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7 June 2012

PROPOSED CRONULLA SHARKS DEVELOPMENT AT 461 CAPTAIN COOK DRIVE, WOOLOOWARE, NSW (MP 10_0229)

MAGNETIC FIELD MEASUREMENTS FROM 132 KV SUBTRANSMISSION LINES AND PRACTICAL ASSESSMENT OF EXPOSURE LEVEL FOR FUTURE OCCUPANTS OF RESIDENTIAL, COMMERCIAL AND RETAIL TENANCIES.

Response to Ausgrid's Comments.

1. Introduction

In its letter to the Department of Planning dated 7 May 2012, Ausgrid raised several concerns about the proposed development in proximity to its existing 132kV subtransmission lines, both, in regards to the construction phase of the project and further after the development is completed and the tenancies are occupied.

The main concerns were related to the following matters:

- safety risk for construction work at elevated heights in the vicinity of the 132kV lines,
- impact of the proposed development on Ausgrid's ability to unobstructed access to the power lines during any maintenance or repair work,
- concern about the lack of precautionary measures incorporated in the development for limiting exposure to electromagnetic field for prospective tenants.

In its letter the Ausgrid made the following comments regarding the electromagnetic field exposure near the power line:

Issues relating to electromagnetic fields are also inadequately addressed in both the original documentation accompanying the concept plan application and section "3.12.4 Electromagnetic Radiation" on page 58 of the proponent's response to submissions (Preferred Project Report and Response to Submissions - Concept Plan Application MP 10-0229). Ausgrid makes the following additional comments for the Department's further consideration in its project assessment:

- there is no evidence in the applicant's project documentation that any consideration has been given to the adoption of low cost measures to reduce people's potential exposure to electromagnetic fields associated with the existing power lines. This is a requirement of the *Draft ARPANSA Standard* and is consistent with the industry's position on this matter;
- Section 3.12.4 (page 58) of the *Preferred Project Report and Response to Submissions - Concept Plan Application MP 10-0229* contains the following statements:

  "Magshield advises that the standard referenced has been in draft format for over five years now and according to official industry news will not be adopted as an Australian Standard".

  Comment: This statement is incorrect. ARPANSA have advised that the standard referenced above is likely to be adopted as an Australian guideline. ARPANSA have also indicated that the precautionary requirements will remain in the document.

  "Given that the relevant international guidelines have already been formulated on the basis of applying the precautionary principle ....."

Comment: This statement is incorrect. International guidelines (ICNiRP and IEEE) do not address possible long term health effects of electromagnetic fields. The referenced levels and inherent safety factors within these guidelines only address short term health effects.

In response to this letter Magshield carried out further assessment of the electromagnetic field emitted by the 132kV subtransmission lines within the area adjacent to the proposed residential development.

This report summarises the results of the practical magnetic field measurements (EMF) carried out in several locations on and off the power line easement near the proposed development and in some other locations along the 132kV subtransmission line.

The report also contains one practical and relatively inexpensive measure that, if implemented, can effectively reduce the magnetic field exposure level not only within the proposed development, but also along the entire route of the 132kV subtransmission line from its supply end, Sydney BSP, to its load end, Kurnell 132kV/33kV Subtransmission Substation (STS) and Kurnell 132kV/11kV Zone Substation.

2. 132kV Subtransmission Lines

The subtransmission line adjacent to the proposed development ground is in fact consists of two separate lines suspended on insulators on either side of the steel support towers.

The lines are connecting the bulk electricity supply substation Sydney South BSP, which is run and operated by TransGrid, to Kurnell 132kV/33kVSTS and Kurnell 132kV/11kV Zone Substation. In addition, one out of the two 132kV subtransmission lines is connected to Cronulla 132kV/11kV Zone Substation.

Fig.1 below shows the electrical schematic diagram for the Sutherland Load Area with two 132kV subtransmission lines (Feeders 916 and 917) supplying power from Sydney South BSP to Kurnell STS with a T-off from Feeder 916 for connection to Cronulla Zone Substation.

