
Biodiversity assessment

Lot 1 DP 328265 & Lot 97 DP 753841,
No 1599 New England Highway,
Kootingal, NSW

Proposed works: Kootingal Solar Farm



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Document Details & History

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1. Introduction

The purpose of this biodiversity assessment is to determine the potential impacts of a proposed solar farm, known as Kootingal Solar Farm, on significant flora and fauna and to recommend measures to mitigate those impacts.

Kootingal is located in the New England Tableland Bioregion which has an area of over 3 million hectares. The bioregion lies between the North Coast and Nandewar bioregions in north-east NSW, extending north into Queensland. It lies mainly in the temperate to cool temperate climate zone of NSW, which is characterised by warm summers, with uniform rainfall generally occurring in summer and includes parts of the MacIntyre, Clarence, Gwydir, Macleay, Namoi and Manning River catchments. (NSW Department of Planning, Industry and Environment <https://www.environment.nsw.gov.au/bioregions/NewEnglandTablelandBioregion.htm> 2020).

The New England Tableland Bioregion is a stepped plateau of hills and plains with elevations between 600 metres AHD and 1500 metres AHD on sedimentary rocks, intrusive granites and extensive basalts. It is characterised by diverse landforms and vegetation communities that are influenced by topography. It is botanically significant due to its high plant species diversity and high level of endemism. Ninety-two fauna species found in the Bioregion are listed in schedules of the *Biodiversity Conservation Act 2016*. Of these, 18 are listed as endangered, 72 are listed as vulnerable and a number of species are considered extinct.

2. The proposed development

The proposed development comprises a solar farm and ancillary facilities with a DC capacity of 6.4MWp and an AC output of 5.0MW at Lot 1 DP 328265 and Lot 97 DP 753841, 1599 New England Highway, Kootingal, NSW. It is located approximately 1 kilometre west of the town centre of Kootingal and is an irregular shape with a total area of 58.2 hectares. The solar farm will occupy approximately 11 hectares of the total site and is proposed to be placed within the centre of the property.

There are proposed to be 12,100 solar modules installed in 140 rows running north to south. There is approximately 6.25 metres spacing between each row. Each row of PV modules will rotate to track the sun across the sky from east to west each day. The hub height of each tracker is 1.5 metres with the peak of the modules reaching an approximate height of 2.7 metres when the array is fully tilted to 60 degrees from horizontal, i.e. in the early morning and late evening.

Two 3MW inverter stations will be installed at the solar farm mounted on a 12.2 metre long skid. Each of these inverter stations incorporates high and moderate voltage switchgear and transformers. Each will connect by way of underground cables to the 11kV feeder line that connects to the electricity grid at the Essential Energy Kootingal Zone substation.

The solar modules are to be enclosed within a chain mesh steel security fence topped with three rows of barbed wire to a total height of 2.3 metres. The fence is to be setback a minimum of 30 metres from the northern boundary and surrounding the array. Solar arrays are to be setback a further 8 metres from the security fence giving a total setback to the private access road of 38 metres and 588 metres to the New England Highway boundary.



Figure 1: Aerial image of the development site. Source: SIX Maps

3. Methodology

A desktop biodiversity assessment has been carried out by Zenith Town Planning Pty Ltd to determine the potential impact on any threatened species and endangered ecological communities that are present on the development site and in the vicinity of the site. This is supported by a site inspection carried out in September 2020.

The following sources of information and data have been used to determine whether any threatened species or endangered ecological communities are likely to occur on or near the site:

- SIX Maps aerial imagery,
- *Tamworth Regional Local Environmental Plan 2010*,
- NSW BioNet Species Sightings records,
- Mapping by the NSW Office of Environment and Heritage (State vegetation type map – Border Rivers Gwydir/Namoi, Native Vegetation Regulatory Map, Biodiversity Values Map)
- Schedules to the *Biodiversity Conservation Act 2016*, and
- Protected Matters Report of the *Environment Protection and Biodiversity Act 1999*.

4. Tamworth Regional LEP 2010

Tamworth Regional Local Environmental Plan 2010 is the local environmental planning instrument that applies to the development site. There are no provisions in *Tamworth Regional LEP 2010* that restrict development due to terrestrial biodiversity, watercourses, riparian lands, wetlands or the like.

5. Significant flora

Native vegetation/ecological communities

A search of the Bionet Atlas listed five endangered ecological communities found within a 100 square kilometre area surrounding the development site. These are:

- Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions
- Howell Shrublands in the New England Tableland and Nandewar Bioregions
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions
- Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner

The first four of these are included as endangered ecological communities in the *Biodiversity Conservation Act 2016* and the last, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, is listed as a critically endangered ecologically community.

The native vegetation map below indicates that there is one vegetation community present on the site with the remainder of the property mapped as possessing non-native vegetation. A small patch of PCT 435 White Box-White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion is mapped as present at the north-eastern corner of the site. The vegetation formation is 'Dry Sclerophyll Forests (Shrub/grass sub-formation)' and the vegetation class is 'North-west Slopes Dry Sclerophyll Woodlands'.

PCT 589 White Box-White Cypress Pine-Silver-leaved Ironbark grassy Woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion is mapped as being present at the south-western corner on the adjoining property to the south. The vegetation formation is 'Grassy Woodlands' and the vegetation class is 'Western Slopes Grassy Woodlands'.

PCT 544 Rough-barked Apple-White Cypress Pine-Blakely's Red Gum riparian open forest woodland of the Nandewar Bioregion and New England Tableland Bioregion is mapped as being present on the property to the north of the development site. This site is occupied by Tamworth Regional Council's Kootingal depot.

The vegetation formation is 'Grassy Woodlands' and the vegetation class is 'Western Slopes Grassy Woodlands'.

Each of these three vegetation communities are representative of the critically endangered ecological community White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland that is listed in Schedule 2 of the *Biodiversity Conservation Act 2016*. The distribution of plant communities in the vicinity of the development site is illustrated in Figure 2.

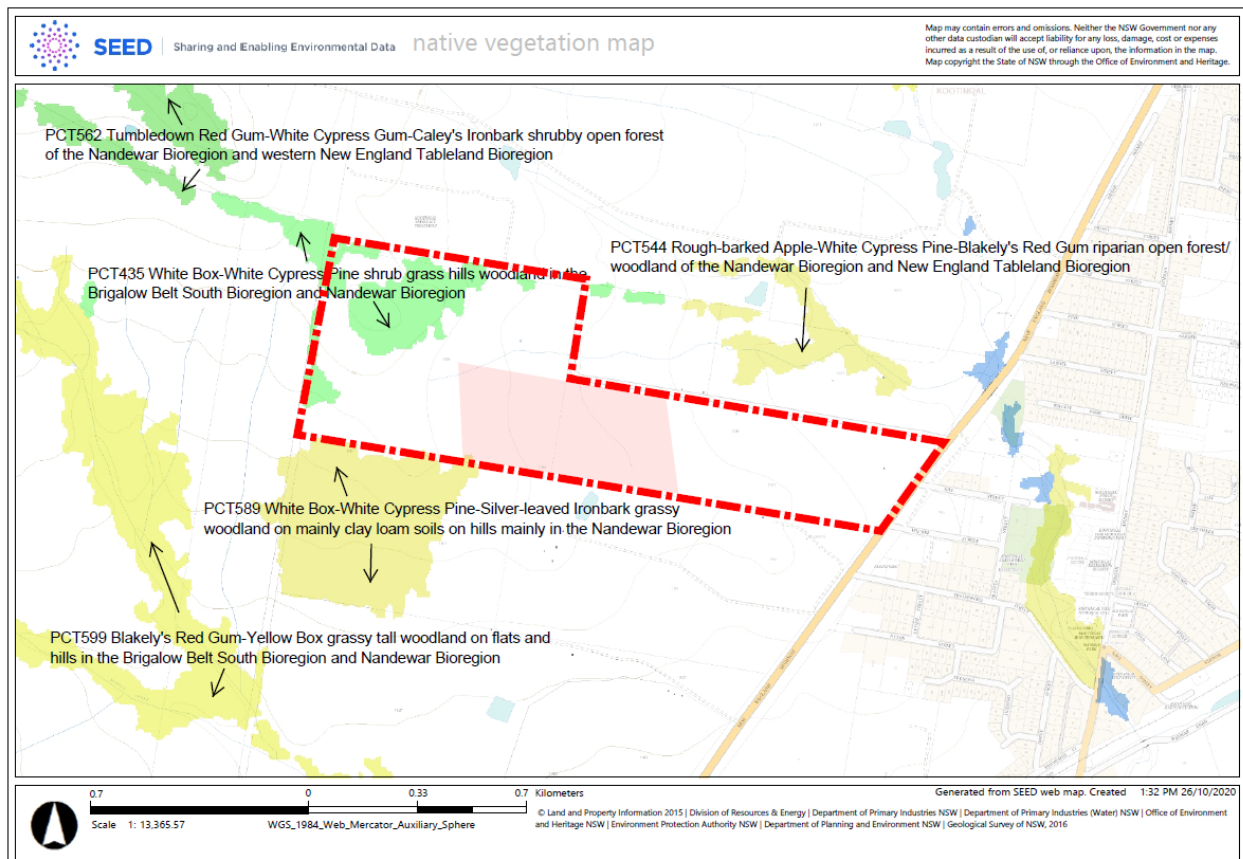


Figure 2: Native vegetation map. Source: DPIE 2020

6. EPBC Protected Matters Report

The *Environment Protection and Biodiversity Conservation Act 1999* affords protection for seven matters of national environmental significance. These matters are world heritage properties, national heritage places, wetlands of national importance, listed threatened species and ecological communities, migratory species, commonwealth marine areas and nuclear actions including uranium mines. Actions that have, or are likely to have, a significant impact on a matter of national environmental significance require the approval of the Australian Government Minister for the Environment and Energy.

Actions include but are not limited to construction, expansion, alteration or demolition of buildings, structures, infrastructure or facilities; storage or transport of hazardous materials; waste disposal;

earthworks; impoundment, extraction and diversion of water; research activities; vegetation clearance; military exercises and use of military equipment; and sale or lease of land. It is the responsibility of the Minister to decide whether assessment and approval is required under the *EPBC Act*.

The provisions of the *EPBC Act 1999* may apply to the development of a solar farm therefore an *EPBC Act Protected Matters Report* has been generated from the website of the Department of Agriculture, Water and the Environment. The report is appended as Attachment B. The report indicates that there are potentially four listed threatened ecological communities, 28 listed threatened species of flora and fauna, and 10 listed migratory species of flora and fauna protected under the *EPBC Act* within the surrounding locality.

There are three threatened ecological communities that may occur within the area that are listed as endangered in the *Environment Protection and Biodiversity Conservation Act 1999*. These are:

- Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland
- New England Peppermint Grassy Woodlands
- Weeping Myall Woodlands

In addition, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland may occur within the area and is listed as critically endangered in the *EPBC Act 1999*. As discussed above, the three plant community types (PCT435, PCT 589 and PCT 544) which are associated with this critically endangered community are located outside the development footprint.

Development footprint

The site is a highly modified grazing paddock. The development footprint comprises land that has been cleared and used for the cultivation of crops and fruit trees and more recently grazing. It appears to be predominantly exotic groundcover species and weeds and with some native grasses present within the cultivated area. A patch of PCT 435 White Box-White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion, which is representative of the critically endangered ecological community White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, remains in the north-western corner of the development footprint but is located about 150 metres away at the closest point. The photographs below indicate the condition of the site and the ground surface. There are a few remaining paddock trees (eucalypts and cypress pines) including a single hollow-bearing eucalypt tree located within the development footprint near the entrance which is to be removed to enable placement of the array. The patch of white box-white cypress pine is located outside the development footprint.

The proposed solar farm is not likely to have a significant impact on the three plant communities in the vicinity of the development footprint. Referral to the Commonwealth Government under the *EPBC Act 1999* is not considered necessary.



Plate 1: Looking south across the development footprint



Plate 2: Looking west across the development footprint



Plate 3: Looking north-west from within the development site towards PCT435



Plate 4: Example of ground cover within the development footprint



Plate 5: Example of ground cover within the development footprint



Plate 6: Example of ground cover within the development footprint



Plate 7: Example of ground cover within the development footprint



Plate 8: Example of ground cover within the development footprint

Off site

Cleared land on the remainder of the development site and on adjoining properties that are used for agricultural purposes is of similar cover, condition and land use to that within the development footprint. Remnant native vegetation in the vicinity of the proposal comprises the following plant community types:

- PCT 435 White Box-White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT 589 White Box-White Cypress Pine-Silver-leaved Ironbark grassy Woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion
- PCT 544 Rough-barked Apple-White Cypress Pine-Blakely's Red Gum riparian open forest woodland of the Nandewar Bioregion and New England Tableland Bioregion

Other vegetation communities mapped as existing on adjacent land but not on land adjoining the development site are:

- PCT562 Tumbledown Red Gum-White Cypress Gum-Caley's Ironbark shrubby open forest of the Nandewar Bioregion and western New England Tableland Bioregion, and
- P CT599 Blakely's Red Gum-Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion



Plate 9: Looking south across the development footprint towards PCT589 on the adjoining property



Plate 10: Looking north from the development site towards PCT544 on the adjoining property

Each of these except PCT562 is representative of the critically endangered ecological community White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. These communities are outside the development site and will be sufficiently distant from the solar farm to remain unaffected.

A corner of the patch of PCT589 on the adjoining property to the south is mapped as extending to the boundary of the development site near the south-western corner of the development footprint. However, the security fence is to be setback 3 metres from the southern boundary and the array a further 8 metres inside the fence. The facility is not likely to impact that EEC south of the development site due to these setbacks and no branches or limbs need to be removed to install the security fence.

7. Significant fauna

A search of the BioNet Atlas maintained by the NSW Department of Planning, Industry and Environment has also been carried to determine the potential for endangered and vulnerable species to be present within a 100 square kilometre area surrounding the site.

Four species listed as endangered and six listed as vulnerable have been recorded in the surrounding area. These species are listed in Table 1 below. The species list generated by the Bionet Atlas search is provided as Attachment A.

The regent honeyeater which is critically endangered in the *Biodiversity Conservation Act* and the *EPBC Act* is likely to occur within the database search area as well as the curlew sandpiper and swift parrot which are both listed as critically endangered in the *EPBC Act*. There are also several species listed as endangered or vulnerable, including the booroolong frog and spotted-tail quoll. The potential for these species or their habitat to be present on the development site is considered in section 10 *Test of Significance* below. In addition to animalia, the plant Bluegrass is also listed as vulnerable in the region.

Table 1: Endangered and vulnerable species recorded near the site (BC Act)

Common name	Class	NSW Status
Regent Honeyeater	Aves	Critically endangered
Booroolong frog	Amphibia	Endangered
Swift parrot	Aves	Endangered
Australian Brush-turkey population in the Nandewar and Brigalow Belt South Bioregions	Aves	Endangered population
Black-chinned honeyeater (eastern subspecies)	Aves	Vulnerable
Spotted-tail quoll	Mammalia	Vulnerable
Koala	Mammalia	Vulnerable
Grey-headed Flying Fox	Mammalia	Vulnerable
Yellow-bellied sheath- tailed bat	Mammalia	Vulnerable
Eastern False Pipistrelle	Mammalia	Vulnerable

Based on the *EPBC Act Protected Matters Report*, critically endangered and endangered species or their habitat that are listed in the *EPBC Act* and that may occur within the area are listed in Table 2 below.

Table 1: Endangered recorded near the site (EPBC Act)

Common name	Class	Commonwealth status
Regent honeyeater	Ave	Critically endangered
Curlew Sandpiper	Ave (migratory)	Critically endangered
Swift Parrot	Ave	Critically endangered
Australasian Bittern	Ave	Endangered
Australian painted snipe	Ave	Endangered
Booroolong frog	Amphibia	Endangered
Spotted-tailed quoll/tiger quoll	Mammalia	Endangered

The koala and grey-headed flying fox listed as endangered in the *Biodiversity Conservation Act 2016* are listed as vulnerable in the *EPBC Act 1999*.

Given that the part of the site to be developed as a solar farm has been cleared and used for the cultivation of crops and fruit for many years and more recently for grazing it is not likely that any endangered, vulnerable or threatened species occur on the site. Figure 3 below shows the search results from the NSW

Bionet Species Sightings map maintained by DPIE. Species records of koalas, superb parrots and other general sightings were accessed. The map indicates that only non-vulnerable species have been recorded on or near the site. This lack of fauna species is likely due to the extensive clearing and cultivation of crops that has fragmented the natural landscape.

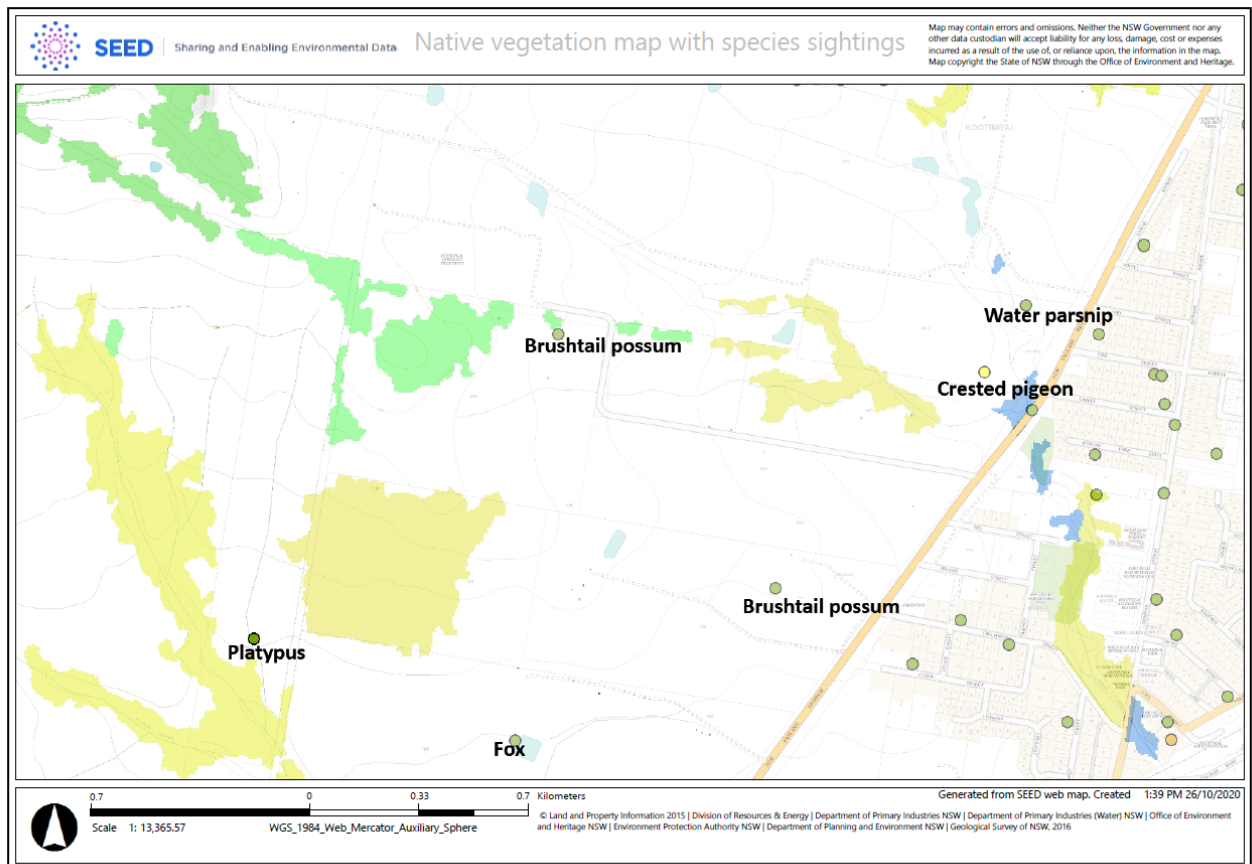


Figure 3: Species sightings and vegetation map. Source: DPIE, 2019

Although there have been no recorded sightings of koalas on or near the site and the fact that Council has not prepared a koala plan of management for the land, Council must still assess whether the proposed development will have an impact on koalas or koala habitat. The assessment process must be carried out in accordance with clause 9 of *State Environmental Planning Policy (Koala Habitat Protection) 2019* and a report prepared in accordance with the *Koala Habitat Protection Guideline* by a qualified and experienced ecologist. That report is submitted under separate cover with the development application.

8. Likelihood of occurrence assessment

Potential direct impacts

The proposal, including access, requires the removal of one eucalypt tree. Extant native vegetation at the north-western corner of the property and vegetation in the adjacent road reserve is to be retained.

Potential indirect impacts

Access to the site will be from an existing entry off the private road that is access to Council's Kootingal depot and sewerage treatment ponds. The road runs parallel to the northern boundary.

Typical potential indirect impacts include noise and light disturbance, introduction of weeds and soil compaction. These factors are already in existence due to ongoing agricultural land use. There is potential for noise and physical disturbance to the vegetation that exists adjacent the southern boundary of the site, mainly in the short-term during construction, as addressed in the test of significance. Safeguards have been developed to mitigate against any impacts (see section 12 *Mitigation measures* below).

9. Biodiversity Values Map

The Biodiversity Offset Scheme Entry Threshold Map is provided as Attachment C. This map identifies land with high biodiversity value as defined by clause 7.3(3) of the *Biodiversity Conservation Regulation 2017*. The Biodiversity Offsets Scheme applies to all clearing of native vegetation and other biodiversity impacts prescribed by the regulation on land identified on the map.

The Biodiversity Offsets Scheme is used to determine whether the Biodiversity Assessment Method is to be used to assess the impacts of a development proposal and applies to local development. The scheme is triggered based on threshold levels of clearing comprising the land area to be cleared and whether the area is mapped on the Biodiversity Values Map. In this case the development site is not mapped as being of high biodiversity value.

A minimum lot size of 40 hectares applies to the development site. The threshold for clearing of native vegetation above which the Biodiversity Assessment Method applies is 1 hectare or more. It is proposed to remove only one eucalypt tree. Supporting posts for panels will be pile-driven into the ground so there would be negligible disturbance of ground cover. Approximately 1,044 square metres would need to be cleared to construct the 4 metre wide internal accessway plus approximately 800 square metres for the car parking and laydown areas. Total clearing would be less than 2,000 square metres, therefore, a biodiversity development assessment report (BDAR) is not required and it is not necessary to engage an accredited assessor to determine the offsets required to enable the project to proceed.

A test of significance under section 7.3 of the *Biodiversity Conservation Act 2016* may be carried out for local development proposals that do not exceed the Biodiversity Offsets Scheme threshold. This test determines whether the potential impacts of development are likely to significantly affect threatened species, ecological communities, and their habitats. Potential threats to biodiversity are already in existence due to continuing agricultural land use, however, a significance assessment has been carried out due to the intention to remove a eucalypt tree.

10. Test of significance

A test of significance under section 7.3 of the *Biodiversity Conservation Act 2016* is required to be carried out for local development proposals that do not exceed the Biodiversity Offsets Scheme threshold. This test determines whether the potential impacts of development are likely to significantly affect threatened species, ecological communities, and their habitats. Below are the results of the test of significance for the proposed solar farm.

- (a) *in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

Birds

Threatened species that may occur on or near the development site include the regent honeyeater, swift parrot, curlew sandpiper, Australasian bittern, painted snipe and black-chinned honeyeater. The regent honeyeater is an flagship species, however, it prefers woodlands with an abundance and diversity of bird species. Similarly, the swift parrot prefers woodlands of profusely flowering eucalypts. The population of the brush turkey which also prefers dense vegetation with tall eucalypts is also threatened. However, the development footprint has been cleared and farmed for many years and is not known to be inhabited by any threatened species. Although there are a number of birds that are listed as critically endangered and endangered that may occur within the area, a search of the Bionet Atlas reveals that there are no recorded sightings of vulnerable species. The site does not contain any foraging or nesting habitat for bird species. Superior and extensive habitat for all faunal groups known from the region occurs in nearby forested land to the east and west of the development site.

Arboreal mammals

The spotted-tail quoll, koala, grey-headed flying fox, yellow-bellied sheath-tailed bat and the eastern false pipistrelle are critically endangered, endangered or vulnerable mammals that may occur on in the vicinity of the development site. There have been no sightings of endangered mammals either on the development site or within the vicinity of the site.

Frogs

The booroolong frog is an endangered species that may occur on or in the vicinity of the site. However, its habitat is along permanent streams and on-stream banks. There are no perennial watercourses flowing through the development site and no species of frogs have been recorded on the development site. It is unlikely that any threatened species of frogs would occur on the development site due to the presence of the riparian vegetation on the property to the north that is occupied by Council's Kootingal depot which would be preferable habitat.

Microbats

No species of bats have been recorded on the development site. It is unlikely that any threatened species of bats would occur on the development site due to the presence of the large area of native vegetation on steep lands to the east and west of Kootingal.

Therefore, the development of a solar farm is not likely to adversely affect the lifecycle of that threatened species or pose a threat to the local population of any threatened species.

- (b) *in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:*
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
 - (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

Mapping of vegetation communities indicates that there are plant community types that are indicative of an endangered ecological community located within the development site at the north-western corner, on adjoining land to the south-west and on public land to the north which is occupied by Council's Kootingal depot. These are PCTs 435, 544 and 589 which are associated with White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland. This vegetation community is listed as a critically endangered ecological community in both the *Biodiversity Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999*. These vegetation patches are not within the development footprint and will not be impacted by the development.

It is recommended that the following mitigation measures be implemented to ensure the ongoing integrity of this vegetation community:

- any vegetation planted to screen the development and any grasses planted to bind the soil following construction of the solar farm be native species endemic to the area
- access to the site is to be limited to that point shown on development plans and within the development footprint
- storage of materials is to be carried out wholly within the development footprint.

- (c) *in relation to the habitat of a threatened species or ecological community:*
- (i) *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*
 - (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*
 - (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,*

The proposed solar farm will occupy 19% of the total site. The remaining land will continue to be used for agriculture or retention of native vegetation. The patch of native vegetation at the north-western corner of the property will be retained and protected. Habitat for threatened species and ecological communities will not be adversely affected by the development as superior and extensive habitat for all faunal groups known from the region occurs in forested lands to the west of the site.

Proposed minor clearing of paddock trees will not cause isolation or fragmentation of habitat. The habitat to be removed is not considered to be of importance for any threatened species or ecological community as it comprises an isolated paddock tree within a heavily modified landscape, and extensive areas of habitat occur adjacent and beyond in the neighbouring forested lands.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The site is not mapped as being of high biodiversity value on the Biodiversity Values Map. The development of a solar farm is not likely to have any adverse effect on areas of outstanding value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The development of a solar farm, including the installation of solar PV panels and ancillary facilities, is not listed as a key threatening process in Schedule 4 of the *Biodiversity Conservation Act 2016*.

Key threatening processes listed in the Act include bushrock removal, clearing of native vegetation, alteration of habitat, loss of hollow bearing trees, predation and invasion by feral animals and plant communities, and removal of dead wood and dead trees.

In this case, exotic plant species are already prevalent in the area and therefore the proposal is unlikely to introduce any more weeds to the locality. No bushrock, dead wood and dead trees, or hollow bearing trees are proposed to be removed. Native vegetation is proposed to be removed, however, this is a single isolated eucalypt tree and is not likely to affect the distribution or representativeness of the vegetation community at the north-western corner of the development site or on adjoining properties.

In summary, the development proposal is to occur on cleared and cultivated or grazed farmland, which lacks any habitat connectivity. The site would be used only be used as flyover by threatened and migratory bird species and bats. Similarly, frogs and arboreal mammals would only be transiting the site if at all due to the lack of cover. Substantial amounts of superior and connected habitat occurs nearby the site in the forested land to the east and west.

Clearing will be limited to a single eucalypt tree and approximately 2,000 square metres of ground cover for car parking, the laydown area and accessways. The threshold for a BDAR is 1 hectare. It is considered that the proposed solar farm will not have a significant impact on threatened species, endangered ecological communities or habitat therefore a BDAR is not required.

11. Native Vegetation Regulatory Map

The Native Vegetation Regulatory Map covers rural land in NSW and categorises land where management of native vegetation can occur without approval or where management of native vegetation may be carried out in accordance with Part 5A Land Management (native vegetation) of the *Local Land Services Act 2013*.

The categories are Category 1 (unrestricted management where clearing is exempt from the *LLS Act*), Category 2 is regulated land where the *LLS Act* applies to clearing as either code based, vulnerable or sensitive, and Excluded Land which is not regulated by the *LLS Act*.

The Native Vegetation Regulatory Map for the development site is appended as Attachment D. The land is not shaded indicating that the categorisation of the land has either not been made or has not been made public by Local Land Services. This means that the approval of Local Land Services is required to remove native vegetation, however, consent granted under the *Environmental Planning and Assessment Act 1979* prevails over the *LLS Act* negating the need to obtain approvals under the *LLS Act*.

12. Mitigation measures

In summary, the development site is not mapped as affected as ecologically sensitive in *Tamworth Regional LEP 2010*. The development site is not mapped on the biodiversity values map, the clearing of native vegetation is not above the threshold based on minimum lot size, and a test of significance has found that there will be no significant impact on the ecological integrity of the property. A biodiversity development assessment report is therefore not required and the biodiversity offsets scheme does not apply.

However, it is recommended that any vegetation planted to screen the development be native species endemic to the area. Access to the site is to be limited to that point shown on development plans and within the development footprint. Storage of materials is to be carried out wholly within the development footprint.

It is also recommended that the eucalypt tree to be removed be inspected to identify any hollows or any other nesting or habitat that may contain fauna. If any fauna is present then it should be located elsewhere on the property such as in the vegetation patch located at the north-western corner. All branches and trunk sections of 300mm or greater girth should be cut into 6 metre or greater lengths and placed on the ground amongst the vegetation patch located at the north-western corner of the development site to act as fauna habitat.

Attachment A

Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°C; ^^ rounded to 0.01°C. Copyright the State of NSW through the Department of Planning, Industry and Environment. Search criteria : Public Report of all Valid Records of Entities in selected area [North: - 31.00 West: 150.99 East: 151.09 South: -31.10] returned a total of 1,369 records of 461 species.

