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Preliminary Assessment of Potential Impact of Electric and Magnetic Fields from Overhead Power Lines

Location:

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Prepared for:

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Report:

2008.105

July 2008

Document Control Summary			
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Title:	**PRELIMINARY EMF ASSESSMENT**		
Job No:	**2008.105**		
Client:	**Polobay Pty Ltd**		

Document Record

Version	Date	Prepared by	Checked by	Approved for issue by
Draft	31.07.08	HT	GJ	GJ
Final	08.08.08	HT	GJ	GJ

Issue Register

Distribution List	Date Issued	Version	Method of Transmission	Number of Copies
John Sherwood (Polobay P/L)	01.08.08			
Darryl Anderson Consulting	08.08.08	Final	Delivery	2

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Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary.

Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time, natural processes and the activities of man.

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1 EXECUTIVE SUMMARY

Polobay Pty Ltd (the client) engaged HMC Environmental Consulting Pty Limited (HMC) to undertake a preliminary assessment of the potential electric and magnetic field (EMF) impacts from the overhead high voltage power line traversing the subject site.

The subject site comprises two (2) existing vacant lots and is located within the village of Bilambil, in the Tweed Shire Council area of NSW. The client is proposing to subdivide the lots to create 57 residential lots, associated open space and parkland, and a commercial lot. The site is bounded by Hogans Road in the south, Bilambil Creek to the west, Bilambil Road to the east and Urliup Road to the north.

An overhead 110kV/50Hz transmission power line supported by a steel tower approximately 35m high traverses Hogans Road and the southern end of the site. In addition, 415V/50Hz distribution lines are located within the abutting road reserves, supported on timber poles.

This report undertakes a preliminary assessment of the potential impact of power frequency electric and magnetic fields on the future occupants of the subject site. A minimum 40m wide safety easement to be established across the centre of the overhead power line, resulting in a minimum buffer distance of 20m to the nearest boundary of a residential lot.

A site inspection, literature review, and investigation of the relevant electrical network & site specifications were carried out by HMC. Using previous electric and magnetic field data documented by various references, the expected EMF profile was produced for the subject site at the easement boundary.

A site inspection, literature review, and investigation of the relevant electrical network characteristics were carried out by HMC. The recommended limits for the electric and magnetic field (EMF) of the 50Hz power frequency were also established.

Using documented electric and magnetic field data from various references world-wide, the expected EMF profile in the vicinity of the transmission line was produced for the subject site. The expected EMF strengths were then compared with the appropriate recommended EMF limits.

Based on the literature research presented in this report, it is concluded that the expected exposure of the future occupants of the nearest residential lot to power frequency EMF is well below the permissible limit for occupational and general public exposure as set out in the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) draft Standard aimed at protection against established adverse health effects.

It is noted that there remains uncertainty of the long term health and biological risks associated with the hazards of Extremely Low Frequency (ELF) magnetic fields and accepted exposure standards. In the context of this report, it is recommended that exposure should be kept to levels as low as reasonably practicable. The report does recommend following the "prudent avoidance" approach adopted by the Energy Network Association of Australia and its energy utility members. All practical & cost effective measures are recommended to be taken to minimise the risk of exposure to power frequency electric and magnetic fields, therefore it is recommended that.

1. The proposed dwellings be located outside a minimum 40m wide transmission line easement, and as far as possible from the overhead power line; and

2. The electricity power supply and reticulation system for the proposed dwelling should be designed and installed to minimise human exposure to the power frequency electric and magnetic fields, as far as is practical and cost effective.

Please note: In the context of this report, the term "EMF" refers to the "electric and magnetic fields" as defined by the Draft Radiation Protection Standard (ARPANSA, 2006).

2 INTRODUCTION

Polobay Pty Ltd (the client) engaged HMC Environmental Consulting Pty Limited (HMC) to undertake a preliminary assessment of the potential electric and magnetic field (EMF) impacts from the overhead high voltage power line traversing the subject site.

The subject site comprises two (2) existing vacant lots and is located within the village of Bilambil, in the Tweed Shire Council area of NSW. The client is proposing to subdivide the lots to create 57 residential lots, associated open space and parkland, and a commercial lot. The site is bounded by Hogans Road in the south, Bilambil Creek to the west, Bilambil Road to the east and Urliup Road to the north.

An overhead high voltage transmission line supported by an off-site steel tower approximately 35m high traverses the southern end of the site (Lot 2) and the adjacent Hogans Road. The transmission line is maintained by PowerLink and is part of the transmission line extending from the Terranora Sub-station to Mudgeeraba in Queensland. In addition, 415V/50Hz distribution lines are located within the abutting road reserves, supported on timber poles.

The client proposes to establish a safety easement $\pm$ 20m from the power line axis to the nearest residential lot boundary, resulting in a total easement width of 40m. This same transmission line traverses other residential areas in the locality. In the case of Ribbonwood Place, Terranora, an easement of 40m width has been established over the power line.

In the context of this report, the term "EMF" refers to the "electric and magnetic fields" as defined by the Draft Radiation Protection Standard (ARPANSA, 2006).

3 OBJECTIVES

The objective of the investigation is to provide a preliminary assessment of the potential impact of power lines on the future occupants of the subject site.

The report references applicable exposure standards and typical EMF strengths associated with overhead power line installations.

The purpose of the report is to provide a responsible and informed recommendation about the degree of compliance with the appropriate EMF exposure standards and guidelines, and the need for further site investigation.

4 SCOPE OF WORK

The scope of work undertaken during the Preliminary Assessment included the following:

- A detailed Site Inspection.
- Literature review,
- Investigation of the relevant electricity supply network specifications and site requirements
- This report does not include a measurement survey of EMF strengths. Existing field data from various sources assessing similar installations is referenced and presented to establish the expected EMF strength on the subject site to enable comparison with the relevant guideline limits.