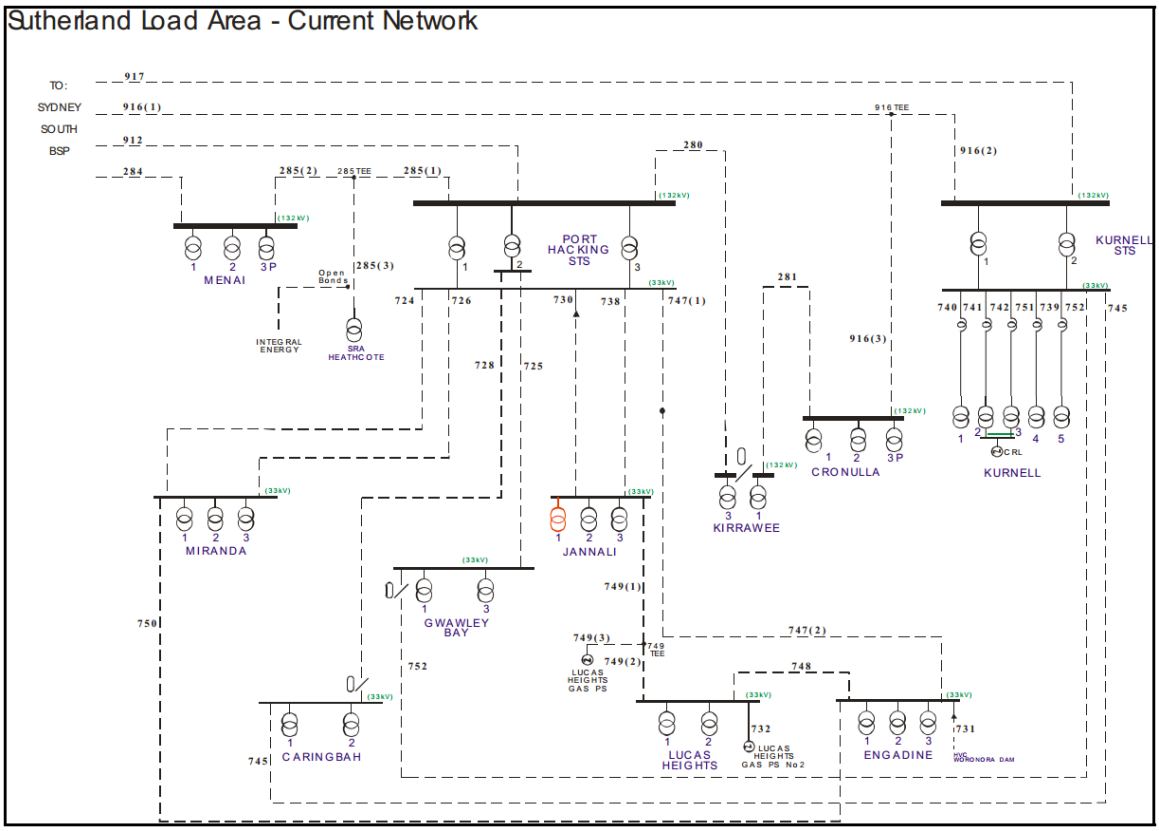
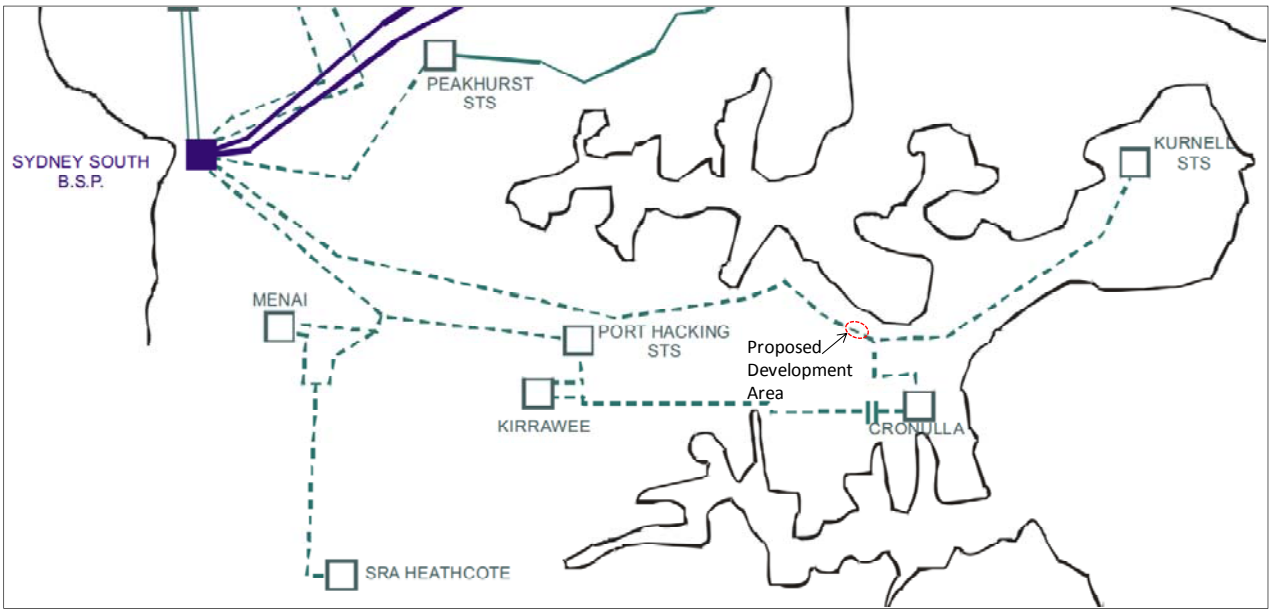


Fig.1 132kV subtransmission lines connected to Kurnell STS and to Cronulla Zone Substations.

The two 132kV feeders, 916 and 917, from Sydney South BSP to Kurnell STS are of overhead construction supported on steel towers. The dual circuit power line is approximately 22.3km and it was commissioned in the early 1960's. Currently it is classified as a Dual Function Asset. The dual function assets are the transmission assets and as such are included in the National Transmission Reliability Framework.

In April 2008 Ausgrid (then known as EnergyAustralia) issued a report entitled "Contingent Project Application, Replacement of feeders 908-909". The report recommends the replacement of feeders 908 and 909 with feeders from Kurnell STS to Bunnerong STS (see diagram in Fig.4 below). This network modification would substantially increase the flow of power through feeders 916 and 917 by more than 300 MVA as the Bunnering STS supplies the southern part of the eastern Sydney load area, (more than 30 suburbs) and has a peak load of more than 300 MVA.

Cronulla Zone Substation consists of two 45MVA transformers and is supplied via the 132kV feeder 916(3) teed off from feeder 916 linking Sydney South BSP and Kurnell STS. The 132kV feeder 281 from Kirrawee provides the back up supply only.



One span of the subtransmission lines, which runs along the proposed development, is suspended on a steel tower at its western end and on two free-standing steel poles at its eastern end (see photos below).

In this part of the power line route the southern easement boundary is lying 18.29m away from the centre of the power line.

Photo #1 ***Steel tower of 132kV Kurnell power line (feedrer No:916 is on the left and feeder No:917 is on the right)***

Photo #2 ***Two steel poles of 132kV Kurnell power line (feedrer No:916 is suspended on the right and feeder No:917 is on the left poles).***

The shortest distances between the proposed residential buildings and the southern easement boundary line, as marked by surveyors, are shown on the plan view drawing in Fig.2.

Among other dimensions, the conductors height of the power line above the natural ground, as well as, the horizontal separation distance in air between the two lines (two feeders) are also shown on the same drawing.

As the conductors of the power line, which are suspended between the two support structures located at either end of the 194.86m long span, are sagging under their natural weight, there is a point at which these conductors would be at their smallest height above the natural ground.

The survey of the power line geometry at that particular location provided the following dimensions:

- The height of the overhead earth wires is 26.43m
- The height of the upper phase conductors is 22.94m
- The height of the middle phase conductors is 19.71m
- The height of the bottom phase conductors is 16.43m
- The horizontal distance between the phase conductors of the two feeders is 9.64m
- The horizontal distance between the two overhead earth wires is 8.72m

The aerial photo below is taken from the Nearmap website mapping program. Among other useful features, the Nearmap program allows user to measure the horizontal distances on the map between various arbitrary points. As can be seen from the photo the horizontal distance between the bottom phases of the two feeders, as measured using the Nearmap program, is 9.3m. This distance is in good agreement with the survey measurements shown in Fig.2