Report generated on 4/11/2020 11:00 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Hylidae	3168	<i>Litoria booroolongensis</i>		Booroolong Frog	E1,P	E	2	
Animalia	Amphibia	Myobatrachidae	3134	<i>Crinia signifera</i>		Common Eastern Froglet	P		1	
Animalia	Amphibia	Myobatrachidae	3058	<i>Limnodynastes dumerilli</i>		Eastern Banjo Frog	P		1	
Animalia	Amphibia	Hylidae	3171	<i>Litoria caerulea</i>		Green Tree Frog	P		1	
Animalia	Amphibia	Hylidae	3314	<i>Litoria wilcoxii</i>			P		1	
Animalia	Amphibia	Bufonidae	3269	<i>Rhinella marina</i>	*	Cane Toad			1	
Animalia	Aves	Psittacidae	0309	^^ <i>Lathamus discolor</i>		Swift Parrot	E1,P,3	CE	4	
Animalia	Aves	Megapodiidae	0008	<i>Alectura lathami</i>		Australian Brush-turkey	E2,P		1	
						population in the Nandewar and Brigalow Belt South Bioregions				
Animalia	Aves	Meliphagidae	0603	<i>Anthochaera phrygia</i>		Regent Honeyeater	E4A,P	CE	1	
Animalia	Aves	Megapodiidae	0008	<i>Alectura lathami</i>		Australian Brush-turkey	P		1	
Animalia	Aves	Phasianidae	9046	<i>Coturnix sp.</i>		Unidentified Quail	P		1	
Animalia	Aves	Anatidae	0208	<i>Anas superciliosa</i>		Pacific Black Duck	P		1	
Animalia	Aves	Anatidae	0202	<i>Chenonetta jubata</i>		Australian Wood Duck	P		5	
Animalia	Aves	Columbidae	0043	<i>Ocyphaps lophotes</i>		Crested Pigeon	P		6	
Animalia	Aves	Podargidae	0313	<i>Podargus strigoides</i>		Tawny Frogmouth	P		9	
Animalia	Aves	Ardeidae	0188	<i>Egretta novaehollandiae</i>		White-faced Heron	P		1	
Animalia	Aves	Threskiornithidae	0180	<i>Threskiornis spinicollis</i>		Straw-necked Ibis	P		2	
Animalia	Aves	Accipitridae	0224	<i>Aquila audax</i>		Wedge-tailed Eagle	P		2	
Animalia	Aves	Falconidae	0240	<i>Falco cenchroides</i>		Nankeen Kestrel	P		2	
Animalia	Aves	Falconidae	9043	<i>Falco sp.</i>		Unidentified Falcon	P		1	
Animalia	Aves	Cacatuidae	0269	<i>Cacatua galerita</i>		Sulphur-crested Cockatoo	P		3	
Animalia	Aves	Cacatuidae	0267	<i>Calyptorhynchus funereus</i>		Yellow-tailed Black-Cockatoo	P		1	
Animalia	Aves	Cacatuidae	0273	<i>Eolophus roseicapillus</i>		Galah	P		14	
Animalia	Aves	Psittacidae	0281	<i>Alisterus scapularis</i>		Australian King-Parrot	P		5	
Animalia	Aves	Psittacidae	0258	<i>Glossopsitta concinna</i>		Musk Lorikeet	P		1	
Animalia	Aves	Psittacidae	0282	<i>Platycercus elegans</i>		Crimson Rosella	P		2	
Animalia	Aves	Psittacidae	0288	<i>Platycercus eximius</i>		Eastern Rosella	P		6	
Animalia	Aves	Psittacidae	T039	<i>Platycercus sp.</i>		Unidentified Rosella	P		3	
Animalia	Aves	Psittacidae	0295	<i>Psephotus haematonotus</i>		Red-rumped Parrot	P		3	
Animalia	Aves	Psittacidae	9947	<i>Trichoglossus haematodus</i>		Rainbow Lorikeet	P		4	
Animalia	Aves	Strigidae	9922	<i>Ninox novaeseelandiae</i>		Southern Boobook	P		3	
Animalia	Aves	Tytonidae	9923	<i>Tyto javanica</i>		Eastern Barn Owl	P		1	
Animalia	Aves	Alcedinidae	0319	<i>Ceyx azureus</i>		Azure Kingfisher	P		1	
Animalia	Aves	Alcedinidae	0322	<i>Dacelo novaeguineae</i>		Laughing Kookaburra	P		9	
Animalia	Aves	Alcedinidae	0326	<i>Todiramphus sanctus</i>		Sacred Kingfisher	P		1	
Animalia	Aves	Meropidae	0329	<i>Merops ornatus</i>		Rainbow Bee-eater	P		2	
Animalia	Aves	Coraciidae	0318	<i>Eurystomus orientalis</i>		Dollarbird	P		1	
Animalia	Aves	Maluridae	0529	<i>Malurus cyaneus</i>		Superb Fairy-wren	P		2	
Animalia	Aves	Acanthizidae	0486	<i>Acanthiza chrysorrhoa</i>		Yellow-rumped Thornbill	P		1	
Animalia	Aves	Acanthizidae	0453	<i>Gerygone olivacea</i>		White-throated Gerygone	P		1	
Animalia	Aves	Pardalotidae	0565	<i>Pardalotus punctatus</i>		Spotted Pardalote	P		2	
Animalia	Aves	Pardalotidae	0976	<i>Pardalotus striatus</i>		Striated Pardalote	P		2	
Animalia	Aves	Meliphagidae	0640	<i>Acanthagenys rufogularis</i>		Spiny-cheeked Honeyeater	P		1	
Animalia	Aves	Meliphagidae	0638	<i>Anthochaera carunculata</i>		Red Wattlebird	P		1	
Animalia	Aves	Meliphagidae	0641	<i>Entomyzon cyanotis</i>		Blue-faced Honeyeater	P		1	
Animalia	Aves	Meliphagidae	0634	<i>Manorina melanocephala</i>		Noisy Miner	P		2	
Animalia	Aves	Meliphagidae	0583	<i>Melithreptus brevirostris</i>		Brown-headed Honeyeater	P		1	
Animalia	Aves	Meliphagidae	0646	<i>Philemon citreogularis</i>		Little Friarbird	P		1	
Animalia	Aves	Meliphagidae	0645	<i>Philemon corniculatus</i>		Noisy Friarbird	P		2	
Animalia	Aves	Meliphagidae	0613	<i>Ptilotula fuscus</i>		Fuscous Honeyeater	P		1	
Animalia	Aves	Meliphagidae	0625	<i>Ptilotula penicillatus</i>		White-plumed Honeyeater	P		2	
Animalia	Aves	Campephagidae	0424	<i>Coracina novaehollandiae</i>		Black-faced Cuckoo-shrike	P		2	
Animalia	Aves	Campephagidae	0425	<i>Coracina papuensis</i>		White-bellied Cuckoo-shrike	P		1	
Animalia	Aves	Artamidae	0700	<i>Cracticus nigrogularis</i>		Pied Butcherbird	P		1	
Animalia	Aves	Artamidae	0705	<i>Cracticus tibicen</i>		Australian Magpie	P		11	
Animalia	Aves	Artamidae	0702	<i>Cracticus torquatus</i>		Grey Butcherbird	P		2	
Animalia	Aves	Artamidae	0694	<i>Strepera graculina</i>		Pied Currawong	P		1	
Animalia	Aves	Rhipiduridae	0364	<i>Rhipidura leucophrys</i>		Willie Wagtail	P		5	
Animalia	Aves	Corvidae	0930	<i>Corvus coronoides</i>		Australian Raven	P		2	
Animalia	Aves	Monarchidae	0415	<i>Grallina cyanoleuca</i>		Magpie-lark	P		3	
Animalia	Aves	Megaluridae	0509	<i>Cincloramphus mathewsi</i>		Rufous Songlark	P		2	
Animalia	Aves	Megaluridae	0522	<i>Megalurus gramineus</i>		Little Grassbird	P		1	
Animalia	Aves	Hirundinidae	0360	<i>Petrochelidon ariel</i>		Fairy Martin	P		1	
Animalia	Aves	Meliphagidae	8303	<i>Melithreptus gularis gularis</i>		Black-chinned Honeyeater	V,P		1	
						(eastern subspecies)				
Animalia	Aves	Columbidae	0957	<i>Columba livia</i>	*	Rock Dove			2	
Animalia	Aves	Alaudidae	0993	<i>Alauda arvensis</i>	*	Eurasian Skylark			1	

Animalia	Aves	Sturnidae	0998	<i>Sturnus tristis</i>	*	Common Myna			1
Animalia	Aves	Sturnidae	0999	<i>Sturnus vulgaris</i>	*	Common Starling			4
Animalia	Aves	Passeridae	0995	<i>Passer domesticus</i>	*	House Sparrow			2
Animalia	Mammalia	Ornithorhynchidae	1001	<i>Ornithorhynchus anatinus</i>		Platypus	P		6
Animalia	Mammalia	Tachyglossidae	1003	<i>Tachyglossus aculeatus</i>		Short-beaked Echidna	P		37
Animalia	Mammalia	Vombatidae	1165	<i>Vombatus ursinus</i>		Common Wombat	P		4
Animalia	Mammalia	Petauridae	1138	<i>Petaurus breviceps</i>		Sugar Glider	P		1
Animalia	Mammalia	Phalangeridae	T082	<i>Trichosurus sp.</i>		brushtail possum	P		15
Animalia	Mammalia	Phalangeridae	1113	<i>Trichosurus vulpecula</i>		Common Brushtail Possum	P		8
Animalia	Mammalia	Macropodidae	1265	<i>Macropus giganteus</i>		Eastern Grey Kangaroo	P		29
Animalia	Mammalia	Macropodidae	1266	<i>Macropus robustus</i>		Common Wallaroo	P		5
Animalia	Mammalia	Macropodidae	T085	<i>Macropus sp.</i>		kangaroo / wallaby	P		27
Animalia	Mammalia	Macropodidae	1242	<i>Wallabia bicolor</i>		Swamp Wallaby	P		6
Animalia	Mammalia	Pteropodidae	T087	<i>Pteropus sp.</i>		Flying-fox	P		1
Animalia	Mammalia	Molossidae	1324	<i>Austronomus australis</i>		White-striped Freetail-bat	P		1
Animalia	Mammalia	Vespertilionidae	1349	<i>Chalinolobus gouldii</i>		Gould's Wattled Bat	P		2
Animalia	Mammalia	Vespertilionidae	1365	<i>Scotorepens orion</i>		Eastern Broad-nosed Bat	P		1
Animalia	Mammalia	Dasyuridae	1008	<i>Dasyurus maculatus</i>		Spotted-tailed Quoll	V,P	E	2
Animalia	Mammalia	Phascolarctidae	1162	<i>Phascolarctos cinereus</i>		Koala	V,P	V	5
Animalia	Mammalia	Pteropodidae	1280	<i>Pteropus poliocephalus</i>		Grey-headed Flying-fox	V,P	V	2
Animalia	Mammalia	Emballonuridae	1321	<i>Saccolaimus flaviventris</i>		Yellow-bellied Sheath-tail-bat	V,P		1
Animalia	Mammalia	Vespertilionidae	1372	<i>Falsistrellus tasmaniensis</i>		Eastern False Pipistrelle	V,P		1
Animalia	Mammalia	Canidae	1531	<i>Canis lupus</i>	*	Dingo, domestic dog			1
Animalia	Mammalia	Canidae	1532	<i>Vulpes vulpes</i>	*	Fox			29
Animalia	Mammalia	Leporidae	1511	<i>Lepus capensis</i>	*	Brown Hare			1
Animalia	Mammalia	Leporidae	1510	<i>Oryctolagus cuniculus</i>	*	Rabbit			2
Animalia	Mammalia	Cervidae	9112	<i>Cervus sp.</i>	*	Unidentified Deer			6
Animalia	Reptilia	Chelidae	2017	<i>Chelodina longicollis</i>		Eastern Snake-necked Turtle	P		2
Animalia	Reptilia	Gekkonidae	2077	<i>Diplodactylus vittatus</i>		Wood Gecko	P		4
Animalia	Reptilia	Gekkonidae	2123	<i>Nebulifera robusta</i>		Robust Velvet Gecko	P		1
Animalia	Reptilia	Gekkonidae	2138	<i>Underwoodisaurus milii</i>		Thick-tailed Gecko	P		2
Animalia	Reptilia	Pygopodidae	2165	<i>Delma tinctoria</i>		Excitable Delma	P		1
Animalia	Reptilia	Scincidae	2375	<i>Ctenotus robustus</i>		Robust Ctenotus	P		1
Animalia	Reptilia	Scincidae	2429	<i>Egernia striolata</i>		Tree Skink	P		1
Animalia	Reptilia	Scincidae	2580	<i>Tiliqua scincoides</i>		Eastern Blue-tongue	P		7
Animalia	Reptilia	Agamidae	2177	<i>Pogona barbata</i>		Bearded Dragon	P		1
Animalia	Reptilia	Varanidae	2271	<i>Varanus gouldii</i>		Gould's Goanna	P		1
Animalia	Reptilia	Varanidae	2283	<i>Varanus varius</i>		Lace Monitor	P		3
Animalia	Reptilia	Typhlopidae	2588	<i>Anilius bituberculatus</i>		Prong-snouted Blind Snake	P		1
Animalia	Reptilia	Elapidae	2655	<i>Demansia psammophis</i>		Yellow-faced Whip Snake	P		1
Animalia	Reptilia	Elapidae	2692	<i>Pseudechis guttatus</i>		Spotted Black Snake	P		2
Animalia	Reptilia	Elapidae	2693	<i>Pseudechis porphyriacus</i>		Red-bellied Black Snake	P		1
Animalia	Reptilia	Elapidae	2699	<i>Pseudonaja textilis</i>		Eastern Brown Snake	P		17
Animalia	Unknown	Unknown Fauna	T350	<i>Fauna sp.</i>		Unidentified Fauna			7
Plantae	Flora	Orchidaceae	4380	<i>Caladenia filamentosa</i>		Daddy Longlegs	P		1
Plantae	Flora	Orchidaceae	7888	<i>Dipodium variegatum</i>			P		1
Plantae	Flora	Orchidaceae	4545	<i>Pterostylis curta</i>		Blunt Greenhood	P		1
Plantae	Flora	Orchidaceae	4555	<i>Pterostylis hamata</i>		Hooked Greenhood	P		2
Plantae	Flora	Orchidaceae	9848	<i>Pterostylis sp. aff. cynnocephala</i> (Bishop)			P		1
Plantae	Flora	Orchidaceae	4576	<i>Pterostylis woolfsii</i>		Long-tailed Greenhood	P		9
Plantae	Flora	Zamiaceae	6336	<i>Macrozamia stenomera</i>			P		1
Plantae	Flora	Poaceae	4895	<i>Dichanthium setosum</i>		Bluegrass	V	V	4
Plantae	Flora	Acanthaceae	1003	<i>Brunoniella australis</i>		Blue Trumpet			1
Plantae	Flora	Acanthaceae	12393	<i>Rostellularia adscendens</i> var. <i>adscendens</i>					3
Plantae	Flora	Alliaceae	8963	<i>Nothoscordum borbonicum</i>	*	Onion Weed			1
Plantae	Flora	Amaranthaceae	7079	<i>Alternanthera nana</i>		Hairy Joyweed			1
Plantae	Flora	Amaranthaceae	7191	<i>Alternanthera pungens</i>	*	Khaki Weed			3
Plantae	Flora	Amaranthaceae	1067	<i>Nyssanthus diffusa</i>		Barbwire Weed			1
Plantae	Flora	Anthericaceae	3517	<i>Arthropodium milleflorum</i>		Pale Vanilla-lily			9
Plantae	Flora	Anthericaceae	9097	<i>Arthropodium sp. B</i>					4
Plantae	Flora	Anthericaceae	3544	<i>Dichopogon fimbriatus</i>		Nodding Chocolate Lily			1
Plantae	Flora	Apiaceae	1098	<i>Ammi majus</i>	*	Bishop's Weed			1
Plantae	Flora	Apiaceae	6505	<i>Berula erecta</i>	*	Water Parsnip			1
Plantae	Flora	Apiaceae	11195	<i>Cyclospermum leptophyllum</i>	*	Slender Celery			1
Plantae	Flora	Apiaceae	1109	<i>Daucus gluchidiatus</i>		Native Carrot			3
Plantae	Flora	Apiaceae	1128	<i>Hydrocotyle laxiflora</i>		Stinking Pennywort			4
Plantae	Flora	Apiaceae	1154	<i>Trachymene incisae</i>		Trachymene			6
Plantae	Flora	Apocynaceae	1239	<i>Tweedia coerulea</i>	*				1
Plantae	Flora	Asphodelaceae	3531	<i>Bulbine bulbosa</i>		Bulbine Lily			1
Plantae	Flora	Asphodelaceae	3532	<i>Bulbine semibarbata</i>		Wild Onion			2
Plantae	Flora	Asteraceae	1283	<i>Bidens pilosa</i>	*	Cobbler's Pegs			9
Plantae	Flora	Asteraceae	1284	<i>Bidens subalternans</i>	*	Greater Beggar's Ticks			3

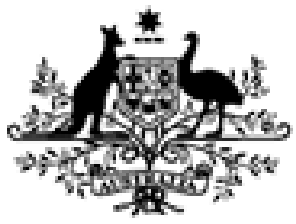
Plantae	Flora	Asteraceae	7265	<i>Brachyscome stuartii</i>	Stuart's Daisy	2
Plantae	Flora	Asteraceae	1337	<i>Calotis cuneifolia</i>	Purple Burr-Daisy	3
Plantae	Flora	Asteraceae	1344	<i>Calotis lappulacea</i>	Yellow Burr-daisy	4
Plantae	Flora	Asteraceae	1354	<i>Carduus pycnocephalus</i>	* Slender Thistle	1
Plantae	Flora	Asteraceae	1355	<i>Carduus tenuiflorus</i>	* Winged Slender Thistle	1
Plantae	Flora	Asteraceae	1358	<i>Carthamus lanatus</i>	* Saffron Thistle	1
Plantae	Flora	Asteraceae	1370	<i>Cassinia quinquefaria</i>		4
Plantae	Flora	Asteraceae	1375	<i>Cassinia uncata</i>	Sticky Cassinia	7
Plantae	Flora	Asteraceae	1382	<i>Centaurea melitensis</i>	* Maltese Cockspur	1
Plantae	Flora	Asteraceae	1383	<i>Centaurea solstitialis</i>	* St Barnabys Thistle	1
Plantae	Flora	Asteraceae	1391	<i>Chondrilla juncea</i>	* Skeleton Weed	4
Plantae	Flora	Asteraceae	8559	<i>Chryscephalum apiculatum</i>	Common Everlasting	5
Plantae	Flora	Asteraceae	8562	<i>Chryscephalum semipapposum</i>	Clustered Everlasting	1
Plantae	Flora	Asteraceae	1400	<i>Cirsium vulgare</i>	* Spear Thistle	1
Plantae	Flora	Asteraceae	1404	<i>Conyza bonariensis</i>	* Flaxleaf Fleabane	4
Plantae	Flora	Asteraceae	1408	<i>Conyza parva</i>	* Fleabane	1
Plantae	Flora	Asteraceae	1432	<i>Dimorphotheca pluvialis</i>	* Cape Marigold	1
Plantae	Flora	Asteraceae	9690	<i>Euchiton sphaericus</i>	Star Cudweed	3
Plantae	Flora	Asteraceae	13989	<i>Glossocardia bidens</i>	Cobbler's Tack	1
Plantae	Flora	Asteraceae	1540	<i>Hypochaeris glabra</i>	* Smooth Catsear	3
Plantae	Flora	Asteraceae	8788	<i>Hypochaeris radicata</i>	* Catsear	7
Plantae	Flora	Asteraceae	1550	<i>Lactuca serriola</i>	* Prickly Lettuce	4
Plantae	Flora	Asteraceae	11831	<i>Leptorhynchus squamatus</i> subsp. <i>squamatus</i>		1
Plantae	Flora	Asteraceae	1590	<i>Olearia elliptica</i>	Sticky Daisy-bush	4
Plantae	Flora	Asteraceae	10480	<i>Olearia elliptica</i> subsp. <i>elliptica</i>		4
Plantae	Flora	Asteraceae	10166	<i>Schkuhria pinnata</i> var. <i>abrotanoides</i>	* Dwarf Marigold	2
Plantae	Flora	Asteraceae	11809	<i>Senecio bathurstianus</i>		1
Plantae	Flora	Asteraceae	1664	<i>Senecio hispidulus</i>	Hill Fireweed	1
Plantae	Flora	Asteraceae	1675	<i>Senecio quadridentatus</i>	Cotton Fireweed	2
Plantae	Flora	Asteraceae	SENE	<i>Senecio</i> spp.	Groundsel, Fireweed	1
Plantae	Flora	Asteraceae	8781	<i>Sigesbeckia australiensis</i>		2
Plantae	Flora	Asteraceae	8789	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	Indian Weed	1
Plantae	Flora	Asteraceae	8253	<i>Solenogyne belliioides</i>	Solengyne	2
Plantae	Flora	Asteraceae	1688	<i>Soliva stolonifera</i>	* Jo-jo	1
Plantae	Flora	Asteraceae	1689	<i>Sonchus asper</i>	* Prickly Sowthistle	2
Plantae	Flora	Asteraceae	1690	<i>Sonchus oleraceus</i>	* Common Sowthistle	7
Plantae	Flora	Asteraceae	14049	<i>Tolpis barbata</i>	* Yellow Hawkweed	1
Plantae	Flora	Asteraceae	1711	<i>Vittadinia cuneata</i>		1
Plantae	Flora	Asteraceae	1712	<i>Vittadinia dissecta</i>		1
Plantae	Flora	Asteraceae	7069	<i>Vittadinia dissecta</i> var. <i>hirta</i>		1
Plantae	Flora	Asteraceae	1719	<i>Vittadinia sulcata</i>		1
Plantae	Flora	Bignoniaceae	1740	<i>Pandorea pandorana</i>	Wonga Wonga Vine	2
Plantae	Flora	Boraginaceae	6757	<i>Anchusa arvensis</i>	* Wild Bugloss	1
Plantae	Flora	Boraginaceae	1747	<i>Cynoglossum australe</i>		3
Plantae	Flora	Boraginaceae	1751	<i>Echium plantagineum</i>	* Patterson's Curse	7
Plantae	Flora	Brassicaceae	1788	<i>Brassica nigra</i>	* Black Mustard	1
Plantae	Flora	Brassicaceae	1790	<i>Brassica tournefortii</i>	* Mediterranean Turnip	2
Plantae	Flora	Brassicaceae	1815	<i>Lepidium africanum</i>	* Common Peppercress	4
Plantae	Flora	Brassicaceae	1841	<i>Rapistrum rugosum</i>	* Turnip Weed	1
Plantae	Flora	Brassicaceae	SISY	<i>Sisymbrium</i> spp.		1
Plantae	Flora	Cactaceae	1872	<i>Opuntia aurantiaca</i>	* Tiger Pear	5
Plantae	Flora	Cactaceae	1875	<i>Opuntia stricta</i>	* Common Prickly Pear	3
Plantae	Flora	Cactaceae	7659	<i>Opuntia stricta</i> var. <i>stricta</i>	* Common Prickly Pear	1
Plantae	Flora	Campanulaceae	1913	<i>Isotoma axillaris</i>	Showy Isotome	8
Plantae	Flora	Campanulaceae	1929	<i>Wahlenbergia communis</i>	Tufted Bluebell	11
Plantae	Flora	Campanulaceae	1934	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	3
Plantae	Flora	Campanulaceae	7314	<i>Wahlenbergia luteola</i>	Bluebell	1
Plantae	Flora	Campanulaceae	8735	<i>Wahlenbergia planiflora</i> subsp. <i>longipila</i>		1
Plantae	Flora	Campanulaceae	WAHL	<i>Wahlenbergia</i> spp.	Bluebell	3
Plantae	Flora	Campanulaceae	8708	<i>Wahlenbergia stricta</i> subsp. <i>stricta</i>	Tall Bluebell	2
Plantae	Flora	Caryophyllaceae	1960	<i>Cerastium glomeratum</i>	* Mouse-ear Chickweed	1
Plantae	Flora	Caryophyllaceae	7584	<i>Petrorhagia nanteuillii</i>	* Proliferous Pink	8
Plantae	Flora	Caryophyllaceae	1979	<i>Polycarpon tetraphyllum</i>	* Four-leaved Allseed	1
Plantae	Flora	Caryophyllaceae	9803	<i>Stellaria pallida</i>	*	1
Plantae	Flora	Chenopodiaceae	14529	<i>Dysphania pumilio</i>	Small Crumbweed	1

Plantae	Flora	Chenopodiaceae	2110	<i>Einadia hastata</i>	Berry Saltbush	2
Plantae	Flora	Chenopodiaceae	2111	<i>Einadia nutans</i>	Climbing Saltbush	3
Plantae	Flora	Chenopodiaceae	6481	<i>Einadia nutans</i> subsp. <i>linifolia</i>	Climbing Saltbush	1
Plantae	Flora	Chenopodiaceae	7909	<i>Einadia trigonos</i> subsp. <i>stellulata</i>		1
Plantae	Flora	Chenopodiaceae	2138	<i>Maireana microphylla</i>	Small-leaf Bluebush	1
Plantae	Flora	Clusiaceae	7240	<i>Hypericum gramineum</i>	Small St John's Wort	3
Plantae	Flora	Clusiaceae	2204	<i>Hypericum perforatum</i> *	St. Johns Wort	2
Plantae	Flora	Commelinaceae	2209	<i>Commelina cyanea</i>	Native Wandering Jew	17
Plantae	Flora	Commelinaceae	COMM	<i>Commelina</i> spp.		1
Plantae	Flora	Commelinaceae	6788	<i>Murdannia graminea</i>		3
Plantae	Flora	Convolvulaceae	2220	<i>Convolvulus erubescens</i>	Pink Bindweed	1
Plantae	Flora	Convolvulaceae	2222	<i>Dichondra repens</i>	Kidney Weed	2
Plantae	Flora	Convolvulaceae	15127	<i>Dichondra</i> sp. <i>Inglewood</i>		7
Plantae	Flora	Convolvulaceae	8278	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>		1
Plantae	Flora	Crassulaceae	8813	<i>Bryophyllum delagoense</i> *	Mother of millions	1
Plantae	Flora	Crassulaceae	2242	<i>Crassula sieberiana</i>	Australian Stonecrop	6
Plantae	Flora	Cupressaceae	2279	<i>Callitris endlicheri</i>	Black Cypress Pine	1
Plantae	Flora	Cupressaceae	6379	<i>Callitris glaucophylla</i>	White Cypress Pine	11
Plantae	Flora	Cupressaceae	CALR	<i>Callitris</i> spp.		2
Plantae	Flora	Cyperaceae	2327	<i>Carex inversa</i>	Knob Sedge	6
Plantae	Flora	Cyperaceae	8845	<i>Cyperus aggregatus</i> *		1
Plantae	Flora	Cyperaceae	2372	<i>Cyperus fulvus</i>	Sticky Sedge	10
Plantae	Flora	Cyperaceae	2374	<i>Cyperus gracilis</i>	Slender Flat-sedge	5
Plantae	Flora	Cyperaceae	CYPE	<i>Cyperus</i> spp.		1
Plantae	Flora	Cyperaceae	7617	<i>Cyperus vaginatus</i>	Stiff Flat-sedge	1
Plantae	Flora	Cyperaceae	7435	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge	8
Plantae	Flora	Cyperaceae	2490	<i>Schoenoplectus validus</i>		2
Plantae	Flora	Dilleniaceae	2526	<i>Hibbertia acicularis</i>		1
Plantae	Flora	Dilleniaceae	HIBB	<i>Hibbertia</i> spp.		4
Plantae	Flora	Droseraceae	2559	<i>Drosera peltata</i>		1
Plantae	Flora	Euphorbiaceae	2681	<i>Bertya cunninghamii</i>	Gooma Bush, Wallaby Bush	3
Plantae	Flora	Euphorbiaceae	2683	<i>Bertya gummifera</i>		2
Plantae	Flora	Fabaceae	2840	<i>Desmodium varians</i>	Slender Tick-trefoil	3
Plantae	Flora	(Faboideae)	2860	<i>Glycine clandestina</i>	Twining glycine	4
Plantae	Flora	Fabaceae	2861	<i>Glycine tabacina</i>	Variable Glycine	8
Plantae	Flora	Fabaceae	2873	<i>Hardenbergia violacea</i>	False Sarsaparilla	1
Plantae	Flora	(Faboideae)	2875	<i>Hovea lanceolata</i>		2
Plantae	Flora	Fabaceae	7544	<i>Indigofera adesmiifolia</i>	Tick Indigo	1
Plantae	Flora	(Faboideae)	2920	<i>Medicago minima</i> *	Woolly Burr Medic	1
Plantae	Flora	Fabaceae	2922	<i>Medicago polymorpha</i> *	Burr Medic	1
Plantae	Flora	(Faboideae)	15128	<i>Oxytes brachypoda</i>	Large Tick-trefoil	5
Plantae	Flora	Fabaceae	3003	<i>Pultenaea microphylla</i>		1
Plantae	Flora	(Faboideae)	3041	<i>Swainsona galegifolia</i>	Smooth Darling Pea	2
Plantae	Flora	Fabaceae	8537	<i>Swainsona reticulata</i>	Knead Swainson-pea	1
Plantae	Flora	(Faboideae)	3073	<i>Trifolium arvense</i> *	Haresfoot Clover	6
Plantae	Flora	Fabaceae	3074	<i>Trifolium campestre</i> *	Hop Clover	3
Plantae	Flora	(Faboideae)	3079	<i>Trifolium glomeratum</i> *	Clustered Clover	1
Plantae	Flora	Fabaceae	3084	<i>Trifolium pratense</i> *	Red Clover	1
Plantae	Flora	(Faboideae)	3085	<i>Trifolium repens</i> *	White Clover	2
Plantae	Flora	Fabaceae	3089	<i>Trifolium subterraneum</i> *	Subterranean Clover	1
Plantae	Flora	(Faboideae)	3738	<i>Acacia cheelii</i>	Motherumbah	1
Plantae	Flora	(Mimosoideae)	3754	<i>Acacia cultriformis</i>	Knife-leaved Wattle	2
Plantae	Flora	Fabaceae	3835	<i>Acacia neriifolia</i>	Silver Wattle	9
Plantae	Flora	(Mimosoideae)	3869	<i>Acacia rubida</i>	Red-stemmed Wattle	1
Plantae	Flora	Fabaceae	3899	<i>Acacia viscidula</i>	Sticky Wattle	10
Plantae	Flora	(Mimosoideae)				
Plantae	Flora	Fumariaceae	FUMA	<i>Fumaria</i> spp.	Fumitory	1
Plantae	Flora	Gentianaceae	3131	<i>Centaurium erythraea</i> *	Common Centaury	1
Plantae	Flora	Gentianaceae	3133	<i>Centaurium tenuiflorum</i> *	Branched Centaury, Slender centaury	1
Plantae	Flora	Geraniaceae	3142	<i>Erodium crinitum</i>	Blue Crowfoot	2

Plantae	Flora	Geraniaceae	10093	<i>Geranium molle</i> subsp. <i>molle</i>	*	Cranesbill Geranium	4
Plantae	Flora	Geraniaceae	3156	<i>Geranium solanderi</i>		Native Geranium	1
Plantae	Flora	Geraniaceae	8226	<i>Geranium solanderi</i> var. <i>solanderi</i>			5
Plantae	Flora	Goodeniaceae	3193	<i>Goodenia pinnatifida</i>		Scrambles Eggs	1
Plantae	Flora	Haloragaceae	3247	<i>Gonocarpus tetragynus</i>		Poverty Raspwort	3
Plantae	Flora	Haloragaceae	3248	<i>Gonocarpus teucrioides</i>		Germander Raspwort	6
Plantae	Flora	Haloragaceae	3254	<i>Haloragis serra</i>			1
Plantae	Flora	Juncaceae	3326	<i>Juncus continuus</i>			1
Plantae	Flora	Juncaceae	3348	<i>Juncus subsecundus</i>		Finger Rush	1
Plantae	Flora	Juncaceae	3350	<i>Juncus usitatus</i>			2
Plantae	Flora	Juncaceae	3356	<i>Luzula densiflora</i>		Woodrush	2
Plantae	Flora	Lamiaceae	3371	<i>Ajuga australis</i>		Austral Bugle	2
Plantae	Flora	Lamiaceae	3381	<i>Marrubium vulgare</i>	*	White Horehound	1
Plantae	Flora	Lamiaceae	MENT	<i>Mentha</i> spp.			2
Plantae	Flora	Lamiaceae	3421	<i>Prostanthera nivea</i>		Snowy Mint-bush	9
Plantae	Flora	Lamiaceae	3447	<i>Scutellaria humilis</i>		Dwarf Skullcap	1
Plantae	Flora	Lamiaceae	15130	<i>Teucrium betchei</i>			2
Plantae	Flora	Linaceae	3583	<i>Linum marginale</i>		Native Flax	1
Plantae	Flora	Lomandraceae	6302	<i>Lomandra filiformis</i>		Wattle Mat-rush	1
Plantae	Flora	Lomandraceae	6308	<i>Lomandra longifolia</i>		Spiny-headed Mat-rush	1
Plantae	Flora	Lomandraceae	LOMA	<i>Lomandra</i> spp.		Mat-rush	1
Plantae	Flora	Loranthaceae	7922	<i>Amyema miraculosum</i> subsp. <i>boormanii</i>			1
Plantae	Flora	Loranthaceae	3607	<i>Amyema pendula</i>			1
Plantae	Flora	Luzuriagaceae	6015	<i>Eustrephus latifolius</i>		Wombat Berry	3
Plantae	Flora	Malvaceae	6128	<i>Brachychiton populneus</i>		Kurrajong	11
Plantae	Flora	Malvaceae	8961	<i>Brachychiton populneus</i> subsp. <i>populneus</i>			1
Plantae	Flora	Malvaceae	7267	<i>Pavonia hastata</i>	*		1
Plantae	Flora	Malvaceae	13208	<i>Sida atherophora</i>			2
Plantae	Flora	Malvaceae	3664	<i>Sida corrugata</i>		Corrugated Sida	2
Plantae	Flora	Malvaceae	3666	<i>Sida cunninghamii</i>		Ridge Sida	2
Plantae	Flora	Malvaceae	3673	<i>Sida rhombifolia</i>	*	Paddy's Lucerne	4
Plantae	Flora	Meliaceae	3680	<i>Melia azedarach</i>		White Cedar	1
Plantae	Flora	Moraceae	3924	<i>Ficus rubiginosa</i>		Port Jackson Fig	2
Plantae	Flora	Myrtaceae	3971	<i>Angophora floribunda</i>		Rough-barked Apple	8
Plantae	Flora	Myrtaceae	ANGO	<i>Angophora</i> spp.			1
Plantae	Flora	Myrtaceae	4039	<i>Eucalyptus albens</i>		White Box	13
Plantae	Flora	Myrtaceae	4057	<i>Eucalyptus blakelyi</i>		Blakely's Red Gum	10
Plantae	Flora	Myrtaceae	4078	<i>Eucalyptus dealbata</i>		Tumbledown Red Gum	5
Plantae	Flora	Myrtaceae	4112	<i>Eucalyptus laevopinea</i>		Silver-top Stringybark	3
Plantae	Flora	Myrtaceae	4120	<i>Eucalyptus macrorhyncha</i>		Red Stringybark	2
Plantae	Flora	Myrtaceae	7230	<i>Eucalyptus malacoxylon</i>		Moonbi Apple Box	3
Plantae	Flora	Myrtaceae	4125	<i>Eucalyptus melliodora</i>		Yellow Box	8
Plantae	Flora	Myrtaceae	8721	<i>Eucalyptus prava</i>		Orange Gum	5
Plantae	Flora	Myrtaceae	4197	<i>Eucalyptus viminalis</i>		Ribbon Gum	2
Plantae	Flora	Oleaceae	6398	<i>Jasminum lineare</i>		Desert Jasmine	2
Plantae	Flora	Oleaceae	4310	<i>Jasminum suavisissimum</i>			1
Plantae	Flora	Oleaceae	4319	<i>Notelaea microcarpa</i>		Native Olive	1
Plantae	Flora	Oleaceae	6695	<i>Notelaea microcarpa</i> var. <i>microcarpa</i>			3
Plantae	Flora	Onagraceae	4339	<i>Oenothera affinis</i>	*		1
Plantae	Flora	Onagraceae	6837	<i>Oenothera indecora</i> subsp. <i>bonariensis</i>	*		1
Plantae	Flora	Onagraceae	8808	<i>Oenothera stricta</i> subsp. <i>stricta</i>	*		1
Plantae	Flora	Ophioglossaceae	10482	<i>Ophioglossum lusitanicum</i>		Adder's Tongue	1
Plantae	Flora	Oxalidaceae	4612	<i>Oxalis chnoodes</i>			3
Plantae	Flora	Oxalidaceae	4621	<i>Oxalis perennans</i>			2
Plantae	Flora	Oxalidaceae	4624	<i>Oxalis radicata</i>			1
Plantae	Flora	Oxalidaceae	OXAL	<i>Oxalis</i> spp.			2
Plantae	Flora	Phormiaceae	6789	<i>Dianella caerulea</i> var. <i>cinerascens</i>			1
Plantae	Flora	Phormiaceae	7783	<i>Dianella longifolia</i>		Blueberry Lily	2
Plantae	Flora	Phormiaceae	3542	<i>Dianella revoluta</i>		Blueberry Lily	1
Plantae	Flora	Phormiaceae	7580	<i>Dianella revoluta</i> var. <i>revoluta</i>			3
Plantae	Flora	Phormiaceae	3569	<i>Stypandra glauca</i>		Nodding Blue Lily	7
Plantae	Flora	Phyllanthaceae	2695	<i>Breynia oblongifolia</i>		Coffee Bush	1
Plantae	Flora	Phyllanthaceae	2750	<i>Phyllanthus subcrenulatus</i>			1
Plantae	Flora	Pittosporaceae	4674	<i>Bursaria spinosa</i>		Native Blackthorn	4
Plantae	Flora	Pittosporaceae	11018	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>		Native Blackthorn	1
Plantae	Flora	Plantaginaceae	4691	<i>Plantago debilis</i>		Shade Plantain	4
Plantae	Flora	Plantaginaceae	4699	<i>Plantago lanceolata</i>	*	Lamb's Tongues	3
Plantae	Flora	Plantaginaceae	9779	<i>Plantago scabra</i>	*	Sand Plantain	4
Plantae	Flora	Poaceae	4731	<i>Aira cupaniana</i>	*	Silvery Hairgrass	1
Plantae	Flora	Poaceae	14896	<i>Anthosachne scabra</i>		Wheatgrass, Common	5
Plantae	Flora	Poaceae	4767	<i>Aristida personata</i>		Wheatgrass	6