5 SITE IDENTIFICATION

Site Address	Lots 2 & 3 Bilambil Road, Bilambil
Property Description	Lot 2 DP 244652 Lot 3 DP 244652 Bilambil Parish of Terranora County of Rous
Site Owner	Jackson International Pty Ltd
Client	Polobay Pty Ltd
Local Government Authority	Tweed Shire Council
Current Zoning	2 (d) Village
Distance from nearest CBD	~6km from Tweed Heads Post Office
Site Area	2.215ha Lot 2 2.2438ha Lot 3
Locality Map	Refer to Appendix 1
Proposed subdivision layout	Refer to Appendix 2
Notes: CBD- Central Business District	

6 SITE BACKGROUND & CHARACTERISATION

6.1 *Current Land Use*

A site inspection was carried out by HMC on 28 July 2008. At the time of the HMC inspection, the Site was vacant land with evidence of earthworks associated with vehicle tracks. The property is bounded by Bilambil Creek to the west and has road frontage to Hogans Road, Bilambil Road and Urliup Road.

An aerial photograph the subject site is shown in the Figure below:

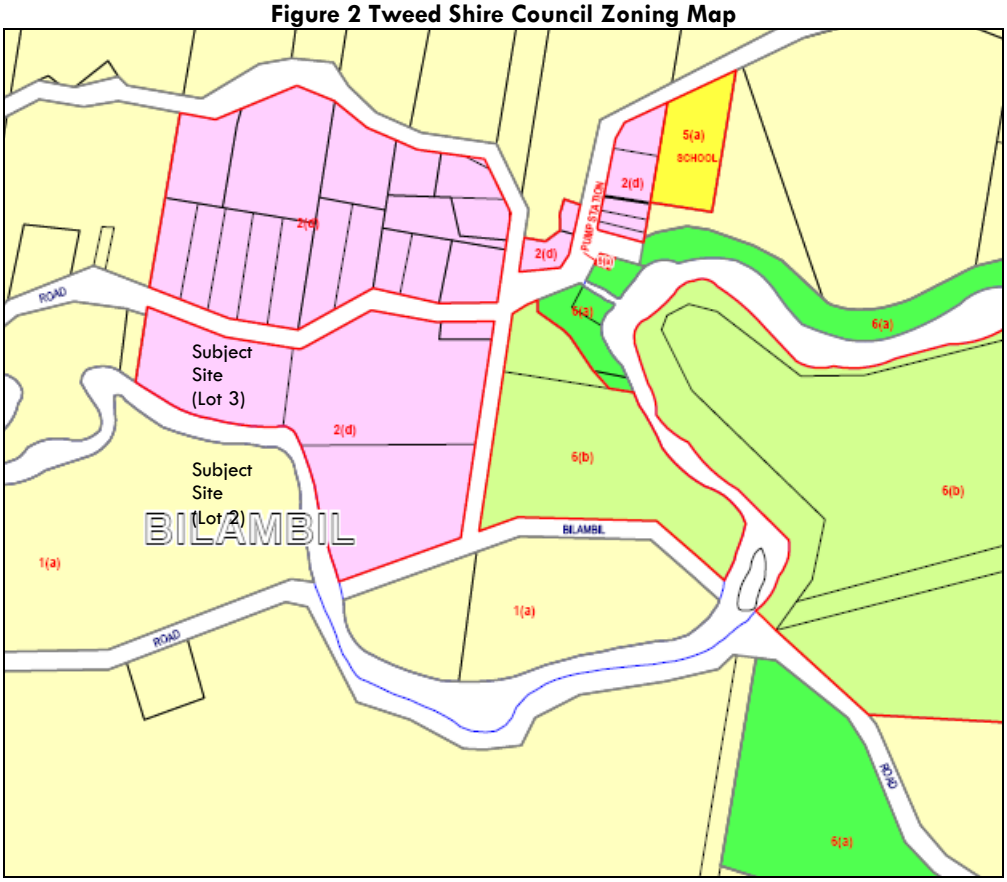
Figure 1 Aerial photo showing existing lot boundaries

6.2 *Zoning*

The subject site is located within Bilambil village and is zoned 2 (d) Village.
The adjacent properties are currently used for rural, residential or sports ground purposes.

Figure 2 below depicts the zoning applicable over the subject site and surrounding properties.

Figure 2 Tweed Shire Council Zoning Map



Legend:
1(a) Rural
2(d) Village
5(a) Special Uses
6(a) Open Space
6(b) Recreation

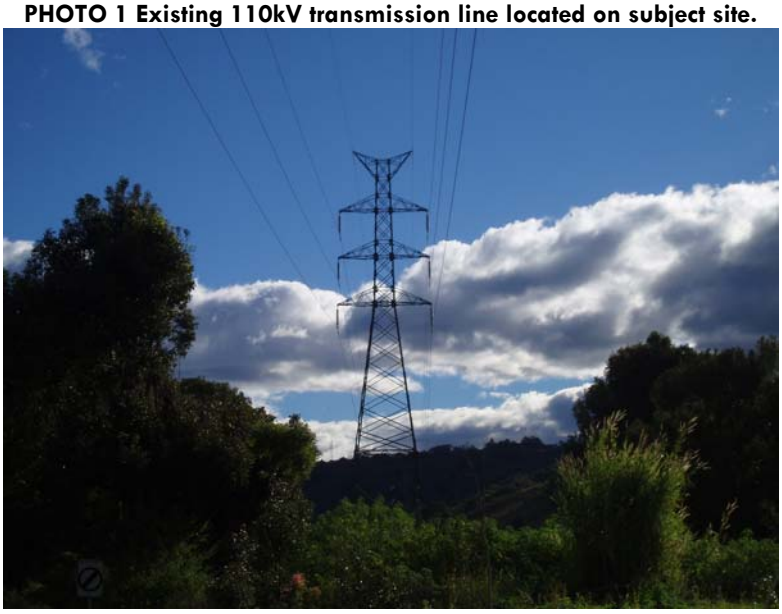
6.3 *Overhead Transmission Line Easement Requirement*

The overhead power line traversing the subject site is owned and the NSW portion of it is maintained by Country Energy, who took it over from Energex in 1981. The power line is a 110kV double circuit line supported on steel towers approximately 35m high on average. The power line extends from Terranora sub-station through to Mudgeeraba in Queensland. Powerlink is the electricity network that is responsible for this power line once it crosses the State border.

