiting traffic speeds;
  - advising the affected community well in advance of any road closures or traffic interruptions;
  - trucks and haulage equipment will maintain a safe speed at all times;
- repairing any damage to Skinners Shoot Road and Yagers Lane caused by construction traffic. These repairs will take place as required during the construction phase with a final repair at completion of construction to return the roads to their pre-existing condition;
- Construction be limited to:
  - Monday to Friday, 7:00am to 6:00pm;
  - Saturday, 8:00am to 1:00pm; and
  - no construction on Sundays or public holidays; and
- having an experienced arborist on hand during any tree trimming works.

Potential impacts of the road works to Cumbebin Swamp (SEPP 14 wetland) could include:

- acid being released into surrounding soils and waterways resulting from interference of ASS;
- damage to wetland vegetation from careless use of machinery; and
- changes to water chemistry caused by sediment runoff.

Given the proximity of the wetland, it will be essential that mitigation measures are in place and understood by the road works contractor. Road works within the SEPP 14 area will not involve excavation. Only general road maintenance works including patching or repairing of damaged road will be undertaken. ASS will therefore not be an issue. Flood levels in the wetland will not be affected. Mitigation measures for road works within the SEPP 14 area would include, at a minimum, following the Country Energy CEM7022.07 - Environmental Operations Manual: Land Use, sediment and erosion measures outlined in the CEMP and adhering to a Traffic Management Plan.

4.14 Noise

A noise impact assessment was commissioned to investigate the construction and operational noise impact of the proposed development (Appendix K). The report compares the results of noise modelling of the substation with applicable noise policies, and provides recommendations to minimise any potential noise impacts and environmental harm.

Noise Terminology
Common used terms to describe noise assessment include:

- dB(A) – Noise level measured in decibels (dB) measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing. A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness.
- L_{10} - The noise level exceed for 10 % of the time. This is commonly referred to as the average maximum noise level.
- L_{90} - The noise level exceeded for 90% of the time. This noise level is described as the average minimum background sound level or simply the background level.
- L_{Aeq} - The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
- RBL – Rating Background Level. The RBL is the overall, single-figure, background level representing each of the day, evening or night assessment periods over the whole monitoring period.
- SWL – Sound Power Level. A measure of how much acoustic power is produced by the equipment.

Existing noise levels
Noise monitoring was conducted to quantify the existing ambient noise environment surrounding the subject site. The noise monitoring data was contaminated due to bad weather (rainfall causes background noise which affects noise readings). Analysis of the usable noise logging data indicated that the Rated Background Level during the night period was likely to be 30 dB(A) or less. As 30 dB(A) is the minimum allowable background noise level under the *NSW Industrial Noise Policy (2000)*, this value was used to calculate the noise criteria.

Sensitive Receivers

The nearest residence to the Site 7 is approximately 360 m to the south east with another approximately 435 m to the north-west. If the proposed artists retreat and eco-village on the former piggery site proceeds, the nearest sensitive noise receptor could be between 200 m and 270 m from the substation, depending on the outcomes of site planning and development approvals. Some of the current buildings are planned to be utilised as craft and artists studios/ workshops and possibly short-term accommodation.

Construction noise

In NSW, the following construction noise criteria are outlined in the EPA *Environmental Noise Manual 1994*:

- For construction periods of four weeks and under, the L_{10} noise level due to the construction site should not exceed the existing L_{90} background noise level by more than 20 dB;
- For construction periods of between four and 26 weeks, the L_{10} noise level due the construction site should not exceed the existing L_{90} background noise level by more than 10 dB; and
- For construction periods greater than 26 weeks, the criteria for a continuously operating source would apply, which would generally mean that the L_{10} noise level due the construction site should not exceed the existing L_{90} background noise level by more than 5 dB.

The *Manual* also stipulates acceptable times for construction noise to be audible at residential dwellings as follows:

- Monday to Friday 7:00 am to 6:00 pm;
- Saturday 8:00 am to 1:00 pm; and
- No construction to take place on Sundays or public holidays.

The applicable daytime construction noise limits are 50 dB(A).

Operational noise

The NSW *Industrial Noise Policy* outlines two separate noise criteria to satisfy the environmental noise objectives of the policy, namely the Intrusiveness Criteria and Amenity Criteria.