Plantae	Flora	Poaceae	4770	<i>Aristida ramosa</i>	Purple Wiregrass	10
Plantae	Flora	Poaceae	4773	<i>Aristida vagans</i>	Threeawn Speargrass	4
Plantae	Flora	Poaceae	10377	<i>Auistrostipa scabra</i>	Speargrass	2
Plantae	Flora	Poaceae	10378	<i>Auistrostipa scabra subsp. scabra</i>	Rough Speargrass	4
Plantae	Flora	Poaceae	10371	<i>Auistrostipa verticillata</i>	Slender Bamboo Grass	4
Plantae	Flora	Poaceae	4780	<i>Avena fatua</i> *	Wild Oats	5
Plantae	Flora	Poaceae	4781	<i>Avena ludoviciana</i> *	Ludo Wild Oats	1
Plantae	Flora	Poaceae	AVEN	<i>Avena spp.</i> *	Oats	3
Plantae	Flora	Poaceae	7559	<i>Bothriochloa decipiens</i> var. <i>decipiens</i>	Pitted Bluegrass	2
Plantae	Flora	Poaceae	4790	<i>Bothriochloa macra</i>	Red Grass	11
Plantae	Flora	Poaceae	BOTH	<i>Bothriochloa spp.</i>	Redgrass, Bluegrass	1
Plantae	Flora	Poaceae	4800	<i>Briza maxima</i> *	Quaking Grass	1
Plantae	Flora	Poaceae	7813	<i>Bromus catharticus</i> *	Praire Grass	2
Plantae	Flora	Poaceae	4806	<i>Bromus diandrus</i> *	Great Brome	2
Plantae	Flora	Poaceae	4811	<i>Bromus molliformis</i> *	Soft Brome	2
Plantae	Flora	Poaceae	4822	<i>Catapodium rigidum</i> *	Rigid Fescue	1
Plantae	Flora	Poaceae	14903	<i>Cenchrus clandestinus</i> *	Kikuyu Grass	1
Plantae	Flora	Poaceae	4824	<i>Cenchrus incertus</i> *	Spiny Burr Grass	1
Plantae	Flora	Poaceae	14952	<i>Cenchrus purpurascens</i>		1
Plantae	Flora	Poaceae	4833	<i>Chloris truncata</i>	Windmill Grass	2
Plantae	Flora	Poaceae	4834	<i>Chloris ventricosa</i>	Tall Chloris	3
Plantae	Flora	Poaceae	6864	<i>Cleistochloa rigida</i>		1
Plantae	Flora	Poaceae	4841	<i>Cymbopogon refractus</i>	Barbed Wire Grass	8
Plantae	Flora	Poaceae	6540	<i>Cynodon dactylon</i>	Common Couch	3
Plantae	Flora	Poaceae	7485	<i>Dichanthium sericeum</i>	Queensland Bluegrass	1
Plantae	Flora	Poaceae	4898	<i>Dichelachne micrantha</i>	Shorthair Plumegrass	6
Plantae	Flora	Poaceae	6857	<i>Digitaria brownii</i>	Cotton Panic Grass	6
Plantae	Flora	Poaceae	4907	<i>Digitaria divaricatissima</i>	Umbrella Grass	4
Plantae	Flora	Poaceae	4929	<i>Echinopogon caespitosus</i>	Bushy Hedgehog-grass	1
Plantae	Flora	Poaceae	7593	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Tufted Hedgehog Grass	1
Plantae	Flora	Poaceae	4931	<i>Echinopogon intermedius</i>	Erect Hedgehog Grass	2
Plantae	Flora	Poaceae	4934	<i>Echinopogon ovatus</i>	Forest Hedgehog Grass	1
Plantae	Flora	Poaceae	4940	<i>Eleusine tristachya</i> *	Goose Grass	1
Plantae	Flora	Poaceae	4945	<i>Enneapogon nigricans</i>	Niggerheads	3
Plantae	Flora	Poaceae	4947	<i>Entolasia stricta</i>	Wiry Panic	3
Plantae	Flora	Poaceae	7921	<i>Eragrostis brownii</i>	Brown's Lovegrass	2
Plantae	Flora	Poaceae	6387	<i>Eragrostis cilianensis</i> *	Stinkgrass	1
Plantae	Flora	Poaceae	4952	<i>Eragrostis curvula</i> *	African Lovegrass	1
Plantae	Flora	Poaceae	4960	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	6
Plantae	Flora	Poaceae	4970	<i>Eragrostis pilosa</i> *	Soft Lovegrass	1
Plantae	Flora	Poaceae	ERAG	<i>Eragrostis spp.</i>		1
Plantae	Flora	Poaceae	4973	<i>Eragrostis tef</i> *	Teff	1
Plantae	Flora	Poaceae	ERIO	<i>Eriochloa spp.</i>		1
Plantae	Flora	Poaceae	7602	<i>Eulalia aurea</i>	Silky Browntop	1
Plantae	Flora	Poaceae	5016	<i>Hyparrhenia hirta</i> *	Coolatai Grass	9
Plantae	Flora	Poaceae	11388	<i>Lachnagrostis filiformis</i>		1
Plantae	Flora	Poaceae	5032	<i>Lolium perenne</i> *	Perennial Ryegrass	3
Plantae	Flora	Poaceae	5037	<i>Microalaena stipoides</i>	Weeping Grass	6
Plantae	Flora	Poaceae	7707	<i>Microalaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	1
Plantae	Flora	Poaceae	6395	<i>Panicum decompositum</i>	Native Millet	3
Plantae	Flora	Poaceae	5055	<i>Panicum effusum</i>	Hairy Panic	1
Plantae	Flora	Poaceae	5059	<i>Panicum miliaceum</i> *	French Millet	2
Plantae	Flora	Poaceae	5077	<i>Paspalidium constrictum</i>	Knottybutt Grass	9
Plantae	Flora	Poaceae	5081	<i>Paspalidium gracile</i>	Slender Panic	1
Plantae	Flora	Poaceae	5086	<i>Paspalum dilatatum</i> *	Paspalum	1
Plantae	Flora	Poaceae	6726	<i>Poa fax</i>	Scaly Poa	2
Plantae	Flora	Poaceae	11196	<i>Poa labillardierei</i> var. <i>labillardierei</i>	Tussock	1
Plantae	Flora	Poaceae	5141	<i>Poa sieberiana</i>	Snowgrass	2
Plantae	Flora	Poaceae	8744	<i>Poa sieberiana</i> var. <i>hirtella</i>		1
Plantae	Flora	Poaceae	5145	<i>Polypogon monspeliensis</i> *	Annual Beardgrass	1
Plantae	Flora	Poaceae	14304	<i>Rytidosperma bipartitum</i>	Wallaby Grass	1
Plantae	Flora	Poaceae	14308	<i>Rytidosperma erianthum</i>	Wallaby Grass	1
Plantae	Flora	Poaceae	14309	<i>Rytidosperma fulvum</i>	Wallaby Grass	9
Plantae	Flora	Poaceae	14312	<i>Rytidosperma longifolium</i>	Long-leaved Wallaby Grass	1
Plantae	Flora	Poaceae	14313	<i>Rytidosperma monticola</i>	Mountain Wallaby Grass	1
Plantae	Flora	Poaceae	14316	<i>Rytidosperma pilosum</i>	Smooth-flowered Wallaby Grass	1
Plantae	Flora	Poaceae	14317	<i>Rytidosperma racemosum</i>	Wallaby Grass	2
Plantae	Flora	Poaceae	14319	<i>Rytidosperma racemosum</i> var. <i>obtusatum</i>	Wallaby Grass	3
Plantae	Flora	Poaceae	14318	<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Wallaby Grass	2
Plantae	Flora	Poaceae	RYTI	<i>Rytidosperma spp.</i>		1
Plantae	Flora	Poaceae	5172	<i>Sorghum halepense</i> *	Johnson Grass	1
Plantae	Flora	Poaceae	5179	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	5
Plantae	Flora	Poaceae	7770	<i>Themeda triandra</i>		2
Plantae	Flora	Poaceae	5228	<i>Triodia scariosa</i>	Porcupine Grass	3

Plantae	Flora	Poaceae	5229	<i>Tripogon loliiformis</i>		Fiveminute Grass	9
Plantae	Flora	Poaceae	7506	<i>Urochloa piligera</i>		Hairy Armgrass	3
Plantae	Flora	Poaceae	5239	<i>Vulpia bromoides</i>	*	Squirrel Tail Fesque	1
Plantae	Flora	Poaceae	8516	<i>Vulpia muralis</i>	*	Wall Fescue	2
Plantae	Flora	Poaceae	5242	<i>Vulpia myuros</i>	*	Rat's Tail Fescue	1
Plantae	Flora	Poaceae	VULP	<i>Vulpia spp.</i>	*	Rat's-tail Fescue	2
Plantae	Flora	Polygonaceae	5265	<i>Acetosella vulgaris</i>	*	Sheep Sorrel	1
Plantae	Flora	Polygonaceae	5296	<i>Rumex brownii</i>		Swamp Dock	7
Plantae	Flora	Portulacaceae	5311	<i>Calandrinia eremaea</i>		Small Purslane	1
Plantae	Flora	Portulacaceae	9652	<i>Portulaca bicolor var. rosea</i>			3
Plantae	Flora	Portulacaceae	5324	<i>Portulaca oleracea</i>		Pigweed	4
Plantae	Flora	Potamogetonaceae	5331	<i>Potamogeton ochreatus</i>		Blunt Pondweed	1
Plantae	Flora	Primulaceae	14614	<i>Lysimachia arvensis</i>	*	Scarlet Pimpernel	5
Plantae	Flora	Pteridaceae	6382	<i>Cheilanthes distans</i>		Bristly Cloak Fern	8
Plantae	Flora	Pteridaceae	10439	<i>Cheilanthes sieberi</i>		Rock Fern	2
Plantae	Flora	Pteridaceae	8007	<i>Cheilanthes sieberi subsp. sieberi</i>		Rock Fern	9
Plantae	Flora	Pteridaceae	8444	<i>Pellaea falcata</i>		Sickle Fern	2
Plantae	Flora	Ranunculaceae	5493	<i>Clematis aristata</i>		Old Man's Beard	1
Plantae	Flora	Ranunculaceae	5495	<i>Clematis glycinoides</i>		Headache Vine	3
Plantae	Flora	Ranunculaceae	5496	<i>Clematis microphylla</i>		Small-leaved Clematis	1
Plantae	Flora	Ranunculaceae	12095	<i>Ranunculus meristus</i>			1
Plantae	Flora	Ranunculaceae	5525	<i>Ranunculus sessiliflorus</i>		Small-flowered Buttercup	4
Plantae	Flora	Rosaceae	5602	<i>Acaena agnipila</i>		Hairy Sheep's Burr	1
Plantae	Flora	Rosaceae	5605	<i>Acaena ovina</i>		Acaena	1
Plantae	Flora	Rosaceae	5635	<i>Rosa rubiginosa</i>	*	Sweet Briar	1
Plantae	Flora	Rosaceae	5646	<i>Rubus ulmifolius</i>	*	Blackberry	1
Plantae	Flora	Rubiaceae	5653	<i>Asperula conferta</i>		Common Woodruff	3
Plantae	Flora	Rubiaceae	5679	<i>Galium aparine</i>	*	Goosegrass	3
Plantae	Flora	Rubiaceae	5686	<i>Galium migrans</i>			5
Plantae	Flora	Rubiaceae	5699	<i>Opercularia hispida</i>		Hairy Stinkweed	1
Plantae	Flora	Rubiaceae	11942	<i>Psydraz odorata</i>		Shiny-leaved Canthium	1
Plantae	Flora	Rutaceae	5836	<i>Zieria cytisoides</i>		Downy Zieria	2
Plantae	Flora	Sapindaceae	5913	<i>Dadonaea viscosa</i>		Sticky Hop-bush	2
Plantae	Flora	Sapindaceae	7690	<i>Dadonaea viscosa subsp. angustifolia</i>			1
Plantae	Flora	Sapindaceae	7830	<i>Dadonaea viscosa subsp. angustissima</i>		Narrow-leaf Hop-bush	1
Plantae	Flora	Scrophulariaceae	7558	<i>Kickxia elatine subsp. crinita</i>	*	Twining Toadflax	1
Plantae	Flora	Scrophulariaceae	7625	<i>Verbascum thapsus subsp. thapsus</i>	*	Great Mullein	3
Plantae	Flora	Scrophulariaceae	5999	<i>Verbascum virgatum</i>	*	Twiggy Mullein	2
Plantae	Flora	Solanaceae	6027	<i>Cestrum parqui</i>	*	Green Cestrum	2
Plantae	Flora	Solanaceae	6040	<i>Lycium ferocissimum</i>	*	African Boxthorn	2
Plantae	Flora	Solanaceae	PHYS	<i>Physalis spp.</i>			1
Plantae	Flora	Solanaceae	6071	<i>Solanum chenopodioides</i>	*	Whitetip Nightshade	1
Plantae	Flora	Solanaceae	6072	<i>Solanum cinereum</i>		Narrawa Burr	2
Plantae	Flora	Solanaceae	6081	<i>Solanum esuriale</i>		Quena	1
Plantae	Flora	Solanaceae	6091	<i>Solanum nigrum</i>	*	Black-berry Nightshade	1
Plantae	Flora	Solanaceae	12295	<i>Solanum parvifolium subsp. parvifolium</i>		Nightshade	1
Plantae	Flora	Thymelaeaceae	6871	<i>Pimelea micrantha</i>		Silky Rice-flower	1
Plantae	Flora	Typhaceae	6217	<i>Typha orientalis</i>		Broad-leaved Cumbungi	2
Plantae	Flora	Urticaceae	6237	<i>Urtica incisa</i>		Stinging Nettle	4
Plantae	Flora	Urticaceae	6238	<i>Urtica urens</i>	*	Small Nettle	2
Plantae	Flora	Verbenaceae	12422	<i>Glandularia aristigera</i>	*	Mayne's Pest	5
Plantae	Flora	Verbenaceae	6256	<i>Verbena bonariensis</i>	*	Purpletop	2
Plantae	Flora	Viscaceae	6277	<i>Notothixos cornifolius</i>		Kurrajong Mistletoe	2
Plantae	Flora	Zygophyllaceae	7655	<i>Tribulus terrestris</i>	*	Cat-head	2



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

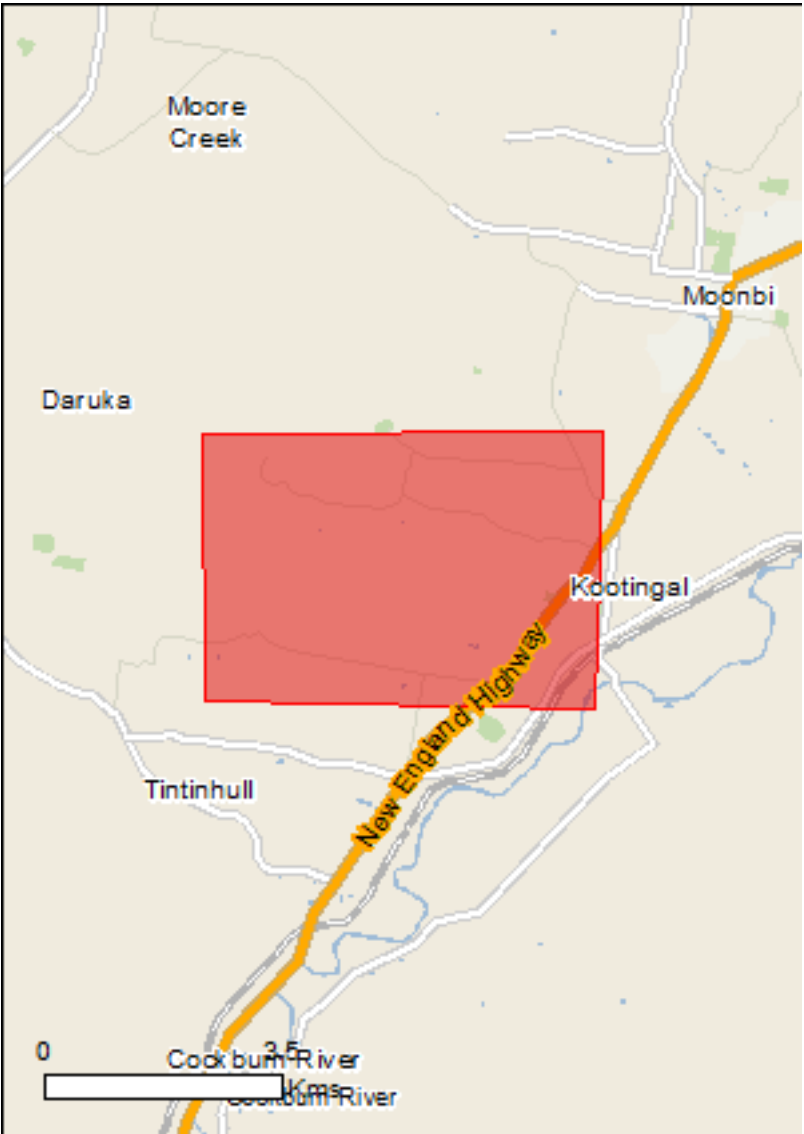
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 26/10/20 13:50:42

- [Summary](#)
- [Details](#)

[Matters of NES](#)[Other Matters Protected by the EPBC Act](#)[Extra Information](#)
- [Caveat](#)
- [Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	28
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	32
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name	Proximity	
Banrock station wetland complex	1000 - 1100km	
Riverland	900 - 1000km upstream	
The coorong, and lakes alexandrina and albert wetland	1100 - 1200km	

Listed Threatened Ecological Communities	[Resource Information]
--	--------------------------

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community may occur within area
New England Peppermint (Eucalyptus nova-anglica)	Critically Endangered	Community may occur within area
Grassy Woodlands	Endangered	Community may occur within area
Weeping Myall Woodlands		
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species	[Resource Information]
---------------------------	--------------------------

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
within area		
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat known to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
Callistemon pungens [55581]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat likely to occur within area
Homoranthus prolixus [55198]	Vulnerable	Species or species habitat may occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area
Reptiles		

Name	Status	Type of Presence
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area
Uvidicolus sphyrurus Border Thick-tailed Gecko, Granite Belt Thick-tailed Gecko [84578]	Vulnerable	Species or species habitat likely to occur within area
Wollumbinia belli Bell's Turtle, Western Sawshelled Turtle, Namoi River Turtle, Bell's Saw-shelled Turtle [86071]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		

Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
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Migratory Terrestrial Species

Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
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Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
---	--	--

Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
--	--	--

Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
--	--	--

Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
--	--	--

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
--	--	--

Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
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Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	area Species or species habitat likely to occur within area

Extra Information

Invasive Species	[Resource Information]
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Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur

Name	Status	Type of Presence
Opuntia spp. Prickly Pears [82753]		within area Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.035279 151.000549,-31.034911 151.053592,-31.06653 151.052562,-31.0655 151.000807,-31.035132 151.000463,-31.035279 151.000549

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
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- [-Australian National Herbarium, Canberra](#)
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- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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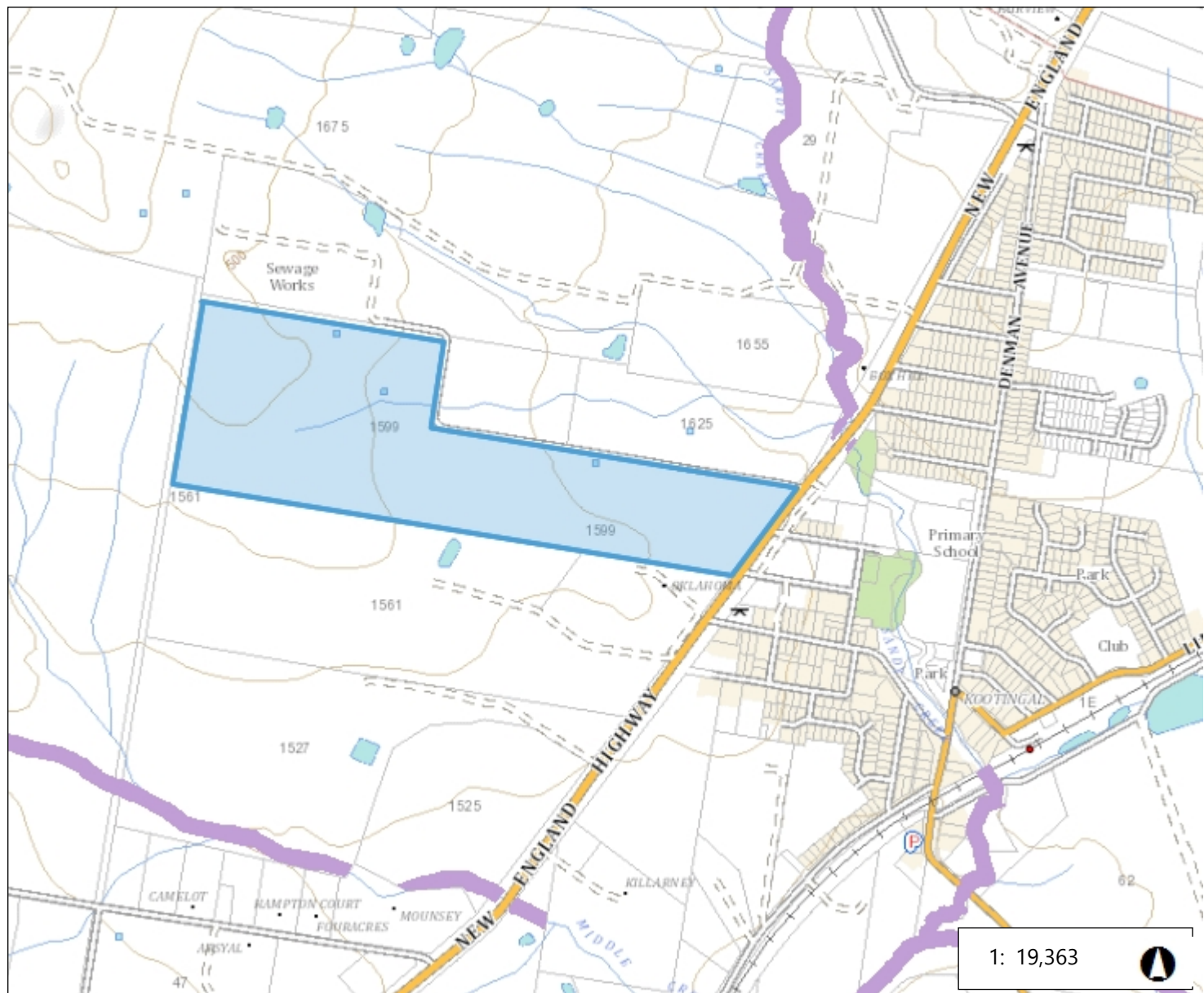
[Department of Agriculture Water and the Environment](#)

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Biodiversity Offset Scheme (BOS) Entry Threshold Map



983.7 0 491.83 983.7 Metres

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Legend

- Biodiversity Values that have been mapped for more than 90 days
- Biodiversity Values added within last 90 days

Notes

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Biodiversity Values Map and Threshold Report

Results Summary

Date of Calculation	26/10/2020 1:16 PM	BDAR Required*
Total Digitised Area	56.77 ha	
Minimum Lot Size Method	LEP	
Minimum Lot Size	40 ha	
Area Clearing Threshold	1 ha	
Area clearing trigger Area of native vegetation cleared	Unknown [#]	Unknown [#]
Biodiversity values map trigger Impact on biodiversity values map(not including values added within the last 90 days)?	no	no
Date of the 90 day Expiry	N/A	

*If BDAR required has:

- at least one 'Yes': you have exceeded the BOS threshold. You are now required to submit a Biodiversity Development Assessment Report with your development application. Go to <https://customer.lmbc.nsw.gov.au/assessment/AccreditedAssessor> to access a list of assessors who are accredited to apply the Biodiversity Assessment Method and write a Biodiversity Development Assessment Report
- 'No': you have not exceeded the BOS threshold. You may still require a permit from local council. Review the development control plan and consult with council. You may still be required to assess whether the development is "likely to significantly affect threatened species' as determined under the test in s. 7.3 of the Biodiversity Conservation Act 2016. You may still be required to review the area where no vegetation mapping is available.

Where the area of impact occurs on land with no vegetation mapping available, the tool cannot determine the area of native vegetation cleared and if this exceeds the Area Threshold. You will need to work out the area of native vegetation cleared - refer to the BOSET user guide for how to do this.

On and after the 90 day expiry date a BDAR will be required.

Disclaimer

This results summary and map can be used as guidance material only. This results summary and map is not guaranteed to be free from error or omission. The State of NSW and Office of Environment and Heritage and its employees disclaim liability for any act done on the information in the results summary or map and any consequences of such acts or omissions. It remains the responsibility of the proponent to ensure that their development application complies with all aspects of the *Biodiversity Conservation Act 2016*.

The mapping provided in this tool has been done with the best available mapping and knowledge of species habitat requirements. This map is valid for a period of 30 days from the date of calculation (above).

Acknowledgement

I as the applicant for this development, submit that I have correctly depicted the area that will be impacted or likely to be impacted as a result of the proposed development.

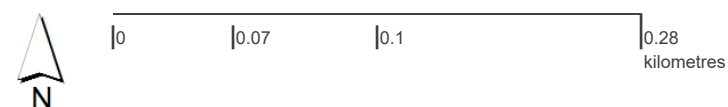
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Legend

- Native Vegetation Regulatory Map (in force)**

-  Category 2 - Vulnerable Regulated Land
-  Category 2 - Sensitive Regulated Land
-  Category 2 - Sensitive & Vulnerable Regulated Land
-  Land Excluded from Local Land Services Act 2013
-  Werriwa & Monaro CEEC Advisory Layer

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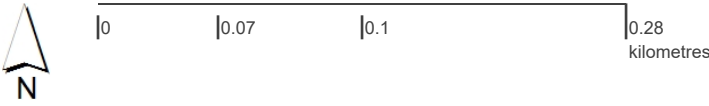
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Transitional Native Vegetation
Regulatory Map

Legend

- Cadastre
- Local Land Services Regions
- Local Government Area
- Native Vegetation Regulatory Map (in force)**
 - Category 2 - Vulnerable Regulated Land
 - Category 2 - Sensitive Regulated Land
 - Category 2 - Sensitive & Vulnerable Regulated Land
 - Land Excluded from Local Land Services Act 2013
 - Werriwa & Monaro CEEC Advisory Layer



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Biodiversity Development Assessment Report

*Kootingal 1C Solar Farm, New England
Highway, Kootingal, NSW 2353*

Prepared for

ITP Development Pty Ltd

Date: 9/8/2021



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Glossary & Acronyms

ACRONYM	DESCRIPTION
BAM	Biodiversity Assessment Methodology
BC Act	NSW <i>Biodiversity Conservation Act 2017</i>
BC Reg	NSW <i>Biodiversity Conservation Regulation 2017</i>
BDAR	Biodiversity Development Assessment Report
BCF	Biodiversity Conservation Fund
BCT	Biodiversity Conservation Trust
DA	Development Application
DoEE	Commonwealth Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDE	Groundwater Dependent Ecosystem
ha	hectare(s)
IBRA	Interim Bioregionalisation of Australia
km	kilometre
LGA	Local Government Area
masl	Metres above sea level
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
PEA	Preliminary Environmental Assessment
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
Subject land	Kootingal Solar Farm - 1599 New England Highway, Kootingal - (Lot 1 DP 328265 & Lot 97 DP 753841)
*	Denotes exotic species
†	Denotes both native and exotic

1 Introduction

1.1 Background

This Biodiversity Development Assessment Report (BDAR) relates to the proposed Kootingal 1C Solar Farm, New England Highway, Kootingal, NSW 2353 (**Figure 1**). The BDAR has been undertaken to accompany a Development Application (DA) under Part 4 of the Environmental Planning and Assessment Act 1979, to be submitted to Tamworth Regional Council. The entire site is to be developed comprising a solar farm and ancillary facilities with a DC capacity of 6.4MWp and an AC output of 5.0MW.

The development site is zoned RU4 Primary Production Small Lots under the Tamworth Regional Local Environmental Plan 2010 (LEP) and native vegetation to be removed as a part of the proposed Solar Farm development, means the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 applies to the proposed development.

The minimum lot size of the *RU4 Primary Production Small Lots Zone* permits <1 Ha of native vegetation to be cleared by the development, any losses exceeding 1 Ha will trigger the Biodiversity Offsets Scheme (BOS) threshold and a Biodiversity Development Assessment Report (BDAR) is required.

This BDAR has been prepared by Damian Wall, an Accredited Assessor (BAAS18081) under the BC Reg, and is consistent with the BAM (OEH 2017a). Sources of information for this report included:

- NSW Planning Portal (NSW Dept. of Planning and Environment 2018);
- BioNet Atlas of NSW Wildlife (NSW Office of Environment and Heritage 2018a);
- Namoi vegetation extant (VIS_ID 4028). The dataset shows extant vegetation of the Nandewar IBRA bioregion within the Namoi CMA. (OEH, 2018);
- State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0. VIS_ID 4467. The dataset shows the PCT vegetation of the Namoi CMA (OEH, 2018);
- NSW (Mitchell) Landscapes data - version 3.1; and
- SIX Maps (LPI 2021).

2 Proposed Development

The proposed development comprises a solar farm and ancillary facilities with a DC capacity of 6.4MWp and an AC output of 5.0MW at Lot 1 DP 328265 and Lot 97 DP 753841, 1599 New England Highway, Kootingal, NSW. There are proposed to be 12,100 solar modules installed in 140 rows running north to south. There is approximately 6.25 metres spacing between each row.

Two 3MW inverter stations will be installed at the solar farm mounted on a 12.2-metre-long skid. Each of these inverter stations incorporates high and moderate voltage switchgear and transformers. Each will connect by way of underground cables to the 11kV feeder line that connects to the electricity grid at the Essential Energy Kootingal Zone substation.

The solar modules are to be enclosed within a chain mesh steel security fence topped with three rows of barbed wire to a total height of 2.3 metres. The fence is to be setback a minimum of 30 metres from the northern boundary and surrounding the array. Solar arrays are to be setback a further 8 metres from the security fence giving a total setback to the private access road of 38 metres and 588 metres to the New England Highway boundary.

The proposed development is shown in **Figure 2**. In accordance with Section 7.4 of the BC Act the proposed development exceeds the biodiversity offsets scheme threshold as it will likely result in the loss of 3.2 ha of native vegetation.

For the purposes of this BDAR, the proposed development would require clearing of native vegetation for the purposes of the Solar Farm within the subject land.