There is currently no easement over the subject site for the purpose of the overhead power line. Enquiries with Country Energy (pers. comm. Steve Goldey, 31.07.08) have revealed that an indicative safety and access easement width of 40m is considered appropriate. An easement of 40m width has been established on other properties in Terranora that are located beneath the same power line.

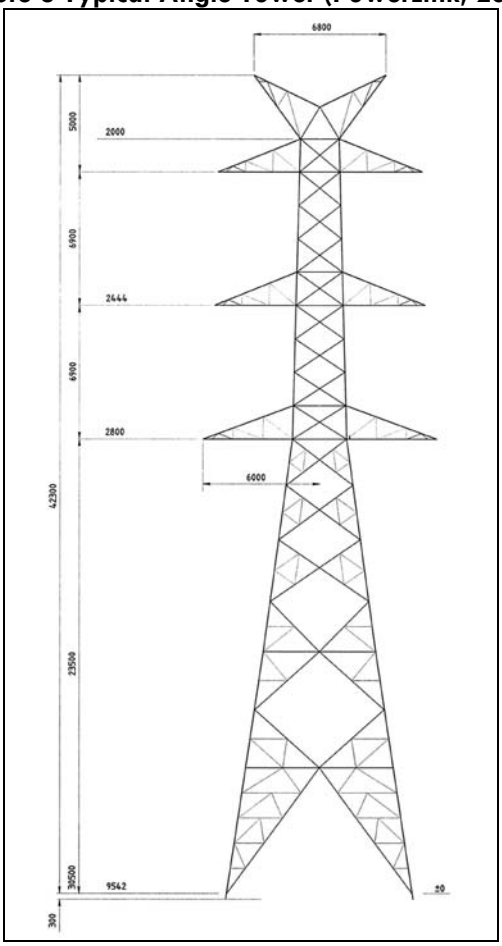
Photo 1 below shows the existing tower (off-site) and overhead power lines, looking west over the subject from Bilambil Road.

PHOTO 1 Existing 110kV transmission line located on subject site.



The figure below depicts the typical construction and dimensions of the supporting tower for a transmission line.

Figure 3 Typical Angle Tower (PowerLink, 2007)



7 BACKGROUND EMF INFORMATION

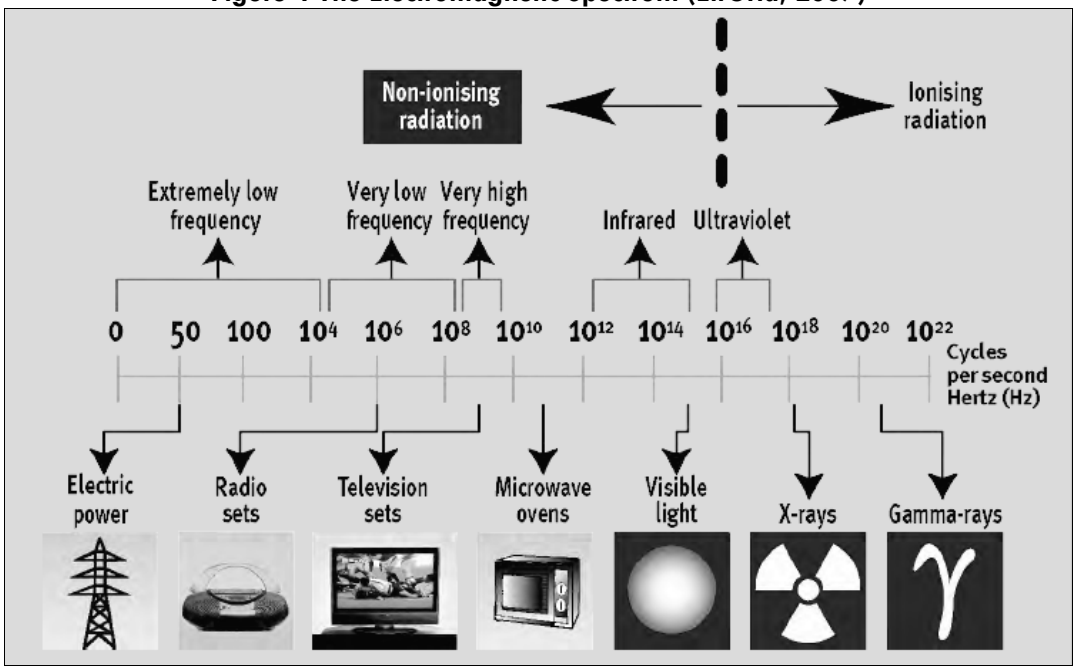
7.1 *Sources of Electric and Magnetic Fields (EMF)*

Magnetic fields are produced where electric current is present, and the strength of a magnetic field depends on the level of current flowing through the conducting material. Magnetic field strength is normally expressed as the magnetic flux density, expressed in tesla (T). This relatively large unit is usually expressed as microtesla (μT) (Eirgrid, 2007).

There are many different sources of EMFs, both natural and artificial. Naturally occurring EMFs are associated with atmospheric processes such as thunderstorms and lightning. Artificial sources are predominantly associated with the generation, distribution and use of electricity. Therefore powerlines, electrical wiring and common appliances (electric blankets, televisions, hairdryers, computers, lights, photocopiers, electric cabling etc) all produce ELF electric and magnetic fields (ARPANSA, 2007).

The figure below demonstrates the Electromagnetic Spectrum.