- Intrusiveness Criteria

Intrusive noise is noise that intrudes above the background level by more than 5 dB. The Intrusiveness Criteria is defined by the equation:

$$L_{Aeq,\ 15\ minutes} \leq RBL + 5\ dB$$

Where $L_{Aeq,\ 15\ minutes}$ represents the noise level from a source over a 15 minute period. Based on the minimum RBL specified in the *NSW Industrial Noise Policy* and the estimated background noise levels, the Intrusiveness Criteria are presented below:

Period	Existing RBL dB (A)	Intrusiveness Criteria dB (A)
Day	40	45
Evening	35	40
Night	30	35

- Amenity criteria

The Amenity Criteria is aimed at the control and prevention of background creep due to the introduction of new industrial activities in an area. Bangalow Road traffic was observed to produce higher noise levels than would be expected for a 'rural' area. Therefore, the area surrounding the proposed site has been classified as 'suburban' as defined in the *Industrial Noise Policy*. Accordingly the 'acceptable' and 'maximum' noise levels are presented below:

Period	Acceptable Noise Level dB (A)	Maximum Noise Level dB (A)
Day	40	45
Evening	35	40
Night	30	35

- Modifying Factors

As the transformer noise is typically tonal/low frequency a modifying factor of -5 dB has been applied resulting in a noise goal of 30 dB(A) at the nearest residences.

Noise Modelling

Noise modelling was undertaken using SoundPLAN computational software, a leading environmental noise software package used worldwide and accepted by councils and the DECC. SoundPlan uses inputs of topography, distance, atmospheric conditions and meteorological conditions to predict noise levels at the closest residential receivers. The calculation method selected for the construction and operational noise prediction is the CONWAVE method because of its capability of incorporating meteorological effects in noise calculations for distances greater than 100 m.

4.14.1 Impacts and mitigation measures

Construction Phase

The noise modelling indicates that the noise criteria at the nearest noise sensitive receiver (50 dB(A)) will be exceeded during the daytime period under neutral weather conditions by up to 5 dB(A) and under worst case weather conditions by up to 8 dB(A) without noise mitigation and management strategies. The noise conditions that trigger the worst case scenario are not likely to occur very often.

It is expected that the following noise reduction measures will minimise the impact of construction noise:

- Provide and maintain low noise equipment;
- Repair or replace defective mufflers on plant and equipment;
- Maintain buffer zones and setbacks from nuisance sensitive places;
- Where practicable, construction should be limited to the following times:
  - Monday to Friday 7:00 am to 6:00 pm;
  - Saturday 8:00 am to 1:00 pm; and
  - No construction to take place on Sundays or public holidays.
  - Note: It is likely that the transformers will need to be transported to the site at night to avoid traffic disruptions along Skinners Shoot Road. All affected residents will be notified well in advance of this date;
- Avoid dropping metal objects onto other metal objects to minimise impulsive noise; and
- Turn off equipment when not in use.

In addition to these measures, any potentially affected residents will be notified prior to construction of the planned construction times and kept regularly informed of progress. Further noise mitigation could include erecting temporary noise barriers subject to consultation with affected residents.

The applicable criteria serve to protect the amenity of nearby residences. For this project there are some exceedances of the noise criteria at nearby residences during the construction period. This does not necessarily indicate loss of amenity of the residents, as the criteria are designed to minimise the potential annoyance for the majority of affected residences.

For this project there are a few specific residences potentially affected. As such the amenity of each residence can best be maintained by consultation with each resident.

Operation Phase
The operational noise modelling indicates that the operational noise will comply with the noise criteria at the nearest noise sensitive receiver (30 dB(A)) during all periods and all weather conditions. Transformers will be designed to comply with statutory noise levels.

The noise modelling was based of a Sound power Level (SWL) of the transformers of 87 dB(A). Country Energy have advised that they can source transformers with a SWL as low as 77 dB(A).

4.15 Visual Impact

The substation site will present some visual impact due to its commanding position on the spur ridge high in the valley landscape. This will be most noticeable for view points in the valley floor. The view from Yagers Lane looking south already contains signs of visual modification including the clearing of vegetation, existing transmission lines and poles, residential dwellings and the large buildings and sheds of the former piggery. The substation will be located within an area of cleared vegetation adjacent to the former piggery. This location is in the background of the view and adjacent to the existing large sheds and other infrastructure.

Bangalow Road offers views to the north and north-east out to Cape Byron and the coastline. Looking down the valley from Bangalow Road, the sheds of the former Yagers Piggery are the major visible man-made structures along with the 66 kV poles extending to the north. Views from Bangalow Road would be mainly from vehicles travelling at speed. The substation will be visible from the roadside above but casual tourists will tend to focus on the more distant viewscapes of the ocean and coastline around Cape Byron. A number of residences look south-east down into the valley from Skinners Shoot Road. The substation will not be visible from the residence at the intersection of Bangalow Road and Coopers Shoot Road.

4.15.1 Impacts and mitigation measures.

Visual amenity impacts for this site will be improved marginally when the high and low voltage feeder lines from the substation site are installed underground.

The incorporation of multi-layered trees and shrubs to screen the site will improve the viewscape at the valley level. Carefully planned landscaping will be undertaken using endemic species to mask the site as far as is both practicable and safe from an operational point of view. This landscaping will be most effective for viewlines within the valley. The impacts from above at any point along Bangalow Road will not be easy to

mitigate but it is likely that attention will focus on the distant views and overlook the substation below. Maximum use of underground cabling will vastly improve visual amenity of the project in the valley.