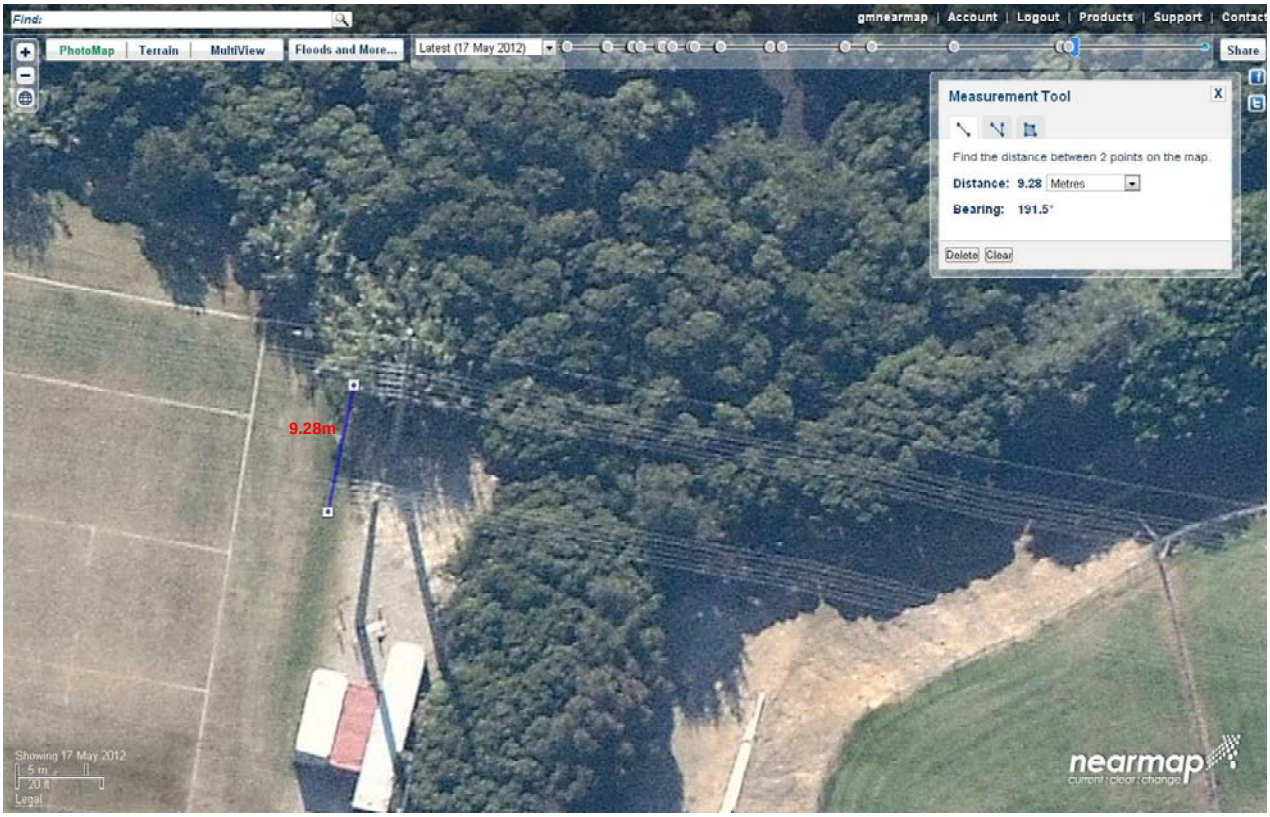


Photo #3 ***Aerial view of the 132kV Kurnell power line with two steel poles at the Sporting ground near the proposed development (see Photo #2).***

Significance of this photograph with its horizontal measurements obtained from the Nearmap software map would be evident in the following sections of this report.

3. EMF Measurements and Calculations

Measurements of the power frequency magnetic field were carried out on the proposed development site on Wednesday, the 23rd of May 2012 in between 11:00am and 11:30am.

The EMF measurements were made using a pre-calibrated HMI-1 hand-held EMF Survey Meter.

The measurements were taken at the following five distinct locations. Four of these locations are labelled as “Paint Mark” on the drawing in Fig.2. At these locations the proposed residential buildings are at their shortest horizontal distance to the power line easement. For ease of identification during the EMF measurements all four locations were marked by surveyors in blue colour on the grass and numbered from 1 to 4 starting from the leftmost point, which is closest to the steel tower shown in Photo #2.

The horizontal line in Fig.2 which marks the southern boundary of the power line easement is located 18.29m away from the centre line of the power line.

Four of the five survey points are also marked on a section of the plane view of the proposed development shown in Fig.3 below.

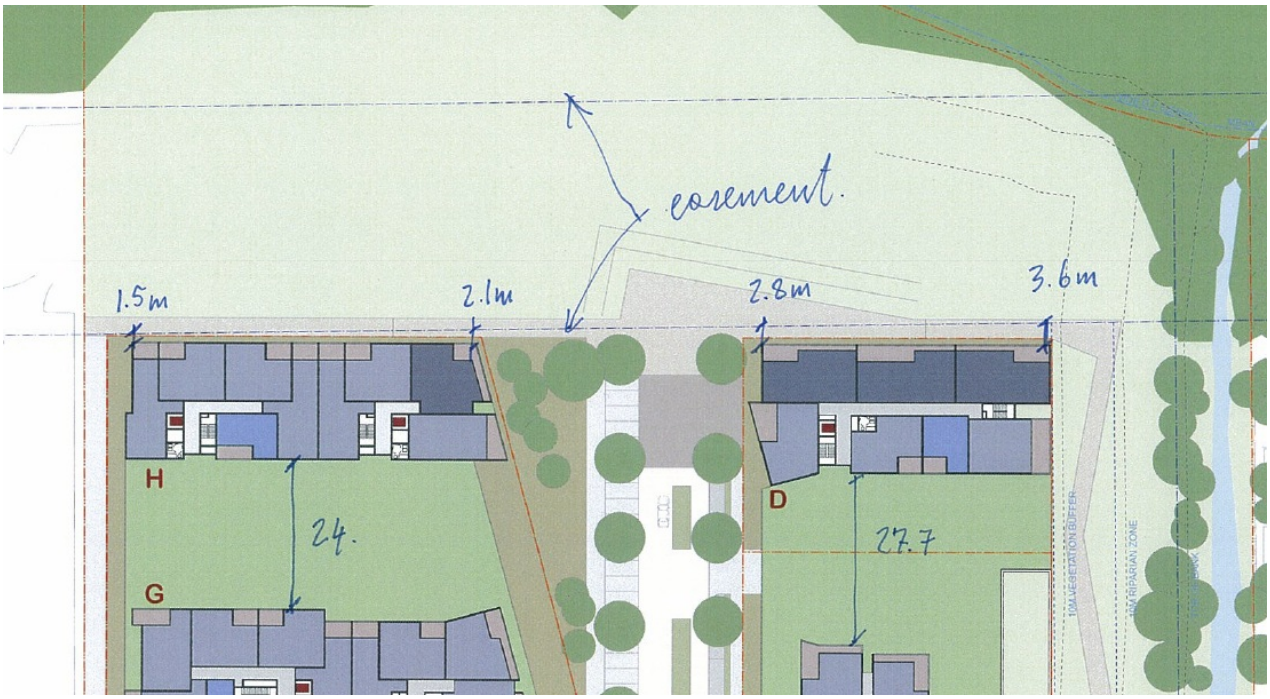


Fig.3 Plan view of the proposed residential development and its proximity to the power line easement.