Figure 4 The Electromagnetic Spectrum (EirGrid, 2007)



The table below provides typical EMF measurements and ranges associated with various appliances and powerlines. (ENA, 2007)

Table 1Typical EMF Measurements (ESSA, 2001)

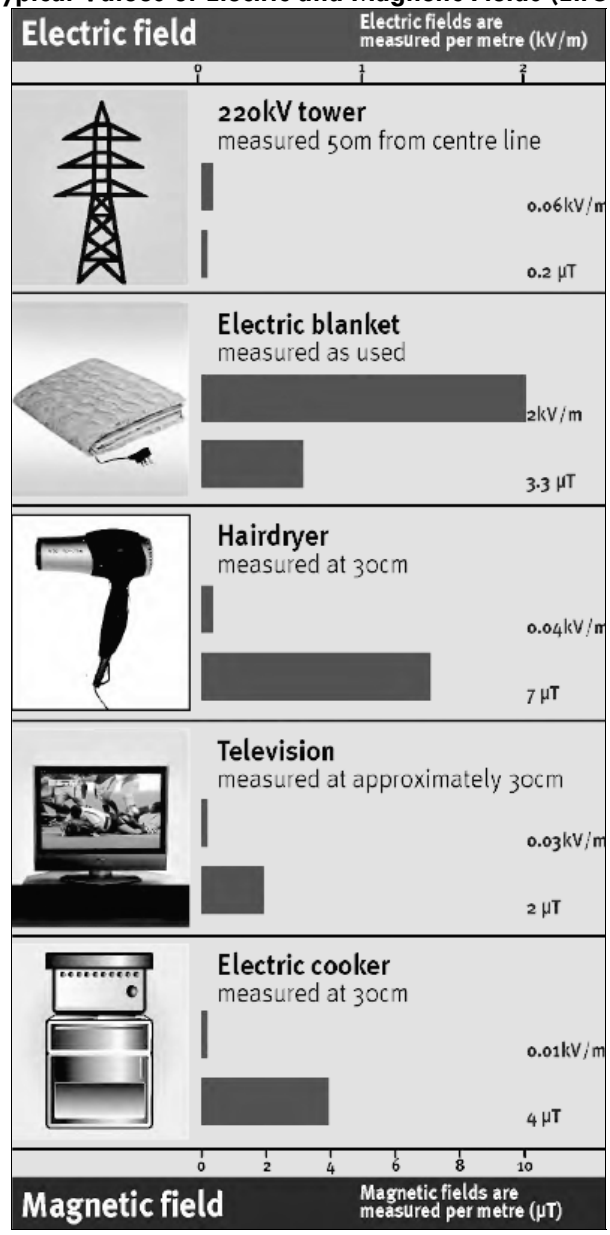
Source	Typical measurement (mG)*	Range of measurements (mG)*
TV	1	0.2 - 2
Fan	1	0.2 - 2
Refrigerator	2	2 - 5
Toaster	3	2 - 10
Kettle	3	2 - 10
Personal computer	5	2 - 20
Electric stove	6	2 - 30

Electric blanket	20	5 - 30
Hair dryer	25	10 - 70
Distribution powerline (under the line)	10	2 - 20
Transmission powerline (under the line)	20	10 - 200
Edge of easement	10	2 - 50

**Note: 1mG = 0.1μT*

Note: Owing to variations in the design of electrical appliances and the loadings on powerlines, the EMF levels may vary. The table above is based on a consistent set of measurements undertaken by power authorities in Australia using similar techniques and protocols to overseas measurements. Measurements are taken at normal user distance using a gaussmeter. The fields are measured in a unit of milligauss (mG).

Table 2 Typical Values of Electric and Magnetic Fields (EirGrid, 2007)



8 BASIS FOR ASSESSMENT CRITERIA

8.1 *Electric and Magnetic Field (EMF) Standards*

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), is an Australian Federal Government agency that has the responsibility for protection the people and the environment from the potential harmful effects of radiation such as exposure to 50Hz EMFs.

ARPANSA has released a draft Extra Low Frequency (ELF) Radiation Protection Standard: Exposure Limits for Electric and Magnetic Fields 0 Hz – 3 Hz 0-3Hz for public comment (ARPANSA, 2006).. According to Alan Melbourne, Manager, Standards Development & Committee Support Section of ARPANSA (pers. comm. 23/7/08), the draft has been changed by the working group in response to public submissions, however the revised draft is still incomplete and has not been released as of yet.

Compliance with the ELF Radiation Protection Standard will only become a mandatory requirement if referenced by a regulating body such as State or Federal Government.

The main objective of the ARPANSA draft Standard (ARPANSA, 2006) is to establish EMF exposure limits and specific risk management practices for the entire ELF range that will ensure that known adverse health effects do not arise from exposure to such fields.

The Draft ELF Radiation Protection Standard issued by ARPANSA will replace the former Interim Guidelines on limits of Exposure to 50/60Hz electric and magnetic fields" published by the National Health and medical Research council (NHMRC) in 1989. These guidelines have been rescinded by the NHMRC as the responsibility has been transferred to ARPANSA to replace them with the new ELF Standard.

The NHMRC guidelines were based on guidelines developed in 1989 by the International Non-ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC). The IRPA/INIRC guidelines were superseded in 1998 by the "Guidelines for limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (Up to 300GHz)" produced by the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998).

The ARPANSA Draft ELF Standard follows international trends and references the ICNIRP Guidelines however the biological approach towards establishing the Basic Restrictions (BRs) and therefore the derivation of the exposure limits, known as Reference Levels, differs significantly(Wood, 2006). In regard to the link with leukaemia risk, the Draft ELF Standard follows the ICNIRP and World Health Organisation (WHO) and does not consider the evidence strong enough to be considered causal and therefore doesn't form the basis for establishing the exposure limits (Wood, 2006).

The ARPANSA draft Standard is stricter in its compliance requirements at 50 Hz than the NHMRC 1989guidelines, as some reference levels are instantaneous rather than time-averaged values. The reference levels are however similar in value in many cases to instantaneous levels of the ICNIRP 1998 (ENA, 2007).

ARPANSA does recommend precautionary measures proportional to the risk, and the minimisation, as appropriate, of ELF electric and magnetic field exposure provided this can be readily achieved without undue inconvenience and at reasonable expense (ARPANSA, 2006). The incorporation of arbitrary additional safety factors beyond the exposure limits of the ELF Standard is not supported by ARPANSA (Wood, 2006).