The substation buildings will be constructed using non-intrusive colours and materials. The buildings will be almond colour (sandstone) concrete blocks and grey or green doors, downpipes and colourbond roof. These colours will help the buildings blend into the natural background.

4.16 Electric and Magnetic Fields (EMF)

Electric and magnetic fields (EMF) are generated by all electric currents. An electric field is an invisible force that relates to voltage under which electricity is forced along wires. A magnetic field is an invisible force produced by the flow of electricity, commonly known as current. As substations and transmission lines create relatively high EMFs close to the source, the issue of EMFs is significant to this project. Research into the issues regarding health effects caused by EMF is being carried out continually. No conclusive links between EMF and their effects on human health have been established.

4.16.1 Background

Electric Fields - Electric fields are produced by voltage. The strength of the electric field depends on the voltage of the source. The strength of the field diminishes rapidly as the distance from the source increases, much the same as the warmth from a fire decreases as we move away from it. Electric fields are measured in volts per metre (V/m) or in kilovolts per metre (kV/m) where one kilovolt equals 1000 volts. Electric fields are shielded, or blocked, by most solid objects.

Magnetic Fields - Magnetic fields are produced by the flow of electricity (current) in a wire. This effect is known as electromagnetism and is often put to practical use, e.g. in electromagnets and electric motors where the magnetic field is essential for the operation of the magnet or motor. The strength of the magnetic field depends on the size of the current (amps) carried and as the distance from the source increases the field dissipates extremely quickly. The magnetic field strength resulting from an electrical installation varies continually with time and is affected by a number of factors including:

- The total electrical load;
- The size and nature of the equipment;
- The design of the equipment; and
- The layout and electrical configuration of the equipment and its interaction with other equipment.

The magnetic field, unlike an electric field, only exists when the appliance or equipment is turned on and there is a current flowing. Once the appliance is turned off, the current stops flowing and there is no magnetic field. The standard unit for measurement of magnetic fields is the tesla but, because the magnetic fields from the use of electricity are much smaller than the tesla, the milligauss (mG) is commonly used when expressing values. A mG is 10 million times smaller than a tesla. Magnetic field strength measurements are taken using a Gauss meter. Magnetic fields will pass through most solid objects.

A guide to relative strengths of EMFs is shown in Table 4-6.

Table 4-6 : Typical magnetic field measurements and ranges

	Typical Measurement (mG)	Range of Measurements (mG)
Stove	6	2-30
PC	5	2-20
TV	1	0.2-2
Electric blanket	20	5-30
Hair dryer	25	10-70
Refrigerator	2	2-5
Toaster	3	2-10
Kettle	3	2-10
Fan	1	0.2-2
Distribution line (under the line)	10	2-20
Transmission line		
• Under line	20	10-200
• Edge of easement	10	2-50

Source: Energy Networks Association, 2006 - Measurements taken at normal user distance

4.16.2 Impacts and mitigation measures.

As per Country Energy procedural guideline CEM7022.09 - Environmental Operations Manual: Social, Country Energy exercise prudent avoidance when selecting zone substation sites and transmission/distribution line routes and when designing construction details for transmission/distribution line standards. Prudent avoidance is doing what can be done without undue inconvenience and at modest expense to avert the possible risk to health from exposure to EMF. Substation and transmission/distribution network design will ensure that public exposure to EMF will be within the National Health and Medical Research Council (NHMRC) recommended limits of exposure (Table 4-7). The substation is located away from residences and other sensitive receivers and adjacent to an existing source of EMF.

Table 4-7 : NHRMC recommended exposure limits

Exposure level	Magnetic fields (mG)	Electric fields kv/m
• Continuous public exposure (24 hours per day)	1,000	5
• Casual public exposure (up to 2 hours per day)	10,000	10
• Occupational exposure (per working day)	5,000	10
• Occupational exposure (up to 2 hours per day)	50,000	30

Country Energy commissioned an in-depth study to assess the EMF likely to be associated with the proposed 132 kV transmission lines and associated substations (Lismore to Mullumbimby Electricity Network Upgrade: Assessment of Transmission Line Electric & Magnetic Fields, Connell Wagner, 2008; and Lismore to Mullumbimby Network Upgrade: Upgrade of a Zone Substation from 66kV to 132kV - EMF Assessment, Connell Wagner, 2008).

The relevant findings of these reports are summarised as follows:

Sources of substation electric fields

While in theory, any energized conductor within a substation is a potential source of electric fields, electric fields are readily shielded and, in the context of a substation, the sheaths of high voltage cables, metallic equipment enclosures, fencing and other structures act as shields. Accordingly, in practice, the only significant sources of electric fields within a zone substation are the exposed high voltage overhead conductors such as busbars. Apart from the immediate vicinity of high voltage overhead lines entering or leaving the substation, electric fields external to a substation would remain negligible.

