



EPURON

APPENDIX P
Telecommunications

BOWMANS CREEK
WIND FARM

environmental impact statement

Lawrence Derrick & Associates

**BOWMANS CREEK WIND FARM - INVESTIGATION OF
POSSIBLE IMPACTS ON RADIOCOMMUNICATION
SERVICES**

Final

30th August 2020

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DISCLAIMER

This Report has been prepared on the basis of ACMA radiocommunications licensing data and Telstra provided customer radio site locations. The Report does not imply that any conclusions are not subject to change.

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INTRODUCTION

Epuron Projects Pty Ltd (Epuron) is seeking approval for the development of the Bowmans Creek Wind Farm (the Project) located near Muswellbrook, NSW. Epuron has engaged Hansen Bailey to prepare an Environmental Impact Statement (EIS) to accompany the Development Application for the Project. Hansen Bailey has subcontracted Lawrence Derrick and Associates to conduct a communications assessment in relation to the Project for inclusion in the EIS.

The wind farm will generally include:

- 60 wind turbines;
- Control and maintenance buildings;
- On-site substation and transmission line; and
- Underground and over-head reticulation lines.

Epuron lodged an application for Secretary's Environmental Assessment Requirements (SEARs) with the Department of Planning, Industry and Environment (DPIE). Under Hazard / Risks – the EIS must include an assessment of the following:

"Telecommunications – identify possible effects on telecommunications systems, assess impacts and mitigation measures including undertaking a detailed assessment to examine the potential impacts as well as analysis and agreement on the implementation of suitable options to avoid potential disruptions to radio communication services; which may include the installation and maintenance of alternative sites;"

This report summarises the findings of the assessment of the impact of the proposed wind farm on existing Telecommunications systems in the area.

METHODS

WIND TURBINE LAYOUT

Attachment 1 lists the current turbine layout coordinates which were used for the map assessment of any impact on radiocommunications links and sites within at least 50 km from the wind farm (Study Area).

ACMA DATA

All licenced radio facilities were identified from the ACMA's RRL database. Radio links have been identified in 2 classes – above 1000 MHz in operating frequency (microwave) and below 1000 MHz (VHF/UHF).

RADIO COMMUNICATION LINK CLEARANCES TO TURBINE BLADE TIPS

All microwave links paths were checked for 2nd Fresnel zone Clearance to the tip of the turbine blades for all turbine locations in the current layout. For VHF/ UHF links a criteria of 0.6 X 1st Fresnel zone clearance was used. This was because of the main reference used by the industry, a Paper written by David Bacon^{1,*} recommended the 2nd Fresnel clearance for Microwave links. Correspondence with the author indicated that a less restrictive clearance was suitable for VHF/UHF links and 0.6 X 1st Fresnel zone clearance was adopted. This is often used as the clearance required for radio link path design for static obstacles (ground, trees, buildings etc). It was assumed that the maximum wind turbine rotor diameter is 160 m. Attachments 2 and 3 show the links crossing or near the wind farm for microwave and the UHF frequency bands.

ADDITIONAL CHECKS FOR OTHER RADIO LINK SITES

To determine if any link sites further away could have paths crossing the wind farm a site search out to 100 km radius was carried out using the ACMA database. No other licenced links were identified crossing within the wind farm boundaries.

¹ Fixed-Link wind-turbine exclusion zone method, Version 1.1, 28 October 2002, D.F. Bacon, OFCOM UK

RESULTS

RADIO COMMUNICATION PATH CLEARANCES TO TURBINE BLADE TIPS

There are no microwave links that intersect with turbine locations. However there is one VHF/UHF link of significance within the project boundary, a 400 MHz NSW Rural Fire Service link which intersects with the swept path of the proposed location of turbine T70. In order to avoid impacts to this link a clearance distance of 160m either side of the ray line will be required to be maintained as calculated in Attachment 5.

The detailed view of the intersecting link in relation to turbine positions are shown in Attachment 3. The path profile shown in Attachment 4 Indicates that clearance over the tip of the blade is insufficient to clear the Fresnel distance required and therefore the turbine T70 is likely to impact on this radio communication link.

To mitigate this impact turbine T70 will need to be:

- Removed, or
- Micro-sited >160m from the ray line, or
- The radio communications link may be rerouted via the installation of a repeater station.

Consultation should be undertaken with the owner of the link to discuss possible mitigation option.