8.2 *Extremely Low Frequency EMF Exposure Limits*

The ARPANSA draft Standard proposes the following instantaneous reference levels for EMF exposure at 50 Hz:

Exposure Characteristics	Electric Field Strength kV/m	Magnetic Field Strength Microtesla (μT)
General Public		
General Public	5	100 (1,000mG)
General Public "Controlled Activity"	10	300 (3,000mG)
Occupational		
Occupational	10	500 (5,000mG)
Occupational "Controlled Activity-head"	20	1500 (15,000mG)
Occupational "Controlled Activity-body"		1800 (18,000mG)

Description of Controlled Activity or Controlled Circumstance (Public Exposure)(including Aware user exposures):
An activity or circumstance in which exposure to ELF electric or magnetic field may reasonable be expected to exceed public exposure reference levels as given above but not to exceed the controlled Activity /Circumstance (Public Exposure) reference levels above.
Such exposure is permissible only if:

- *Signage at all entry points is present to inform all likely visitors/occupants that the fields exceeding the general public limits may be present and that visitors/occupants may wish to minimise duration of their stay;*
- *That such signage includes reference by telephone number (available at least during normal business hours) and internet URL to a source of more comprehensive information about the likely exposure levels, and possible risks to health;*
- *That where exposures are highly localised, the signage clearly indicates which locations are affected; and*
- *Documentation is prepared and maintained explaining why such exposures are practically necessary.*

Description of Controlled Activity or Controlled Circumstance (Occupational Exposure):
An activity or circumstance in which exposure to ELF electric or magnetic field may reasonable be expected to exceed occupational exposure reference levels as given above but not to exceed the controlled Activity /Circumstance (Occupational Exposure) reference levels above.
Such exposure is permissible only if the persons being exposed:

- *Are made aware of the probable exposure and given information about possible biological effects and risk of adverse health effects;*
- *Give informed consent to such exposures;*
- *Are given sufficient training and information so they may minimise their exposure consistent with operational requirements and may avoid accidents or injuries if biological effects do occur; and*
- *Are suitable screened for the presence of electronic or metallic medical implants that may put them at risk n the range of fields expected.*
- *Such activity or circumstance must also be:*
- *Under the super vision of a competent person who must ensure that exposures cannot exceed the Controlled Activity/Circumstance (Occupational Exposure) reference levels;*
- *Be subject to appropriate access controls and signage to prevent inadvertent entry and exposure; and*
- *Be documented and signed so that areas exceeding normal occupational reference levels are clearly indicated.*

Where a Controlled Activity or controlled Circumstance is likely to result in exposures exceeding the normal occupational reference levels for more than one hour per day, records of staff undertaking the activity must be kept giving estimated weekly exposure times and levels.

The now rescinded NHMRC guidelines recommended EMF limits as follows:

Exposure Characteristics	Electric Field Strength kV/m	Magnetic Flux Density milliGauss (mG)*
General Public		
Up to 24 hours per day (c)	5	1,000
Few hours per day (d)	10	10,000
Occupational		
Whole working day	10	5,000
Short erm	30 (a)	50,000 (b)
For limbs		250,000
Notes: *(a) The duration of exposure to fields between 10 and 30kV/m may be calculated from the formula t≤80/E where t is the duration in hours per work day and E is the electric field strength in kV/m.* *(c) This restriction applies to open spaces in which members of the public might reasonably be expected to spend a substantial part of the day, such as recreational areas meeting grounds and the like.* *(d) These values can be exceeded for a few minutes per day provided precautions are taken to prevent indirect coupling effects.*		

**1000mG = 100μT*

To further compare the current guidelines, the ICNIRP short term exposure levels that are applicable to 50Hz electric and magnetic fields are as follows:

Description	**Reference Level**	
	Electric Field kV/m	**Magnetic Field Microtesla (uT)**
General Public Population	5	100 (1000mG)
Occupational Population	10	500 (5000mG)

(Adapted from rounded off values in Table 4,6,7 and Figures 1 & 2 of the Guidelines for Limiting Exposure to Time-varying Electric, Magnetic and Electromagnetic Fields Up to 300GHz, ICNIRP, 1998).

9 EXPECTED EMF EXPOSURE – OVERHEAD POWERLINES

9.1 *Electric & Magnetic Fields*

A transmission line is a high-voltage overhead power line operated by various electricity suppliers/utilities for long-distance transmission of electricity. Typically transmission lines are supported by single pylons, or steel towers with two separate circuits, one each side of the towers, each with three wires or bundles of wires.

Distribution lines are at lower voltages (typically 415V) than transmission lines and are used by electricity utilities to distribute electricity round an area. Typical supports are constructed of timber poles (ENA, 2008).

Generally, powerlines contribute little to the electrical fields that can be measured inside a house or office. This is because the walls of the building, in fact any solid object, create a shield from the electrical field. A typical house generally shields at least 90% of the electrical fields from outside (Energex, 2008)

Both high voltage lines and distribution lines produce magnetic fields. Magnetic field strengths associated with powerlines depend on the amount of current flowing along the line and the distance from the power line. Fields rapidly decrease in strength with distance from the individual power line.(Energex, 2008).

9.2 *Typical EMF Levels Under Power Lines*

The following information presents the typical magnetic field strengths underneath powerlines, as recorded in the field or calculated by the referenced electricity utilities/agencies.