Sources of substation magnetic fields

Every piece of substation equipment carrying an electric current (amps) is a potential source of magnetic fields and these are not readily shielded.

Potential sources of magnetic fields include:

- incoming and outgoing overhead lines or underground cables;
- busbars and other overhead or underground connections within the substation;
- transformers;
- switchgear; and
- reactive plant.

Because magnetic fields are caused by the amps rather than the volts, the 11 kV connections are frequently the most significant source of fields associated with a substation, whether 66/11 kV or 132/11 kV.

The assessment indicates that magnetic fields created by the substation (busbars, incoming and outgoing feeders, transformers) have largely dissipated to less than 1 mG beyond 20 m from the origin. Given the minimum 15 m buffer around the substation, magnetic fields around the substation will be minimal.

Transmission lines

The 132 kV transmission line will enter the substation from the south aboveground and exit underground to the west. This underground section will be approximately 1 km long and connect back to the existing aboveground lines along Yagers Lane. The underground cables will be in PVC ducts with a minimum depth of cover of 900 mm and will be located under the access road verge.

The EMF transmission line assessment looked at an area located between Ewingsdale and Suffolk Park, adjacent to the existing 8508 66 kV line. This area was selected for specific assessment because it is an example of the line route passing through an area of scattered rural residential properties.

Because part of the new line route near Ewingsdale will be of underground construction, a profile of the magnetic field produced by a 132 kV underground cable carrying the 2012 load was included in Figure 4-7. This assessment was not specifically for the underground section leaving the Suffolk Park substation. Nevertheless it can be used as a reliable indicator of the likely readings between the Suffolk Park substation and Yagers Lane. It can be seen that the magnetic field directly above the cable is very similar to that directly below the 132 kV overhead line, but it drops off more rapidly as one moves away from the cable, decreasing to less than 1 mG within 8 m.

Based on the distance of the nearest receptors from the substation and these low levels of exposure it may be concluded that no adverse health impacts are expected due to EMF from this substation. The exposure of residents at the nearest houses would be dominated by background field levels that already exist in the

homes. EMF is covered in further detail in the overall Lismore to Mullumbimby 132 kV Upgrade project Part 3A EAR.

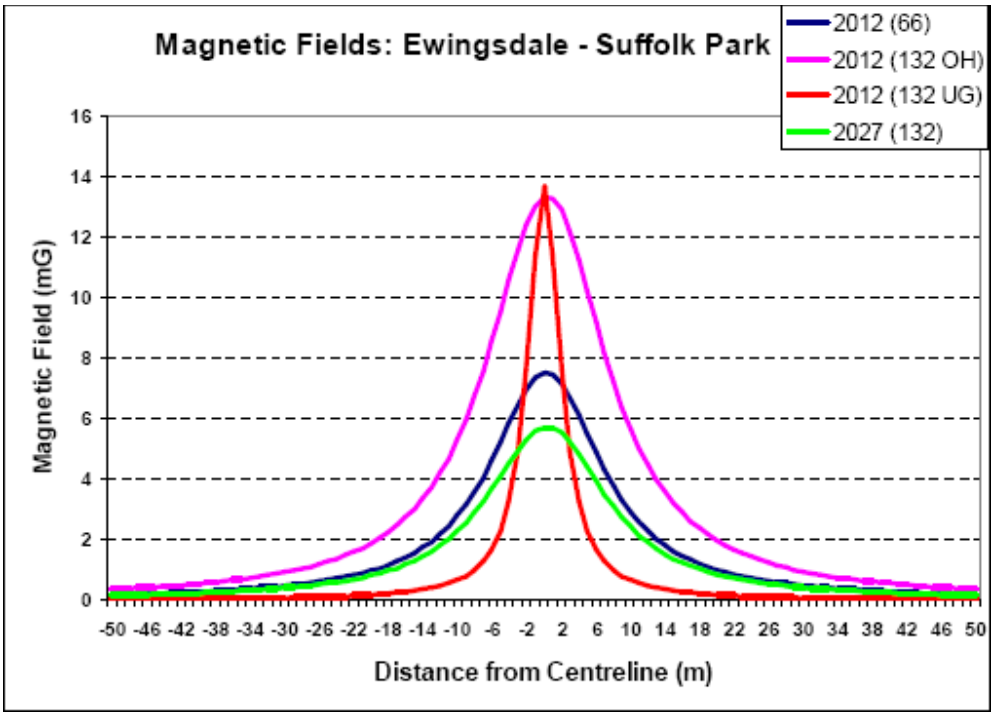

Figure 4-7: Magnetic field between Ewingsdale and Suffolk Park (from Connell Wagner, 2008)

4.17 Cultural Heritage

A search of the DEC Aboriginal Heritage Information Management System (AHIMS Register) found that five Aboriginal objects and/or Aboriginal places are recorded in or near the area of investigation (Appendix K).