Any micro siting of other close turbines to this link, for example turbine T69 will need to maintain the specified clearance of 160 m.

No other links from other sites in the area were identified as crossing the wind farm site near wind turbines.

FM RADIO BROADCASTING SITES IN THE STUDY AREA

| ACMA SITE ID | LOCATION | FREQUENCY (MHz) | COMMENTS |
|--------------|------------------|---------------------|------------|
| 10012955 | Bulga Mine | 89.3, 90.1, 90.9 | Low power |
| 10014607 | Liddell Mine | 89.3, 90.1, 90.9 | Low power |
| 10001580 | Ravensworth Mine | 91.7, 93.3, 94.9 | Low Power |
| 250177 | Muswellbrook | 98.1 | High Power |
| 139001 | Glendell Mine | 99.1, 100.9 | Low Power |
| 6361 | Aberdeen | 103.3, 104.9, 105.7 | High Power |

The above listed FM broadcast transmitter sites are sufficiently distant from the wind farm to not have an impact on the coverage of these stations. The four mine site stations are low power and only provide coverage to the mine site areas individually.

The impact of the turbines on residents living near the turbines is unlikely as FM signals have been shown to be somewhat immune² to turbine impacts on reception.

TV BROADCASTING SITES IN THE STUDY AREA

| ACMA SITE ID | LOCATION | FREQUENCY (MHz) | COMMENTS |
|--------------|--------------------------------|-----------------------------------|-------------------------|
| 151218 | Rossgole | 550.5 | In Band Link (IBL) only |
| 6361 | Aberdeen (Upper Hunter TV STN) | 655.5, 662.5, 676.5, 683.5, 669.5 | Medium Power |

The station at site 151218 is a commercial TV relay station to the Upper Hunter TV station only. No impact is expected. The Upper Hunter medium power station is located at site and is about 27 km from the nearest turbines which is too far to impact on general coverage, however in some locations close to the wind farm it is used by residents for TV reception. This is discussed in the next section.

MAIN TV BROADCASTING SERVICES IN THE AREA

An investigation was carried out on the possible main TV transmitting sites for coverage of the residents in the area surrounding the wind farm. The Government My Switch³ prediction online tool was used to predict coverage areas and to identify the transmitting stations available.

This tool was used to predict coverage at some known town locations as follows:

| TOWN | TV STATION(S) PREDICTED | QUALITY OF RECEPTION |
|---------------|-------------------------|----------------------|
| Bowmans Creek | Newcastle | Patchy |
| Hebden | Newcastle/ Upper Hunter | Patchy |
| Muscle Creek | Upper Hunter | Good |
| McCullys Gap | No Cover | |
| Goorangoola | No Cover/Upper Hunter | Patchy |
| Rouchel Brook | No Cover | |

The observation from the prediction maps online is that terrestrial TV reception is available at the elevated sites with a clear outlook to one of the 2 stations available (Newcastle and Upper Hunter). In the valleys or where terrain blockage toward the stations exist no reception is possible. The VAST⁴ satellite service would be available to dwellings with no terrestrial cover and some residents would already be using it.

Should TV reception of the 2 main stations be impacted by turbines located in the direction of the main TV stations, the VAST Satellite service could be used as mitigation. Satellite TV is not generally

² Electromagnetic Interference from Wind Turbines, Sengupta & Senior, Chapter 9, Wind Turbine Technology Ed. David E. Spera ASME Press 1994

³ <https://myswitch.digitalready.gov.au/>

⁴ Viewer Access Satellite Television service, or VAST, is a satellite television platform in Australia, providing digital television and radio services to remote and black spot areas

affected by wind turbines as the resident antennas will normally be receiving the satellite at a high elevation angle above the wind turbine blades. The antenna reception beam width is also very narrow at the frequencies used.

It may be prudent to carry out a pre-construction TV survey at a sample of dwellings in the wind farm area out to 5 km from the nearest turbine as a benchmark of TV reception. This would provide TV reception data to compare with any claimed interference after completion of the wind farm.

AVIATION

| ACMA SITE ID | LOCATION | FREQUENCY (MHz) | COMMENTS |
|--------------|----------------|-----------------|--------------|
| 10013103 | Scone Airport | 134.55 | Aeronautical |
| 6232 | SES Singleton | 119.1 | Aeronautical |
| 6285 | Army Singleton | 132.9 | Aeronautical |

No interference to the ground air directional communications system is expected due to the separation distance between the wind farm site and the aviation ACMA sites. No Radar licences were found in the 50 km study radius. It is understood that that a that a study has been carried out by other consultants on aviation aspects of the project including radar at distances beyond the study area for this report.