The fifth point, which is located on the Easement Centre Line, is marked on the drawing in Fig.2 by an arrow with numerical height of the power line conductors written behind it.

In all five locations the EMF measurements were made at two different heights, at 0m and at 1m above the natural ground.

The resultant magnetic flux density in milliGauss and its three orthogonal components, two in the horizontal directions – x & y, and one in the vertical direction – z, at each of the five locations were recorded.

It should be noted that during the measurements the HMI-1 meter was held such that its horizontal “x” axis was parallel to the power line easement (parallel to the power line conductors), “y” – axis was at the right angle to the easement (at the right angle to the conductors) and “z” axis was in the vertical orientation.

The results of EMF measurements are summarised in the table below

Location No:		B_{res}	B_x	B_y	B_z
1	at 0m ➔	18.3	0	2.2	17.6
	at 1m ➔	19.1	0	2.9	18.8
2	at 0m ➔	17.5	0	2.6	17.4
	at 1m ➔	18.4	0	3.9	18.0
3	at 0m ➔	15.2	0	2.2	15.0
	at 1m ➔	15.8	0	3.8	15.6
4	at 0m ➔	12.2	0	1.8	12.0
	at 1m ➔	12.6	0	2.0	12.4
5	at 0m ➔	34.9	0	34.9	0
	at 1m ➔	37.7	0	37.7	0

The most interesting data in the above table is at the location No:5. At this location the EMF has only the horizontal component of the magnetic flux density oriented in the direction across the power line wires. The EMF components in the vertical and in the horizontal direction parallel to the wires are equal to zero.

Such result strongly indicates that both feeders of the power line have the same sequence of phases in respect to each other and that their respective load currents are either equal or very similar in magnitude and they flow in the same direction and have either zero or a very small electrical angle shift between them.

In practical terms this means that Phase A of feeder No:916 is horizontally opposite Phase A of feeder 917, Phase B of feeder 916 is horizontally opposite Phase B of feeder 917 and Phase C of feeder 916 is horizontally opposite Phase C of feeder 917.

Such phase sequence of both feeders in respect to each other is the most unfavourable one in terms of the level of EMF emission from the double circuit power line.

A reversal of phases in one feeder in respect to the other one would result in substantial reduction of the EMF emitted by the power line.

In addition to this benefit the overall inductance of the power line would also be smaller, resulting in smaller reactive losses.

The reversal of phases makes almost no measurable difference to the active power losses in the power line as the a.c. resistance of the wires would barely change from re-phasing of the feeder. In addition, the active power loss, due to the induced current in the overhead earth wires, would be similar for both cases (the same sequence or the reversed sequence of phases),

The above provided information on possible EMF reduction due to the reversal of phases is supported by computer modelling and calculations. The results of such calculations are given in graphical form in Fig.4 below.

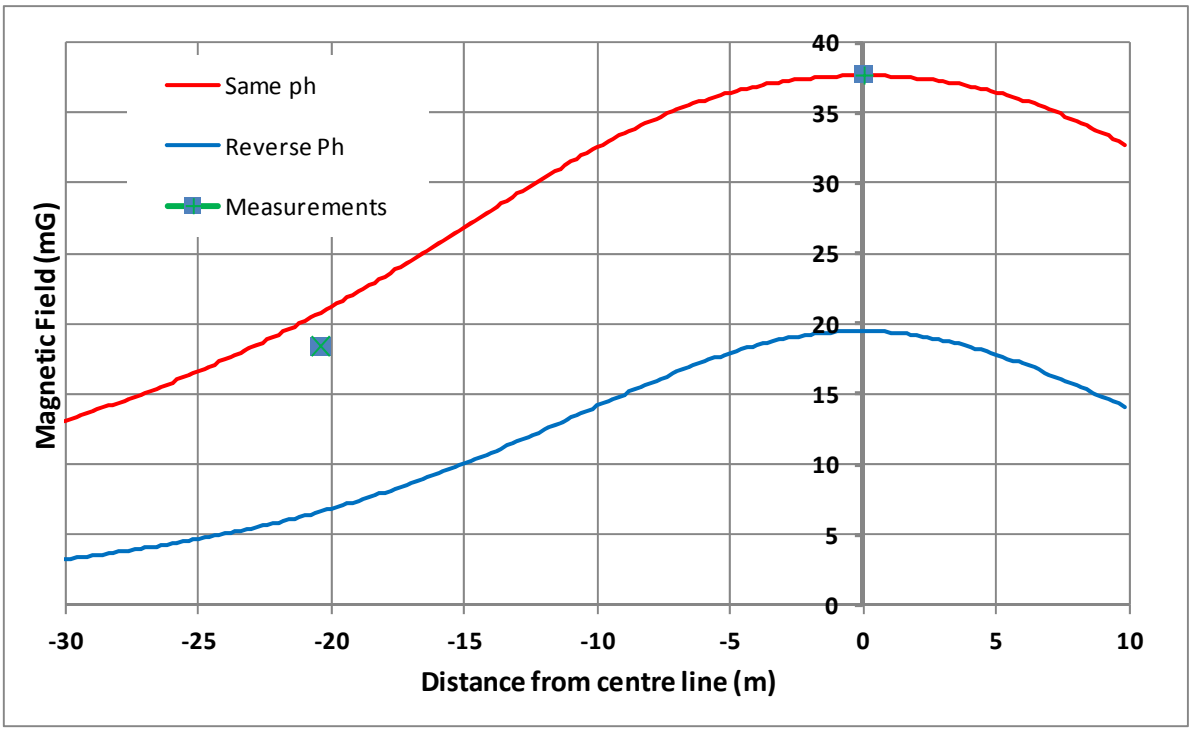


Fig.4 EMF profiles calculated at 1m height above ground across the power line easement at the point of the smallest conductor height above the ground.