Figure 1: Site location. Scale 1:5,000

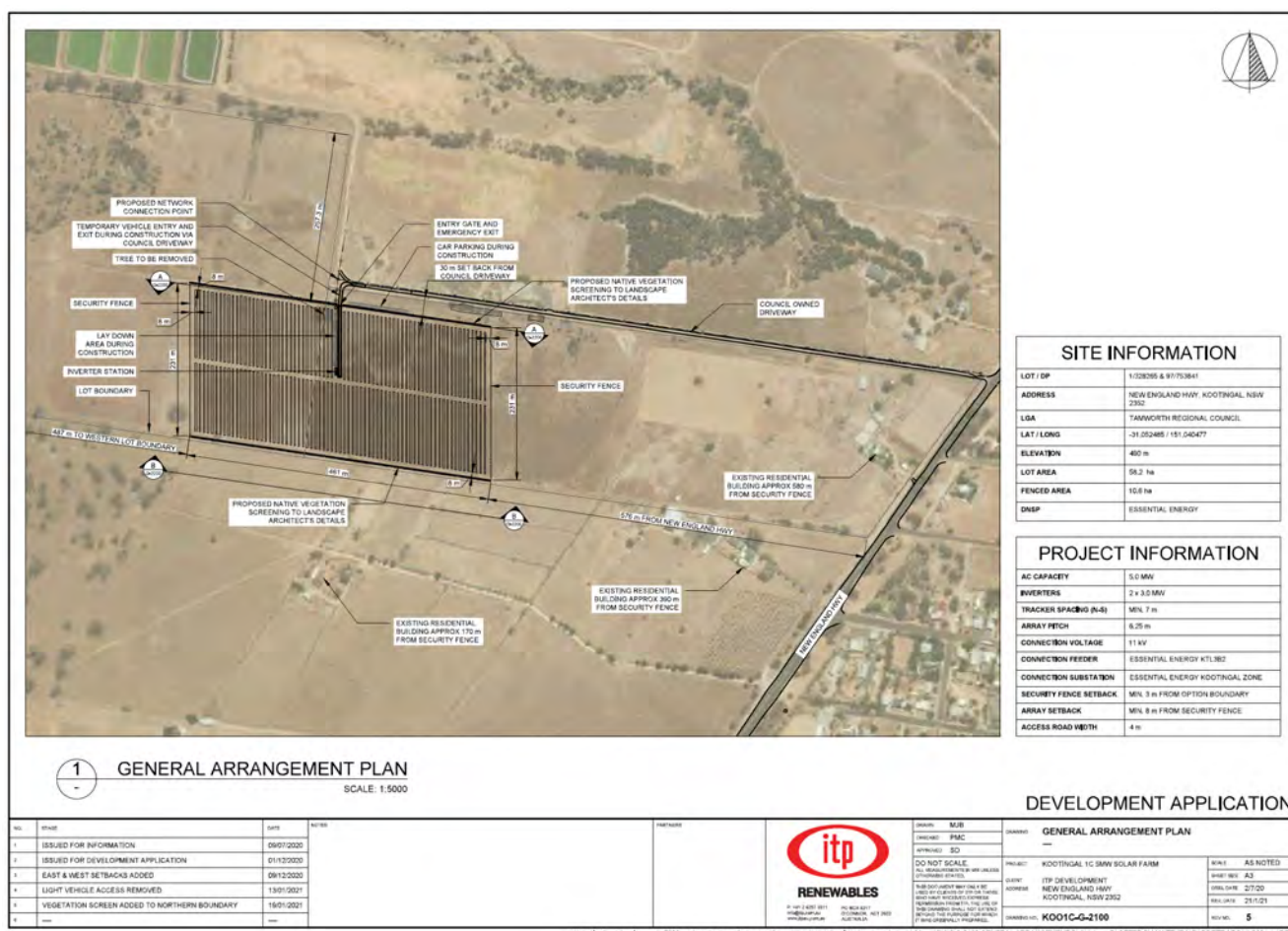


Figure 2: Proposed development footprint. Source: ITP Development Pty Ltd.

3 Landscape context

3.1 Identify Landscape Features

In accordance with the BAM, a number of features are assessed within and surrounding the subject site. Provided below are details related to IBRA region and subregion and NSW landscape regions (Mitchell Landscapes). Other features, such as rivers, streams, estuaries and wetlands, habitat connectivity, karst areas or areas of outstanding biodiversity value are considered where appropriate.

3.1.1 IBRA bioregions and IBRA subregions

Interim Biogeographic Regionalisation of Australia (IBRA) regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna species present. The subject land is located entirely within the Peel subregion (version 7) and within the Nandewar IBRA region (version 7).

3.1.2 NSW landscape regions (Mitchell Landscapes)

The subject site occurs in only one NSW Mitchell Landscape, being the 'Mooni – Walcha Granites' landscape (Mitchell Landscapes V3), **Figure 3**. The Mooni – Walcha Granites' Mitchell Landscape was entered into the BAM calculator due to it being the only Mitchell Landscape within the subject land.

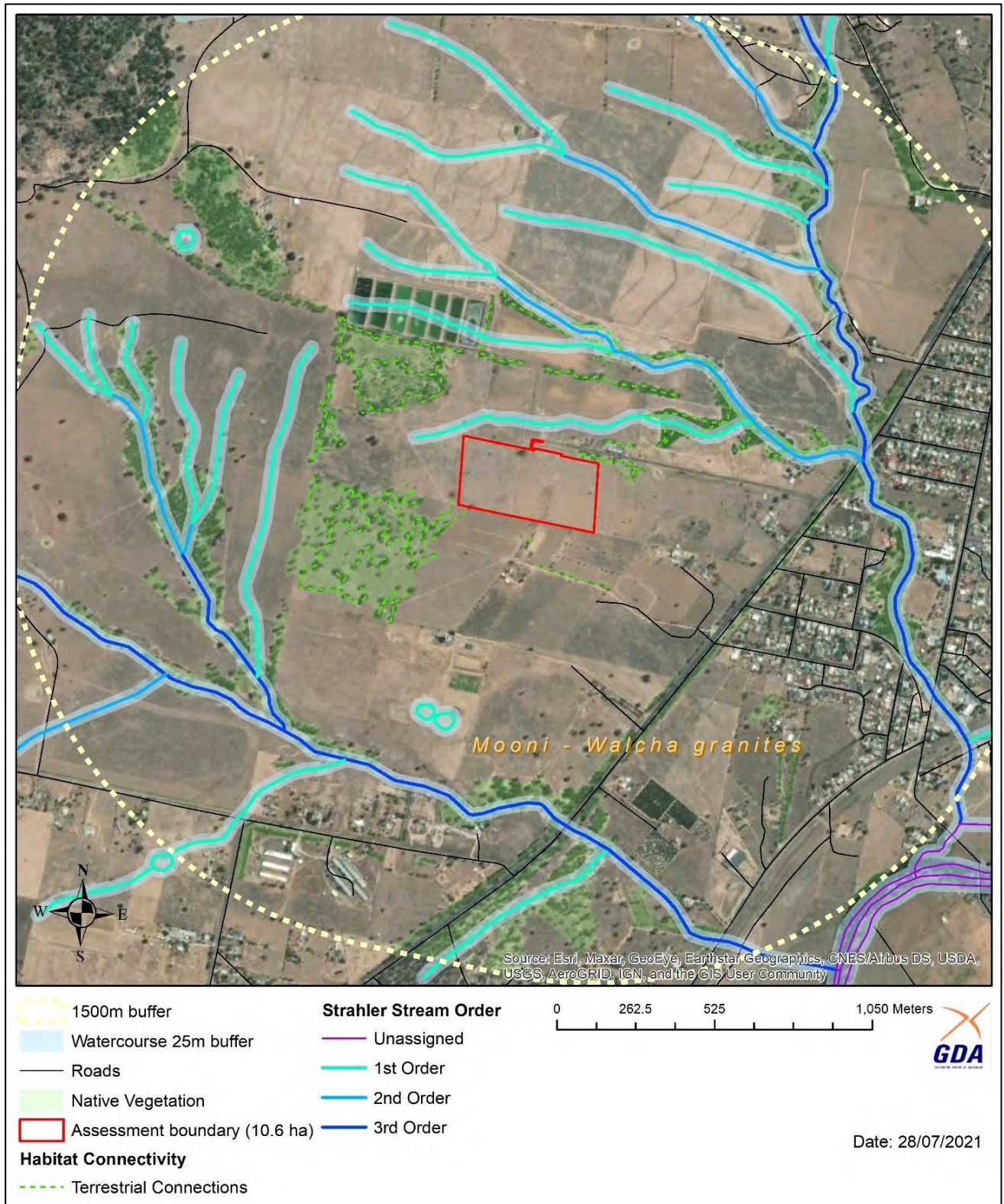


Figure 3: Location map showing Mitchell Landscape. Scale 1:16,000

3.1.3 Other features

Rivers, streams and estuaries

Multiple drainage lines are within the subject land and Sandy Creek and Middle Creek are mapped within the 1,500 m assessment circle (**Figure 3**). A desktop analysis using LPI data identified no major watercourses within the study area, however Sandy creek and Middle creek are both tributaries to the Cockburn River, just outside of the study area.

The site is generally a north aspect site that slopes gradually from West to East, eventually draining to the north east corner. Stormwater and overland flow eventually drains into Sandy Creek approximately 900m north of the area. No field validation of these streams was conducted and the mapped riparian buffers associated with the surrounding watercourses have been calculated in accordance with *Appendix 3* of the BAM.

3.2 Determining Site Context

3.2.1 Assessing native vegetation cover

A layer of native vegetation cover is required for a 1,500 m buffer around the study area to determine the context of the site. The extent of native vegetation on the subject site and immediate surrounds was mapped using the State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0. (VIS_ID 4467) and Namoi CMA vegetation extant map, 2013. (VIS_ID 4028) with edits made to the layer where obvious changes to vegetation extent had occurred.

The total area of the 1,500 m buffer around the study area is 925 ha, with the area of vegetation mapped within the buffer being 136 ha. This equates to a native vegetation cover of 22%, falling in the >10-30% class, which was entered into the BAM calculator.

3.2.2 Assessing patch size

Patch size as defined by the BAM as *'an area of native vegetation that:*

- a) occurs on the development site or biodiversity stewardship site, and*
- b) includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems).*

Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site. In assessing patch size, stands of native vegetation within 100 m (where in a moderate to good condition) but which are separated by hard barriers including permanent artificial structures, wide roads or other barriers have been treated as separate patches. These highly modified breaks in vegetation connectivity would significantly alter ecological function of these areas of native vegetation such that these areas warrant recognition as separate patches. Patch size was calculated for the vegetation on the development site using the field validated map of vegetation types identified and the updated native vegetation extent data layer prepared for the 1,500 m buffer (based on OEH 2015). Patch size is required to be assessed as one of four classes per vegetation zone mapped, being <5 ha, 5-24 ha, 25-100 ha or >100 ha.

No patches of moderate to good condition native vegetation (as defined by the BAM) were identified on site.

4 Native vegetation

Assessment and mapping of Plant Community Types (PCTs) were undertaken on the 28th July 2021. The study area was traversed to identify the vegetation structure and dominant species within the patch of native vegetation. The extent of the patch of vegetation was traversed to sample any spatial variation, identify boundaries between vegetation communities and to identify and map vegetation zones in accordance with the BAM (variation in the broad condition state of vegetation polygons).

Based upon traverses of the entire study area, a single vegetation community was identified, and its boundary was mapped. The floristics of the vegetation community was then sampled within 20x20 m plot-based floristic vegetation surveys, consistent with Section 5.2.1.9 of the BAM. The plot was also the location of a vegetation integrity plot in accordance with Section 5.3 of the BAM. The location of the floristic vegetation plot was based upon a randomly sampled area of the vegetation community, whilst ensuring that the plot-based survey included representative areas of the community and avoided, where possible, edge effects (i.e. located close to edges of vegetation extent) or ecotones with adjacent vegetation zones.

The identification of a PCT was in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification (OEH 2018). Determination of the most appropriate PCT for vegetation communities within the study area used the BioNet Vegetation Classification database to identify PCT types which matched the geographic distribution (based upon IBRA subregions), vegetation formation and floristics of vegetation within the subject land.

The data for the potential PCT including vegetation formation, descriptive attributes and distribution information were then reviewed to determine the most appropriate PCT for each of the vegetation community sampled within the subject land. Observations of vegetation structure and composition made during traverses of the study area as well as adjacent areas also informed the determination of most appropriate PCT for the vegetation community within the subject land.

It is noted that identification of vegetation communities and PCTs was complicated by the fact that field observations were of disturbed, fragmented and previously cleared stands of vegetation. Consequently, the identification of vegetation communities was based on expert opinion of an experienced observer of the Namoi Catchment vegetation types. Due to the highly modified state of the vegetation onsite, which was predominantly exotic pasture grasses with sparse occurrences of native forbs, grasses and scattered trees, a quantitative analysis was not undertaken or considered likely to provide accurate analysis of the PCTs present.

4.1 Plant community types (PCTs) and Threatened Ecological Communities

Review of previous vegetation mapping (State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0. VIS_ID 4467) did not identify any PCTs on the site, with the closest native vegetation community likely being PCT 589 *White Box - White Cypress Pine - Silver-leaved Ironbark grassy woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion*.

Identification of vegetation communities within the subject land and community nomenclature followed the vegetation classification of NPWS (2002). Based on the floristic composition of the vegetation in the study area, a single mixed exotic & native grass community, with varying condition classes, was identified (Figure 5).

Therefore, the subject land will not require assessment in accordance with the Significant Impact Guidelines Commonwealth Department of the Environment (DoE) (2013). A summary of the PCT within the subject land including areas of vegetation zones, the percent cleared for the PCT and Serious and Irreversible Impacts (SII) candidate entities is included in **Table 1**.

Table 1: Details of PCTs within the subject land including area of vegetation zones and candidate SII entities

Plant Community Types (PCTs)	Vegetation Formation & class	Vegetation zones	Area (ha)	PCT percent cleared	Threatened Ecological Communities (TECs)	SII candidate entity
Exotic vegetation, predominantly Coolatai Grass (<i>Hyparrhenia hirta</i>)	NA	Exotic vegetation	10.6	N/A	N/A	N/A

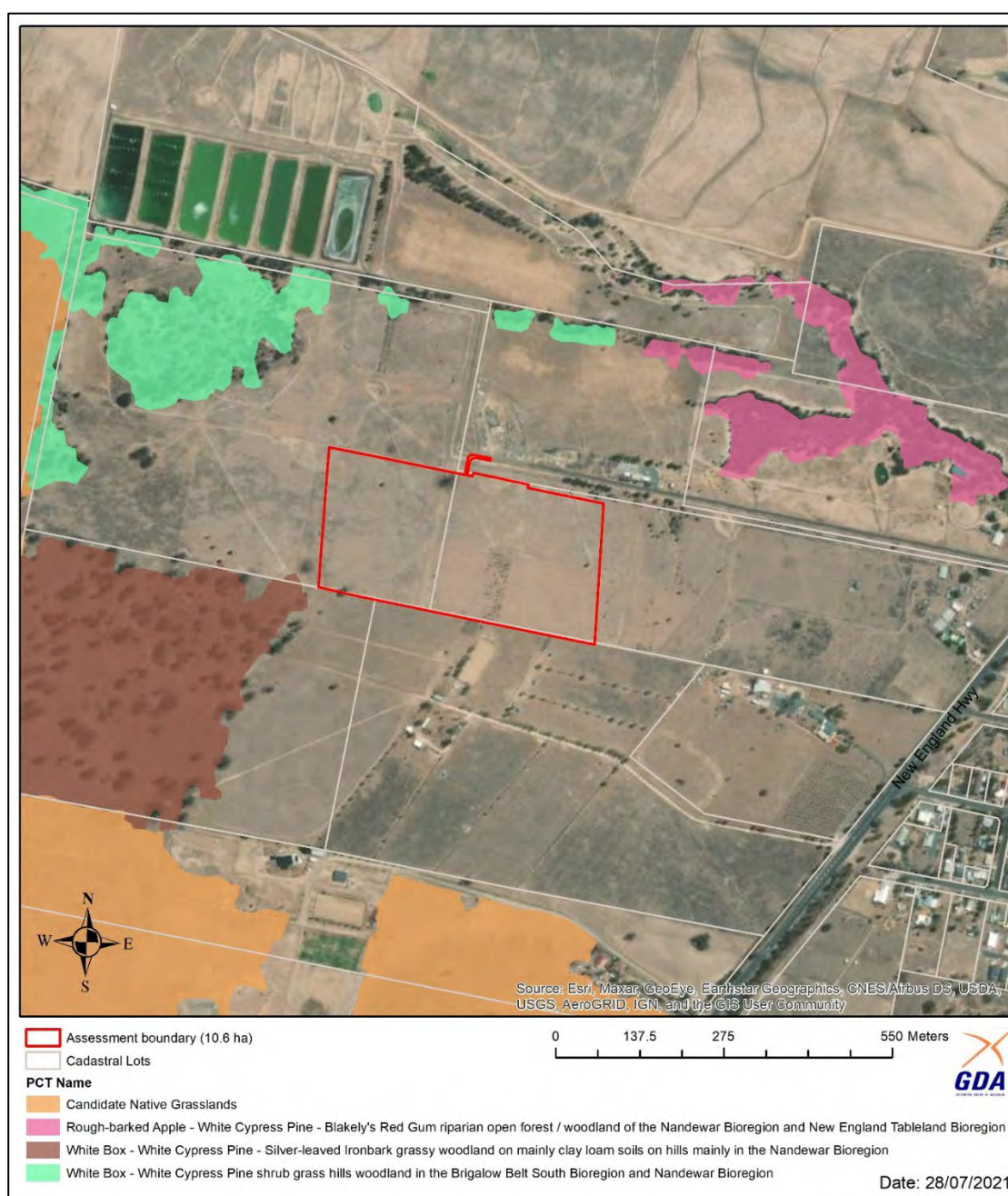


Figure 4: Vegetation types (State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0. VIS_ID 4467)

4.1.1 White Box - White Cypress Pine - Silver-leaved Ironbark grassy woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion (PCT 589)

Tall woodland to open forest (with *Callitris* regrowth) dominated by White Box (*Eucalyptus albens*) and White Cypress Pine (*C. glaucophylla*) and sometimes with Silver-leaved Ironbark (*E. melanophloia*) or Yellow Box (*E. melliodora*). The shrub layer is sparse and the ground layer is dense to mid-dense with a well developed mix of grasses and forbs. Grass species include *Austrostipa* spp., *Cymbopogon refractus*, *Dichanthium sericeum* subsp. *sericeum*, *Themeda australis*, *Aristida* spp., *Austrodanthonia bipartite* and *Eragrostis leptostachya*.

The invasive weed Coolatai grass (*H. hirta*) is a serious threat to this community and is the dominant groundcover in some areas.

None of this PCT persists on site but the classification was used in the BAMC . Evidence of past clearing, earthworks, horticulture practices and over grazing was identified on site and initial observations estimated the understorey in the loss zone is predominantly exotic (>90%, up to 100 % in some areas). The site is dominated by Coolatai grass and contained only 2 scattered trees.

Identification of the corresponding PCT was based on review of vegetation mapping and review the BioNet Vegetation Classification and specifically PCTs which occur within the Peel subregion within the Nandewar IBRA region (version 7) and included *Callitris* spp. as a dominant species. Based upon this search PCT 589 was identified as the most appropriate PCT based upon the floristic description and the description of it being a tall woodland with a sparse shrub layer and a dense grassy groundcover occurring on upper hillslopes and hillcrests.



Photo 1: Remnant White Box - White Cypress Pine - Silver-leaved Ironbark grassy woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion (PCT 589) outside the development area, on north boundary.

4.1.2 Other vegetation

Exotic vegetation over exotic pasture – cleared land

Exotic grassland dominated by Coolatai Grass (*Hyparrhenia hirta*) identified within the subject land and was not assigned to a native vegetation community or an equivalent PCT.

This grassland vegetation was noted to be 90% exotic species and included large areas throughout the subject land which have been subject to previous clearing and now support grasslands dominated by exotic grasses and herbaceous weeds including Annual rye (*Lolium rigidum*) with pockets of native species including Native Carrot (*Daucus glochidiatus*), and Rough speargrass (*A. scabra*).



Photo 2: Exotic grasslands dominated by Coolatai Grass (*Hyparrhenia hirta*) within the subject lands.



Figure 5: Validated vegetation (Red-Gum Environmental, 2021). Scale 1:4,000

4.2 Vegetation Zones

4.2.1 Condition classes, subcategories and areas

The PCTs identified within the development site were classified into a single loss zone being *Exotic vegetation over exotic pasture – cleared land* - for credit calculation purposes (**Figure 5**). The vegetation zone was based on the condition descriptions above with the area of the zone was the calculated area to me impacted by the proposed development (3.2 Ha) shown in **Table 2**.

Table 2: Vegetation integrity scores.

Veg zone number	Plant community type	Condition class	Area impacted (ha)	Veg integrity score – before development	Veg integrity score – after development
1	Exotic vegetation over exotic pasture – cleared land	Exotic grasslands – cleared	3.2	7.7	0

4.2.2 Vegetation integrity survey plots

While 'Exotic grasslands' was not identified as a native vegetation community or assigned a PCT, it was considered the 'loss area' therefore five (5) vegetation integrity survey plots were completed with all being used to meet the requirements of the BAM (**Appendix B** for data captured).

4.2.3 Current and future vegetation integrity scores

Vegetation integrity scores were calculated based on the vegetation integrity survey plot collected for the single vegetation zone assigned the loss site.

The vegetation integrity scores for the assessed zone is provided in **Table 2**. Vegetation integrity score for this zone was 7.7/100. The project will ultimately involve complete clearing of all vegetation and the default future vegetation integrity score of 0 was retained.

5 Threatened species

Section 6 of the BAM, details the process for determining the habitat suitability for threatened species.

Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species. Those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which a targeted survey has a low probability of detection, are identified as 'ecosystem' credit species. Targeted surveys are not required for ecosystem species and potential impacts to these species are assessed in conjunction with impacts to PCTs.

Threatened species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey are identified as 'species' credit species. A targeted survey or an expert report is required to confirm the presence or absence of these species on the subject land.

For some threatened species, they are identified as both ecosystem and species credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species may have foraging habitat as an ecosystem credit, while their breeding habitat represents a species credit.

The following sections outline the process for determining the habitat suitability for threatened species within the subject lands, and the results of targeted surveys for candidate threatened species.

5.1 Identify threatened species for assessment

Threatened species that require assessment are initially identified based upon the following criteria:

- The distribution of the species includes the IBRA subregion in which the subject land (Lower slopes IBRA subregion);
- The study area is within any geographic constraints of the distribution of the species within the IBRA subregion;
- The species is associated with any of the PCTs identified within the study area;
- The native vegetation cover within an assessment area including a 1,500m buffer around the study area is *equal to or greater than* the minimum required for the species;
- The patch size that each vegetation zone is part of is equal to or greater than the minimum required for that species; and
- The species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

The process for identifying threatened species which meet the above criteria is completed through the BAM Calculator. The PCTs identified within the study area, patch sizes and native vegetation cover, as outlined in **Section 3**, were entered into the BAM Calculator and a preliminary list of threatened species were identified.

5.2 Ecosystem Credit Species

The ecosystem credit species predicted on site are provided in **Table 3**. All ecosystem credit species were maintained in the assessment. Additionally, areas of exotic grassland were not considered as habitat for any ecosystem credit species.

Table 3: Ecosystem credit species predicted within the subject land.

Species / common name	NSW listing status* (BC Act)	National listing status* (EPBC Act)
<i>Anthochaera phrygia</i> Regent Honeyeater (Foraging)	CE	CE
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	V	-
<i>Chthonicola sagittate</i> Speckled Warbler	V	-
<i>Climacteris picumnus victoriae</i> Brown Treecreeper (eastern subspecies)	V	-
<i>Lathamus discolor</i> Swift Parrot (Foraging)	E	CE
<i>Melanodryas cucullata cucullate</i> Hooded Robin (south-eastern form)	V	-
<i>Petroica boodang</i> Scarlet Robin	V	-
<i>Petroica phoenicea</i> Flame Robin	V	-
<i>Stagonopleura guttata</i> Diamond Firetail	V	-
<i>Falco subniger</i> Black Falcon	V	-
<i>Calyptrorhynchus lathamii</i> Black Cockatoo	V	-
<i>Pteropus poliocephalus</i> Grey-headed Flying fox	V	V
<i>Phascolarctos cinereus</i> Koala	V	V
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat	V	-
<i>Glossopsitta pusilla</i> Little Lorikeet	V	-
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	V	E
<i>Haliaeetus leucogaster</i> White-bellied Sea Eagle	V	M
<i>Hirundapus caudacutus</i> White-throated Needletail	V	V

* CE – Critically Endangered; E – Endangered; V – Vulnerable, M - Migratory

5.3 Species credit species

As outlined in Section 5.2, species credit species are predicted in the BAM Calculator following assessment of geographic and habitat features in the credit calculator, such as site location (IBRA subregion), PCTs and condition, patch size and the area of surrounding vegetation within the 1,500 m buffer of the study area.

Some species require further assessment of habitat constraints and/or geographic limitations before being confirmed as candidate species for assessment. **Table 4** outlines the questions asked for these species, and whether the species is confirmed as a candidate species.

Table 4: Assessment of habitat constraints and geographic limitations.

Scientific Name / Common Name	Habitat constraints / Geographic limitations	Response to BAM Tool question	Maintained as candidate species
<i>Acacia atrox</i> Myall Creek Wattle	On the upper slope and crest of a low hill.	No (surveyed)	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)
<i>Dichanthium setosum</i> Bluegrass	Disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched	No (surveyed)	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)
<i>Digitaria porrecta</i> Finger Panic Grass	Commonly associated tree species are <i>E. albens</i> and <i>Acacia pendula</i> .	No (surveyed)	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)
<i>Homopholis belsonii</i> Belson's Panic	Grows in dry woodland (e.g. Belah) often on poor soils. Site heavily degraded.	No (surveyed)	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)
<i>Picris evae</i> Hawkweed	Grows in open Eucalypt forest with a <i>Dichanthium</i> grassy understory. Site heavily degraded	No (surveyed)	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)
<i>Prasophyllum</i> sp. Wybong Prasophyllum sp. Wybong	Occurs in open eucalypt woodland and grassland, site however is heavily degraded.	No (surveyed) *Survey months are outside of the months specified in Bionet.	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)
<i>Thesium australe</i> Austral Toadflax	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>).	No (surveyed)	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)
<i>Tylophora linearis</i> Tylophora linearis	Dry eucalypt/Callitris woodlands Altitudes are generally in the range of 300 - 400 m a.s.l.	No (surveyed)	No. Habitat substantially degraded such that species is unlikely (Section 6.4.1.17)

5.4 Identify candidate species credit species for further assessment

In accordance with Section 6.4.1.17 of the BAM, a predicted candidate species can be considered unlikely to occur within the subject land (or specific vegetation zones) where habitat is substantially degraded such that the species is unlikely to utilise area, or where an expert report identifies that the species is unlikely to be present within the subject land (or a vegetation zone within the subject land).

A predicted candidate species credit species that is not considered to have suitable habitat on the subject land (or specific vegetation zones) does not require further assessment on the subject land (or specific vegetation zones). The reasons for determining that a predicted species credit species is unlikely to have suitable habitat on the subject land (or specific vegetation zones) must be documented.

As discussed in **Section 3**, much of the vegetation within the subject land has been previously cleared, is fragmented and subject to set-stocking which would represent substantial degradation for selected species credit species. To inform an assessment of how habitat degradation has impacted candidate threatened species a search of the Atlas of NSW Wildlife (OEH 2018a) was undertaken for a 10 km radius around the study area. Using these Atlas results, the likelihood of occurrence of candidate threatened species was assessed by:

- Review of location and date of recent (<5 years) and historical (>5-20 years) records;
- Review of available habitat within the subject land and surrounding areas;
- Review of the scientific literature pertaining to each species and population; and
- Applying expert knowledge of each species

The potential for each threatened species, population and/or migratory species to occur was then considered following review of location and date of records of threatened species, available habitat within the subject land, and the condition of such habitat. **Table 5** outlines the predicted candidate species which were deemed to not have suitable habitat within the study area, including justification for this decision.

Table 5: Candidate species for which the subject land is not considered suitable habitat.

Species	Justification*
FAUNA	
<i>Phascolarctos cinereus</i> (Koala) (Breeding)	The nearest record of this species is approximately 2 km south of the subject land in 2006. Location notes stated that: <i>Koala observed in tree by WIRES members, dogs had Koala bailed up.</i> No suitable habitat on site as the scattered trees to be removed do not form part of connected vegetation, nor are they suitable food species for koala.
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Breeding)	The nearest record of this species is approximately 1.7 km south-east of the subject land in 2013. Noted to be encountered due to entanglement. No suitable breeding habitat within the site or surrounding area.
<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle) (Breeding)	No large stick nests observed within subject land. No recorded sightings in BioNET (10km buffer).

Species	Justification*
FAUNA	
<i>Litoria booroolongensis</i> Booroolong Frog	The nearest record of this species is approximately 1.6 km south-east of the subject land in 2017. Noted as trapped during an opportunistic stream search. No suitable habitat with the subject land as site contains no watercourses. May still be present within the broader study area.
<i>Uvidicolus sphyrurus</i> Border Thick-tailed Gecko	Requires forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. As site is significantly degraded, there is no suitable habitat on site. No recorded sightings in BioNET (10km buffer).
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	No suitable trees on site for nesting as well as lack of connected vegetation on site, suggests habitat on site is unsuitable. May be present in surrounding study area. No recorded sightings in BioNET (10km buffer).
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo	Preferable sheoak trees such as Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak are absent from site. No suitable nesting sites that form connected vegetation. No recorded sightings in BioNET (10km buffer).
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat	No suitable roosting sites on site or broader study area. Site does not have enough tree coverage regardless. No recorded sightings in BioNET (10km buffer).
<i>Anthochaera phrygia</i> Regent Honeyeater	The nearest record of this species is approximately 4.7 km south-west of the subject land in 2003. No notes on the record were provided. No suitable habitat on site as the scattered trees on site are not favoured by the species and they do not form connected vegetation.
<i>Petaurus norfolcensis</i> Squirrel Glider	No suitable habitat on site as the scattered trees to be removed do not form connected vegetation required by the species. No recorded sightings in BioNET (10km buffer).
<i>Lathamus discolor</i> Swift Parrot	The nearest record of this species is approximately 3.2 km south-west of the subject land in 2007. No notes on the record were provided. Occur when eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. However, there is no favoured feed trees on site and habitat is significantly degraded, making site unsuitable.
Tusked Frog population in the Nandewar and New England Tableland Bioregions	They are usually found near creeks, ditches and ponds, nests under leaf litter or other cryptic sites such as old yabbie burrows near or in water. Habitat on site is heavily degraded and lacking suitable water habitats. No recorded sightings in BioNET (10km buffer).

* Unless otherwise stated, habitat information is sourced from OEH (2018b)

5.5 Determine presence or absence of a candidate species credit species

Confirmed candidate species were assessed consistent with Steps 4-6 of Section 6.4 of the BAM. Targeted surveys for species credit species were undertaken in accordance within section 6.5 of the BAM, including undertaking surveys during the nominated survey period specified for each candidate species and in accordance with OEH threatened species survey guidelines. The survey effort, timing and locations for threatened flora and fauna are outlined in the following sections.

5.5.1 Targeted field surveys - flora

Following vegetation survey and habitat assessment undertaken on 11/01/2021 & 1/4/21 the subject land was considered too degraded to retain any habitat for candidate flora species credit species in accordance with Section 6.4.1.17 (**Table 5**). No candidate threatened flora species were recorded on the subject land.

5.5.2 Targeted field surveys – fauna

Targeted surveys for candidate threatened fauna species were conducted following modelled results from the BAMC (**Table 6**). **Table 7** is a summary of methodologies employed on site over two (2) days and one (1) night from 11/01/2021 & 1/4/21¹. All survey was conducted by Damian Wall (Red-Gum Environmental Consulting).

Impromptu surveys for three species were also conducted throughout March 2021, however for shorter periods than the original field work stage. These visits were primarily for other native vegetation assessment requirements and fauna survey was opportunistic and not structured as per the Jan and April 2021 surveys.

Table 6: Survey periods for candidate threatened fauna species (BAMC)

Name	Presence	Survey Months
<i>Acacia atrox</i> Myall Creek Wattle	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☒ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Dichanthium setosum</i> Bluegrass	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☒ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Digitaria porrecta</i> Finger Panic Grass	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

¹ Survey effort was guided by the 2018 OEH publication 'Field survey methods for environmental consultants and surveyors when assessing proposed developments or other activities on sites containing threatened species'.