CELLULAR AND PRIVATE, BUSINESS AND GOVERNMENT MOBILE

The main carriers and other private, business and government mobile base stations are distributed through the Study Area. A check has been made of the separation between these sites and the nearest turbine. All are sufficiently distant to have no impact on the coverage of these services. The nearest sites include:

| ACMA SITE ID | Dist. To Nearest WT (km) | LOCATION | FREQUENCY (MHz) | COMMENTS |
|--------------|--------------------------|--------------|-----------------|----------------------------|
| 10018413 | 7.53 | McCullys Gap | 700 Band | Telstra Cellular |
| 10009214 | 9.71 | Muswellbrook | 700 /900 Band | Optus Cellular |
| 10007082 | 7.53 | McCullys Gap | 148.5625 | NSW RFS Paging |
| 10018083 | 12.04 | Ravensworth | 450 | Liddel Coal |
| 6338 | 8.48 | Muswellbrook | 700 / 900Bands | Telstra /Vodafone cellular |
| 203870 | 6.74 | Grasstree | 450 | Aust Rail Track mobile |
| 40233 | 6.95 | Antiene | 450 | Aust Rail Track mobile |

PRECISION GPS SYSTEMS

No licensed systems were identified in the Study Area.

NBN SERVICES

| ACMA SITE ID and Dist (km) | LOCATION | FREQUENCY (MHz) | COMMENTS |
|-----------------------------------|-----------------|------------------------|-----------------|
| 9018843 / 30 | Parkville | 2.3 GHz Band | PMP |
| 9023221 / 15 | Muswellbrook | 2.3 GHz Band | PMP |
| 9018844 / 29 | Scone | 2.3 GHz Band | PMP |
| 9023317 / 30 | Roughit | 2.3 /3.2GHz Band | PMP |

These NBN Sites have microwave Point to Multipoint Systems operating on them to connect residents in the surrounding area to the broad network via these microwave systems. The ACMA database does not identify the customer ends of these links so the line of site from these base stations to customers houses cannot be checked for turbine clearance. As 3 of the base stations are about 30 km from the nearest turbine there is low risk of interference to the customer links. The Muswellbrook base station is 15 km from the nearest turbine with a greater chance of a few customers being connected via that base station.

.It is recommended that NBN be advised of the project details to allow confirmation of no customer impacts.

METEOROLOGY BUREAU

No Met Bureau weather radar sites were identified within the Study Area. A number of registrations on 151.5 MHz are for Weather Balloon signal receiving and are not considered to be impacted by the turbines.

CONCLUSION

The current turbine layouts have been checked for adequate clearance from all link paths crossing or near the wind farm site.

A single 400 MHz NSW Rural Fire Service radio communications link has one turbine (T70) too close to the ray line and will require a clearance calculated in Attachment 5 to be maintained. The path profile shown in Attachment 4 indicates that clearance over the tip of the blade is insufficient to clear the Fresnel clearance required. Therefore to mitigate this impact turbine T70 will need to be:

- Removed, or
- Micro-sited >160m from the ray line, or
- The radio communications link may be rerouted via the installation of a repeater station.

No other links from other sites in the area were identified as crossing the wind farm site near wind turbines.

Any further micro siting of the wind turbines during the development of the project will need to maintain adequate clearances to the link ray lines.

It is possible that some residents within 5 km of turbines who receive TV from the main Newcastle or Upper Hunter stations may have interference from turbines. This is where the direction of reception to the stations are through turbines and is caused by scattering or blocking of the TV signals due to the moving turbine blades. The VAST satellite service could be used for mitigation of the reception interference. Some residents may already be using the VAST service which is unlikely to be affected by the wind farm. It is recommended that a pre-construction TV reception survey be carried out at a sample of dwellings within 5 km of turbines as a bench mark for any eventual TV reception complaints after the project completion.