Two data points, which were taken from the table of EMF measurements, are marked by green colour squares on the drawing in two locations - Locations 2 and 5 in the table. The Location No:2 is close to the point in mid-span of the power line at which the phase conductors are at the smallest height above the ground.

As can be seen from the graphs in Fig.4, a reversal of phases in one feeder in respect to the other one can substantially reduce the EMF emitted by the power line. Such EMF reduction is especially significant in the area outside the power line easement designated for the proposed residential development.

A cross-sectional drawing of the power line with two different phase sequences is shown in Fig.5 below. The power line wires (the phase conductors) are represented by colour dots on the drawing.

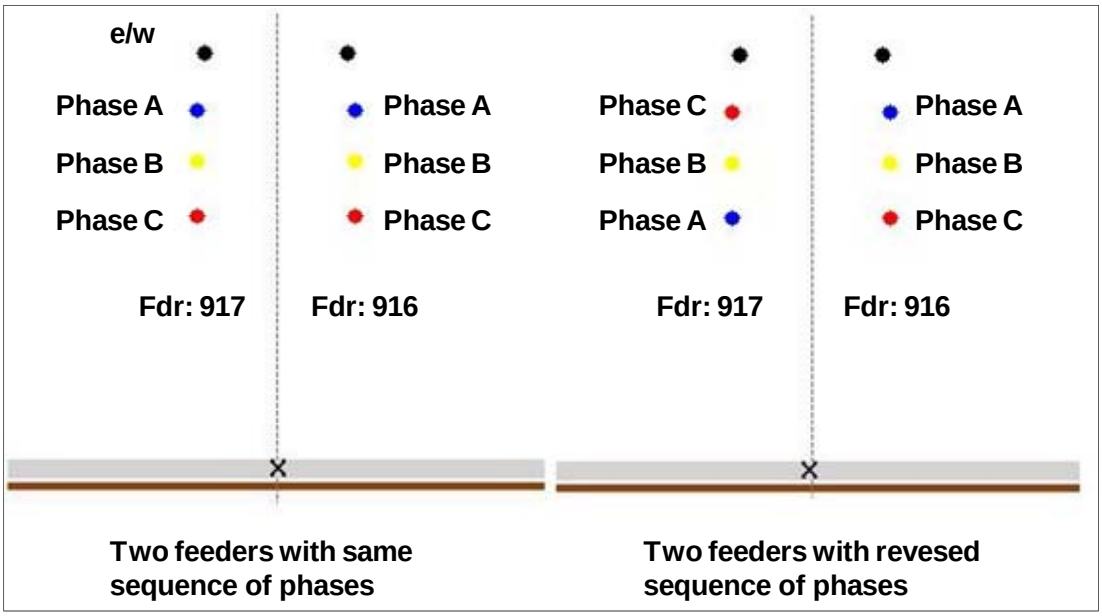


Fig.5 Power line with two feeders and two different phase sequences

In practical terms the reversal of phases of the power line can be accomplished by re-termination of only two phases of one feeder at both ends of the power line. Since feeder No: 916 is also connected to the 132kV Cronulla Zone substation, it is more easier to re-terminate the feeder No:917.

The above proposed reversal of phases of feeder No:917 would not only significantly reduce the EMF in the area designated for the proposed residential development, but it would also reduce the EMF everywhere else along the power line route between the 330/132kV Sydney South BSP and the 132kV Kurnell STS.

It should be noted that the EMF measurements were made at a particular date and at a particular time of the day. However, as the load current in both feeders can fluctuate hourly, daily, weekly, monthly, seasonally and annually, the measured EMF may not be the highest one as the magnetic field emitted by the power line is directly proportional to the load current.

We do not have the loading data for the two feeders at the time of our EMF measurements. However, from the measurements of resultant EMD and its three orthogonal vectors and using the geometry of the power line at the location of the EMF measurements, it is possible to recalculate the electric currents in the feeders.

This load current we've used for calculation of the EMFs on the different floors of the proposed multi-storey residential building located close to the power line easement.

The elevation view of the building with RL values for each floor is given in Fig.6 below.

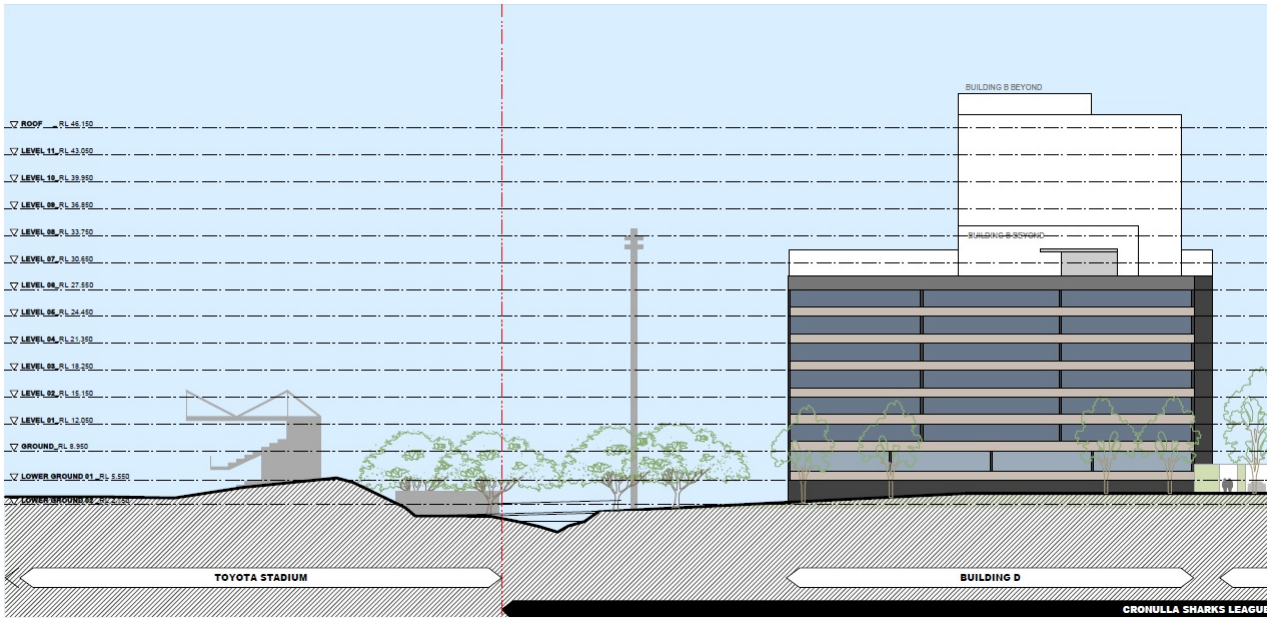


Fig.6 Elevation view of residential building near the power line easement

EMF was calculated at 1m above every floor of the building shown in Fig.6. The EMFd were calculated at the front wall of the building facing the easement and at 5m away from the front wall into the building. The calculations were made for the following two cases:

- Case #1: two feeders have the same phase sequence
- Case #2: the phase sequence of feeder No: 917 was reversed in respect to feeder No:916

The result of calculations are given in units of milliGauss (mG) and summarised in the table below:

Floor level	Same sequence of phases of Fdr:916 and Fdr:917		Reversed sequence of phases of Fdr:917 in respect to Fdr. 916	
	At front wall	5m away from front wall	At front wall	5m away from front wall
Lower Gr. Fl. (-0.2m ab/gr)	19.7 mG	15.7 mG	6.1 mG	4.3 mG
Gr. Fl. (3.2m ab/gr)	22.9 mG	17.5 mG	7.8 mG	5.1 mG
Level 1 (6.3m ab/gr)	26.3 mG	19.1 mG	9.6 mG	5.9 mG
Level 2 (9.4m ab/gr)	29.9 mG	20.7 mG	11.6 mG	6.7 mG
Level 3 (12.5m ab/gr)	33.3 mG	21.9 mG	13.6 mG	7.4 mG
Level 4 (15.6m ab/gr)	35.6 mG	22.6 mG	15.2 mG	7.9 mG
Level 5 (18.7m ab/gr)	36.1 mG	22.5 mG	15.8 mG	8.0 mG
Level 6 (21.8m ab/gr)	34.3 mG	21.5 mG	15.2 mG	7.7 mG
Level 7 (24.9m ab/gr)	30.6 mG	20.0 mG	13.5 mG	7.1 mG
Level 8 (28.0m ab/gr)	26.0 mG	17.7 mG	11.3 mG	6.3 mG
Level 9 (31.1m ab/gr)	21.5 mG	15.5 mG	9.0 mG	5.3 mG
Level 10 (34.2m ab/gr)	16.8 mG	12.8 mG	7.0 mG	4.4 mG
Level 11 (37.3m ab/gr)	14.2 mG	11.2 mG	5.4 mG	3.6 mG

Notes: 1. ab/gr – above ground. This is the height above the natural ground plus 1m height above each floor,
2. shielding effectiveness of steel reinforced walls and floor slabs in the building were not included in calculations.

4. Future Load Growth for Power Line and EMF

As the EMF emitted from the power line is directly proportional to the load current flowing in its wires we should assess future increase in EMF near the power line easement due to the increase in electricity consumption in future years in the area supplied by the power line.

Ausgrid in its report on “DEVELOPMENT OF KURNELL 132/11kV ZONE SUBSTATION DUAL FUNCTION ASSET” dated the 24th December 2010, concluded that new Kurnell 132/11kV zone substation should be developed and the existing 33/11kV Kurnell Zone substation should be decommissioned. In accordance with the report the work is scheduled to be completed by mid 2012.

With this development and the load growth in the area the maximum demand in winter 2016 for Kurnell 132/33kV STS substation would increase from 59.8 MVA in 2010 to 65.4 MVA in 2016 and for Kurnell 132/11kV Zone Substation would increase from 25.4 MVA in 2010 to 25.8 MVA in 2016. The Caltex refinery winter maximum demand is remaining steady in the coming years at 5.82 MVA.

As the feeder 916 is teeing off from the main 916 feeder at Woolooware Road, Woolooware to supply power to the 132/11kV Cronulla Zone substation, it is important to take into account the load growth at the Cronulla Zone substation. Based on Ausgrid load forecasting the winter demand at Cronulla Zone substation would increase from 67.3 MVA in winter 2008 to 85.2 MVA in winter 2015. Feeder 916 is the main supply feeder to the substation, while the 132kV feeder 281 from Kirrawee provides back up supply.

Based on the above analysis the average growth in winter power demand in the area supplied by feeders 916 and 917 over the coming years would be in the order of 1.6%.per year.

This means that the average growth in EMF emission from the 132kV power line would be 1.6% per year.

One possible 132kV network modification that could drastically increase the EMF emission from the power line in future years is a replacement of the existing two old cable feeders, 908 and 909, installed between the 132kV Canterbury STS and 132kV Bunnerong STS, with two new cable feeders 908 and 909 that could be installed between the 132kV Kurnell STS and 132kV Bunnerong STS.

If ths proposal will be implemented the power flow through the feeders 916 and 917 would increase by 300 MVA or by twice. This would increase the EMF emission from the power line also by nearly twice.

5. Proximity of Power Line to Existing Residential Properties

Our analysis of the entire route of the 132kV power line between the 330/132kV Sydney South BSP and 132kV Kurnell STS revealed that in many locations along its route the power line is located at considerably smaller distances from the residential houses than would be the case for the proposed development at Cronulla Sharks.

Along the entire route the power line is constructed on the same type of the steel towers as is shown in Photo #1. There is no diversion of the load current away from the power line to any other substation along its route between the Sydney South BSP and the tee off point at Woolooware Rd, Woolooware. This implies that the EMF level emitted from the power lines at the location of many residential properties located much closer to the power line than the proposed residential development at Cronulla Sharks is much higher.

The photos of some such residential properties located in close proximity to the power line are given below together with indicative distances between the centre of the power line and the houses.

Photo #4 132kV power line with 916 and 917 feeders near houses in Billingara Rd, Sylvania Waters.