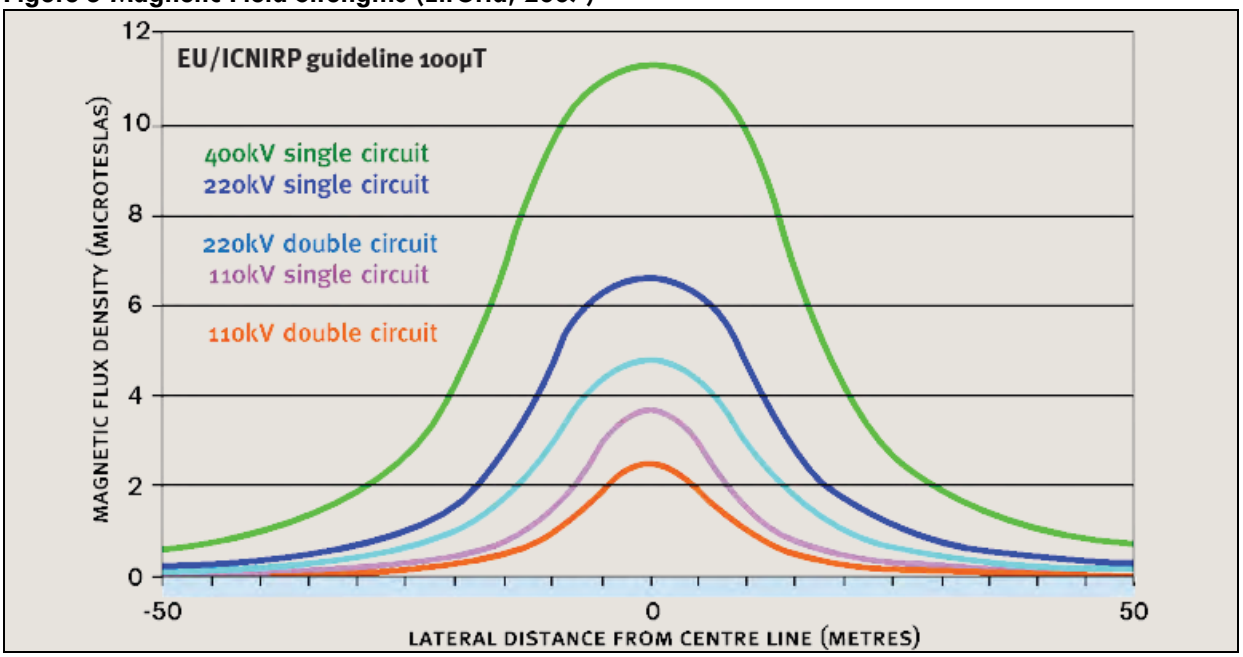
It is to be noted that EMF strengths will vary according to line design, ground clearance, load (current) and phasing (ARPANSA, 2006).

9.2.1 Ireland/UK

The graph below has been published in "Information on Electric and Magnetic Field" (Eirgrid, 2007), and depicts the typical magnetic field strengths, and the decrease in strength as the distance from the centre line increases. The orange line depicts the expected field strengths under the existing power line traversing the subject property.

According to this data set, the expected field strength at 20m distance from the centre line of a 110kv double circuit line is <0.5µT.

Figure 5 Magnetic Field Strengths (EirGrid, 2007)



The table below provides the actual field values presented by National Grid web site, the company that operates the England and Wales high-voltage electricity transmission network, and is also involved in electricity transmission or distribution in Australia, North America, Africa and South America.).

Table 3 Magnetic Field Strength Calculated at Distance from Centreline (National Grid, 2008)

Line Voltage, Design & Current Load					Magnetic Field in μT at distance from centreline				
					maximum under line	10 m	25 m	50 m	100 m
132 kV	largest lines	L7 twin bundles 0.305 m lynx	maximum	clearance 7 m phasing U load 1.4/1.4 kA	30.445	20.532	5.553	1.528	0.392
			typical	clearance 10 m phasing U load 0.13/0.13	1.848	1.359	0.468	0.138	0.036
	smaller lines	L132 single conductors 0.4 sq in	maximum	clearance 7 m phasing U load 1.2/1.2 kA	24.585	17.217	4.587	1.247	0.318
			typical	clearance 10 m phasing U load 0.13/0.13 kA	1.731	1.317	0.451	0.132	0.034
	smallest wood-pole design	trident 150 m span single conductors lynx	maximum	clearance 7 m single circuit load 0.7 kA	12.347	12.347	0.738	0.192	0.048
			typical	clearance 10 m single circuit load 0.1 kA	1.764	0.385	0.099	0.027	0.007

Note:
1. All fields calculated at 1 m above ground level.
2. All fields are given to the same resolution for simplicity of presentation (1 nT = 0.001 μT) but are not accurate to better than a few percent.
3. Calculations ignore zero-sequence current. This means values at larger distances are probably underestimates, but this is unlikely to amount to more than a few percent and less closer to the line.
4. The "maximum field under the line" is the largest field, which is not necessarily on the route centreline; it is often under one of the conductor bundles.
5. Sometimes, a 132 kV circuit could be carried on a line designed for 275 kV or 400 kV. Then the magnetic fields could be larger than shown here.

In the table below, another data set is presented by the UK National Grid provides the range of EMF strengths, as measured in the field.

Table 4 Typical ground-level UK field levels from overhead power lines (National Grid, UK, 2008)

Item	Description	Magnetic Field microteslas (μT)	Electric Field (kV/m)
Smaller steel pylons (132 kV)	Maximum field (under line) Typical field (under line) Typical field (25 m to side)	40 0.5 – 2 0.05-0.2	4 1-2 0.1-0.2
Wooden poles (11 kV and 33 kV)	Maximum field (under line) Typical field (under line) Typical field (25 m to side)	7 0.2-0.5 0.01-0.05	0.7 0.2 0.01-0.02

9.2.2 Energex (2008)

The range of EMF measurements expected by taken underneath various power lines by the Auckland Power Board (Gledhill, 1992) are presented in Table 5 below.

Common Sources of EMF	Range of measurements (mG)	Range of measurements (μT)*
Television	0.2-2	0.02-0.2
Pedestal Fan	0.2-2	0.02-0.2
Fridge	2-5	0.2-0.5
Toaster	2-10	0.2-1
Kettle	2-10	0.2-1
Personal Computer	2-10	0.2-1
Electric Stove	2-30	0.2-3
110kV overhead powerline at 20m	2-5-	0.2-0.5
Electric Blanket	5-30	0.5-3
Hair Dryer	10-70	1-7

*1000mG = 100μT

9.2.3 Auckland Electric Power Board, NZ

Field measurements taken underneath various power lines by the Auckland Power Board (Gledhill, 1992) are presented in Table 5 below.