Two sites are located approximately 200 m south-west of the junction of Skinners Shoot Road and Yagers Lane and approximately 450 m west of the culvert on Yagers Lane. One is an open camp site with features described in the AHIMS report as artefacts. Just south of this camp site is a midden with site features described as artefacts, earth mound and shells. Two open camp sites are located in the north-west of the investigation area near the quarry. There is also a midden site located approximately 1 km north of the investigation area. None of these sites will be impacted by a development at Site 7 or the associated infrastructure upgrades.

There is currently an active registered Native Title claim within the study area lodged by the Byron Bay Bunjalung People (Tribunal number: NC01/8).

There is high potential for other indigenous heritage sites in the area of investigation given the search results and proximity to Belongil Creek, which would have been used as a food and drinking resource. Further investigation including field survey will be necessary to confirm the presence or absence of heritage sites should any disturbance be planned in this area.

Historical records show that the area around Site 7 was cleared in the late 1800s and early 1900s, and for many years were used for banana production before reverting to pasture and low intensity grazing. It is likely that past land use has significantly disturbed any evidence of indigenous use of these areas. Prior to clearing, these areas were covered by dense rainforest and/or wet sclerophyll forest in the higher elevations and by wet tea tree communities in the valley floor. The extent to which the indigenous community used the dense forests for cultural activity other than food foraging is unknown but not considered to be high based on experience elsewhere. Nevertheless, detailed investigation will be required for the selected site both prior to construction and during all earthmoving activities.

The State Heritage Register, the North Coast REP, 1998, the Byron LEP 1988, and the RTA Heritage and Conservation Register did not identify any registered non-indigenous heritage sites in or near the investigation area. Cultural heritage issues are covered in more depth as part of the Cultural Heritage Study in the Lismore to Mullumbimby EAR.

4.17.1 Impacts and mitigation measures.

The history of land use would suggest that there are not likely to be any significant finds of cultural material, but there is evidence of indigenous occupation and transitory use of the valley and ridge crests in the area.

Consultation should be undertaken with the Native Title claimants before starting the project final design to identify any issues of concern. Implementation of clearance investigations prior to and during all earthworks involving participation of the Bunjalung People will ensure that there are no adverse impacts on cultural heritage material as a consequence of the project. Development of an agreement to a Burial Management Plan with the Bunjalung People will be necessary prior to project start-up to ensure that procedures are agreed in advance should any burial sites be affected by the earthmoving activities.

Note: Care should be taken with road construction from the piggery to the substation site as there is anecdotal evidence that diseased pigs were buried in a pit along the fenceline. Identification of any bones exposed will require assessment as to whether they are human or pig before invoking the Burial Management Plan procedures.

4.18 Bushfire

Within the study area there is a wide range of land uses, landforms and vegetation types contributing to the level of bushfire hazard. The current bushfire prone land map for the study area from the Byron Bay, Suffolk Park and Ewingsdale Local Environmental Study (Figure 4-8) shows large parts of the Cumbebin Swamp and Belongil floodplain vegetation as being in Category 1 (which is more fire prone than Category 2). Category 2 vegetation is found in the Hayters Hill Nature Reserve and extending to the north along Skinners Shoot Road. Another small patch is found at the intersection of Skinners Shoot Road and Yagers Lane. A 100 m buffer to all Category 1 vegetation would also affect a large area of land. Much of this buffer is unlikely to contain significant vegetation.

The site is located entirely in a cleared area of grassland with the only timbered area being the vegetation in the gully line to the south-east.