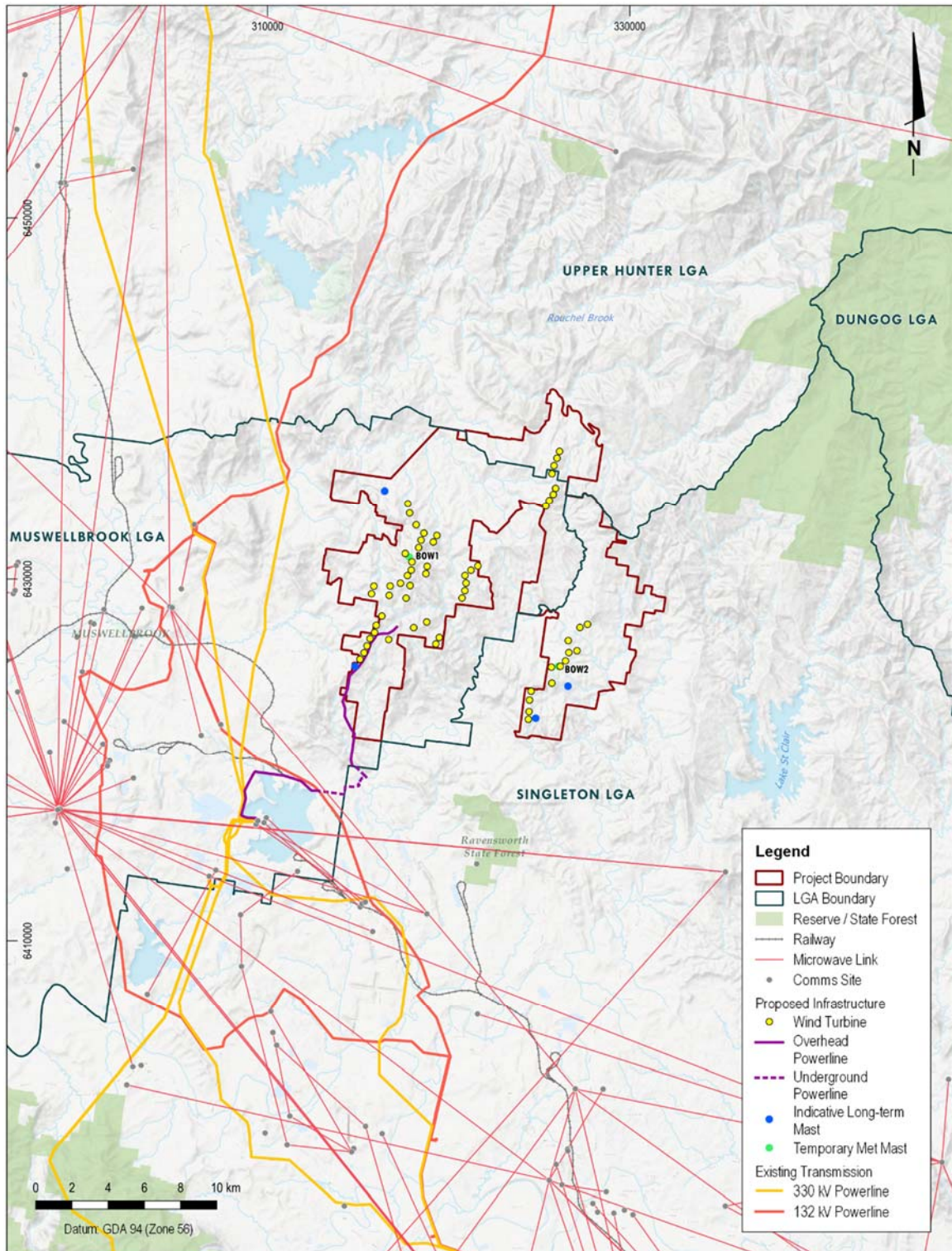
ATTACHMENT 1 WIND TURBINE COORDINATES AND ELEVATIONS