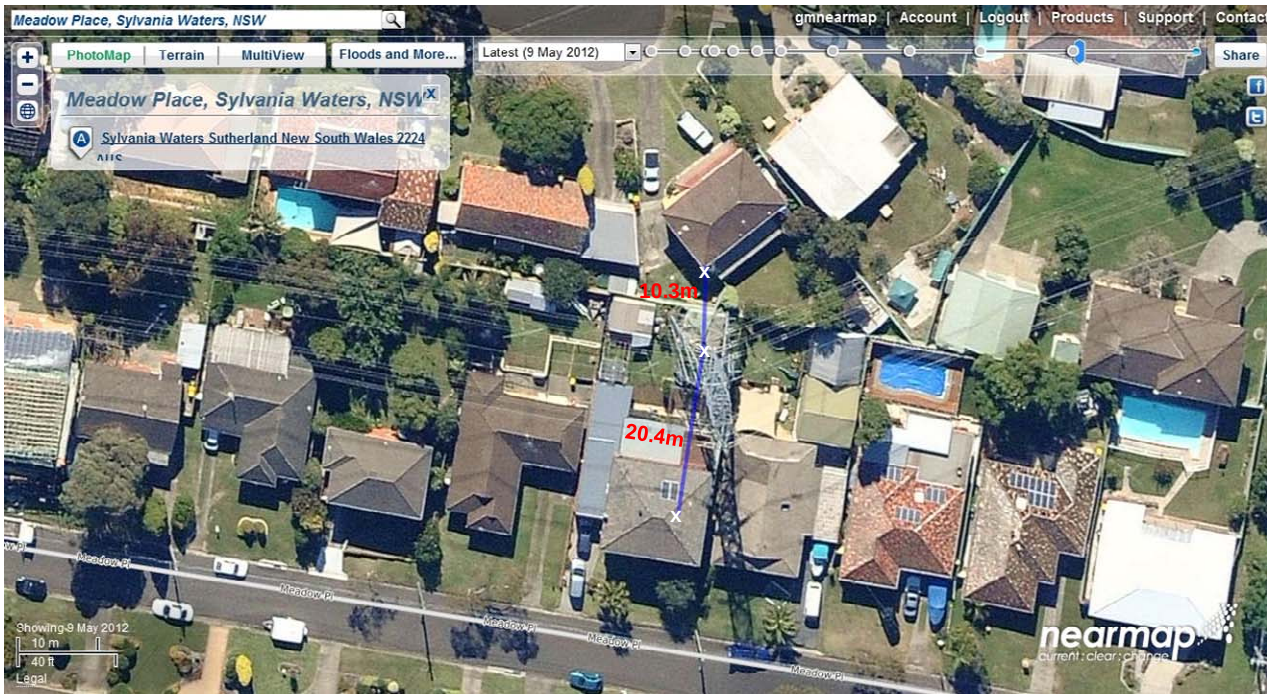


Photo #5 132kV power line with 916 and 917 feeders near houses in Meadow Pl., Sylvania Waters.

In addition to the above locations we've conducted EMF measurements near three storey residential apartment buildings with units 17-52 at 3 Ramu Close, Sylvania Waters.

The EMF was measured there on Wednesday, the 23rd of May 2012 at around 12:10 pm. The measurements were made in several locations at 1m above the ground. The results are presented below:

- 41.5 mG in the centre of the power line at mid-span
- 30.5 mG at the building wall closest to the power line (13m away from the centre of the power line)
- 11.7 mG at the building wall furthest away from the power line (approximately 31m away from the centre of the power line).

As can be seen from the above results the measured EMF there were higher that those measured near the proposed development area. The reason why the EMF at the centre of the power line was higher here than at the Cronulla Shark ground, is because of the smaller conductor to ground clearance.

6. Response to Ausgrid's Comments on EMF Report

We would like to formulate the response to Ausgrid critique of our EMF report sitting references to documents published either by Ausgrid or by Transgrid. Both companies engaged in construction and operation of the 132kV lines in NSW.

The following extract printed in italics is reproduced from the TransGrid Easement Guide.

Transmission Line Easements in NSW

Easements are acquired for two essential reasons. The first is so that TransGrid can construct, reconstruct, operate and maintain its lines. The second is to ensure protection of the public by controlling activities under or near the line that may create an unsafe situation.

P E R M I T T E D

1. *Agricultural activities, subject to restrictions in machinery height of under 4.3m*
2. *Most domestic recreational activities (excluding the flying of kites and model aircraft)*

3. *Gardening, provided that mature plant height is under 4m*
4. *Vehicle parking, provided vehicle height is under 4.3m*
5. *Storage of non-flammable materials, under 2.5m*
6. *Minor structures under 2.5m such as washing lines or barbecues (provided that metallic parts are earthed)*

M A Y B E P E R M I T T E D

1. *Operation of machinery exceeding 4.3m*
2. *Building of fencing and yards*
3. *Landscaping*
4. *Use of irrigation equipment*
5. *Installation of utilities such as electricity, telephone and water*
6. *Outbuildings such as sheds, stables, garages and carports*
7. *Additions of unroofed verandas and pergolas to residences*
8. *Sporting and recreational facilities (including tennis courts)*
9. *Swimming pools, if the pool is not within 30m of a transmission line structure*
10. *The development of subdivisions (including the constructions of roads)*
11. *Excavation*
12. *Quarrying activities,*

N O T P E R M I T T E D

1. *The construction of houses, buildings or other substantial structures*
2. *The installation of fixed plant or equipment*
3. *The storage of flammable materials or explosives*
4. *The storage of garbage materials or fallen timber*
5. *Planting vegetation with a mature height which exceeds 4m*
6. *Any obstructions placed within 15m of a transmission line structure or supporting ropes, wires or chains*
7. *Flying of kites or model aircraft*

We would also like to refer to the current Ausgrid Network Standard No: NS143 Easements. This standard was revised in September 2005 and it provides no reference to the draft of ARPANSA Standard, although such draft has already been available in various forms since 2002.

Extract from the Appendix A on page 6 of the NS143 standard is given below in italics:

6. EMF levels.

The limits recommended by the International Radiation Protection Association for EMF exposure for the general public are as follows:

	Electric Field Strength	*Magnetic Field Strength*
Up to 24 hours/day	*5kV/m*	*100uT*
Few hours/day	*10kV/m*	*1000uT*

The Gibbs Report recommended a policy of prudent avoidance for new lines only and then only where the additional cost involved was not too great.

Electric Field Strength

The ESAA leaflet "Electric and Magnetic Fields" states that it is now generally accepted by scientists and doctors that electric fields, at the levels that we experience in our everyday lives, are not detrimental to health. Overhead lines are designed to meet the international guidelines and, therefore, electric fields are not further considered.