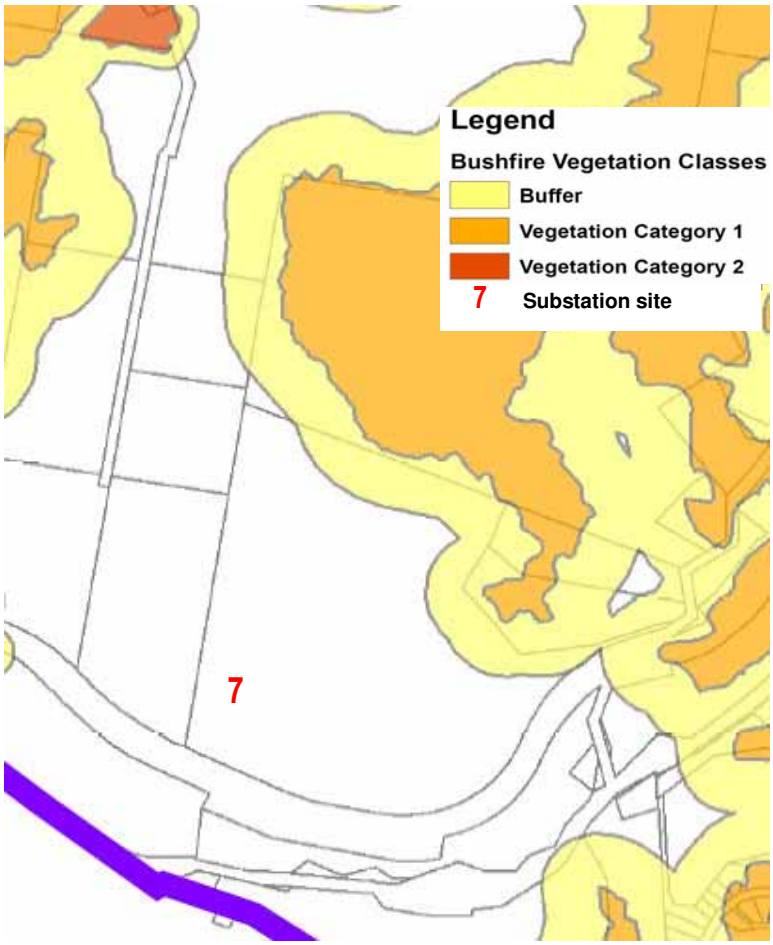

Figure 4-8: Bushfire prone land (from Byron LES, 2004, Map 16)

4.18.1 Impacts and mitigation measures.

Bushfire hazard is not considered a significant risk for this site. Nevertheless, mitigation strategies could include:

- Weed matting and prostrate species should be used in the perimeter landscaping for ground cover rather than pine bark which is fire prone;
- development of a bushfire management plan; and
- selection of appropriate species and landscaping materials to reduce fire risk immediately adjacent to the substation.

The risk of fires being created by fallen livewires is a universal risk and is best managed by normal clearing and maintenance strategies applied generally by Country Energy protocols.

5. Summary

This EA has investigated the environmental, technical and social impacts associated with Site 7 for both the construction of a substation and the installation of 11 kV and 132 kV high voltage lines to service the Suffolk Park area.

A summary of impacts and mitigation measures for both sites is set out in Table 5-1.

Table 5-1 : Summary of environmental, technical and social impacts and mitigating strategies for Site 7.

Issue	Site 7
Soils and geology	Soils do not present any issues of concern. The exposure of soil layers containing hailstone gravel though should indicate the need to investigate seepage at the site and the need to design for intercept drainage. The site is located entirely in weathered sediments of the Bundamba Group. These are erodible when exposed and may have sodic horizons at times though none were detected in the limited field investigations. ***Mitigating strategies***: ▪ Limit the height of batter slopes; ▪ Minimise the amount of area cleared at any one time; ▪ Protect any temporary stockpiles; and ▪ Once design is finalised prepare and implement a sediment and erosion control plan.
Acid sulfate soils	There are no ASS associated with the substation site. ASS may be intercepted along Yagers Lane during road upgrade works including replacing the culvert crossing. ***Mitigating strategies***: ▪ Conduct detailed ASS investigations prior to excavation or road works along Yagers Lane; ▪ If ASS encountered develop and implement an ASS Management Plan according to ASSMAC Guidelines (1998); ▪ follow Country Energy Procedure CEPG2033 – Management of Acid Sulfate Soils.
Contaminated lands	No impacts associated with this site. There may be some impacts with road access and culvert upgrades associated with Yagers Lane within the buffer zone of the former dip site. ***Mitigation strategies***: ▪ Comply with SEPP 55 Guidelines if road upgrades affect the former dip site.
Topography/geomorphology	Site will be constructed on a spur ridge that requires cut and fill. Drainage is directed naturally to either side of the site and runoff from the railway leads to the gullies. There is a moderate fall from the site towards the east that could lead to moderate cut

Issue	Site 7
	and fill earthworks. ***Mitigation strategies***: ▪ Minimise cut and fill where practicable; ▪ Plan stormwater management to avoid flow from the spur ridge across the site.
Surface water	Runon to the site from the overlying spur ridge is minimal due mainly to its convex crest and drainage controls from the railway line. Stormwater management should not present any significant issues provided discharge to the gullies is appropriately managed. There is an issue regarding flooding risk associated with the floodplain along Yagers Lane that will affect all-weather access for maintenance and incident management. Significant upgrades are required to the road and culverts to increase flood immunity in this area. As access to Site 7 is to be via the piggery property, then appropriate design will be needed to manage stormwater flows and coordinated drainage around the southern storage pond and the crossing over the gully to the west of the site. ***Management strategies***: ▪ Design road and culvert upgrades on Yagers Lane to increase flood immunity for access to site; ▪ Consider stormwater management coordination for multiple drainage paths to west of site associated with the access road through the piggery; and ▪ Develop an appropriate stormwater management plan during final design for the actual site to deal with both runon and site runoff.
Groundwater	There are no groundwater issues associated with this site apart from the likelihood of seepage associated with any hailstone gravel beds that may be exposed on excavation. There will be groundwater issues associated with any installation of underground powerlines to the north of the site and across the floodplain to Yagers Lane. Groundwater in this area will most likely include ASS management as well. ***Management strategies***: ▪ Manage any seepage arising from earthworks exposure of hailstone gravel beds and redirect off-site as part of stormwater management plan; and ▪ Use appropriate powerline installation measures and methods if feeders are to be laid underground northwards and across the floodplain to Yagers Lane.
Land use and land tenure	Approval in principle for access via the former piggery has been given already provided the feeder powerlines are placed underground along the eastern boundary or underground along the upgraded road access through the property. A decision is required as there are Development Applications pending for development of this site for alternative land uses. ***Mitigating strategies***: ▪ The preferred access should be confirmed as soon as possible to permit