<i>Homopholis belsonii</i> Belson's Panic	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☒ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Picris evae</i> Hawkweed	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Prasophyllum sp. Wybong</i> Prasophyllum sp. Wybong	No (surveyed) *Survey months are outside of the months specified in Bionet.	☒ Jan ☐ Feb ☐ Mar ☒ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☒ Survey month outside the specified months?
<i>Thesium australe</i> Austral Toadflax	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Tylophora linearis</i> Tylophora linearis	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☒ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Table 7: Survey methodology

Intended Target	Methodology	Survey Period Notes
Diurnal Birds (Swift Parrot, Square-tailed Kite, Superb Parrot, Regent Honeyeater, Gang-gang Cockatoo.)	Area search, where the observer walked the length of the site twice in its entirety.	Conditions on the 11 th Jan, 28°C, light wind & partly cloudy. Conditions on the 1/4/21, 13°C, partly cloudy. Minimal observation count. Many peri-urban species including Noisy Miner, House sparrow and black birds co-existing with Magpies, Larks and Red-Wattle Bird.
	Point Count method, where observations were made from 3 points for 20 minutes each.	Two (2) point count sites (Figure 6) were visited as close to 6am, 12pm and 6pm each as the 20 minute survey period allowed over the 2 days.
Nocturnal Birds (Masked Owl)	Day habitat search. Search habitat for pellets, and likely hollows.	Conditions were light wind & clear. No hollows were observed and no scats found. No stick nests observed.
	Stag-watching. Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.	1 large tree on site was targeted during the one-night survey. Temps ranged from 13 to 20 °C. and conditions were clear. Play-back method was employed for 1 hr at 2 sites.
Mammals (Squirrel Glider)	Spotlighting on foot – 2hrs hour walking the site on 1 night.	Entire site was traversed twice with hand-held spotlight and periodic stops to focus on the single large tree momentarily.
	Stag-watching. Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.	The one potential habitat tree on site was targeted for night-time survey together with its immediate surrounds.

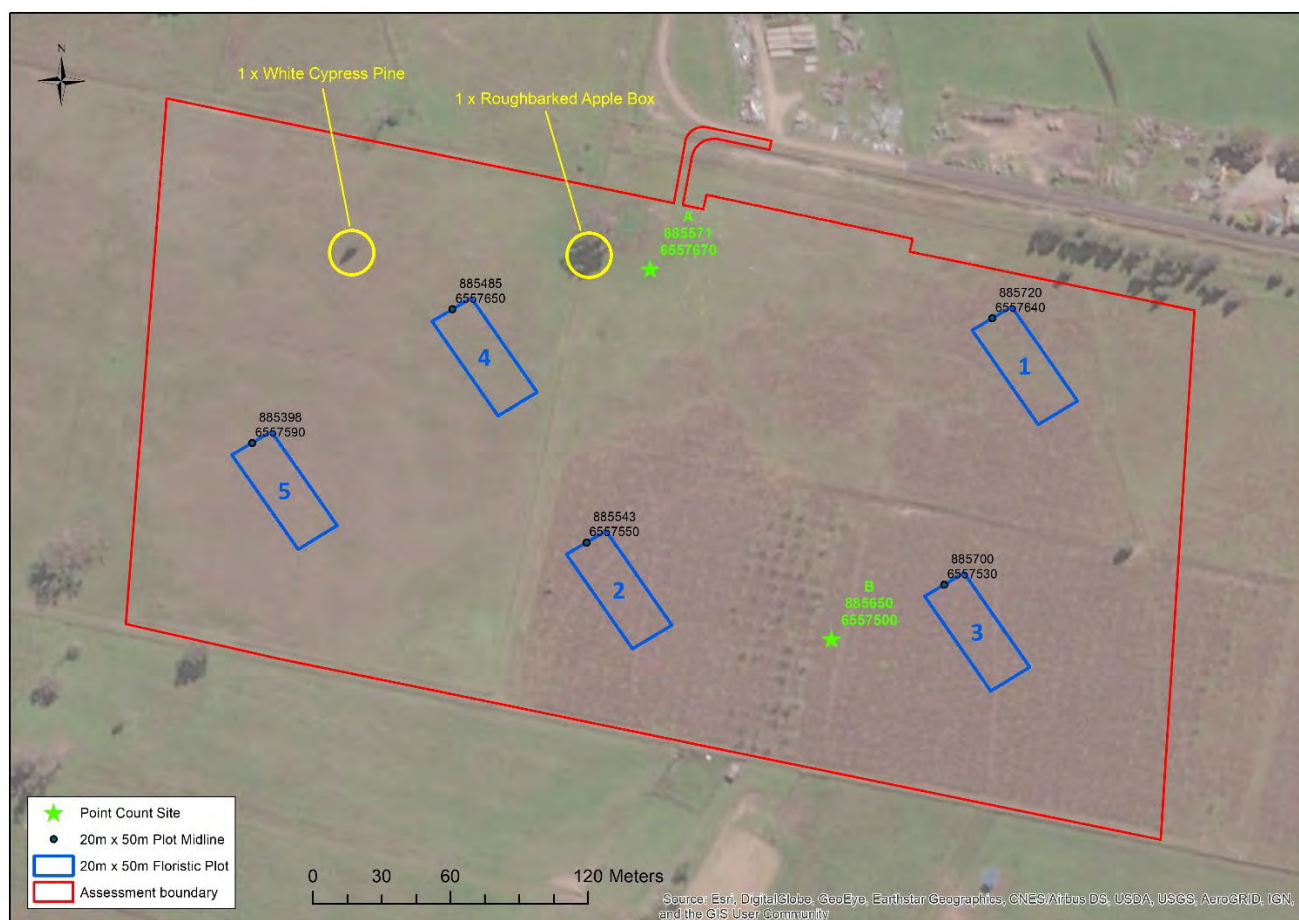


Figure 6: Point Count survey sites

6 Avoiding and minimising impacts on biodiversity values

6.1 Avoiding & minimising impacts on native vegetation and habitat during project planning

A total of 3.2 Ha of highly degraded mixed exotic and native grassland will be impacted by the proposal.

These impacts will occur to highly modified and degraded vegetation zones, which have been subject to previous clearing, heavy grazing, horticulture practices and invasion by highly competitive exotic pasture grasses. Accordingly, the vegetation integrity scores calculated for vegetation zones within the subject land are extremely low (see **Section 7**).

The impacts associated with the project, including the clearing of native vegetation, will be contained to that part of the site shown in **Figure 1**. The clearing zone will be clearly delineated before works commence to avoid impacts to connected areas of native vegetation and any other land not within the development footprint.

6.2 Avoiding & minimising prescribed biodiversity impacts during project planning

No prescribed biodiversity impacts are anticipated from the proposed development.

7 Assessing and offsetting impacts

7.1 Assessment of impacts

7.1.1 Assessing impact to native vegetation and habitat, threatened ecological communities and threatened species habitat

The direct clearing and subsequent development of the subject land would not likely represent a permanent impact, or loss, of native vegetation and habitat on site.

7.1.2 Assessing indirect impacts on native vegetation and habitat

It is difficult to quantify indirect impacts associated with the project, but these may include impacts such as noise and/or erosion associated with the construction phase of the project. The location of the subject lands adjacent to existing urban infrastructure and supporting highly modified native vegetation is considered unlikely to have inadvertent impacts on adjacent areas of native vegetation and habitat.

Given the highly modified nature of the subject land and broader locality, and its proximity to urban areas, the project is considered unlikely to reduce viability of any adjacent native vegetation or habitat due to edge effects, noise dust or light spill, or disturbance to breeding habitats.

Changes to the drainage and hydrology of the subject land may have an impact on downstream habitats. Measures to mitigate and manage indirect impacts are discussed in **Section 7.3**.

7.2 Assessing prescribed biodiversity impacts

No prescribed biodiversity impacts are anticipated from the proposed development.

7.3 Mitigating & managing impacts on biodiversity values

As described above, the project has been situated to minimise impacts to native vegetation where achievable. However, it has not been possible to avoid the 2 remaining scattered trees, which are generally found as individual trees over exotic pasture. Several measures will be implemented to reduce impacts where possible, such as appropriate pre-clearance protocols, habitat augmentation and a CEMP. Details are provided below.

7.3.1 Preclearance protocols

Several non-threatened fauna species such as birds and amphibians are likely to be present at the development site. Appropriate pre-clearance protocols will be put in place at the time of construction to avoid and mitigate any potential harm or injury to these individuals. These protocols will include, as a minimum, pre-clearance surveys and soft-felling techniques and clearing supervision where habitat trees are appropriate. These measures should be included as a component of the CEMP.

7.3.2 Habitat augmentation & monitoring

Nest box installation

Nest boxes are not a viable option to augment lost habitat given that the scale of the development will not leave sufficient area or trees to install boxes.

Pre-clearance Protocols

Pre-clearance for trees with hollows will be conducted, with hollows to be felled during the construction phase will be felled in accordance with the following procedures:

- Felling will be supervised by a fauna specialist appropriately licensed under the *NSW National Parks and Wildlife Act 1974*, for the purpose of rescuing displaced fauna;
- An appropriately skilled local wildlife carer must be notified at least 24 hours prior to the tree felling, that animals may be captured and that these animals may need care;
- Any non-hollow bearing trees around those with tree hollows to be felled will be removed first. At least 1 day will be left between clearing of the non-hollow-bearing trees and the hollow bearing trees to allow fauna time to vacate the trees;
- Prior to felling of the identified and marked hollow-bearing trees, the trees will be shaken or nudged by tree felling equipment to encourage any fauna to vacate the trees;
- If no animals emerge from the hollows after shaking or nudging, then the tree will be felled and lowered to the ground if possible;
- If an animal emerges from a hollow following shaking or nudging of the tree, then at least 30 minutes will be allowed for the animal to leave the tree. If the animal comes to the ground, or when it is on the lower trunk, attempts will be made to capture the animal using a net. Captured animals will be immediately transferred to a suitably sized cotton bag and checked for obvious injury during the transfer process;
- Captured animals will be placed in individual bags unless they are a family group to which separation would risk the survival of the young (i.e. lactating female with young);
- Once the tree has been felled, a search will be made of the branches around the tree for any fleeing fauna and hollows should be inspected with a torch for the presence of any animals. Attempts will be made to capture any fleeing fauna with a net, and animals inside hollows should be extracted by hand. Captured animals will be immediately transferred to a suitably sized cotton bag and checked for obvious injury during the transfer process;
- Injured, shocked or immature captured animals will be placed in a cotton bag secured at the top. Bags will be wrapped in appropriate insulating material such as blankets and placed in a quiet, warm and preferably dark place until the wildlife carer can collect them. Details on the location of the capture and proposed release areas will be provided to the wildlife carer; and
- Uninjured animals will be released in appropriate habitat as soon as practicable (at night for nocturnal species).

7.3.3 Wildlife management plan

A *Wildlife Management Plan* is not considered warranted at this site.

7.3.4 Construction Environmental Management Plan (CEMP)

To avoid potential indirect offsite impact during construction, an appropriate erosion and sedimentation control plan should be in place following best practice protocols such as Landcom (2004). It is recommended that this is included in a site CEMP, prior to any construction works taking place.

The CEMP will be required to span the pre, during and post-construction period, and will include the above pre-clearance and fauna management protocols.

7.4 Adaptive management for uncertain impacts

Excluding the need for a CEMP, no additional adaptive management measures are proposed.

7.5 Thresholds for the assessment and offsetting of impacts of development

7.5.1 *Serious and Irreversible impacts*

White Box - White Cypress Pine - Silver-leaved Ironbark grassy woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion (PCT 589) has not been identified as an SAI entity in the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017b) or within the BioNet database as entities at risk of a serious and irreversible impact. PCT 589 will not be affected by the proposal.

7.5.2 *Impacts which require an offset*

Given that the Vegetation integrity score for the lost vegetation is below the thresholds provided in Section 9.2 of the BAM, an offset liability is not required for impacts to this vegetation.

7.5.3 *Impacts that do not require further assessment*

As outlined above, impacts to those areas mapped as 'Exotic/Degraded grassland' do not require or warrant offsetting and entry into the BOS.

8 References

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- Department of Finance and Services (NSW) (2020). *Spatial Information eXchange*. Online resource available at: <https://maps.six.nsw.gov.au/>, accessed July 2021.
- Department of Planning and Environment (NSW) (2018). *NSW Planning Portal*. Online database available at: <https://www.planningportal.nsw.gov.au/find-a-property>, accessed July 2021.
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- Simpson, K. and Day, N. (eds) (1993). *Field Guide to the Birds of Australia*. Viking O'Neil, Victoria.
- Threatened Species Scientific Committee (TSSC) 2015, Advice to the Minister for the Environment and Heritage from the on Amendments to the List of Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

9 Appendix

Appendix A: Vegetation integrity plot data – field sheets

BAM Site – Field Survey Form						Site Sheet no: 1	
Date		Survey Name		Zone ID		Recorders	
Zone		Kootingal				D. wall	
Datum		Plot ID		1-5		Photo #	
Easting		Northing		IBRA region		Midline bearing from 0 m	
				BBS			
Vegetation Class		Grassland				Confidence: H M L	
Plant Community Type		Maybe 435 is closest				EEC: N (1) Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)		Sum values
Count of Native Richness	Trees	—
	Shrubs	—
	Grasses etc.	2
	Forbs	4
	Ferns	—
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	—
	Shrubs	—
	Grasses etc.	95
	Forbs	5
	Ferns	—
	Other	—
High Threat Weed cover		55-85%

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	30	30	30	15	25															
Average of the 5 subplots	25																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (density, native stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m ² plot: Sheet 1 of 1		Survey Name	Plot Identifier	Recorders			
Date		Kootingal	1-5	D. Wall			
GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher	
(P1) → (P3)							
H	3 Yellow Burr-daisy	N	0.1	100	G		
H	4 New Holland daisy	N	5	200			
H	5 tufted blue bell	N	5	200			
H	6 Native carrot	N	10	500			
G	7 Rough Speargrass	N	25	7500			
G(E)	8 Coolatai	HTE	25	71000			
G(E)	9 Annual Kye	E	25	7000	↓		
	10						
	11						
(P4)							
	12						
	13						
G(E)	14 Coolatai	HTE	50	71000	G		
G(E)	15 Annual Kye	E	10	7500			
H	16 Native carrot	N	5	500			
H	17 New Holland daisy	↓	10	100			
G	18 Slender Rat-tail grass	↓	20	500	↓		
H	19 Tufted blue bell		5	200			
	20						
(P5)							
	21						
	22 Coolatai	HTE	85	71000	G		
	23 Slender Rat-tail grass	N	10	500	↓		
	24 New Holland daisy	N	5	100			
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF – circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Appendix B: Flora observed in BAM plots

Genus	Species	Common name	Native/Exotic	Growth form	% Foliage Cover					High Threat Weed
					BAM1	BAM2	BAM3	BAM4	BAM5	
<i>Calotis</i>	<i>lappulacea</i>	Yellow Burr Daisy	Native	Herb	0.1	0.1	0.1			
<i>Vittadinia</i>	<i>muelleri</i>	New Holland Daisy	Native	Herb	5	5	5	10		
<i>Wahlenbergia</i>	<i>capillaris</i>	Tufted Blue Bell	Native	Herb	5	5	5	5	5	
<i>Daucus</i>	<i>glochidiatus</i>	Native Carrot	Native	Herb	10	10	10	5		
<i>Stipa</i>	<i>scabra</i>	Rough Spear Grass	Native	Grass	25	25	25			
<i>Lolium</i>	<i>Sp</i>	Rye grass	Exotic	Grass	25	25	25	10		
<i>Hypericum</i>	<i>gramineum</i>	Small St. John's wort	Native	Herb						
<i>Sporobolus</i>	<i>creber</i>	Slender Rats-Tail Grass	Native	Grass				20	10	
<i>Hyparrhenia</i>	<i>hirta</i>	Coolati Grass	Native	Grass	25	25	25	50	85	X
<i>Avena</i>	<i>fatua</i>	Wild oats	Exotic	Grass						
<i>Bromus</i>	<i>Sp</i>	Brome grass	Exotic	Grass						
<i>Vulpia</i>	<i>Sp.</i>	Silver grass	Exotic	Grass						
<i>Hypochaeris</i>	<i>radicata</i>	Cats ear daisy	Exotic	Herb						
<i>Dactylis</i>	<i>glomerata</i>	Cocksfoot	Exotic	Grass						
<i>Silybum</i>	<i>marianum</i>	Milk thistle	Exotic	Herb						
<i>Briza</i>	<i>minor</i>		Exotic	Herb						X
<i>Trifolium</i>	<i>arvense</i>	Hare's-foot clover	Exotic	Forb						
<i>Phalaris</i>	<i>Sp</i>		Exotic	Grass						X
<i>Cynosurus</i>	<i>echinatus</i>	Rough dogs-tail	Exotic	Grass						

Appendix C: Fauna observed (11th Jan 2021 & 1st April 2021)

Common Name	Species Name	Point Count Site A	Point Count Site B	Stags & spotlighting (night survey)
Australian Magpie	<i>Cracticus tibicen</i>	Y	Y	
Australian Raven	<i>Corvus coronoides</i>	Y	Y	
Australian White Ibis	<i>Threskiornis molucca</i>		Y	
Australian Wood Duck	<i>Chenonetta jubata</i>		Y	
Common Blackbird*	<i>Turdus merula</i>	Y	Y	
Common Starling*	<i>Sturnus vulgaris</i>	Y	Y	
Crested Pigeon	<i>Ocyphaps lophotes</i>			
Eastern Rosella	<i>Platycercus eximius</i>	Y		
Galah	<i>Eolophus roseicapillus</i>	Y	Y	
House Sparrow*	<i>Passer domesticus</i>	Y	Y	
Noisy Miner*	<i>Manorina melanocephala</i>	Y	Y	
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	Y		
Tree Martin	<i>Petrochelidon nigricans</i>	Y		
Welcome Swallow	<i>Hirundo neoxena</i>			
Willie Wagtail	<i>Rhipidura leucophrys</i>	Y		
Cat*				Y
Total count		11	9	

* Exotic species

Appendix D: BAM Calculator reports



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00026856/BAAS18081/21/00026857	Kootingal Solar Farm	10/06/2021
Assessor Name	Assessor Number	BAM Data version *
Damian James Wall	BAAS18081	45
Proponent Names	Report Created	BAM Case Status
	26/07/2021	Open
Assessment Revision	Assessment Type	Date Finalised
0	Clearing (General)	To be finalised
BOS entry trigger	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BOS Threshold: Area clearing threshold		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

Assessment Id	Proposal Name	Page 1 of 3
00026856/BAAS18081/21/00026857	Kootingal Solar Farm	



BAM Biodiversity Credit Report (Like for like)

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
589-White Box - White Cypress Pine - Silver-leaved Ironbark grassy woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion	Not a TEC	3.2	0	0	0

Assessment Id	Proposal Name	Page 2 of 3
00026856/BAAS18081/21/00026857	Kootingal Solar Farm	



BAM Biodiversity Credit Report (Like for like)

589-White Box - White Cypress Pine - Silver-leaved Ironbark grassy woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Western Slopes Grassy Woodlands This includes PCT's: 201, 202, 266, 267, 274, 275, 276, 277, 278, 280, 282, 283, 286, 301, 337, 383, 426, 433, 437, 441, 444, 483, 509, 516, 589, 590, 593, 599, 847, 955, 1303, 1304, 1315, 1329, 1383, 1695	Western Slopes Grassy Woodlands >=70% and <90%	589_poor	No	0	Peel, Eastern Nandewars, Hunter, Inverell Basalts, Kaputar, Liverpool Plains, Liverpool Range, Northern Basalts, Tomalla and Walcha Plateau. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

Assessment Id

00026856/BAAS18081/21/00026857

Proposal Name

Kootingal Solar Farm

Page 3 of 3

Mr Zaed Aznam
ITP Development
Project Manager – Planning
PO Box 6127
O'Connor, ACT 2602



By email on 11th January, 2021

***Re: Biodiversity inspection report – Kootingal 1C Solar Farm, New England
Highway, Kootingal, NSW 2353***

Dear Zaed,

Thank-you for the opportunity to assist with the project. Please be advised that in this engagement, I am assuming the role of your Ecological Consultant and Biodiversity Assessment Method (BAM) Accredited Assessor. I confirm that I am listed on the Biodiversity Assessment Method (BAM) Accredited Person database.

Desk-top review

Database searches concluded that the likely Plant Community Type (PCT) adjacent to the area is either PCT 435, White Box-White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion or PCT 544 Rough-barked Apple-White Cypress Pine-Blakely's Red Gum riparian open forest woodland of the Nandewar Bioregion and New England Tableland Bioregion. Aerial photography confirmed that as at 11/1/2021 the entire site is likely cleared of native shrubs and trees, but native grasses may persist under a likely grazing regime (i.e. nil cropping evident). Review of the site plans showed that native vegetation removal has been minimised through detailed design, which avoids one of the two large Rough-barked Apple (*Angophora floribunda*) in the west of the site. Pre-inspection database searches revealed that zero sightings of Koala (*Phascolarctos cinereus*) have been recorded in and around the site.

Site inspection

Site inspection on 11/01/2021 was conducted mid-afternoon and extended into the early evening. Conditions were clear and 27°C. I confirm that the one (1) tree proposed for removal within the designated 'clear zone' have been thoroughly inspected in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*. The following observations were made at the time of inspection:

1. The single large tree (*Angophora floribunda*) is hollow bearing but not considered viable Koala habitat given it's declining health (senescent) and isolation from core native vegetation patches in the area (**Photo 1**);
2. If any threatened native fauna (birds) are present (in particular Grey-crowned Babbler & Superb Parrot) they were not recorded during survey on the loss site on 11/01/2021 and the nesting period for these species is closed (both typically breed between June and December) meaning that the possibility of harming a fledgling is unlikely.
3. The site is a highly modified grazing paddock with some native grasses present and an obvious history of horticulture (**Photo 2**);
4. The development will not impact on the high conservation value vegetation in the north west of the site (**Photo 3**).
5. The site has had obvious disturbance in the form of horticulture pursuits since abandoned (**Photo 4**).
6. No Koalas, scats or other evidence of use of this zone or the development site were recorded in 5 hours of survey effort.

Summary of Findings

Typical home ranges are from 2ha of connected vegetation to hundreds of hectares. Koalas feed almost exclusively on a few preferred tree species which are of primary and secondary importance. The occurrence of both primary and secondary tree species varies widely on a regional, local and even a seasonal basis, meaning that koalas are unevenly distributed across their range. In the study area, primary food tree species are River red gum (*E. camaldulensis*) and Coolabah (*E. coolabah*) with secondary food tree species being Bimble box (*E. populnea*), Western grey box (*E. microcarpa*), Blakeley's red gum (*E. blakelyi*) and Yellow box (*E. melliodora*). No viable food sources are present on site.

Importantly, there are numerous core vegetation areas surrounding the site which represent much more viable habitat that Koalas are unlikely to leave to frequent the single large tree in the site that is proposed for removal.

Recommendations

By way of a clearing process that minimizes the risk to wildlife that may be opportunistically using the site, I recommend:

- I. Clearing limits and exclusion zones clearly identified prior to work;
- II. A visual inspection is conducted by environmental staff before clearing commences to identify any trees that might have viable nests present. If seen, mark the tree, clear all trees around it and then bump the tree with the excavator. If nothing leaves the nest proceed to pushing the tree. Inspect the nest after felling and if any wildlife is viable, follow your BMP instructions on wildlife catching and handling. For more information see *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*;
- III. Push all trees over, removing the root ball in its entirety, and drag them outside the works zone. DO NOT stockpile. This will make mulching difficult if anything but a tub-grinder is employed on site as the stockpiles will be filled with dirt;
- IV. Mulching of regrowth is considered a good 'low-impact' option and it is recommended that the main stem is painted with round-up immediately to prevent epicormic growth in the future.

Regards



Mr Damian Wall
Managing Director
BAppSc, MEnvMgt, GradCert CHM, MAACAI

11th January 2021

SITE INFORMATION

LOT / DP	1/328265 & 97/753841
ADDRESS	NEW ENGLAND HWY, KOOTINGAL, NSW 2352
LGA	TAMWORTH REGIONAL COUNCIL
LAT / LONG	-31.265486 / 151.040477
ELEVATION	490 m
LOT AREA	56.9 ha
FENCED AREA	10.6 ha
DNSP	ESSENTIAL ENERGY

1

GENERAL ARRANGEMENT PLAN

SCALE: 1:5000

PROJECT INFORMATION	
AC CAPACITY	5.0 MW
INVERTERS	2 x 3.0 MW
TRACKER SPACING (N-S)	MIN. 7 m
ARRAY PITCH	5.25 m
CONNECTION VOLTAGE	11 kV
CONNECTION FEEDER	ESSENTIAL ENERGY KTL382
CONNECTION SUBSTATION	ESSENTIAL ENERGY KOOTINGAL ZONE
SECURITY FENCE SETBACK	MIN. 3 m FROM OPTION BOUNDARY
ARRAY SETBACK	MIN. 8 m FROM SECURITY FENCE
ACCESS ROAD WIDTH	4 m

NO.	STAGE	DATE	NOTES
1	ISSUED FOR INFORMATION	09/07/20	
2	ISSUED FOR DEVELOPMENT APPLICATION	21/12/20	
3	DEVELOPMENT APPLICATION	04/12/2023	
4	---	---	
5	---	---	
6	---	---	

PREPARED BY

DATE

P: +61 2 6297 3011
E: info@itp.com.au
W: www.itp.com.au

PO BOX 8257
OTCOMBE ACT 2655
AUSTRALIA

DESIGN	DATE
NL MJB	
CHECKED: PMC	
APPROVED: SD	

DO NOT SCALE.
ALL DIMENSIONS IN MM UNLESS OTHERWISE STATED.

IF DISCREPANCY BETWEEN ANY OF THE DIMENSIONS AND THE USE OF THE DIMENSIONS SHALL NOT BE A BASIS FOR CLAIMS OR DAMAGES.

DEVELOPMENT APPLICATION

GENERAL ARRANGEMENT PLAN	
PROJECT	KOOTINGAL 10 MW SOLAR FARM
CLIENT	ITP DEVELOPMENT
ADDRESS	NEW ENGLAND HWY KOOTINGAL, NSW 2352
DESIGN NO.	KO01C-G-2100
SCALE	AS NOTED
SHEET NO.	A3
DATE	2/7/20
REV. DATE	4/12/20
REV. NO.	3

Attachment 2: Photos from the Site Inspection



Photo 1: Large Tree for removal.



Photo 2: Site devoid of native shrubs and trees. Some grasses persist.



Photo 3: High conservation value vegetation in the north west corner of the site.



Photo 4: Evidence of Horticulture since abandoned.



**MCG QUANTITY
SURVEYORS**

DEVELOPMENT APPLICATION COST PLAN

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OUR EXPERTISE

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March 15, 2021

Zaed Aznam

ITP Development

Level 1, 19 Moore Street

Turner, ACT, 2612

p

1300 795 170

w

www.mcggs.com.au

e

steve.weeks@mcggs.com.au

RE: Development Application Cost Plan - New England Highway, Kootingal NSW 2352

Dear Zaed,

MCG Quantity Surveyors have prepared the following Development Application Cost Plan for ITP Development, and not in any other capacity.

1.0 Development Location

Development Type: Solar Farm Development

Client Details: ITP Development

Address: New England Highway

Suburb: Kootingal NSW 2352

1.1 Development Summary

The development consists of the construction of a solar farm including tree removal, solar panels, associated solar infrastructure, an inverter station, security fencing, road works and screen landscaping.

Please note the attached Indicative Development Application Cost Plan has been calculated from the total development costs. Therefore this only provides a broad indication of the likely percentages of the total development cost against each of the projects trade elements.

2.0 Financial Summary

MCG Quantity Surveyors believe that the attached Development Application Cost Plan and subsequent development cost, reflects a fair and competitive cost to complete the proposed development, based on the material provided to our offices.

The MCG Quantity Surveyors Development Application Cost Plan for construction costs totals \$6,229,865 exclusive of GST or \$6,852,852 inclusive of GST, with a further \$218,045 payable in consultants fees.

Trade	Total GST Exclusive	Total GST Inclusive
Total Construction Cost	6,229,865	6,852,852
Consultant Fees	218,045	239,850
Total	6,447,910	7,092,701

The development consists of a total site area of 565,667 square metres.

3.0 Construction Program

MCG Quantity Surveyors anticipate a period of 9 months to be appropriate for the construction of a development of this scope and nature.

4.0 Descriptive Summary

The development involves the construction of a Solar Farm Development located at New England Highway, Kootingal NSW 2352.

An appropriate level of finishes and quality has been allocated to the development.

Please refer to attached Schedule of Finishes and Assumptions which have been included for within the MCG Quantity Surveyors Development Application Cost Plan.

The development construction cost per watt is \$1.29 exclusive of GST or \$1.42 inclusive of GST.

5.0 Disclaimer

MCG Quantity Surveyors have prepared this report on the basis of information supplied by ITP Development.

Whilst all professional care and skill have been exercised to ensure the accuracy of this report, MCG Quantity Surveyors are unable to provide any guarantee on any estimates relying on information provided by the client or other third party, and will not be liable to any party for any loss arising as a result of any such information subsequently being found to be inaccurate or lacking authenticity.

6.0 Report Conclusion

It is the recommendation of MCG Quantity Surveyors that the contents of the aforementioned report be treated as advice on the likely construction cost of the development, and is not a reflection of the current market valuation of the development.

Please do not hesitate to contact our office should you have any further queries.

Yours Sincerely,



Steve Weeks
Quantity Surveyor
MCG Quantity Surveyors

Schedule of Finishes

The following is a schedule of the finishes assumed by MCG Quantity Surveyors in the preparation of the Development Application Cost Plan.

- ° Tree removal
- ° Security fencing
- ° Upgrade to road entry
- ° Inverter station
- ° Power conversion unit
- ° Solar panels and infrastructure
- ° Landscape screening

Schedule of Information

The following is a schedule of the information used by MCG Quantity Surveyors in the preparation of the Development Application Cost Plan.

- ° Written and verbal information provided by ITP Development
- ° Site Plans - Job Number: KOO1C, Drawing Number: G-0400 - E-4300 2, 19 January 2021; as prepared by: Renewables

Schedule of Exclusions

The following is a schedule of the exclusions within the MCG Quantity Surveyors preparation of the Development Application Cost Plan.

- ° Design contingency
- ° Land and legal costs
- ° Rise and fall
- ° Holding costs, interest charges and finance costs
- ° Unknown ground conditions and rock excavation
- ° Goods and services tax
- ° Leasing and marketing costs
- ° Removal of hazardous materials and contaminated soils
- ° Staging, phasing or delay costs
- ° Cost increase beyond March 15, 2021
- ° Works not clearly noted on the provided plan documentation
- ° All authority fees
- ° Heritage Work if applicable

Indicative Development Application Cost Plan

Indicative Development Application Cost Plan

Development Type: Solar Farm Development
Development Address: New England Highway, Kootingal NSW 2352
Watts: 5,000,000 watts

No	Trade Description	% Job	Cost (\$/m2)	Total Cost Excl GST	Total Cost Incl GST
	Trade Breakup				
1	Preliminaries	5.60	0.07	348,872	383,760
2	Substructure		0.00	-	-
	Superstructure				
3	Columns		0.00	-	-
4	Upper Floors		0.00	-	-
5	Staircases		0.00	-	-
6	Roof		0.00	-	-
7	External Walls & Windows		0.00	-	-
8	External Doors		0.00	-	-
9	Internal Walls		0.00	-	-
10	Internal Screens		0.00	-	-
11	Internal Doors		0.00	-	-
	Finishes				
12	Wall		0.00	-	-
13	Floor		0.00	-	-
14	Ceiling		0.00	-	-
	Fittings				
15	Fitments		0.00	-	-
	Services				
16	Plumbing		0.00	-	-
17	Mechanical		0.00	-	-
18	Fire		0.00	-	-
19	Electrical	90.70	1.13	5,650,488	6,215,536
20	Transportation		0.00	-	-
21	External Works	3.70	0.05	230,505	253,556
	Sub Total	100.00	1	6,229,865	6,852,852
	Consultant Fees	3.18	0.04	218,045	239,850
	Contingency			-	-
	Totals		1	6,447,910	7,092,701

Indicative Development Application Cost Plan

Development Type: Solar Farm Development
Development Address: New England Highway, Kootingal NSW 2352
Watts: 5,000,000 watts

Trade Description	Total Cost Excl GST	Total Cost Incl GST
Demolition & Site Prep Demolition & Site Prep (Cost per m2 Site Area)	1,750 0.00	1,925 0.00
Excavation Excavation (Cost per m2 Site Area)		
Construction - Commercial Construction - Commercial (Cost per watt)	6,000,000 1.20	6,600,000 1.32
Construction - Residential Construction - Residential (Cost per m2 Residential Area)		
Construction - Retail Construction - Retail (Cost per m2 Retail Area)		
Construction - Site Works Construction - Site Works (Cost per m2 Site Area)	228,115 0.40	250,927 0.44
Fit Out - Commercial Fit Out - Commercial (Cost per m2 Commercial Area)		
Fit Out - Residential Fit Out - Residential (Cost per m2 Residential Area)		
Fit Out - Retail Fit Out - Retail (Cost per m2 Retail Area)		
Sub Total	6,229,865	6,852,852
Consultant Fees % of Construction Cost % of Development Cost	218,045	239,850 3.50% 3.38%
Totals	6,447,910	7,092,701
Total GST		644,791



Marty Sadlier

Director - Senior Quantity Surveyor (Associate Member of the Australian Institute of Quantity Surveyors - AAIQS - 9374)

MCG Quantity Surveyors



Glint and Glare Assessment

Kootingal Solar Farm

August 2020

ENGINEERING | STRATEGY | ANALYTICS | CONSTRUCTION

DOCUMENT CONTROL

Report Title		Glint and Glare Assessment – Kootingal Solar Farm			
ITP Project Number		Kootingal 1C			
Rev	Date	Status	Author/s	Reviewed By	Approved
1	21/08/2020	First Revision	I Berwick	S Dedman	Approved
2	09/09/2020	Second Revision (Minor corrections)	S Dedman	S Dedman	Approved

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Project No. Kootingal 1C – Glint and Glare Assessment August 2020

ABOUT ITP RENEWABLES

ITP Renewables (ITP) is a global leader in renewable energy engineering, strategy, construction, and energy sector analytics. Our technical and policy expertise spans the breadth of renewable energy, energy storage, energy efficiency and smart integration technologies. Our range of services cover the entire spectrum of the energy sector value chain, from technology assessment and market forecasting right through to project operations, maintenance and quality assurance.