Magnetic Field Strength Near a Twin Circuit 132kV Tower Line

The magnetic field strength near a twin circuit tower line has been calculated using the following assumptions:

a) *Minimum conductor ground clearance of 6.7m and 10m*
b) *4m vertical separation between phases*
c) *3m vertical separation between top phase and earth conductor*
d) *Both circuits carrying symmetrical 3 phase current of 2600A (600MVA each circuit).*

Conclusions from the above calculations

a) *The magnetic field strength at a height of 1.8m above ground level is less than the recommended maximum levels <u>for continuous exposure</u> even for the minimum ground clearance of 6.7m. Conductor height is normally significantly higher than this.*

b) *For a 20m wide easement, the magnetic field strength at all points vertically above the easement boundary is below the recommended maximum level <u>for continuous exposure</u> under no wind conditions*

c) *At a horizontal distance of 3m from the conductors (ie under blow-out conditions), the magnetic field strength exceeds the 24 hour/day exposure limit above 4m in vertical height but is well below the 'few hours/day' limit. This is considered acceptable as it is a temporary phenomenon experienced during 'blowout' conditions.*

d) *As highlighted in this report the additional EMF measurements taken onsite confirm the proposed master plan development as identified under the PPR for MP10_0229 comply with the acceptable levels of EMF exposure as per the IRPA, NHMRC & ICNIRP Guidelines (for details, please, refer to our previous report dated the 25th of August 2011) and also as per the Ausgrid Network Standard No: NS143 – "Easements". It is also important to note that by reversing the phase sequence of one feeder of the power line in respect to the other one the EMF levels are further substantially reduced to be well under half of the currently measured levels in all locations within the proposed development area. This further highlights that as a precautionary principle such re-phasing option should be seriously considered.*

In summary, easement widths determined using the statutory clearance as the limiting factor are acceptable from an EMF point of view using the IRPA guidelines.

<u>Note:</u> A current of 2600A in both circuits has been used for the above calculations.
Although Ausgrid has circuits rated at this level, it would be very unusual and only in an emergency that actual currents could reach this figure and then probably not in both circuits. The actual magnetic field strength, therefore, will be less than that calculated above. The most onerous condition of phasing - ABC top to bottom on both circuits - has been assumed.

We would like to point out that the above reproduced part of the Ausgrid Network Standard is in direct conflict with the statement in Ausgrid letter on precautionary principle. It appears that in accordance with the NS143 standard both, the electric and magnetic fields <u>within the 132kV power line easement</u> are below the recommended maximum level for continuous exposure.

In regards to provision of precautionary principle to minimise the EMF exposure for prospective residents of the proposed residential development, we strongly recommend to implement the EMF mitigation measure comprising of reversal of two outer phases of feeder 917, as specified in the earlier part of this report.

We would like to reiterate here once again that our previous statement made regarding the ARPANSA draft standard remains correct, as the intended document will never be published as an <u>Australian Standard</u>, but rather it would be published as <u>Guidelines</u>.

In addition to the above, any reference to a draft standard or guidelines is inappropriate until such document is finally approved for publication and is published. At this stage it is unclear whether the ARPANSA draft would be finally published as the Guidelines without any further changes.

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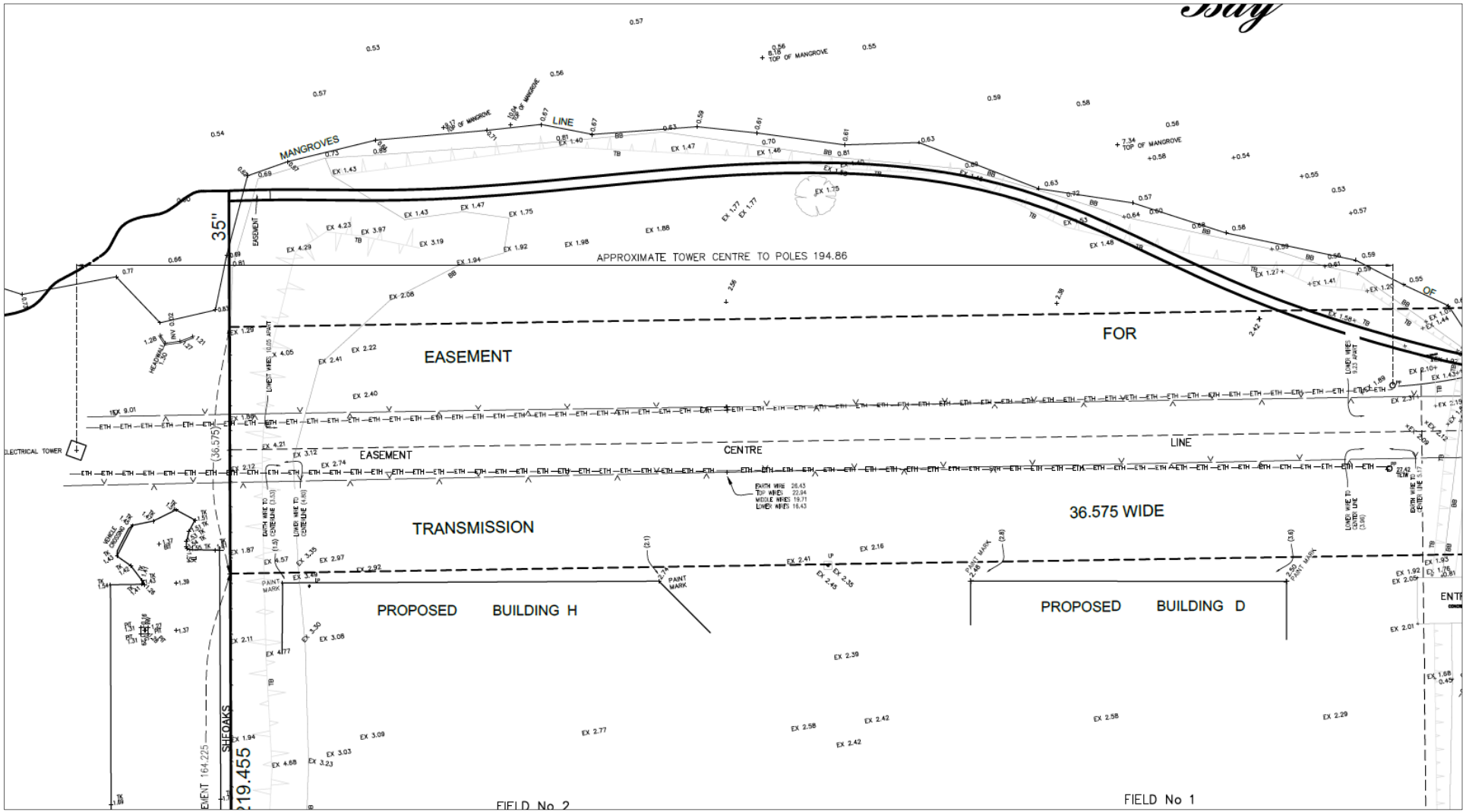

Fig.2 Survey map of power line easement in respect to proposed residential buildings

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