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	progressing of the Development Applications by the landowner; and ▪ Negotiations should be initiated with the two landholders involved in providing land for the substation site and for the feeder line corridors.
Fauna	Three species listed under the TCS Act or the EPBC Act have been recorded and a further three are likely to occur. No significant impact is anticipated as a consequence of the development as the areas of occupation will not be disturbed and are remote from the construction area. Habitat and corridor values will not be impacted due to the level of clearing and fragmentation of the surrounding area that already exists. ***Mitigating strategies***: ▪ Consider compensatory plantings where possible; ▪ Minimise vegetation clearing; and ▪ Use underboring of railway.
Flora	One species listed under the TSC Act and the EPBC Act was identified approximately 800 m east of the site (Green-leaved Rose Walnut). This will not be disturbed by site construction activities. Several weed species are present at and around the site. Minimal clearing of vegetation (mainly slash pine and camphor laurel) will be required for relocation of the incoming powerline. *Mitigating strategies*: ▪ A species impact assessment has been prepared (see Appendix G); ▪ Control of camphor laurel and lantana will promote recovery of this listed species; and ▪ Implement weed control management programs as part of site activities.
Social issues	There will be loss of 1-2 ha of land for the substation site to agricultural production, mainly low intensity grazing. Grazing will be able to continue across the easements taken for powerline installation. There will be temporary impacts associated with construction traffic and future maintenance requirements at the site. ***Mitigating strategies***: ▪ Minimise the footprint of the substation to reduce the area required for the proposal; and ▪ Develop a traffic management plan that considers local landholders in terms of timing of disruptions, school bus times, and future maintenance needs, including advance notification of likely impacts.
Visual amenity	This site has the greatest impact on visual amenity for those viewlines within the valley of Belongil Creek. It will also be visible from Bangalow Road but to a lesser extent as the focus from here would be predominantly towards the ocean and Cape Byron. The site will not be visible from the residence near the Coopers Shoot intersection. ***Mitigating strategies***: ▪ Use multi-layered vegetation screening vegetation as part of the landscaping plan; ▪ Use underground powerlines where practicable and remove existing overhead lines to improve the viewscape within the valley; and

Issue	Site 7
	▪ building materials and colours to be neutral, non-reflective and consistent with the surrounding environment.
Access	Access to this site presents the greatest impacts for the project. ▪ There is a need for considerable upgrade of parts of Skinners Shoot Road. Pruning to provide clearance for high loads will be required. Yagers Lane will also require widening, new pavement and upgraded culverts to provide a trafficable surface for heavy loads. ▪ Access from Yagers Lane via the piggery property. There will be impacts on two gullies and the need to construct a berm on the storage pond embankment to provide suitable road geometry and assist in coordinating drainage across the property. This is the preferred route. It will facilitate the installation of underground powerlines as well and provide all-weather access. ▪ Alternative access proposals across the floodplain and through Lot 9/588885 are not recommended due to problems associated with wetness, flooding risk, ASS, complex drainage, the need to import large volumes of fill and high long-term maintenance costs. This may provide an emergency access route for those times when flooding of Cumbebin Swamp closes Skinners Shoot Road. ***Mitigating strategies***: ▪ Liaise with Byron Shire Council regarding road works; ▪ Use an experienced arborist to ensure no long-term damage to vegetation occurs; and ▪ Coordinate with affected landholders to ensure best environmental outcomes and least land use and social impacts.
Existing infrastructure	There are a number of 11 kV lines that will need to be placed underground as part of the provision of the new network. This may include the undergrounding of the existing 66 kV line down the eastern boundary of the piggery property, though this may be removed and installed as part of a road through the property if that approach is adopted. There are two water mains from the reservoir that traverse Lot 7/8385 to Yagers Lane. These may be impacted if undergrounding or additional poles are required in this area. There is telecommunications cable along Yagers Lane that will need to be catered for if the Lane is to be upgraded. There are no impacts on the railway line for this site. There is a need to coordinate with the owners of the piggery property to ensure that any developments are compatible with their future plans for the progressive re-development of the property. ***Mitigating strategies***; ▪ Ensure close coordination with all affected landholders during all phases of planning, design and construction; and ▪ Liaise with external stakeholders (namely Byron Council, Rous Water and Telstra) in managing impacts on their infrastructure.