We were established in 2003 and operate out of offices in Canberra (Head Office), Sydney, North Coast NSW, Adelaide and Auckland, New Zealand. We are part of the international ITP Energised Group, one of the world's largest, most experienced and respected specialist engineering consultancies focussing on renewable energy, energy efficiency, and carbon markets. The Group has undertaken over 2,000 contracts in energy projects encompassing over 150 countries since it was formed in 1981.

Our regular clients include governments, energy utilities, financial institutions, international development donor agencies, project developers and investors, the R&D community, and private firms.

ABBREVIATIONS

AC	Alternating current
CASA	Civil Aviation Safety Authority
DC	Direct current
FAA	Federal Aviation Administration (United States)
Ha	Hectare
ITP	ITP Renewables
MW	Megawatt, unit of power (1 million Watts)
MWp	Megawatt-peak, unit of power at standard test conditions used to indicate PV system capacity
NSW	New South Wales
OP	Observation point
PV	Photovoltaic
SGHAT	Solar Glare Hazard Analysis Tool

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1 INTRODUCTION

1.1 Overview

ITP Development is proposing to develop a solar farm as described in Table 1. It will be located approximately 1km west of the town of Kootingal, NSW (see Figure 1).

Table 1. Site Information

Parameter	Description
Solar farm name	Kootingal Solar Farm
Site reference	Kootingal 1C
Lot/DP(s)	1/328265 and 97/753841
Street address	"Roseamere", 1599 NEW ENGLAND HIGHWAY, KOOTINGAL
Council	Tamworth Regional Council
AC capacity	5 MW
DC capacity	6.4 MW
Project area	Approx. 11 ha
Current land use	Unused

This report provides a desktop glint and glare assessment to support the Development Application for the project. It provides:

- Identification of potential receptors of glint and glare from the proposed solar farm; and
- Assessment of the glint and glare hazard using the Solar Glare Hazard Analysis Tool (SGHAT) GlareGauge analysis.

1.2 Glint and Glare

Glint is defined as a momentary flash of bright light, while glare is a continuous source of excessive brightness relative to ambient lighting (Federal Aviation Administration [FAA], 2018). The GlareGauge analysis used to assess the glint and glare hazard (see Section 3) was run with a simulation interval of one minute, as sunlight reflection from PV modules typically lasts for at least one minute. Glint, which lasts for less than one minute, is unlikely to occur from the sun based on how slowly the sun and modules move, so has not been considered further in this assessment.

Solar photovoltaic (PV) modules are designed to absorb as much light as possible to maximise efficiency (generally around 98% of the light received). To limit reflection, the modules are constructed from dark, light-absorbing material and the glass is treated with an anti-reflective coating. As a result, the glare generated from PV modules is lower than from many other surfaces, including cropping/grassland and concrete (an albedo of 20% is typically assumed for PV modules, compared to 25-30% for grass and up to 25% for concrete; Ramírez & Muñoz, 2012).

However, the glass modules still have the potential to generate glare. This needs to be assessed to ensure that visual receptors—such as road users, nearby buildings, air traffic control towers and aircraft pilots—are not impacted by the development of solar farms.

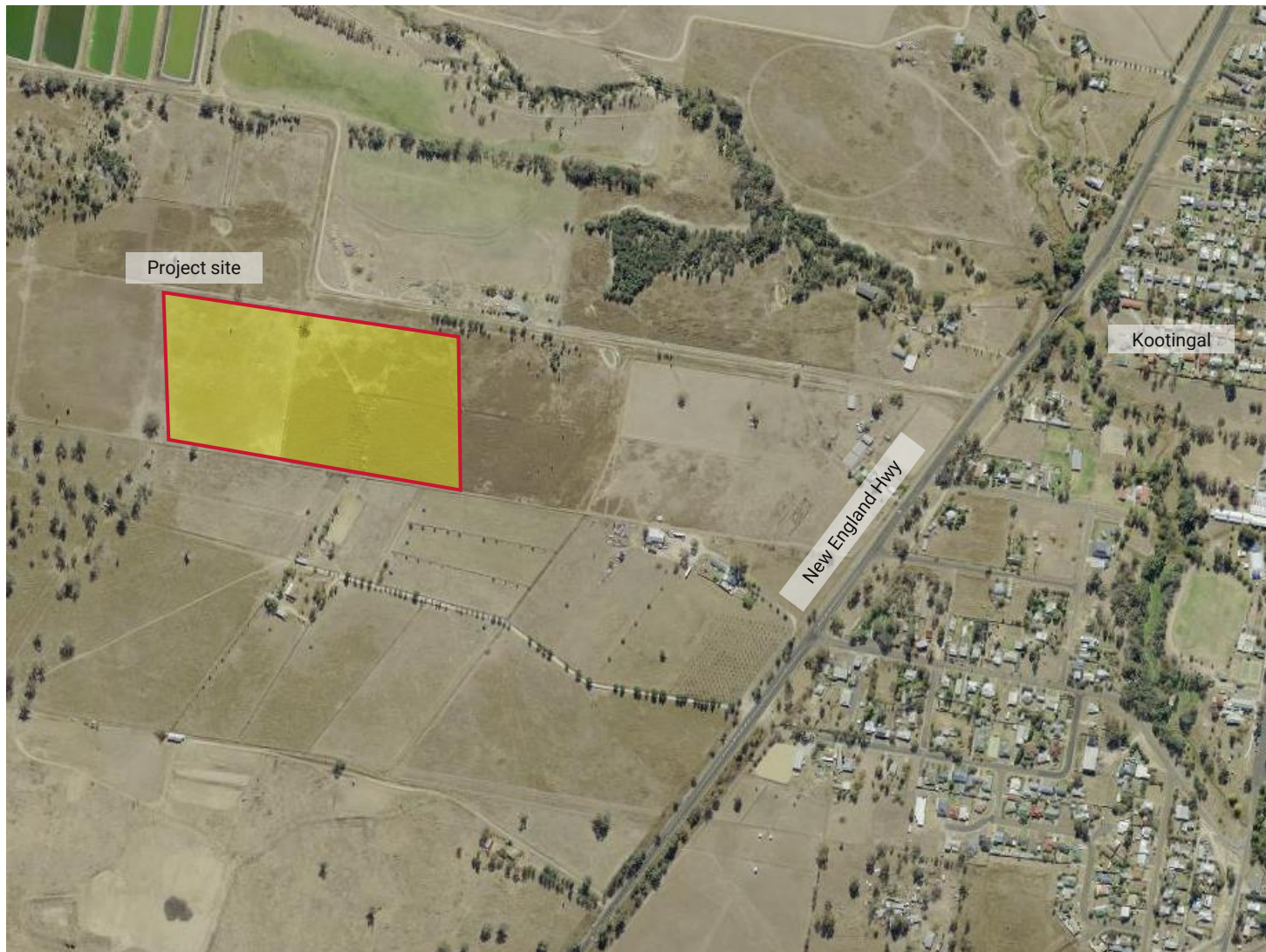


Figure 1. Proposed solar farm site and surrounding area
Project No. Kootingal 1C – Glint and Glare Assessment August 2020

2 PROJECT DESCRIPTION

ITP Development is proposing to construct a solar farm with a DC capacity of 6.4 MW_p and AC output of 5 MW, on an approximately 11 ha site that is currently unused.

There are to be approximately 12,100 solar modules installed on 140 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The hub height of each tracker will be around 1.5m, with the peak of the modules reaching a height of approximately 2.7m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm is shown on drawing K001C-G-210, and the array tracker details on drawing K001C-E-341.

The solar farm will also comprise two 3MW inverter stations. These inverters are to be located within the array and are each mounted on a 12.2m skid. Each of these inverter stations incorporate the high voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing K001C-E-430.

The mounting system is constructed on piles that are driven into the ground. During construction, there is expected to be 50 personnel on site working from 7am – 4pm, Monday to Friday. The construction is expected to take approximately 3 months. Once operational, the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 – 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site will be returned to the pre-development land use.

3 ANALYSIS

3.1 Overview

In a fixed-tilt PV array, the angle of incidence at which direct sunlight hits the PV modules varies as the sun moves across the sky. It will be smallest around noon when the sun is overhead and largest in the early morning and late afternoon when the sun is near the horizon. If the PV array is mounted on a single-axis tracking system as proposed in this project, the variation in the angle of incidence will be much smaller since the modules rotate to follow the sun. The main variation will be seasonal, i.e. because the sun is higher in the sky during summer and lower during winter. A PV array that is mounted on a tracking system therefore has less potential to cause glare.

The SGHAT was developed by Sandia National Laboratories to evaluate glare resulting from solar farms at different viewpoints, based on the location, orientation and specifications of the PV modules. This tool is required by the United States FAA for glare hazard analysis near airports and is also recognised by the Australian Government Civil Aviation Safety Authority (CASA).

The GlareGauge analysis uses SGHAT to provide an indication of the type of glare that can be expected at each potential receptor. Glare is indicated by three colours according to severity:

- Green glare: Low potential for temporary after-image;
- Yellow glare: Potential for temporary after-image; and
- Red glare: Retinal burn, not expected for PV.

The parameters used in the SGHAT model for the project are detailed in Table 2. GlareGauge default settings were adopted for the analysis time interval, direct normal irradiance, observer eye characteristics and slope error. The heights of the observation points were assumed to be 1.5m for a road user (i.e. sitting in a car) and 1.65m for a person (i.e. standing).

Table 2. SGHAT specification inputs

Parameters	Input
Time zone	UTC+10:00
Module tracking	Single
Module surface material	Smooth glass with ARC (anti-reflective coating)
Tracking axis tilt	0°
Tracking axis orientation	0°
Module offset angle (angle between module and tracking axis)	0°
Maximum tracking angle	60°
Resting angle	30°
Height of modules above ground	1.7m

3.2 Potential Receptors

For this project, visual receptors within 2 km of the site were considered including residences and road users. A 2-km radius from the site was considered appropriate based on it being highly unlikely for glint and glare impacts at distances greater than this. As shown in Figure 2, 27 residential observation points were identified as potential visual receptors of the site. The potential for glare was also assessed along ten different road routes.

While there was a greater number of residential/commercial properties considered, some were discounted based on large stands of trees and other structures acting as visual barriers.

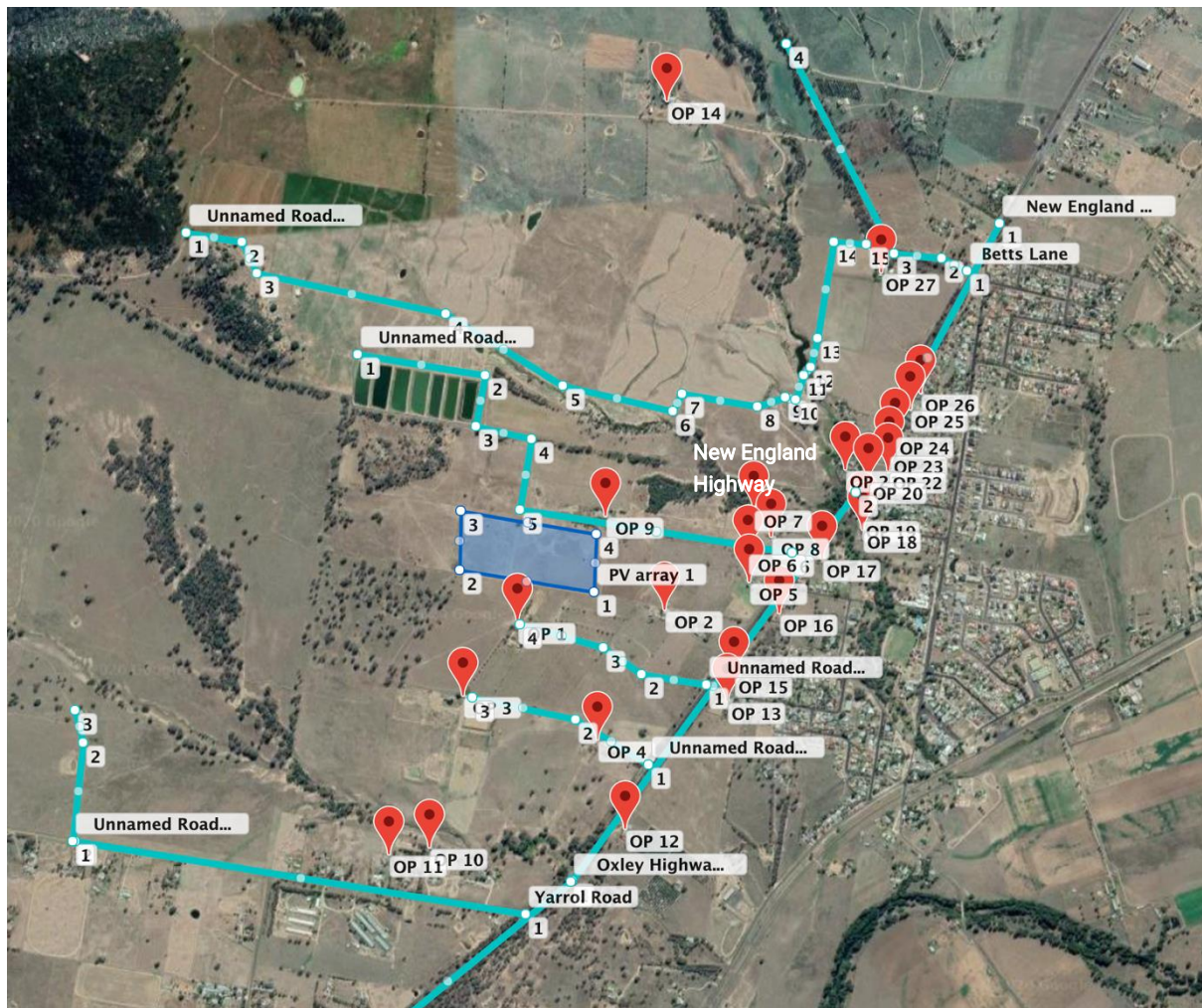


Figure 2. Map showing potential visual receptors within 2km of the site

3.3 Assumptions

The visual impact of solar farm development depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment, and any proposed screening measures to reduce visibility of the site. Some potential viewpoints were discounted because of significant existing features (such as trees or buildings), however, minor screening—such as roadside vegetation—was not assessed in detail. The GlareGauge analysis results are therefore considered conservative as the model assumes there is no screening. It is noted that the site is almost entirely cleared with only a few trees within the property.

Atmospheric conditions such as cloud cover, will also influence light reflection and the resulting impact on visual receptors. The same is true of varying tilt angles of the modules. Varying atmospheric conditions have not been accounted for in the GlareGauge analysis, nor have the complexities of backtracking (due to the software's limitations). The GlareGauge analysis assumes clear sky conditions, with a peak direct normal irradiance (DNI) of 1,000 W/m² which varies throughout the day.

3.4 Results

The results of the GlareGauge analysis (attached in Appendix A) at each of the observation points are summarised in Table 3. None of the residences or road users are expected to experience any glare from the solar farm. Many residences will also not have direct view of the solar farm due to visual obstruction from trees and other structures.

Table 3. Glare potential at observation points

	Type of Observation Point	Location relative to solar farm	Green glare (minutes)	Yellow glare (minutes)	Glare potential
OP1	Residential	0.34 km south	0	0	No glare
OP2	Residential	0.66 km south-east	0	0	No glare
OP3	Residential	0.61 km south	0	0	No glare
OP4	Residential	0.83 km south-east	0	0	No glare
OP5	Residential	0.93 km east	0	0	No glare
OP6	Residential	0.89 km east	0	0	No glare
OP7	Residential	0.90 km east	0	0	No glare
OP8	Residential	0.97 km east	0	0	No glare
OP9	Residential	0.38 km north-east	0	0	No glare
OP10	Residential	1.16 km south	0	0	No glare
OP11	Residential	1.22 km south	0	0	No glare
OP12	Residential	1.17 km south-east	0	0	No glare
OP13	Residential	1.02 km south-east	0	0	No glare
OP14	Residential	1.62 km north	0	0	No glare
OP15	Commercial	0.99 km south-east	0	0	No glare
OP16	Residential	1.04 km east	0	0	No glare
OP17	Residential	1.17 km east	0	0	No glare
OP18	Residential	1.29 km east	0	0	No glare

OP19	Residential	1.29 km east	0	0	No glare
OP20	Residential	1.31 km east	0	0	No glare
OP21	Residential	1.24 km north-east	0	0	No glare
OP22	Residential	1.39 km north-east	0	0	No glare
OP23	Residential	1.40 km north-east	0	0	No glare
OP24	Residential	1.44 km north-east	0	0	No glare
OP25	Residential	1.40 km north-east	0	0	No glare
OP26	Residential	1.56 km north-east	0	0	No glare
OP27	Residential	1.62 km north-east	0	0	No glare
Betts Lane	Road Route	North-east	0	0	No glare
New England Highway	Road Route	East	0	0	No glare
Oxley Highway	Road Route	South	0	0	No glare
Yarrol Road	Road Route	South	0	0	No glare
Unnamed Road 1	Road Route	North	0	0	No glare
Unnamed Road 2	Road Route	North	0	0	No glare
Unnamed Road 3	Road Route	South-east	0	0	No glare
Unnamed Road 4	Road Route	South-east	0	0	No glare
Unnamed Road 5	Road Route	South	0	0	No glare

4 SUMMARY

The results of the GlareGauge analysis indicated that the selected observation points are unlikely to receive glare due to the proposed solar farm.

Existing roadside vegetation and structures are expected to provide a physical obstruction between the solar farm and road users on the major roads at risk of glare (New England Highway, Oxley Highway and Betts Lane), further minimising the visual impact of the project. Road users approaching the solar farm along Yarrol Road and the unnamed roads to the north and south of the site, are also not expected to experience any glare.

5 REFERENCES

Federal Aviation Administration (FAA) (2018). Solar Guide: Technical Guidance for Evaluating Selected Solar Technologies on Airports. Retrieved from the FAA website: <https://www.faa.gov/airports/environmental/>

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APPENDIX A. FORGESOLAR GLARE ANALYSIS

FORGESOLAR GLARE ANALYSIS

Project: **KOO1C**

Site configuration: **All receptors**

Analysis conducted by ITP Engineering (engineering@itpau.com.au) at 04:52 on 17 Aug, 2020.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at <https://www.federalregister.gov/d/2013-24729>

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m²
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 41895.7647



PV Array(s)

Name: PV array 1
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 30.0°
Rated power: 6400.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.053681	151.042004	469.23	1.70	470.93
2	-31.052973	151.037015	488.48	1.70	490.18
3	-31.051108	151.037079	486.67	1.70	488.37
4	-31.051843	151.042079	467.04	1.70	468.74

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-31.054620	151.039192	475.44	1.65
OP 2	2	-31.054263	151.044618	463.98	1.65
OP 3	3	-31.056965	151.037172	461.04	1.65
OP 4	4	-31.058379	151.042131	448.87	1.65
OP 5	5	-31.053388	151.047756	448.76	1.65
OP 6	6	-31.052473	151.047734	448.35	1.65
OP 7	7	-31.051046	151.047952	447.78	1.65
OP 8	8	-31.051929	151.048585	446.49	1.65
OP 9	9	-31.051282	151.042432	465.44	1.65
OP 10	10	-31.061794	151.035935	443.93	1.65
OP 11	11	-31.062003	151.034411	449.46	1.65
OP 12	12	-31.061214	151.043155	436.36	1.65
OP 13	13	-31.057178	151.046962	452.84	1.65
OP 14	14	-31.038104	151.044734	475.00	1.65
OP 15	15	-31.056323	151.047219	453.12	1.65
OP 16	16	-31.054367	151.048893	445.67	1.65
OP 17	17	-31.052652	151.050482	439.38	1.65
OP 18	18	-31.051726	151.051961	436.59	1.65
OP 19	19	-31.051383	151.051928	437.66	1.65
OP 20	20	-31.050185	151.052176	443.55	1.65
OP 21	21	-31.049822	151.051334	442.40	1.65
OP 22	22	-31.049835	151.052916	446.30	1.65
OP 23	23	-31.049316	151.052954	448.03	1.65
OP 24	24	-31.048748	151.053164	451.27	1.65
OP 25	25	-31.047883	151.053730	457.00	1.65
OP 26	26	-31.047373	151.054114	459.47	1.65
OP 27	27	-31.043543	151.052648	467.79	1.65

Route Receptor(s)

Name: Betts Lane

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.043491	151.055835	478.25	1.50	479.75
2	-31.043078	151.054870	480.46	1.50	481.96
3	-31.042949	151.053132	474.05	1.50	475.55
4	-31.036281	151.049134	476.52	1.50	478.02

Name: New England Highway

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.041991	151.057050	479.15	1.50	480.65
2	-31.050496	151.051698	441.85	1.50	443.35
3	-31.062812	151.041184	436.83	1.50	438.33

Name: Oxley Highway

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.062849	151.041141	437.06	1.50	438.56
2	-31.069198	151.032081	460.21	1.50	461.71

Name: Unnamed Road 1

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.046138	151.033245	508.14	1.50	509.64
2	-31.046781	151.037966	484.88	1.50	486.38
3	-31.048417	151.037644	486.98	1.50	488.48
4	-31.048822	151.039683	475.45	1.50	476.95
5	-31.051064	151.039275	477.94	1.50	479.44
6	-31.052423	151.049358	443.49	1.50	444.99

Name: Unnamed Road 2

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.042273	151.026902	572.41	1.50	573.91
2	-31.042567	151.028962	553.13	1.50	554.63
3	-31.043569	151.029530	548.00	1.50	549.50
4	-31.044851	151.036538	494.35	1.50	495.85
5	-31.047121	151.040835	473.95	1.50	475.45
6	-31.047944	151.044934	457.18	1.50	458.68
7	-31.047392	151.045266	457.71	1.50	459.21
8	-31.047779	151.048082	449.87	1.50	451.37
9	-31.047484	151.049090	448.82	1.50	450.32
10	-31.047558	151.049466	448.27	1.50	449.77
11	-31.046777	151.049788	448.82	1.50	450.32
12	-31.046547	151.050034	449.29	1.50	450.79
13	-31.045609	151.050277	451.42	1.50	452.92
14	-31.042573	151.050889	463.55	1.50	465.05
15	-31.042646	151.052086	469.42	1.50	470.92

Name: Unnamed Road 3

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.056605	151.046165	455.03	1.50	456.53
2	-31.056292	151.043794	456.54	1.50	458.04
3	-31.055447	151.042356	462.84	1.50	464.34
4	-31.054693	151.039288	475.15	1.50	476.65

Name: Unnamed Road 5

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.059135	151.044010	446.13	1.50	447.63
2	-31.057701	151.041318	452.74	1.50	454.24
3	-31.057012	151.037498	461.13	1.50	462.63

Name: Unnamed Road 6

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.061569	151.022722	481.83	1.50	483.33
2	-31.058444	151.023109	476.58	1.50	478.08
3	-31.057414	151.022787	477.38	1.50	478.88

Name: Yarrol Road

Path type: Two-way

Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.063903	151.039484	443.05	1.50	444.55
2	-31.061569	151.022795	481.59	1.50	483.09

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt	Orient	"Green" Glare	"Yellow" Glare	Energy
	(°)	(°)	min	min	kWh
PV array 1	SA tracking	SA tracking	0	0	18,860,000.0

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0
OP 26	0	0
OP 27	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
Betts Lane	0	0
New England Highway	0	0
Oxley Highway	0	0
Unnamed Road 1	0	0
Unnamed Road 2	0	0
Unnamed Road 3	0	0
Unnamed Road 5	0	0
Unnamed Road 6	0	0
Yarrol Road	0	0

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0
OP 26	0	0
OP 27	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
Betts Lane	0	0
New England Highway	0	0
Oxley Highway	0	0
Unnamed Road 1	0	0
Unnamed Road 2	0	0
Unnamed Road 3	0	0
Unnamed Road 5	0	0
Unnamed Road 6	0	0
Yarrol Road	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 26

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 27

0 minutes of yellow glare

0 minutes of green glare

Route: Betts Lane

0 minutes of yellow glare

0 minutes of green glare

Route: New England Highway

0 minutes of yellow glare

0 minutes of green glare

Route: Oxley Highway

0 minutes of yellow glare

0 minutes of green glare

Route: Unnamed Road 1

0 minutes of yellow glare

0 minutes of green glare

Route: Unnamed Road 2

0 minutes of yellow glare

0 minutes of green glare

Route: Unnamed Road 3

0 minutes of yellow glare

0 minutes of green glare

Route: Unnamed Road 5

0 minutes of yellow glare

0 minutes of green glare

Route: Unnamed Road 6

0 minutes of yellow glare

0 minutes of green glare

Route: Yarrol Road

0 minutes of yellow glare

0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.

Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.

The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.

Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Refer to the Help page at www.forgesolar.com/help/ for assumptions and limitations not listed here.



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Landscape character & visual impact assessment

Lot 1 DP 328265 & Lot 97 DP 753841, Nos
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Proposed Kootingal Solar Farm



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Attachment A: Photomontages & indicative views from public places

Document Details & History

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Author	Allen Grimwood, Director
Qualifications	Bachelor of Arts (Honours) UNSW Master of Urban & Regional Planning, USyd 
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The report has been prepared using information supplied by the client and other stakeholders. All care is taken to ensure the accuracy and veracity of this information, however, no responsibility is accepted for the interpretation of that information by end users.

1. Introduction

The purpose of this report is to assess the landscape character and visual impacts of a proposed solar farm at Kootingal, located in Tamworth Regional local government area and to be known as the Kootingal Solar Farm.

The scope of this report is to evaluate the potential impacts on landscape character and visual amenity. To achieve this end the report addresses:

- the location and physical characteristics of the site on which the works are proposed,
- the character of the surrounding landscape and the visual catchment within which the proposed works may be of significance,
- potential impacts on the landscape, viewpoints and receivers located within the visual catchment, and
- means to avoid or mitigate potential impacts.

2. Methodology

Impacts on the visual and scenic amenity of the proposed Kootingal Solar Farm have been assessed by Zenith Town Planning Pty Ltd using the RMS guideline *Environmental Impact Assessment Practice Note– Guideline for Landscape Character and Visual Impact Assessment* (EIA-N04 Version 2.1 released on 14 December 2018). Details of methodology are given below.

Site inspections of the location of the proposed works and the surrounding area took place in September 2020. The visual catchment, the context of the site of the proposed works and observation points were identified at this time. Land uses and characteristics of the environment such as topography, vegetation, architecture of neighbouring buildings and any heritage values of any significant sites in the vicinity of the proposed solar farm were noted and the capacity of the area to absorb physical change is assessed.

Development plans for the solar farm have been reviewed and the likely impacts on landscape character identified. This is determined by the sensitivity of the landscape to physical change and the magnitude, or relative size and scale, of the works.

The visual significance of the site to observation points and receivers within the visual catchment is described in terms of proximity to the site, landscape character, the composition of views and the sensitivity to change that will affect scenic values. The visual impacts that will be experienced by each

receiver are identified and evaluated in terms of the sensitivity of each receiver to change and the magnitude of that change in terms of the proposed works.

The impacts are calculated and ranked according to negligible, low, moderate or high impact based on the following matrix (Table 1).

Table 1: Landscape character and visual impact grading matrix. Source: RMS Guideline for Landscape Character and Visual Impact Assessment, 2018

Landscape character and visual impact grading matrix					
Sensitivity	Magnitude				
		High	Moderate	Low	Negligible
	High	High impact	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

An explanation of the rankings of impacts on landscape character and visual amenity are provided in Table 2, sourced from *Pacific Highway HW10 and Wyong Road MR335 intersection and approaches upgrade Tuggerah* by Peter Andrews & Associates Pty Ltd/Corkery Consulting Pty Ltd, September 2012.

Table 2: Explanation of rankings based on sensitivity and magnitude.

Rank	Landscape character	Visual amenity
High	The development would be the dominant feature in the landscape and would significantly affect and alter character	There is a substantial change to visual amenity or a total loss of view towards key features caused by the introduction of new elements that contrast with existing landscape character
Moderate	The development introduces a new element to the landscape and would form a significant and recognisable part of the landscape that alters character	There is partial loss or change of visual amenity towards key features caused by the introduction of new elements that may be prominent but not substantially in contrast with existing landscape character.
Low	The development constitutes a minor element of the wider view that merges with other land uses	There is a minor loss or change of visual amenity towards key features caused by the introduction of new elements that are consistent with existing landscape character
Negligible	The development is either not visible or only a small part is visible that due to distance separation does not alter character	There is very minor loss or change to visual amenity towards key features caused by the introduction of new elements that are consistent with existing landscape character approximating no change

Where magnitude and sensitivity impacts differ, the ranking would be a hybrid of the two impacts, e.g. moderate-high. Such a ranking would combine elements of both the explanation of a moderate rank and that of a high rank.

The RMS methodology has been validated by the Land and Environment Court. For example, in the case of *Houghton V Shoalhaven City Council* [2016] NSWLEC 1195 the commissioner upheld an appeal by the applicant and agreed with the findings of the visual assessment that was prepared using this methodology.

The methodology of the guidelines addresses impacts in both qualitative and quantitative terms. The qualitative assessment involves the use of descriptive and conceptual data such as descriptions of landscape characteristics and the setting of the development or viewpoint. The quantitative assessment uses numbers and values such as the distance of a viewpoint from the development and the direction of the view towards the development. The purpose of the assessment is to identify impacts and to determine whether these impacts are acceptable given the benefits of the development to the community and economy.

Although the proposed Kootingal Solar Farm is not classified as a state significant project reference has been made to the Large-Scale Solar Energy Guideline during the preparation of plans, drawings and reports. The document provides the following guidance for assessing visual impacts:

The impacts on landscape character and values and the visual amenity of landholders and communities.

Using the RMS methodology, which is based on the magnitude (size and scale) of the development and the sensitivity of the landscape and visual receivers to change, ensures that an objective judgement of impacts is made by the assessor. The methodology prevents the assessor from making subjective judgements. Sensitivity is a measure of how sensitive the character of the setting is to the proposed change and its capacity to absorb the change. Magnitude refers to the scale, form and character of a development proposal.

Planning principles established by the NSW Land and Environment Court were also considered as a check on the findings of the landscape character and visual assessment. These principles are derived from the case *Tenacity Consulting v Warringah* [2004] NSWLEC 140 when considering the acceptability of the impact of a proposed development on views enjoyed from private property in the vicinity of that development, and from *Rose Bay Marina Pty Ltd V Woollahra Municipal Council and Anor* [2013] NSWLEC 1046 when assessing the impact of a development on the public domain.

THE RMS methodology has been compared with that required by government guidelines that apply in other states, i.e. South Australia, Victoria and Queensland. South Australia's guideline is silent on the issue of visual assessment and the Queensland guideline suggests that visual amenity and proximity to sensitive receptors should be investigated when assessing the feasibility and impacts of a project. The Victorian guideline includes advice on minimising impacts on landscape values and on providing screening to reduce visual impacts. It also recommends that design includes visual simulations (photomontages) to illustrate the development in the context of the surrounding area and key viewpoints, and that an assessment of the impacts have regard to the scale of the project, the sensitivity of the landscape to change, visibility to private property and public places, the locations and distances from which a facility may be seen, the significance of the landscape and landscape/environmental values. This assessment applies a methodology that would comply with the Victorian guidelines.

The findings of the landscape character and visual impact assessments are summarised in the conclusion. Recommendations as to refinements of the development plans to avoid or mitigate significant landscape and visual impacts are made if necessary.

3. Proposed works

ITP (Development) Pty Ltd proposes to develop a solar farm and ancillary facilities with an AC output of 5.0MW at 1599 New England Highway, Kootingal, NSW. The site is located approximately 1 kilometre west of the town centre of Kootingal and is an irregular shape with a total area of 58.2 hectares. The proposed development would occupy approximately 11 hectares of the total site.

There are proposed to be 12,100 solar modules installed in 140 rows running north to south. There is approximately 6.25 metres centre to centre spacing between each row. Each row of PV modules will rotate to track the sun across the sky from east to west each day. The hub height of each tracker is 1.5 metres with the peak of the modules reaching an approximate height of 2.7 metres when the array is fully tilted to 60 degrees from horizontal, i.e. in the early morning and late evening.

Two 3MW inverter stations will be installed at the solar farm mounted on a 12.2 metre long skid. Each of these inverter stations incorporates high and moderate voltage switchgear and transformers. Each will connect by way of underground cables to the 11kV feeder line that connects to the electricity grid at the Essential Energy Kootingal Zone substation.