Table 5 Summary of EMF Measurements, Auckland area

Line Voltage (kV)	Magnetic flux density (microtesla)	Electric field strength (kV/m)	Comments
11	Negligible	negligible	
33	1.1	1.6	Decreases to 0.4 μT, 0.9 kV/m at 10 m.
66	0.4	0.25	
110	0.7 - 2.5	0.4 - 1.5	
220	2.5 - 3.5	0.5 - 1.0	Various line configurations

Gledhill (1992) also compared the calculated EMF strengths for certain types of lines from overseas data collected by Lee et al, 1986. The levels are presented in the table below:

Table 6 Summary of EMF Measurements, overseas data collected by Lee et al, 1986.

Line voltage (kV)	Current (Amps per phase)	Total power (MW)	Electric field strength (kV/m)	Magnetic flux density (microtesla)
230	954	800*	2-3	13
500	2624	5000*	7-8	33
1100	4800	10000#	9	30

* Double circuit
\# Single circuit

9.3 *EMF Validation*

The data presented in the previous section show that there is a broad range of magnetic flux densities and electric field strengths beneath, and in the vicinity of, high voltage power transmission lines. An assessment of the likely magnetic flux density beneath any particular line remains difficult to predict without some knowledge of the loading conditions.

However the data presented does show that, conservatively, the expected maximum ELF electric and magnetic field levels at the nearest residential lot boundary will be well below the limit recommended by all of the guidelines presented previously in Section 8.2:

- Draft ELF Standard prepared by ARPANSA, and
- NHRMRC guidelines, and
- ICNIRP guidelines.

Provided a minimum 20m setback from the centreline to the nearest dwelling is upheld by the establishment of a minimum 40m easement over the power line on the subject site, it is not considered necessary to carry out field measurements of EMF strengths.

Should concerns be raised by stakeholders in the future, it would be appropriate to produce a mapped survey of the outdoor areas and at the dwellings near the power lines. Data would be recorded by a sampling gaussmeter at regular intervals across the surveyed space, and could be processed to produce a 3-dimensional representation of the recorded field strength. Such field data would enable comparison with expected field strengths and the EMF exposure limits recommended by the relevant guidelines.

9.4 *Reducing Exposure to Power Frequency EMFs – Dwelling Construction Stage*

According to a recent report presented to the UK Health Department by the Stakeholder Advisory Group on ELF EMF's (SAGE), there are ways to minimise EMF exposure within the home established by the National Grid with the remit to provide advice to the government. The SAGE process was initiated by National Grid (UK) and is now under the leadership of the UK Department of Health.

In the "First Interim Assessment: Power Lines and Property, Wiring in Homes, and Electrical Equipment in Homes" (SAGE, 2007), some options for reducing EMF exposure are provided, and these are summarised in the table below.

Table 7 Reducing EMFs inside the Home

To Reduce Magnetic Fields	Changing ring-power circuits to radial circuits
	Inserting plastic sections in metal services such as gas and water pipes
	Keep "go" and "return" currents together at all times.
	Protect whole installation with a residual current device (RCD)
To Reduce Electric Fields	Placing all wiring in metal conduits
	Use all-metal accessories and mounting boxes
	Use cable with a screen
	String- pull or remote control light switches
	Locate sockets away from the bed
	Apply earthed metal screening tape over cables in walls and ceilings
	Use demand switches to disconnect voltage when circuit not in use.
To Reduce Both Magnetic & Electric Fields	Site the meter and consumer unit appropriately.
	Use extra-low voltage circuits in homes.
	Use DC circuits in homes.

10 DISCUSSION

Based on the literature research presented in this report, the expected exposure of the future occupants of the site to power frequency EMF is compared to the permissible limits for occupational and general public exposure as set out in the relevant guidelines.

The table below conservatively summarises the maximum range of expected magnetic field levels obtained within the literature research and presented previously in Section 9. The expected levels underneath and in the vicinity of a 110kV overhead power line are then compared to the limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and ARPANSA draft Standard aimed at protection against established adverse health effects.

Table 8 Summary of Range of Expected Maximum EMF Strengths

Source of EMF	Range of Magnetic Field Strength (μT)*	ARPANSA Draft Standard Public Exposure Limit	ICNIRP Guidelines Public Exposure Limit
110kV overhead powerline (directly underneath)	0.2-40*	100μT	100μT
110kV overhead powerline (10m distance)	0.2-20.5		
110kV overhead powerline (25m distance)	0.2-5.5		

*Conservative estimate including the use of 132kV power line calculations/measurements, maximum load, 7m clearance and instantaneous measurements.

11 CONCLUSIONS

Based on the literature research presented in this report, it is concluded that the expected exposure of the future occupants of the site to power frequency EMF is well below the permissible limit for occupational and general public exposure as set out in the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and ARPANSA draft Standard aimed at protection against established adverse health effects.

In line with the approach of "prudent avoidance", adopted by the Electrical Supply Association of Australia and its member supply authorities, it is recommended that:

1. The proposed dwellings be located outside a minimum 40m wide transmission line easement over the subject property, and as far as possible from the overhead power line; and

2. The electricity power supply and reticulation system for the proposed dwelling should be designed and installed to minimise human exposure to the power frequency electric and magnetic fields, as far as is practical and cost effective.

12 PROVISION

Any conclusions presented in this report are relevant to the site condition at the time of inspection and legislation enacted as at date of this report. Actions or changes to the site after time of inspection or in the future will void this report as will changes in relevant legislation.

13 SIGNATURE

This report has been prepared by Helen Tunks of HMC Environmental Consulting Pty Ltd.