Issue	Site 7
EMF	The proposed substation site is located approximately 200 m from the nearest residence. Nevertheless, the transmission lines are currently located close to the former piggery buildings which are earmarked for development. ***Mitigating strategies:*** ▪ Country Energy will exercise prudent avoidance when selecting transmission and distribution line routes and when designing construction details for transmission and distribution line standards. Transmission and distribution network design will ensure that public exposure to EMF will be within the National Health and Medical Research Council (NHMRC) recommended limits of exposure.
Cultural heritage	Based on the historical clearing in the area there are not likely to be significant finds of cultural heritage material. Nevertheless, mitigating strategies should be undertaken. ***Mitigating strategies:*** ▪ Consultation undertaken with Native Title claimants before starting project final design; ▪ Implementation of a Burial Management Plan prior to earthworks; ▪ all contractors must be advised of the appropriate cultural heritage legislation and requirements; and ▪ all construction works should cease if indigenous artefacts or relics are uncovered and the relevant statutory authority contacted.
Bushfire hazard	No impacts anticipated from bushfire at this site.
Noise	Noise modelling indicates that for the construction phase the noise criteria at the nearest noise sensitive receiver (50 dB(A)) will be exceeded during the daytime period under neutral weather conditions. Operation noise from the substation complies with noise criteria at the nearest receiving residence. ***Mitigating strategies***: ▪ Provide and maintain low noise equipment; ▪ Repair or replace defective mufflers on plant and equipment; ▪ Maintain buffer zones and setbacks from nuisance sensitive places; ▪ Where practicable, construction should be limited to the following times: – Monday to Friday 7:00 am to 6:00 pm; – Saturday 8:00 am to 1:00 pm; and – No construction to take place on Sundays or public holidays. – Note: It is likely that the transformers will need to be transported to the site at night to avoid traffic disruptions along Skinners Shoot Road. All affected residents will be notified well in advance of this date; ▪ Avoid dropping metal objects onto other metal objects to minimise impulsive noise; and ▪ Turn off equipment when not in use. ▪ Develop a noise management strategy to respond to any community complaints during construction of the substation.

Issue	Site 7
Air quality	Air quality is not likely to be an issue except during the construction phase. ***Mitigating strategies***: ▪ Prepare and implement dust management plan as part of the construction EMP to control dust during construction; ▪ Provide dust suppression capability on-site by water truck as there is no potable water supply available; ▪ Use reclaimed water supplies for dust suppression if available; ▪ all trucks transporting soil/gravel material should be covered during transit; ▪ dust generating activities should be limited during windy weather; and ▪ Minimise the area of land cleared for construction to that which is essential.

6. Conclusions

This EA has been prepared to assess the environmental impacts of locating the proposed Suffolk Park 132/11 kV zone substation on Lot 9/588885 at the southern end of Yagers Lane, Skinners Shoot. The EA has been prepared in accordance with Country Energy's procedures for Environmental Impact Assessment Preparation (CEM 7022.01).

The EA presents details of the proposal, assesses the existing natural and social environments, describes the potential impacts on the environment and summarises management measures and safeguards to minimise and, where possible, avoid identified impacts. The EA has been prepared in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), including, in particular, the requirements of sections 111 and 112 and includes the consideration of factors prescribed by Clause 228 of the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) as well as the Department of Planning (DOP) guideline "Is an EIS Required".

Section 112 of the EP&A Act states that the activity must not be approved if it is likely to significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats unless Country Energy has examined and considered an environmental impact assessment in respect of the activity.

Considerable time and effort was put into the site selection process to identify the best practicable location based on environmental, social, technical and economic constraints. The investigation area was restricted by the need to be situated close to the existing 66 kV network and close to the future demand area of Suffolk Park. The location of the substation and access road has in-principle landowner support.

The major findings of this EA are:

- no significant impacts to flora and fauna, public safety, flooding, heritage or water quality are expected;
- the proposed substation development will not significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats;

- the proposed substation development will not have a significant impact on Matters of National Environmental Significance as described in the *EPBC Act* and therefore does not need to be referred to the Minister;
- noise impacts during operation are manageable and would not exceed the DECC environmental criteria;
- noise impacts during some construction components exceed the noise criteria – these will be managed through complying with the CEMP and by close consultation with affected residences;
- there would be some short-term disturbance to the local community due to increased traffic movements along Skinners Shoot Road during the construction period. This would be managed through implementing a Traffic Management Plan; and
- there would be some visual impact on the surrounding area from the substation however this would decrease over time as the landscaped vegetation matures.

Potential impacts have been identified and appropriate mitigation measures recommended in this EA. These measures are to be implemented in the undertaking of all works associated with the development.

Consequently, this EA indicates that no significant adverse environmental impacts are likely to occur as a consequence of undertaking the proposed development. Therefore, an Environmental Impact Statement (EIS) is not required. Based on the findings of this EA, Site 7 is a suitable location for the Suffolk Park zone substation.

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