The solar farm is to be enclosed within a 1.8 metre high security fence topped with three rows of barbed wire to give a total height of 2.3 metres. The fence will be setback 30 metres from the northern boundary, 576 metres from the eastern boundary, 3 metres from the southern boundary and 487 metres from the western boundary. Solar arrays are to be setback 8 metres from the security fence. The layout of the

solar farm is shown on General Arrangement Plan (Drawing No KOO1C-G-210) prepared by ITP Renewables.

4. Description of the landscape

The character of the landscape near the site of the Kootingal Solar Farm is predominantly an open modified agricultural landscape that has been shaped by farming on the western side of the New England Highway and urban residential on the eastern side of the highway. The land is gently undulating with some remnant vegetation and surrounded by steep vegetated land that provides a backdrop to the township and farms. The residential area of Kootingal is in close proximity to the development site but separated by the New England Highway which defines the urban-rural interface. The site itself is rural and located west of the township of Kootingal. Structures within the vicinity of the site comprise mostly rural farm dwellings set amongst primary production land uses with scattered farm outbuildings. Council's Kootingal depot and sewerage treatment ponds are located one the adjoining property to the north. Elements of the existing landscape character are described in Table 5 below.

Table 2: Landscape character in the vicinity of the development site

Item	Description
Land use	The development site is zoned RU4 Rural Small Holdings. The urban area of Kootingal is adjacent the site but the nearest urban property to the development footprint is approximately 640 metres to the east. Land west of the highway and surrounding the development site is predominantly farmland with farm dwellings located on adjoining land to the west and south. Small rural lots exist further to the south. The village of Kootingal is experiencing outward expansion with recent urban residential and large lot residential subdivisions occurring on the eastern flanks. Much of the land surrounding the village is zoned for further large residential growth. Although in close proximity to the regional centre of Tamworth, Kootingal maintains its own identity and distinctive character of wide streets without kerb and guttering or concrete pathways. Houses are generally single storey detached on large blocks
Structures	The site is occupied by a dwelling house and several farm sheds in close proximity to the dwelling and two others about 180 metres to the west. These structures are located adjacent the New England Highway at the eastern end of the property. Structures within the vicinity of the site comprise scattered rural farm and rural lifestyle dwellings set within primary production land uses.
Topography	The topography is gently undulating with a gentle fall to the east-north-east. An intermittent creek runs from the centre west of the property, through the Council depot land to the north to enter Sandy Creek near the highway about 250 metres north of the private access road. Sandy Creek drains to the Cockburn River just south of the village of Kootingal. The township, surrounding rural land and the village of Moonbi are situated in a valley that runs north-south and is enclosed within steep vegetated hills

Item	Description
Vegetation	The rural landscape has been cleared in the past for agricultural use other than scattered eucalyptus trees and riparian vegetation along watercourses. A cluster of native trees and shrubs remain at the north-western corner of the property, however, the majority of the property is covered with exotic pasture grasses. Native vegetation is predominant on the steep hills that enclose the locality
Infrastructure	The New England Highway which provides a frontage to the development site is an arterial road connecting the north west region of NSW to south-east Queensland and Brisbane, and Tamworth to Newcastle in the south. Local roads in the vicinity of the site connect residences to the highway and on to Armidale or Tamworth. The Council Kootingal Depot is located on adjoining land to the north of the site and sewerage treatment ponds are located on council - managed land adjoining the site at the north-western corner. An 11kV feeder line connects to the Kootingal Zone substation.

Below are photographs of the landscape surrounding the development site. All photographs were taken by Zenith Town Planning Pty Ltd at the time of the site inspection in September 2020.



Plate 1: Looking south towards the development site from the private access road



Plate 2: Looking east along the private access road towards Kootingal and steep vegetated country



Plate 3: Looking north-east across the council depot from the private access road



Plate 4: Looking north from the near the entry gate



Plate 5: Looking west from within the development site near the entry gate

5. Assessment of impacts on landscape character

The character of the landscape near the site of the Kootingal Solar Farm is predominantly an open modified agricultural landscape that has been shaped by farming. It is gently undulating with some remnant vegetation and surrounded by steep vegetated land that provides a backdrop to the township and farms. The residential area of Kootingal is in close proximity to the development site but separated by the New England Highway which defines the urban-rural interface. The site itself is rural and located west of the township of Kootingal. Structures within the vicinity of the site comprise scattered rural farm dwellings set amongst primary production land uses with scattered farm outbuildings. The landscape is assessed to have moderate sensitivity to change. Elements of the existing landscape character are described in Table 5 below.

The rural landscape in the vicinity of Kootingal is one that has been modified by human activity associated with the agricultural industry. It is characterised by a mix of farming, rural uses, the settlement itself and surrounding vegetated slopes. The project occupies approximately 11 hectares and the panels have a maximum height of 2.7 metres. The development footprint is situated almost a kilometre from the arterial road and topography diminishes visibility and overall influence on landscape character. The size and scale, or magnitude, of the project and impact on landscape character is considered to be moderate for private property and negligible for public roads.

The sensitivity of the private property to landscape change is low to moderate given the existing modified landscape which is predominantly agricultural, distance separation from most residences and topography. The sensitivity would decrease with distance so that visibility of the solar farm to dwellings and other structures beyond 2 kilometres would be negligible. The overall impact on landscape character in relation to private property is assessed to range from negligible to moderate.

The sensitivity of public places such as the New England Highway to landscape change would be high in close proximity to a new development, however, distance separation and topography mitigates that sensitivity and in this case it is assessed to be negligible. The works would not be visible to motorists travelling along the New England Highway in either direction. The works would be visible from some local public roads and the private access road. There are also distant views towards the site from amongst the vegetation on the slopes to the east and west of the site, however, these viewpoints would be over 2.5 kilometres away at the closest point to the west and over 5 kilometres to the east. Vegetation on private properties and topography would provide effective screening. The overall impact on landscape character in relation to the public domain is assessed to range from low to moderate.

6. The visual catchment

The visual impact of solar farms depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment; vegetation; and any proposed screening measures to reduce visibility of the site. Some potential observation points may not have a clear line of sight towards the solar farm because of significant existing features such as built structures and vegetation. Figure 2 below shows the approximate viewshed of the development site, i.e. the area within which the site may be visible based on contours and not taking into account features that would diminish or obscure the visibility of the solar farm.

For the purposes of this analysis the visual catchment of the site of the proposed Kootingal Solar Farm is defined by an area within 2 kilometres of the development site from which the works may be visible as shown on the visual catchment map below (Figure 3). This area is the same as that considered in the glare and glint analysis and the observation points are identical. The greater the distance from the development site the less clear is the view of the solar farm. The ability to distinguish the type of land use and the actual composition of materials diminishes with distance. The separation distances from each dwelling to the nearest point of the development area are given in Table 3. The distance has been measured using SIX Maps as a straight-line from the nearest point of a residence to the approximate centre of the solar array.

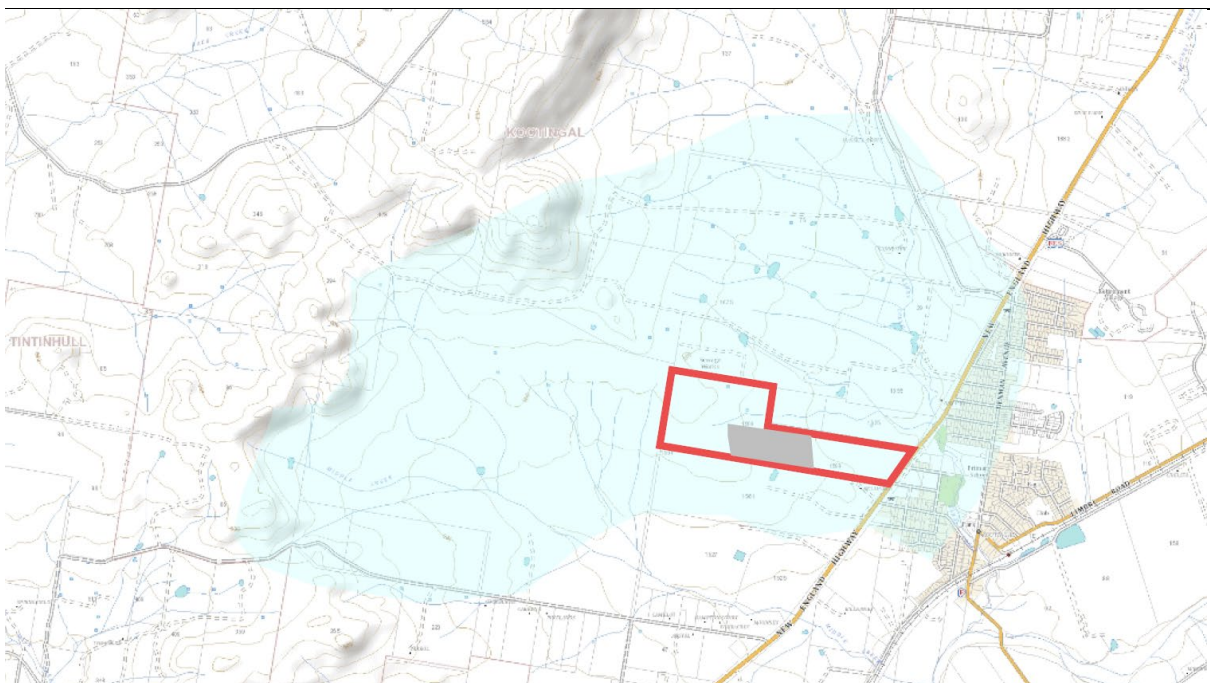


Figure 2: The viewshed surrounding the development site

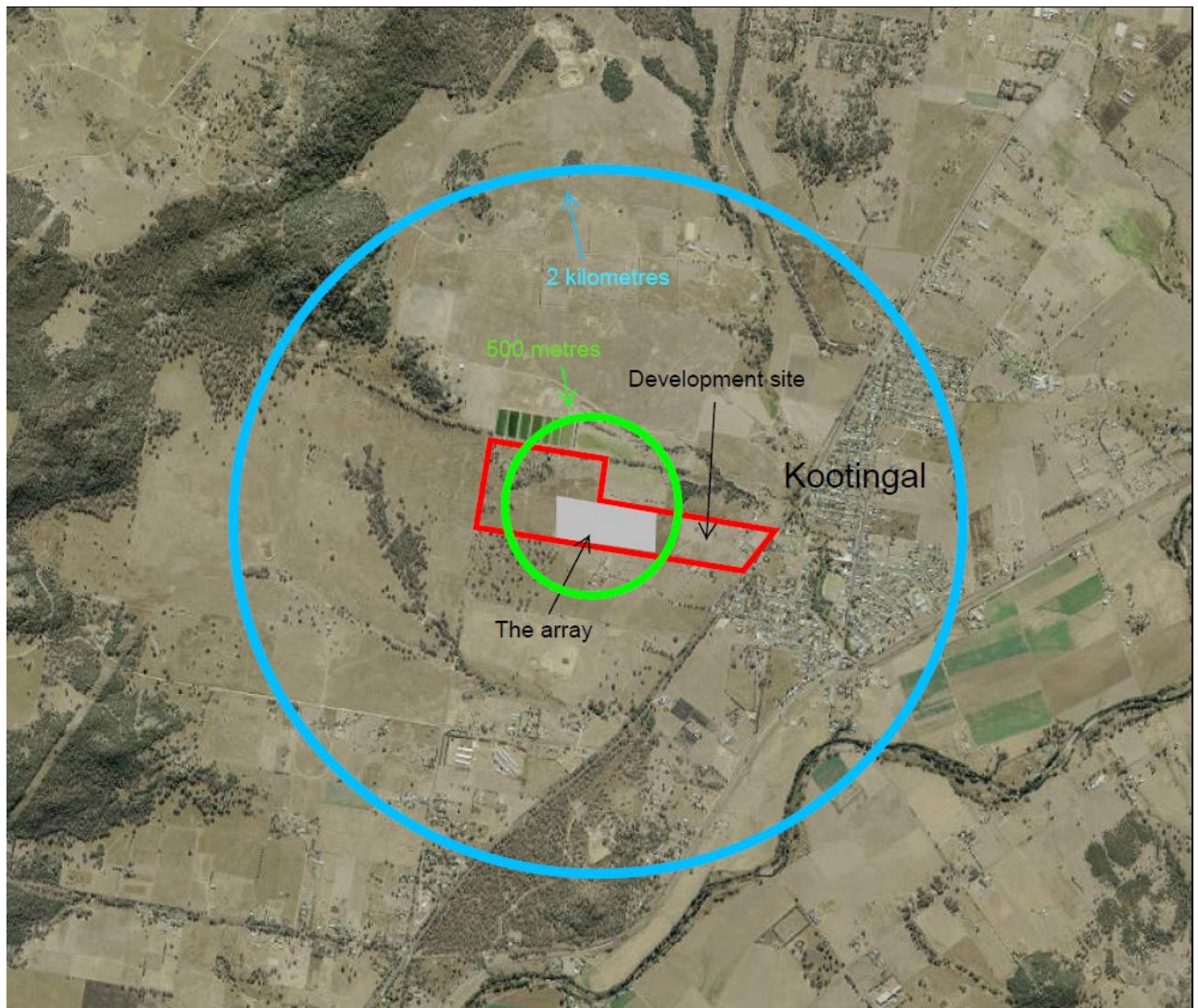


Figure 3: The visual catchment. Source: SIX Maps

Below are photographs of views towards the development site from public roads and the elevated part of the village of Kootingal. The photos demonstrate the extent of visibility of the site from a number of locations and each primary compass direction. Other than the photos taken from the private road, all photos are taken from public land as it is not possible to gain access to private property to take photos. Images taken from the New England Highway show that the development area is hidden from the view of passing motorists by topography. Photomontages that show the site prior to development and after completion of the solar farm are provided as Attachment A. The photomontages indicate that the panels will not be visible from the highway or dwellings on neighbouring properties. Due to the complexity of the undulating landscape and the solar farm design, photomontages can be difficult to produce and do not necessarily provide a realistic view of how the constructed solar farm will look. These are indicative only and the actual development may differ from these images.



Plate 6: Looking west from the private access road/New England Highway intersection



Plate 7: Looking north towards the development site from the New England Highway



Plate 8: Looking south-west from near the intersection of Denman Avenue and Oak Street, Kootingal



Plate 9: Looking south-west from the intersection of Denman Avenue and Oak Street, Kootingal

The directional areas within the viewshed shown as A1 to A6 in Figure 4 include 27 dwellings within the visual catchment of 2 kilometres radius of the development site. Nine roads including the private access road are also within the visual catchment. There are two dwellings within a 500 metre radius of the development area which are residences on properties to the south that are located 170 metres and 390 metres to the south from the security fence as shown on the General Arrangement Plan KOO1C-G-2100. The residence on the development site that is occupied by the landowners is located 580 metres east of the facility. Note that distances provided in Table 5 may differ marginally from the General Arrangement Plan due to whether it is calculated from the security fence or the centre of the array. The council depot located immediately to the north of the development site is not considered in this visual analysis as it is essentially an industrial type use that would not be impacted by the presence of a solar farm. The site itself is mostly cleared and there are no existing structures or vegetation in the development area that would screen the site. However, the fall of the land and the topography of the surrounding countryside provides interference with direct views over the property from most directions.

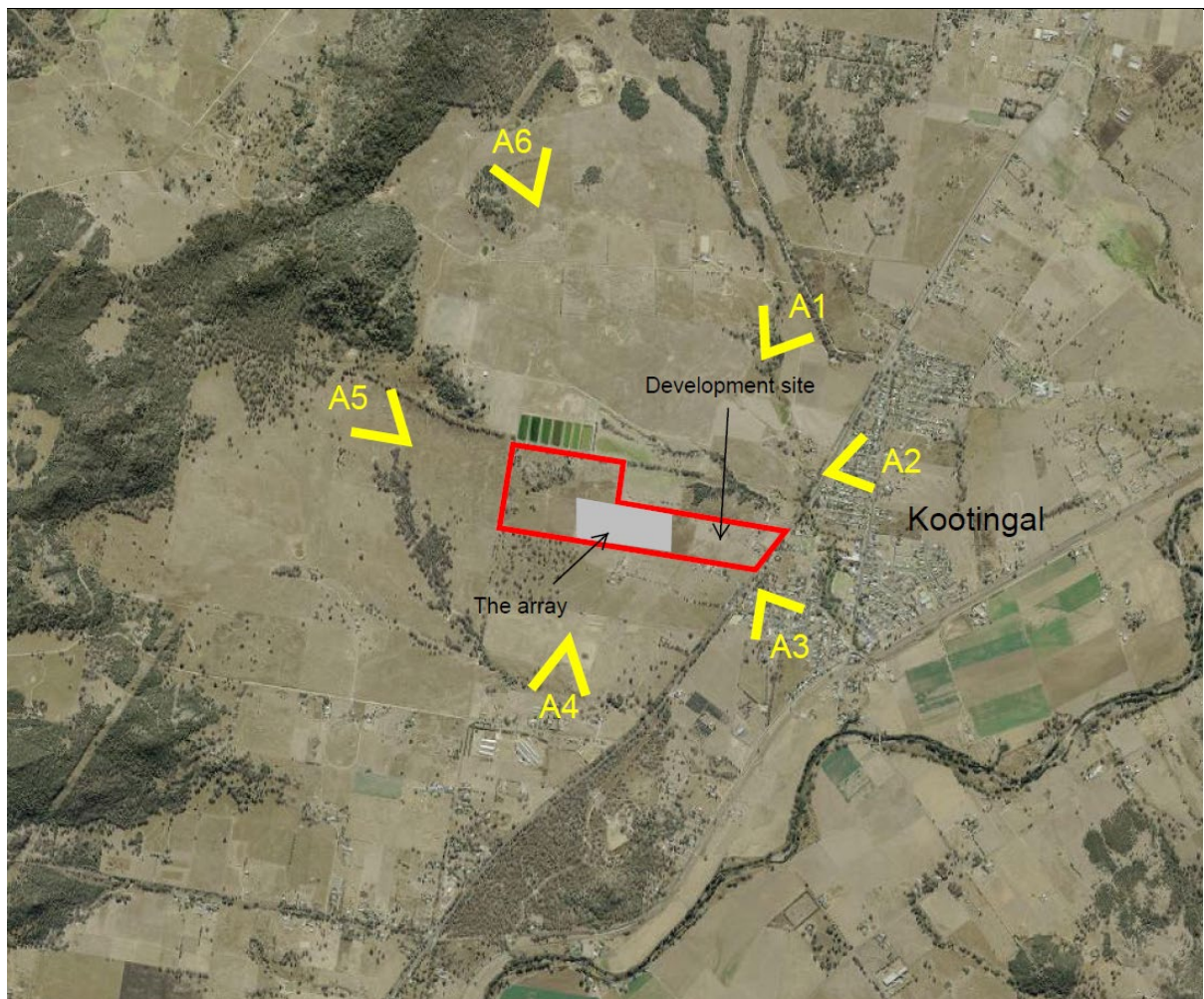


Figure 4: Directional areas within the viewshed and visual catchment. Source: ITP Renewables

Whilst it is acknowledged that the array may be visible from unoccupied parts of a property, it is considered that the view from a dwelling is more critical than from yards and paddocks. Regardless of the distance, the visual assessment takes into account the sensitivity of the observation point to the development and ranks impacts according to the matrix given above in Table 4.

7. Assessment of visual impacts

The observation points located within the viewshed and visual catchment are identified in Figure 5 below. These observation points coincide with those used to assess the potential impacts of glare and glint in the Glare and Glint Assessment dated 9 September 2020 and prepared by ITP Renewables.

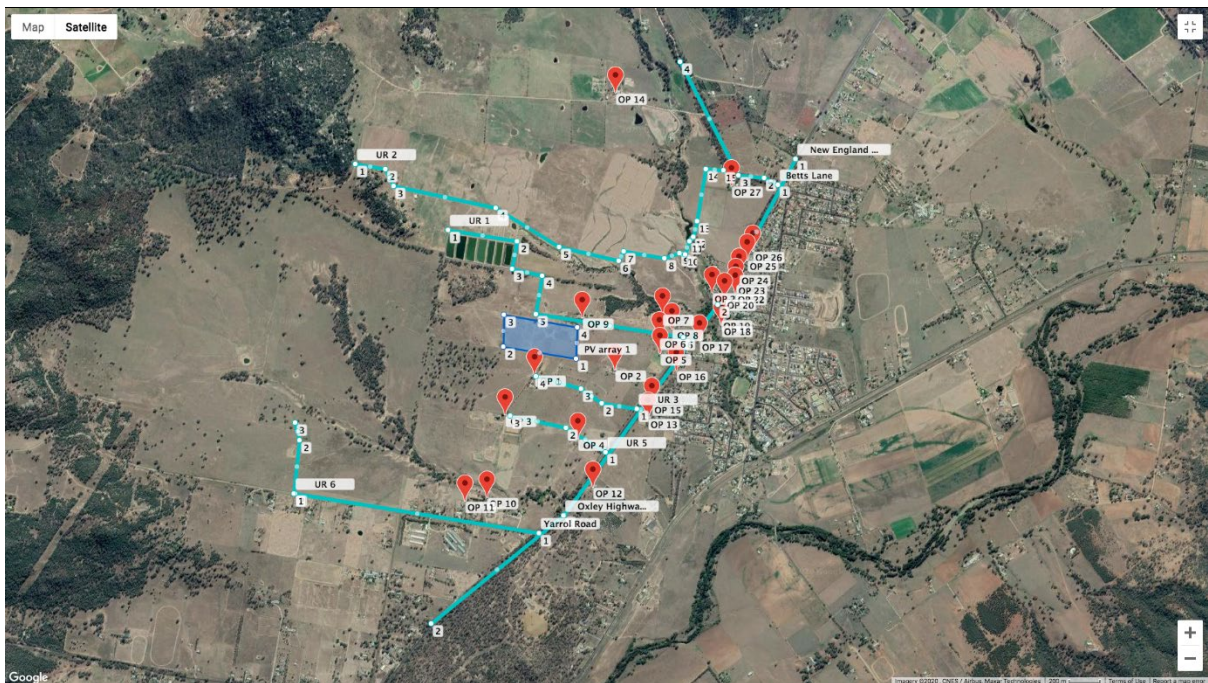


Figure 5: Observation points within the viewshed and visual catchment. Source: ITP Renewables

Table 5 below indicates the magnitude of the proposed solar farm in terms of the visual change in the landscape and proximity to the observation point, and the degree of sensitivity based on the quality of the view, whether the site is clearly visible or obscured by landform or vegetation, the direction and composition of the view, and how sensitive the view is to changes in the landscape that will result from the proposed development.

A rating is then given based on magnitude and sensitivity using the landscape character and visual impact grading matrix.

Table 5: Observation point impacts

Observation point	Directional area	Location relative to solar farm	Comment	Magnitude	Sensitivity	Impact rating
OP1 Residential	A4	0.34 km south	The fall of the land away to the north-north-east prevents visibility of the development from the dwelling	Moderate	High	Moderate-high
OP2 Residential	A4	0.66 km south-east	The fall of the land away to the north-north-east prevents visibility of the development from the dwelling	Moderate	Low	Low
OP3 Residential	A4	0.61 km south	The fall of the land away to the north-north-east prevents visibility of the development from the dwelling	Moderate	Low	Low-moderate
OP4 Residential	A4	0.83 km south-east	The fall of the land away to the north-north-east prevents visibility of the development from the dwelling	Moderate	Low	Low-moderate
OP5 Residential	A3	0.93 km east	Distance separation and vegetation and structures on intervening land prevents visibility of the development	Moderate	Low	Low-moderate
OP6 Residential	A3	0.89 km east	Distance separation and vegetation and structures on intervening land prevents visibility of the development	Moderate	Low	Low-moderate
OP7 Residential	A3	0.90 km east	Distance separation and vegetation and structures on intervening land prevents visibility of the development	Moderate	Low	Low-moderate
OP8 Residential	A3	0.97 km east	Distance separation and vegetation and structures on intervening land prevents visibility of the development	Moderate	Low	Low-moderate
OP9 Industrial	n/a	0.38 km north-east	The development will be visible. Impacts are negligible due to the industrial character	Negligible	Negligible	Negligible
OP10 Residential	A4	1.16 km south	Distance separation, topography and vegetation and	Low	Low	Low

Observation point	Directional area	Location relative to solar farm	Comment	Magnitude	Sensitivity	Impact rating
			structures on intervening land prevents visibility of the development			
OP11 Residential	A4	1.22 km south	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP12 Residential	A4	1.17 km south-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP13 Residential	A3	1.02 km south-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP14 Residential	A1	1.62 km north	The development will be visible in the distance. Intervening vegetation will lessen the impact	Moderate	Moderate	Moderate
OP15 Residential	A3	0.99 km south-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP16 Residential	A3	1.04 km east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP17 Residential	A2	1.17 km east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low

Observation point	Directional area	Location relative to solar farm	Comment	Magnitude	Sensitivity	Impact rating
OP18 Residential	A2	1.29 km east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP19 Residential	A2	1.29 km east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP20 Residential	A2	1.31 km east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP21 Residential	A2	1.24 km north-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP22 Residential	A2	1.39 km north-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP23 Residential	A2	1.40 km north-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP24 Residential	A2	1.44 km north-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP25 Residential	A2	1.40 km north-east	Distance separation, topography and vegetation and	Low	Low	Low

Observation point	Directional area	Location relative to solar farm	Comment	Magnitude	Sensitivity	Impact rating
			structures on intervening land prevents visibility of the development			
OP26 Residential	A2	1.56 km north-east	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
OP27 Residential	A1	1.62 km north-east	The development will be visible in the distance. Intervening vegetation will lessen the impact	Moderate	Moderate	Moderate
Betts Lane (road route)	A1	North-east	The development will be visible due to the elevation of this road	Moderate	Moderate	Moderate
New England Highway (road route)	A2/A3	East	The development will not be visible to motorists due to topography	Low	Low	Low
Yarrol Road (road route)	A4	South	Distance separation, topography and vegetation and structures on intervening land prevents visibility of the development	Low	Low	Low
Unnamed Road (road route)	A6	North	The development will be visible. Impacts are negligible due to the character of development along this road and private use by council staff	Negligible	Negligible	Negligible
Unnamed Road (road route)	A5	North	The development will be visible in the distance from the western extent of this road	Moderate	Low	Low-moderate
Unnamed Road (road route)	A3	South-east	The fall of the land away to the north-north-east prevents visibility of the development	Low	Low	Low
Unnamed Road 4 (road route)	A4	South	The fall of the land away to the north-north-east prevents visibility of the development	Low	Low	Low

The visual impact of the proposed works is assessed to range from negligible to moderate-high for the observation points identified in this assessment – being 27 dwellings and nine roads including the private access road. The solar farm would not be visible to dwellings in close proximity south of the site due to topography. The land falls to the north-north-east away from these properties as well as to road routes in this direction. Some observation points to the east of the development site in the township of Kootingal are elevated above development site, however, trees and structures on intervening land would impede visibility of the solar farm. Roadside vegetation and the sloping topography of the land within a two kilometre radius would serve to minimize visual impacts to all other observation points including the New England Highway and local roads, except Betts Lane, the two unnamed roads immediately north of the site and to two dwellings in elevated positions to the north. These dwellings are sufficiently distant to render the impact as moderate.

These impacts are considered acceptable given the nature of the proposed development and that it will contribute to renewable energy generation and provide a source of electricity for domestic and commercial use whilst at the same time assisting to reduce greenhouse gas emissions and our reliance on fossil fuels.. It is expected that acceptance of and adaptation to change will occur within a relatively short space of time following completion of works.

8. Assessment against planning principles

The Land and Environment Court consistently applies a set of planning principles derived from the case *Tenacity Consulting v Warringah* [2004] NSWLEC 140 when considering the acceptability of the impact of a proposed development on views enjoyed from private property in the vicinity of that development. These planning principles are addressed below in relation to the proposed Kootingal Solar Farm.

Impact on private property

Step 1: The views to be affected

The solar farm would be visible to dwellings in elevated positions to the north of the development site. These dwellings are over 1.5 kilometres away so views would be distant. Elsewhere vegetation, topography and distance would obstruct direct visibility of the array.

The view enjoyed from these properties is one of an undulating mixed rural landscape interspersed with rural and rural lifestyle dwellings situated adjacent an urban area.

Step 2: From what part of the property the views are obtained

District landscape views are from dwellings, yards, paddocks and access roads. Private property has not been accessed during preparation of this assessment, however, the parts of the properties that obtain views would vary depending upon the orientation of each dwelling and positioning relative to topography.

Step 3: The extent of the impact

The scale of the solar farm within the landscape is limited and accounts for only a small visible area. The array will occupy 11 hectares of the 58.2 hectare property – a coverage of 19% of the total property. The nature of the landscape is undulating and traversed with watercourses that have vegetated riparian areas meaning that extensive views are generally interrupted by either topography or vegetation. The extent of the impact is therefore considered moderate, especially given that the development site is a working farm and the proposed footprint of the array is less than one-fifth of the whole property.

Step 4: The reasonableness of the proposal that is causing the impact

The proposed solar farm is a project that is suited to a rural location. The property is a working farm and the production of solar energy is an activity that is mandated by *SEPP (Infrastructure)* as permissible in a rural zone. The development will contribute to the viability of other farm operations, be compatible with those operations and enable the property to continue to be productive. A solar farm is considered a reasonable land use of the development site.

Impact on the public domain

The case *Rose Bay Marina Pty Ltd V Woollahra Municipal Council and Anor* [2013] NSWLEC 1046 established planning principles to be considered when assessing the impact of a development on the public domain. The process must account for reasonable development expectations as well as the enjoyment of members of the public of outlooks from public places.

Step 1: The nature and scope of existing views

Views from the public domain towards the development site are from local unnamed roads to the immediate north of the site and from Betts Lane. These views are across an open rural landscape that is occupied by sewerage treatment ponds and Council's Kootingal depot which contains materials scattered across the yards.

Step 2: The locations from which the potentially interrupted view is enjoyed

The views are potentially interrupted from local roads in close proximity to the north comprising an unnamed road that runs east to west adjacent the sewerage treatment ponds and the private road adjacent the development site and provides access to those ponds and the Council depot. The location is not visible from the New England Highway due to topography.

Step 3: The extent of the obstruction at each relevant location

The photomontages indicate the extent of view obstruction from the private access road to the sewerage treatment ponds and the depot. There are no significant landscape features that would be obstructed by the solar farm as the array would be on higher ground than the road pavement. The extent of obstruction to the unnamed road to the north and the private road are negligible as views towards the development site are across infrastructure works. The extent of obstruction to Betts Lane would be moderate but mitigated by the varied components of the landscape and separation distance.

Step 4: The intensity of public use of those locations where that enjoyment will be obscured

The local roads are used to access rural properties and infrastructure works and are of low intensity of use. It is estimated that usage of the public roads would be approximately 4 vehicle movements per day per dwelling. Other local roads, including the private access road which is used by Council maintenance staff for the sewerage treatment plant and depot, would experience greater use.

Step 5: Whether or not there is any document that identifies the importance of the view

There is no strategic plan of Tamworth Regional Council or the NSW Government that identifies the importance of the view. It is not mapped as a scenic landscape or as visually sensitive land in *Tamworth Regional LEP 2010*.

In summary, assessment against the planning principles established by the NSW Land and Environment Court finds that the potential impacts of the proposed solar farm on views from both private property and the public domain are acceptable. It is important to note that all development has a visual impact, irrespective of the size or scale of that development.

The planning principles are not predicated on a position that a landowner or occupant has a proprietary right to retain all or part of the views enjoyed from their land. The Court has acknowledged that even entire view loss is reasonable in certain circumstances (Lindsay Taylor Lawyers, November 2015). In

this case there is no view loss, the impact is a change to the view – a new element within a rural landscape that is likely to merge with and add interest to that landscape.

9. Conclusion and recommendations

The landscape of Kootingal is one that has been modified by human activity associated with the agricultural industry and urban development. To the west of the New England Highway it is characterised by a mix of farming, rural uses and infrastructure including roads, sewerage treatment ponds and the council depot. To the east of the highway it is characterized by urban residential development surrounded by rural residential allotments. The impact of the proposed Kootingal Solar Farm on landscape character has been assessed to range from negligible to low for private property and from low to moderate for the public domain. Overall, the impact is assessed to be low based on a ranking of the magnitude of works and sensitivity to change in landscape character.

The visual impact of the proposed works is assessed to range from negligible to high-moderate for the observation points identified in this assessment – being 27 dwellings and nine roads. The solar farm would only be visible to dwellings in elevated positions to the north of the development site and to Betts Lane and unnamed roads to the north. Distance separation and infrastructure works on intervening land would assist to mitigate the impact to these observation points. Roadside vegetation, built structures and the slope of the development site to the north-north-east would serve to obstruct visibility to most observation points.

The findings of the assessment acknowledge that there will be impacts on the landscape and visual amenity as there are with any type of development. However, there is no view loss; the impact is a change to the view – a new element within a complex and varied landscape that may well add interest to that landscape. Impacts are greatest in close proximity to the solar farm as the further the distance a viewpoint is from the site the less the overall visual impact as the development occupies a lesser proportion of the total view.