Helen Tunks
DIRECTOR

… **31 July 2008**.
Completion Date

14 REFERENCES

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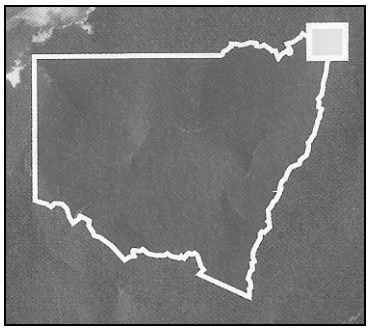
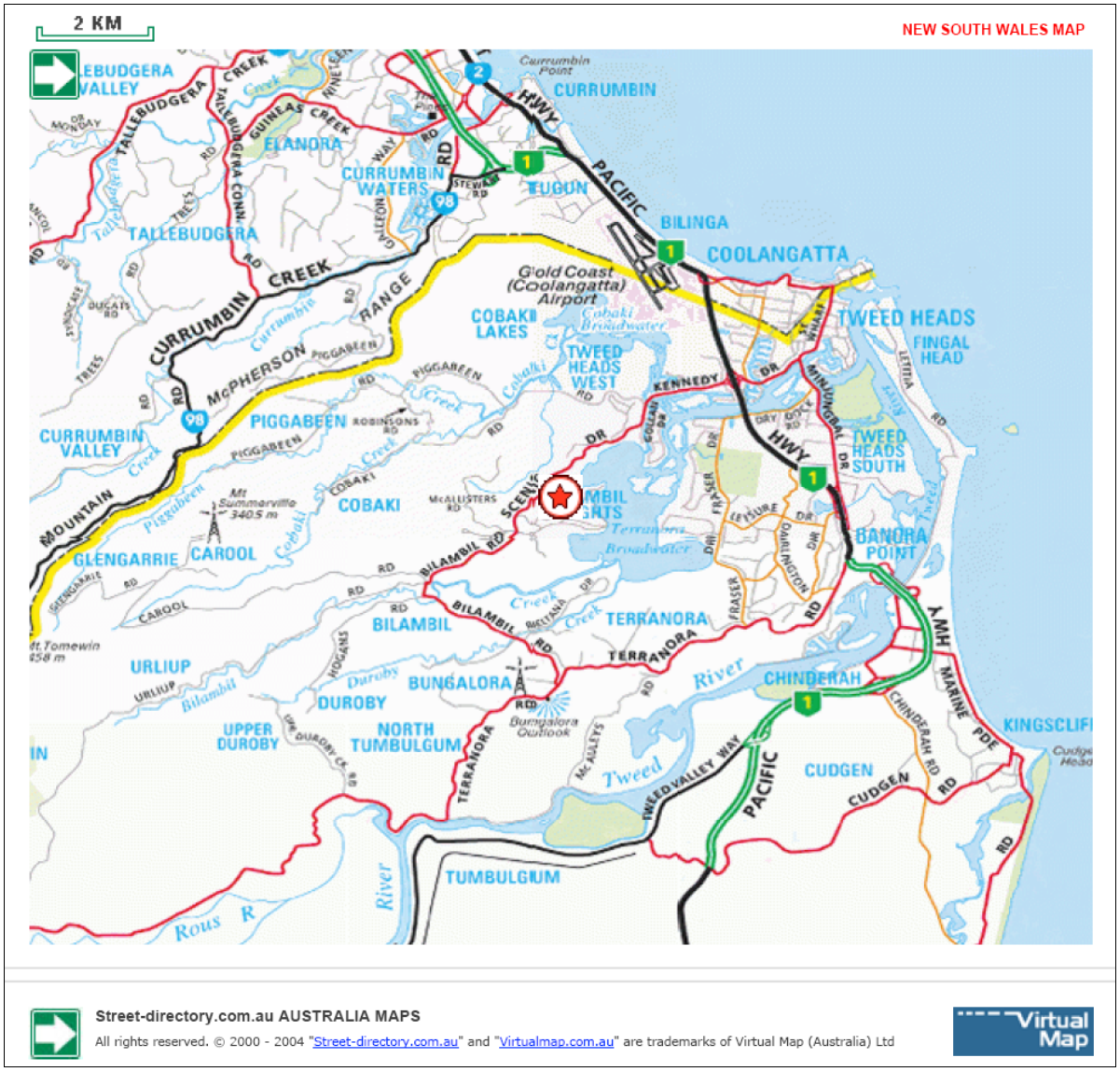
15 APPENDICES

15.1 APPENDIX 1 Site Location

The figures below provide a location of the site located within the locality of Ocean Shores. Area within box identifies approximate location within the northern area of NSW.





15.2 APPENDIX 2 Proposed Development

SEE NEXT PAGE

15.3 APPENDIX 3 Title Searches

The current ownership and property description forming Lot 2 within the subject site are detailed in the following information:

Department of Lands

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 2/244652

SEARCH DATE	TIME	EDITION NO	DATE
30/7/2008	10:31 AM	1	20/3/2008

LAND

LOT 2 IN DEPOSITED PLAN 244652
AT BILAMBIL
LOCAL GOVERNMENT AREA TWEED
PARISH OF TERRANORA COUNTY OF ROUS
TITLE DIAGRAM DP244652

FIRST SCHEDULE

JACKSON INTERNATIONAL PTY LTD (T AD839350)

SECOND SCHEDULE (1 NOTIFICATION)

1 LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND CONDITIONS IN FAVOUR OF THE CROWN - SEE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

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WARNING: THE INFORMATION APPEARING UNDER NOTATIONS HAS NOT BEEN FORMALLY RECORDED IN THE REGISTER.

Department of Lands Page 1 of 2

Department of Lands

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 3/244652

SEARCH DATE	TIME	EDITION NO	DATE
31/7/2008	2:00 PM	1	20/3/2008

LAND

LOT 3 IN DEPOSITED PLAN 244652
AT BILAMBIL
LOCAL GOVERNMENT AREA TWEED
PARISH OF TERRANORA COUNTY OF ROUS
TITLE DIAGRAM DP244652

FIRST SCHEDULE

JACKSON INTERNATIONAL PTY LTD (T AD839350)

SECOND SCHEDULE (1 NOTIFICATION)

1 LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND CONDITIONS IN FAVOUR OF THE CROWN - SEE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

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