Bowmans Creek Turbine Elevations for 60WTG EIS Layout

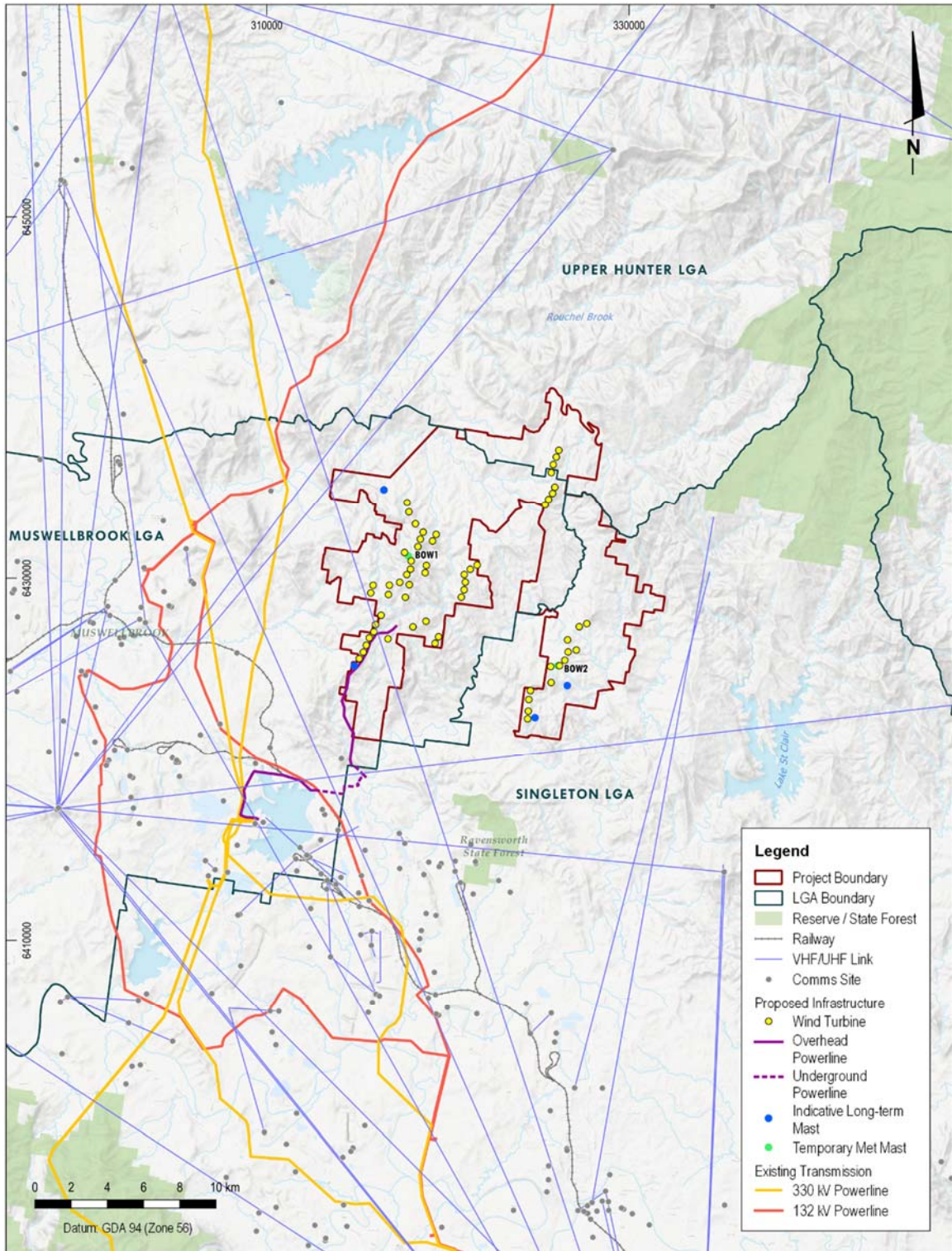
| Vertical datum: AHD | | | | | |
|---------------------|---------|----------|----------------------|-------------------|--|
| ID | Easting | Northing | Ground elevation (m) | Tip elevation (m) | |
| 6 | 326641 | 6425938 | 400 | 620 | |
| 7 | 327090 | 6426042 | 416 | 636 | |
| 8 | 326607 | 6426600 | 448 | 668 | |
| 9 | 327253 | 6427327 | 377 | 597 | |
| 10 | 327671 | 6427498 | 408 | 628 | |
| 12 | 326127 | 6437085 | 526 | 746 | |
| 13 | 325782 | 6434694 | 635 | 855 | |
| 14 | 325907 | 6435040 | 622 | 842 | |
| 15 | 325709 | 6435849 | 571 | 791 | |
| 16 | 325821 | 6436296 | 591 | 811 | |
| 17 | 325986 | 6436709 | 566 | 786 | |
| 18 | 326167 | 6425180 | 435 | 655 | |
| 19 | 325701 | 6424256 | 436 | 656 | |
| 20 | 326457 | 6425481 | 405 | 625 | |
| 21 | 325559 | 6434354 | 618 | 838 | |
| 22 | 324402 | 6422259 | 435 | 655 | |
| 23 | 324441 | 6422683 | 459 | 679 | |
| 24 | 324468 | 6423318 | 413 | 633 | |
| 25 | 324556 | 6423809 | 467 | 687 | |
| 26 | 320963 | 6429776 | 560 | 780 | |
| 27 | 320742 | 6428949 | 557 | 777 | |
| 28 | 320897 | 6429356 | 523 | 743 | |
| 29 | 320906 | 6430194 | 553 | 773 | |
| 30 | 321236 | 6430487 | 515 | 735 | |
| 31 | 321617 | 6430718 | 509 | 729 | |
| 32 | 319486 | 6426773 | 457 | 677 | |
| 33 | 319292 | 6426414 | 525 | 745 | |
| 34 | 318636 | 6432530 | 616 | 836 | |
| 35 | 317972 | 6430942 | 684 | 904 | |

| | | | | |
|-----------|----------|---------|-----|-----|
| 36 | 317607 | 6431408 | 674 | 894 |
| 37 | 318345 | 6431731 | 657 | 877 |
| 38 | 319354 | 6432404 | 528 | 748 |
| 39 | 319155 | 6432041 | 621 | 841 |
| 40 | 318479 | 6432142 | 673 | 893 |
| 41 | 317652 | 6428942 | 495 | 715 |
| 42 | 317341 | 6429767 | 589 | 809 |
| 43 | 317872 | 6429637 | 599 | 819 |
| 44 | 318747 | 6430296 | 604 | 824 |
| 45 | 318812 | 6430696 | 579 | 799 |
| 46 | 317729 | 6430189 | 691 | 911 |
| 47 | 317937 | 6430494 | 688 | 908 |
| 48 | 316690 | 6426659 | 593 | 813 |
| 49 | 318072 | 6427316 | 562 | 782 |
| 50 | 318791 | 6427627 | 498 | 718 |
| 51 | 317846 | 6433652 | 606 | 826 |
| 52 | 318208 | 6432995 | 617 | 837 |
| 57 | 317749 | 6434174 | 548 | 768 |
| 58 | 316718 | 6429096 | 526 | 746 |
| 59 | 316312 | 6427955 | 532 | 752 |
| 60 | 315743 | 6429184 | 472 | 692 |
| 61 | 315870 | 6429605 | 526 | 746 |
| 63 | 316770 | 6429613 | 539 | 759 |
| 64 | 315658 | 6426711 | 560 | 780 |
| 66 | 315103.5 | 6425568 | 497 | 717 |
| 67 | 315329 | 6425926 | 521 | 741 |
| 68 | 315493 | 6426309 | 555 | 775 |
| 69 | 315911 | 6427045 | 573 | 793 |
| 70 | 316004 | 6427446 | 553 | 773 |
| 71 | 325370 | 6434047 | 543 | 763 |
| 72 | 325676 | 6425133 | 425 | 645 |

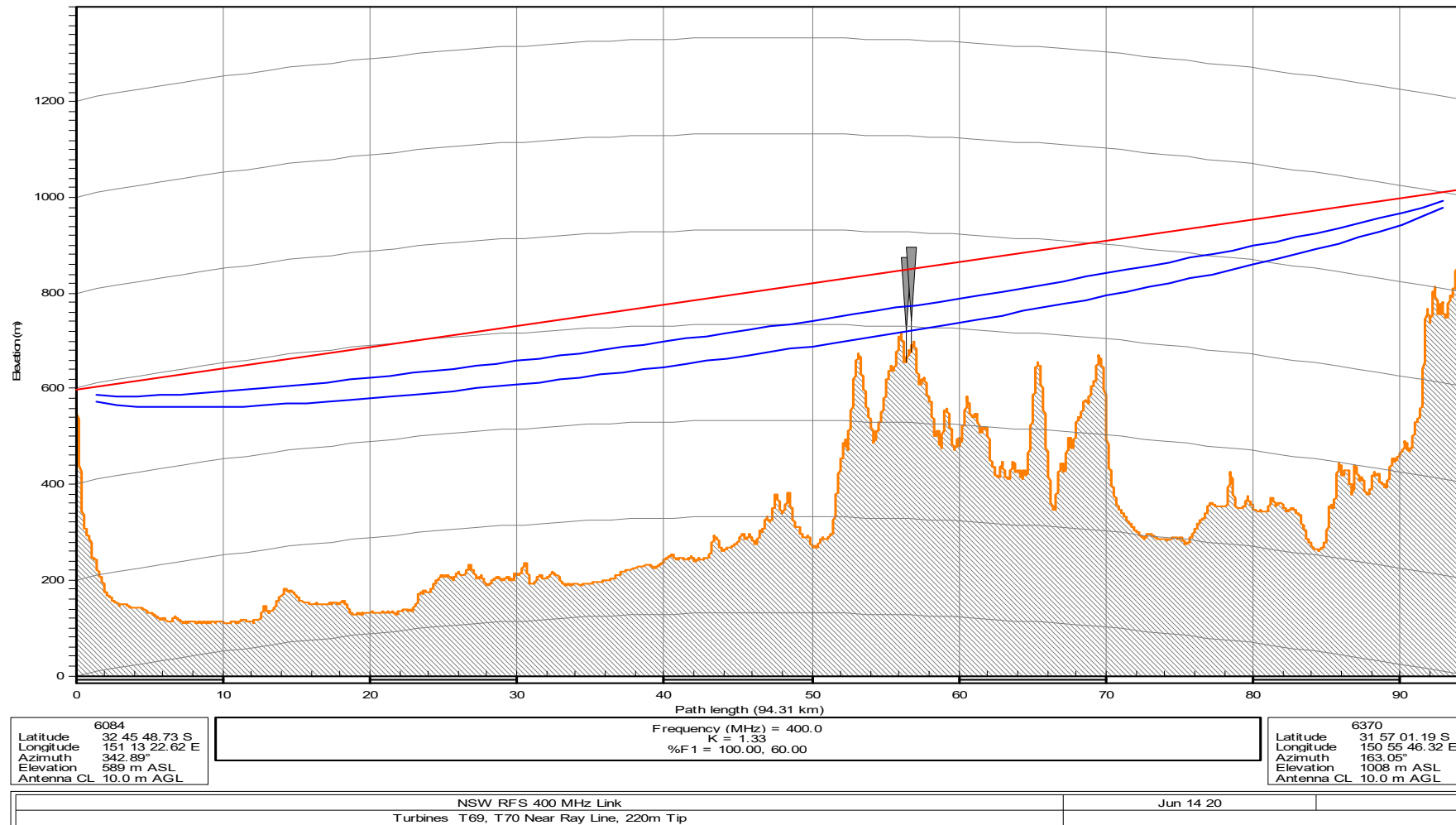
ATTACHMENT 2 LINK MAPPING MICROWAVE LINKS



ATTACHMENT 3 LINK MAPPING VHF/UHF LINKS



ATTACHMENT 4 PATH PROFILE RURAL FIRE SERVICE 400 MHz LINK



ATTACHMENT 5 CALCULATED LINK CLEARANCES UHF/VHF LINKS

| Site 1 (ID, Lat, Long) | Site 2 (ID, Lat, Long) | Operator | Freq (MHz) | Path (m) | Middle distance (m) | 2nd Fresnel Radius (m) | 0.6 x 1st Fresnel Radius (m) | Blade Length (m) | Nearest Turbines | Required clearance between ray line and wind turbine centre (m) | Clearance to closest wind turbine (m) |
|------------------------------------|---------------------------------------|-----------------------|---------------|-------------|---------------------------|---------------------------------|------------------------------------|---------------------|---------------------|--|--|
| 6084, -32.763537, 151.222949 | 6370, -31.950331, 150.929533 | NSW RFS | 400 | 94,310 | 47,155 | 188.06 | 79.79 | 80 | T70, T69 | 159.79 | 50, 170 |
| 6336, -32.363383, 150.858919 | 7461, -32.257486, 152.120464 | NSW Elec. Networks | 44 | 119,380 | 26,400 | 529.52 | 224.66 | 80 | T22 | 304.66 | 2,000 |
| 6337, -32.36381, 150.857529 | 35908, -32.040154, 151.190712 | NSW Police | 450 | 47,700 | 23,850 | 126.10 | 53.50 | 80 | | 133.50 | |
| 6277, -32.507666, 151.158371 | 9011127, -32.251415, 151.242733 | Telstra | 160 | 38,460 | 19,230 | 189.88 | 80.56 | 80 | | 160.56 | |
| 6277, -32.507666, 151.158371 | 6038, -32.224052, 151.245584 | Telstra | 160 | 29,500 | 14,750 | 166.30 | 70.56 | 80 | | 150.56 | |