On balance and having regard to other matters for consideration under section 4.15 *Evaluation of the Environmental Planning and Assessment Act 1979*, the impacts are considered acceptable given that the solar farm will contribute to renewable energy generation and provide a source of electricity for local domestic and commercial use whilst at the same time assisting to reduce greenhouse gas emissions and our reliance on fossil fuels.

It is recommended that a vegetation screen be planted along the northern and southern extent of the arrays. Plants that are endemic to the Kootingal area and that grow to a maximum height of 2.5 to 3

metres would be selected for the northern boundary. Larger plants may be appropriate along the southern boundary as overshadowing of the panels is not likely to occur.

It is considered that screening with vegetation on the eastern and western sides of the array would not be of benefit as the array would not be visible to the New England Highway and the hills to the west are elevated and overlook the site.

Screening is not likely to visually diminish or obscure the development when seen from properties that overlook the development site in any direction due to their elevation and distance separation.

Attachment A

Photomontages and indicative views from public places



Image 1: Looking east from the private access road near the property entrance



Image 2: Looking west from the private access road near the property entrance



Image 3: Looking south from the private access road



Image 4: Looking west towards the development area from the intersection of the private access road and the New England Highway



Image 5: Looking north-west towards the development area from the New England Highway



Image 6: Looking south-west towards the development area from an elevated position near the intersection of Denman Avenue and Oak Street, Kootingal

Noise Assessment

Kootingal Solar Farm
Kootingal, NSW.



Document Information

NOISE ASSESSMENT

Kootingal Solar Farm, Kootingal NSW.

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APPENDIX A – GLOSSARY OF TERMS		

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by ITP Development Pty Ltd (ITP) to complete a Noise Assessment (NA) for the proposed Kootingal Solar Farm near Kootingal, NSW (the 'project'). This report presents the methodology and findings of the NA for the construction and operation of the project.

1.1 Purpose and Objectives

A NA is required as part of the Statement of Environmental Effects (SEE) to be submitted to the Tamworth Regional Council (TRC) as part of the Development Application (DA). The purpose of the NA is to quantify potential environmental noise emissions associated with the construction and operation of the project. Where impacts are identified, the assessment includes recommendations for potential noise mitigation and management measures.

1.2 Scope of the Assessment

The NA includes the following key tasks:

- review construction and operating activities to identify key noise generating plant, equipment, machinery or activities proposed to be undertaken as part of the project;
- identify the closest and/or potentially most affected receivers situated within the area of influence to the project;
- establish existing noise levels to determine project-specific construction Noise Management Levels (NMLs), and operational noise criteria;
- undertake 3D noise modelling to predict levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receivers;
- provide a comparison of predicted noise levels against relevant construction and operational criteria;
- assess the potential noise impacts associated with construction and operational aspects of the project; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where NMLs or operational criteria may be exceeded.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Project Description

2.1 Background

ITP propose to construct and operate a 5 Megawatt (MW AC) solar farm using photovoltaic (PV) technology at “Roseamere”, 1599 New England Highway, approximately 1km west of Kootingal, NSW.

2.2 Description of Proposed Construction Works

The project includes installation of groups of north facing PV modules (approximately 2m x 1m) on mounting structures up to approximately 2.7m in height. An estimated 12,100 PV panels will be installed using a single axis tracking system, tilted +/- 60° along the north-south axis. The PV mounting structure would comprise steel posts driven up to approximately 1.5 to 3.5m below ground using a small pile driver. Additional support structures would be attached to the piles, which would then support the PV panels.

Earthworks will primarily involve trenching which is required for cabling of each PV array/module to the inverters. Other minor earthworks would be completed for the preparation of the site and in most cases a concrete slab would be required to support the ancillary infrastructure. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

It is anticipated that the solar farm would be constructed in stages, with two to three stages in construction at any one time over a three month period during standard construction hours.

During construction and operational phases, all vehicles would access the project from the New England Highway onto the TRC owned road (which provides access to the water treatment plant).

During construction, traffic generated by the project would include employee and delivery vehicles. During the peak construction period, the daily traffic volume is expected to be up to four heavy vehicles (semi-trailers or b-doubles) per hour and 20 light commercial vehicles or equivalent mini buses for worker transport during the morning and afternoon peaks.

2.3 Description of Proposed Operation

PV infrastructure on site will comprise of groups of PV panels installed in rows running north to south. Each row of PV modules will rotate to track the sun across the sky from east to west each day. There is approximately 6.25m spacing between each row. The hub height of each tracker is 1.5m with the peak of the modules reaching a height of 2.7m when the array is fully tilted.

Electrical cabling would be attached beneath the modules and would connect the individual PV modules to each other. Inverters will be located centrally to groups of PV panels and connected to each other by underground cables. The PV modules will be on a single axis tracker system which will follow the sun and move in an east to west direction.

The project will be contained solely within the site as shown in **Figure 1**.

The project would operate 24 hours a day, 7 days a week, with no permanent staff on site. During operation, the PV panels would generate electricity which would be fed into the power grid via connection located on New England Highway. Key noise emissions from the operation of the project are associated with the inverter and transformer(s). It is noted that emissions from these sources are anticipated to be acoustically insignificant compared to ambient background noise levels at assessed receivers.

When required, maintenance activities will occur during standard working hours (except for emergencies) and are expected to include:

- panel cleaning;
- repairs or replacement of infrastructure, as required; and
- land management including mowing to control vegetation as required.

Typical noise sources associated with maintenance activities would include light vehicle movements on site and maintenance of equipment.

2.4 Potentially Sensitive Receivers

Using aerial photography, geospatial information and other project design information, MAC has identified the following potentially sensitive receivers that may be affected by noise from operation or construction activities and project related road traffic. **Table 1** presents a summary of receiver identification address and coordinates. These are reproduced visually in **Figure 1**.

Table 1 Noise Sensitive Receivers				
ID	Description/Address	Receiver Type	Coordinates (MGA 55)	
			Easting	Northing
R1	1581 New England Highway	Residential	312900	6562650
R2	1653 New England Highway	Residential	313503	6562705
R3	1525 New England Highway	Residential	313209	6562277
R4	1527 New England Highway	Residential	312682	6562415
R5	1599 New England Highway	Residential	313747	6562843
R6	1625 New England Highway	Residential	313850	6563048
R7	Pine Street, Kootingal	Residential	314191	6563259
R8	1655 New England Highway	Residential	314059	6563267
R9	Willow Park Drive, Kootingal	Residential	314098	6563016
R10	1620 New England Highway	Residential	313983	6562954
R11	11 Gill Street, Kootingal	Residential	314104	6562817
R12	1 Gill Street, Kootingal	Residential	313907	6562862
R13	1600 New England Highway	Residential	313869	6562771
R14	2 Chelmsford Street	Residential	313695	6562562
R15	Hyson Street, Kootingal	Residential	313630	6562428
R16	Levien Street, Kootingal	Residential	313850	6562504
R17	Lenora Street, Kootingal	Residential	313822	6562312
R18	259 Sandy Road, Kootingal	Residential	313769	6562197
R19	1498 New England Highway	Residential	313319	6561953

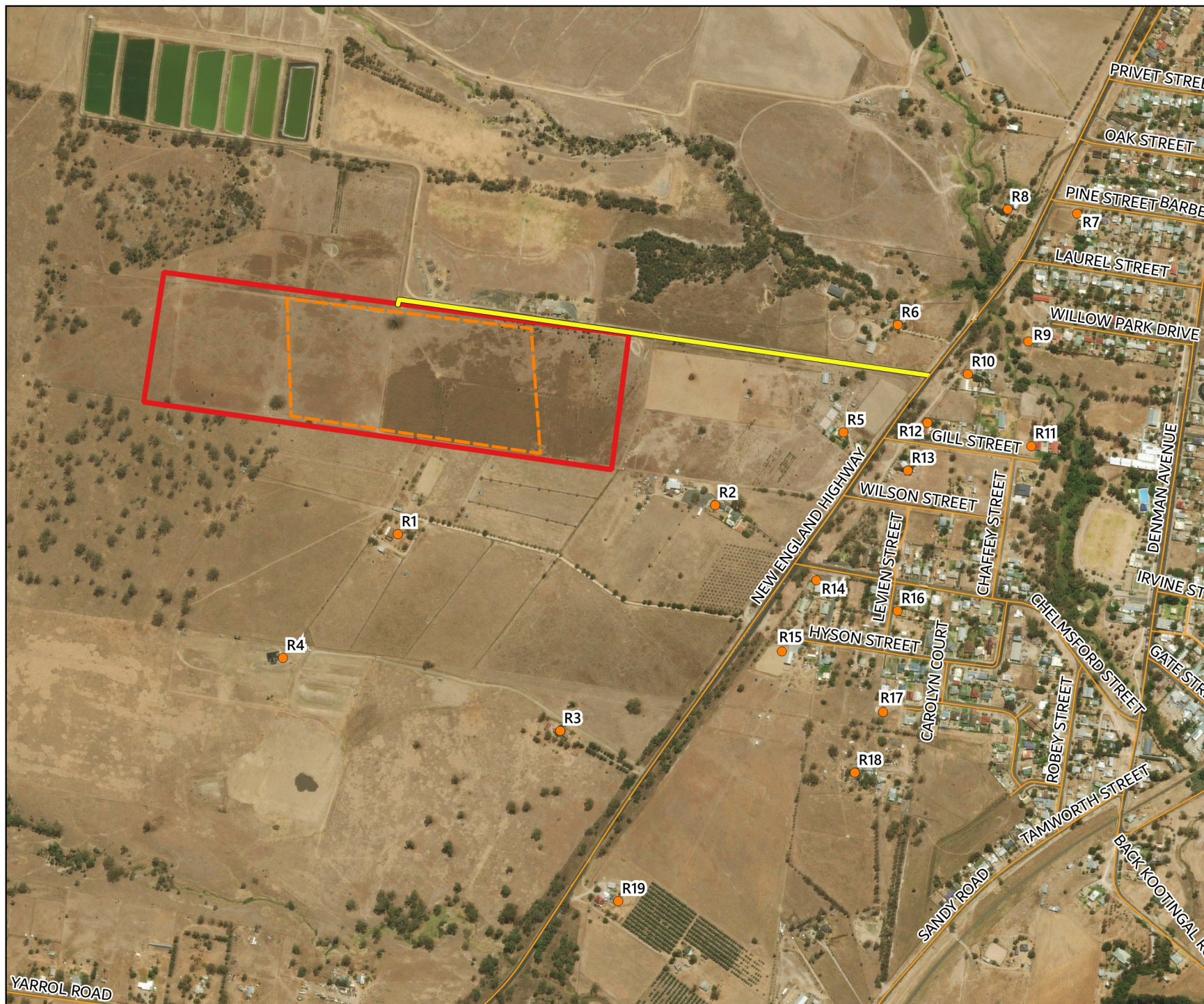


FIGURE 1
Project Layout
MAC180781-11
Kootingal Solar Farm

KEY

- Receivers
- Primary Access Route
- - - Panel Array
- ▭ Project Boundary



3 Noise Policy and Guidelines

This Noise Assessment has been conducted in accordance with the following key policy and guidelines:

- NSW Department of Environment and Climate Change, NSW Interim Construction Noise Guideline (ICNG), 2009;
- NSW Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), 2011; and
- US Federal Highways Administration/Environmental Protection Agency-Report 550/9-74-004 March (US FHWA).

The assessment has also considered and applied the following additional policy, guidelines and standards where relevant:

- Australian Standard AS 2436-2010 (R2016) (AS 2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites;
- Australian Standard AS 1055:2018 – Description and Measurement of Environmental Noise;
- Australian Standard AS /NZS IEC 61672.1-2019 (AS 61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring; and
- Australian Standard AS IEC 60942-2004 (AS 60942) – Electroacoustics – Sound Calibrators.

3.1 Interim Construction Noise Guideline

The assessment and management of noise from construction work is completed with reference to the Interim Construction Noise Guideline (ICNG). The ICNG is specifically aimed at managing noise from construction work regulated by the EPA and is used to assist in setting statutory conditions in licences or other regulatory instruments. The types of construction regulated by the EPA under the POEO Act (1997), include construction, maintenance and renewal activities carried out by a public authority, such as road upgrades as described in Schedule 1 of the POEO Act.

The ICNG sets out procedures to identify and address the impact of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; or
- Qualitative, which is suited to short term infrastructure maintenance (for projects with a typical duration of less than three weeks).

The methodology for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest relevant receivers. The qualitative assessment methodology is a more simplified approach that relies more on noise management strategies. This study has adopted a quantitative assessment approach.

The quantitative approach includes identification of potentially affected receivers, description of activities involved in the project, derivation of the construction noise management levels, quantification of potential noise impact at receivers and, provides management and mitigation recommendations.

Table 2 summarises the ICNG recommended standard hours for construction.

Table 2 Recommended Hours for Construction																									
Hour Commencing	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	
	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	
Monday	OOH Period 2							Standard Hours												OOH Period 1					
Tuesday																									
Wednesday																									
Thursday																									
Friday																									
Saturday																									
Sunday								OOH Period 1												OOH Period 2					
Public Holiday																									

The recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Work conducted outside of standard hours are considered out of hours work (OOH). OOH periods are divided into two categories representing evening and night periods and cover the hours listed below:

Period 1 (evening/low risk period): Monday to Friday – 6pm to 10pm, Saturdays – 1pm to 6pm, Sundays – 8am to 6pm.

Period 2 (night/medium to high risk period): Monday to Friday – 10pm to 7am, Saturdays/Sundays – 6pm to 7am (8am on Sunday mornings).

There are no out of hours work proposed for this project.

3.1.1 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 3** provides the ICNG recommended LAeq(15min) NMLs and how they are to be applied.

Table 3 Noise Management Levels		
Time of Day	Management Level LAeq(15min) ¹	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

3.1.2 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.

4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.
5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
6. Monitor and report environmental noise levels from the development.

3.2.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.2.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period.

The RBLs relevant to the project are contained in **Section 4**.

3.2.3 Project Intrusiveness Noise Level (PINL)

The PINL ($L_{Aeq}(15min)$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment.

3.2.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing on the project being assessed.

Additionally, Section 2.4 of the NPI states: “*to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows*”:

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The NPI states with respect to high traffic noise areas:

The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LAeq noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the LAeq, period(traffic) minus 15 dB(A).

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 4**.

Table 4 Amenity Criteria

Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship			
- internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

3.2.5 Maximum Noise Assessment Trigger Level

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- LAeq(15min) 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- LAmax 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in **Section 4.3**.

4 Assessment Criteria

Background noise monitoring has not been conducted for this project and hence, the minimum applicable RBLs of 35dBA for the daytime period and 30dBA for the evening and night time periods have been adopted in accordance with NPI methodology.

4.1 Construction Noise Management Levels

Noise Management Levels (NMLs) for construction activities at all residential receivers are 45dB LAeq(15min) (RBL +10dB). Construction activities are planned for standard hours, however the relevant NML standard construction hours and out of hours periods are summarised in **Table 5**.

Table 5 Construction Noise Management Levels			
Location	Assessment Period ¹	RBL, dBA	NML dB LAeq(15min)
All Residential Receivers	Day (Standard Hours)	35	45 (RBL+10dBA)
	Evening (OOH Period 1)	30	35 (RBL+5dBA)
	Night (OOH Period 2)	30	35 (RBL+5dBA)

Note 1: See table 2 for Recommended Standard Hours for Construction.

4.2 Operational Noise Criteria

4.2.1 Project Intrusiveness Noise Levels

The PINLs for the project are presented in **Table 6** and have been determined based on the RBLs +5dBA.

Table 6 Project Intrusiveness Noise Levels			
Receiver	Period ¹	Adopted RBL dB LA90	PINL dB LAeq(15min)
All Residential Receivers	Day	35	40
	Evening	30	35
	Night	30	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2.2 Project Amenity Noise Levels

The PANLs for receivers potentially affected by the project are presented in **Table 7**.

Table 7 Project Amenity Noise Levels					
Receiver Type	Noise Amenity Area	Assessment Period ¹	Recommended ANL dB LAeq(period) ²	PANL dB LAeq(period) ³	PANL dB LAeq(15min) ⁴
Residential	Rural	Day	50	50	53
		Evening	45	45	48
		Night	40	40	43

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Recommended amenity noise levels as per Table 2.2 of the NPI.

Note 3: Project Amenity Noise Level equals the amenity noise level as there is no other industry in the area.

Note 4: Includes a +3dB adjustment to the amenity period level to convert to a fifteen-minute assessment period as per Section 2.2 of the NPI.

4.2.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINLs or the PANLs. **Table 8** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI. For this assessment the night time PNTL of 35dB LAeq(15min) is the limiting criteria for residential receivers.

Table 8 Project Noise Trigger Levels				
Catchment	Assessment Period ¹	PINL dB LAeq(15min)	PANL dB LAeq(15min)	PNTL dB LAeq(15min)
Residential	Day	40	53	40
Receivers	Evening	35	48	35
(Rural)	Night	35	43	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 9** are based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 9 Maximum Noise Assessment Trigger Levels			
Residential Receivers			
LAeq(15min)		LAmax	
40dB LAeq(15min) or RBL + 5dB		52dB LAmax or RBL + 15dB	
Trigger	40	Trigger	52
RBL +5dB	35	RBL +15dB	45
Highest	40	Highest	52

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays; Night 10pm to 8pm.

Note: As per Section 2.5 of the NPI, the highest of the two criteria are adopted as the trigger level.

4.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the RNP. For this assessment, there are receivers along the New England Highway. The relevant road traffic noise criteria are provided in the RNP and are presented in **Table 10** for residential receivers.

Table 10 Road Traffic Noise Assessment Criteria for Residential Land Uses				
Road category	Road Name	Type of Project/Development	Assessment Criteria - dBA	
			Day	Night
			(7am to 10pm)	(10pm to 7am)
Arterial Roads	New England Highway	Existing residences affected by		
		additional traffic on existing arterial	60dBA LAeq(15hr)	55dBA LAeq(9hr)
		roads generated by land use developments	external	external

Note: For road noise assessments, the day period is from 7am to 10pm (ie there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

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5 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2020.0) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

5.1 Construction Assessment Methodology

Construction activities are proposed to be progressive (trenching, piling and assembly) and will occur at several locations simultaneously. Noise emissions were modelled for the following four scenarios:

- earthworks for internal road and compound construction including the stripping of topsoil and unsuitable soil and the placement and compaction of road base;
- earthworks involving trenching for cabling;
- piling of panel supports; and
- assembly of the panels.

It is envisaged that all construction scenarios have the potential to occur simultaneously at up to three locations across the site. Noise emission data and assumptions used in this assessment are summarised in **Table 11**. All significant noise generating construction activities will be limited to standard construction hours. Where low intensity construction activities are required to be undertaken outside standard construction hours, such as cabling, minor assembly, use of hand tools etc, they will be managed such that they are not audible at any residential receivers.

Table 11 Construction Equipment Sound Power Levels, Lw dBA re 10⁻¹² W				
Noise Source/Item	Utilisation %	Quantity	Lw/Item	Total Lw
Trenching & Earthworks				
Backhoe	80	1	104	103
Light vehicle	25	2	76	73
Total – Trenching & Earthworks				103
Piling				
Piling Rig (hydraulic)	80	1	113	112
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Total – Piling				113
Assembly				
Mobile Crane/HIAB	75	1	104	103
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Hand tools/Power tools	50	1	102	99
Welder	50	1	105	102
Total – Assembly				109
Transport (on site)				
Heavy vehicle	40	1	104	101
Tele-handler	50	1	106	103
Total – Transport				105

5.2 Operational Assessment Methodology

5.2.1 Operational Noise Modelling Scenarios

For this assessment, noise predictions were modelled for a typical worst-case operational scenario over a 15-minute assessment period based on the assumptions and sound power levels in **Table 12**. Plant noise emission data used in modelling for this assessment were obtained from manufacturers data or the MAC database. Where relevant, modifying factors in accordance with Section 3.3 and Fact Sheet D of the NPI have been applied to calculations.

Table 12 Operational Equipment Sound Power Levels, Lw dBA re 10⁻¹² W

Noise Source/Item	Activity	Quantity	Lw/Item	Total Lw
PV Panel Tracking Motor ^{1,2}	All tracking motors in operation 1 minute per 15-minute period	140	78	81
3MW Inverter	Constant	2	94 ²	97
5MVA Transformer	Constant	1	87 ²	87

Note 1: Tracking motor is situated underneath the PV panel, -5dB attenuation applied to account for shielding provided by the panel.

Note 2: Modifying factor penalty of +5dB added for low frequency and +5dB added for tonality.

5.2.2 Meteorological Analysis

Noise emissions from industry can be significantly influenced by prevailing weather conditions. Light stable winds (<3m/s) and temperature inversions have the potential to increase noise at a receiver.

Fact Sheet D of the NPI provides two options when considering meteorological effects:

- adopt the noise enhancing conditions for all assessment periods without an assessment of how often the conditions occur – a conservative approach that considers a source to receiver winds for all receivers and F class temperature inversions with wind speeds up to 2m/s at night; or
- determine the significance of noise enhancing conditions. This requires assessing the significance of temperature inversions (F and G Class stability categories) for the night time period and the significance of light winds up to 3m/s for all assessment periods during stability categories other than E, F or G.

Given that a detailed analysis of the significance of noise enhancing conditions has not been undertaken the meteorological conditions adopted in the noise modelling assessment are summarised in **Table 13**.

Table 13 Modelled Site Specific Meteorological Parameters

Assessment Condition ¹	Temperature	Wind Speed / Direction	Relative Humidity	Stability Class
Day - Calm	20°C	3m/s all directions	50%	D
Evening - Calm	10°C	3m/s all directions	50%	D
Night - Calm	10°C	2m/s all directions	50%	F

Note 1: Day 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening 6pm to 10pm; Night - the remaining periods.

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6 Results

6.1 Construction Noise Results

Noise levels were predicted at each assessed receiver at a height of 1.5m above ground level for typical construction activities. **Table 14** summarises the maximum predicted noise level from each of the construction scenarios (trenching, piling and assembly) at each receiver.

Table 14 Predicted Construction Noise Levels

Receiver ID	Description/Address	Predicted Noise Level Range dB LAeq(15min) ¹	Highest Predicted Noise Level dB LAeq(15min)	NML Standard Hours dB LAeq(15min)	Compliance Achieved
R1	1581 New England Highway	30-51	51	45	No
R2	1653 New England Highway	32-48	48	45	No
R3	1525 New England Highway	23-42	42	45	Yes
R4	1527 New England Highway	22-42	42	45	Yes
R5	1599 New England Highway	34-43	43	45	Yes
R6	1625 New England Highway	33-43	43	45	Yes
R7	Pine Street, Kootingal	27-38	38	45	Yes
R8	1655 New England Highway	29-39	39	45	Yes
R9	Willow Park Drive, Kootingal	26-36	36	45	Yes
R10	1620 New England Highway	28-38	38	45	Yes
R11	11 Gill Street, Kootingal	26-37	37	45	Yes
R12	1 Gill Street, Kootingal	31-41	41	45	Yes
R13	1600 New England Highway	29-39	39	45	Yes
R14	2 Chelmsford Street	26-40	40	45	Yes
R15	Hyson Street, Kootingal	24-40	43	45	Yes
R16	Levien Street, Kootingal	24-38	38	45	Yes
R17	Lenora Street, Kootingal	22-37	37	45	Yes
R18	259 Sandy Road, Kootingal	21-38	38	45	Yes
R19	1498 New England Highway	20-37	37	45	Yes

Note 1: Noise levels from construction activities vary due to their location across the project site.

Noise levels at the two nearest receivers (R1 and R2) are expected to exceed the NMLs when works are nearest to those locations. The exceedance would be temporary, and of short duration and is primarily due to piling and earthworks activities when at their closest point to receivers.

6.2 Operational Noise Results

Noise levels were predicted at each assessed receiver at a height of 1.5m above ground level during worst case noise enhancing meteorological conditions. **Table 15** summarises the predicted operational noise levels which are demonstrated to comply with the PNTLs at all residential receivers.

Table 15 Predicted Operational Noise Levels				
Receiver ID	Description/Address	Predicted Noise Level dB LAeq(15min)	Limiting Night PNTL dB LAeq(15min)	Compliance Achieved
R1	1581 New England Highway	<30	35	Yes
R2	1653 New England Highway	<30	35	Yes
R3	1525 New England Highway	<30	35	Yes
R4	1527 New England Highway	<30	35	Yes
R5	1599 New England Highway	<30	35	Yes
R6	1625 New England Highway	<30	35	Yes
R7	Pine Street, Kootingal	<30	35	Yes
R8	1655 New England Highway	<30	35	Yes
R9	Willow Park Drive, Kootingal	<30	35	Yes
R10	1620 New England Highway	<30	35	Yes
R11	11 Gill Street, Kootingal	<30	35	Yes
R12	1 Gill Street, Kootingal	<30	35	Yes
R13	1600 New England Highway	<30	35	Yes
R14	2 Chelmsford Street	<30	35	Yes
R15	Hyson Street, Kootingal	<30	35	Yes
R16	Levien Street, Kootingal	<30	35	Yes
R17	Lenora Street, Kootingal	<30	35	Yes
R18	259 Sandy Road, Kootingal	<30	35	Yes
R19	1498 New England Highway	<30	35	Yes

6.3 Maximum Noise Level Assessment - Operations

A detailed maximum noise level assessment is not required as predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40dB LAeq(15min) and there are no operational noise sources that could be considered to cause maximum noise events.

6.4 Road Traffic Noise Assessment

Access to the site will be directly off the New England Highway and would be the major transport route for all vehicles to access the project site. During construction, traffic generated by the project includes employee/subcontractor and delivery vehicles. The traffic volume over a typical day for standard construction hours is expected to be up to four heavy vehicles (semi-trailers or B-doubles) per hour and 20 light commercial vehicles or equivalent mini buses for worker transport during the morning and afternoon peak hour periods.

Predicted noise levels from project related construction traffic at 20m from the road to represent the potential for receivers situated close to the New England Highway, between the project site and the township, has been completed using the United States (US) Environment Protection Agency's road traffic calculation method and results are presented in **Table 16**. The US FHWA road traffic calculation method (based on equations in Appendix A-13) was used to predict the LAeq noise levels from construction vehicles travelling past receivers along public roads. This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered.

Table 16 Predicted Construction Road Traffic Noise Levels

Road Name	Offset Distance to Receiver	Predicted Noise Level	RTN Criteria	Compliance Achieved
New England Highway	20m	44dB LAeq(15hr)	60dBA LAeq(15hr)	Yes

Results demonstrate that project construction traffic noise levels would comply with the relevant RNP criteria.

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7 Recommendations

7.1 Construction Noise Recommendations

It is noted that construction noise emissions are expected to exceed the relevant NMLs at the two nearest receivers to the project. Recommendations for consideration during construction activities to reduce emissions to the surrounding community for this project may include:

- a construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community;
- where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (eg unloading and laydown areas);
- operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations;
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimise impact noise wherever possible;
- utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm;
- provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities;
- signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site; and
- utilise project related community consultation forums to notify residences within close proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.

7.2 Operational Noise Recommendations

Operational noise predictions identify that relevant noise criteria would be satisfied at all receivers. Notwithstanding, it is recommended that the proponent actively minimise potential noise emissions from the project. To assist in noise management for the project it is recommended that a one-off noise validation monitoring assessment be completed to quantify emissions from site and to confirm emissions meet relevant criteria.

8 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by ITP Development Pty Ltd (ITP) to complete a Noise Assessment (NA) for the proposed Kootingal Solar Farm near Kootingal, NSW. The assessment has quantified potential noise emissions associated with the construction and operation of the project.

The results of the NA demonstrate that construction noise levels have potential to exceed relevant construction NMLs at the two nearest receivers to the project. Recommendations have been provided to minimise the potential noise impacts from construction, albeit of a temporary nature during the daytime over a three month construction period.

Operational noise levels satisfy the NPI PNTLs for assessed receivers. However, recommendations to ensure noise levels are verified have been provided in this report.

Additionally, the NA demonstrates that the road noise criteria as specified in the RNP will be satisfied at receivers on the proposed transport route.

Based on the NA results, there are no noise related issues which would prevent the approval of the project. The results of the assessment shows compliance with the relevant operational and road noise criteria. Accordingly, no additional ameliorative measures will be required.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in Table A1.

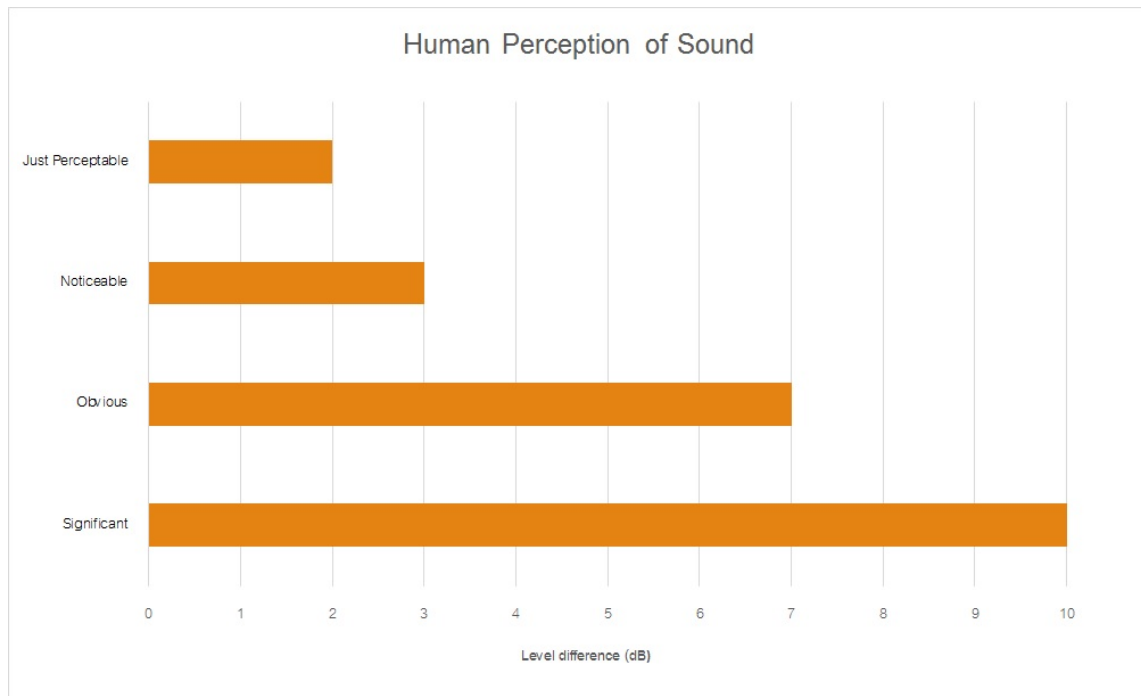
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically, a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmx	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : $= 10 \cdot \log_{10} (W/W_0)$ Where: W is the sound power in watts and W₀ is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Preliminary Site Investigation

Proposed Development at:
1599 New England Highway,
Kootingal, NSW, 2352

Lot 1 / - / DP328265, Lot 1 / - / DP722545 and
Lot 97 / - / DP753841

N4398

27th April 2021

Report distribution

Preliminary Site Investigation

Address: 1599 New England Highway, Kootingal, NSW, 2352
 Application Number: N4398
 Date of Report Written: 27th April 2021

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Version	Prepared for	Prepared by	Reviewed by	Date issue
FINAL	ITP Development	Luke Brevia Environmental Consultant 	Nick Caltabiano Project Manager 	27 th April 2021

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Executive Summary

NEO Consulting Pty Ltd was commissioned by ITP Development ('the client') to undertake a Preliminary Site Investigation (PSI) for the property located at 1599 New England Highway, Kootingal, NSW, 2352 ('the site'). The site is legally identified as Lot 1 / - / DP328265, Lot 1 / - / DP722545 and Lot 97 / - / DP753841 and has a total area of approximately 580298.69m². However, the area of the proposed development has an area of approximately 106491m² and is located within the middle of the site. The site is currently zoned as RU4 - Primary Production Small Lots.

The objectives of the PSI were to provide a preliminary assessment of potentially contaminating activities which may have impacted the site. The scope of work undertaken includes:

- A site inspection to identify potential sources of contamination;
- Historical investigations relating to the site (if any);
- Current and Historical Certificates of Title;
- Local Council records and planning certificates;
- NSW Environment Protection Authority (EPA) environmental contaminated lands register;
- Protection of the Environment Operations (POEO) Act public register;
- Dial-Before-You-Dig enquiry for an evaluation into local underground services and assets;
- Review of local geological and hydrogeological information, including an evaluation of the WaterNSW registered groundwater bore database;
- Acid Sulphate Soils (ASS) data maps; and
- Review laboratory results provided by the client for the site.

A site investigation was conducted on the 23rd March 2021 by NEO Consulting. The entire lot is vacant and contains a grass groundcover. The proposed development is located within the centre of the lot within a relatively flat surface. The site is located east of the main town district. The area of the proposed development has an approximate area of 106491m². The entire lot is 580298.69m² and is situated on an L-shape land.

There were no visible or olfactory indicators of potential contamination. There were also no obvious features associated with any underground tanks (bowzers, breather pipe, inlet valve and piping) or odour that would indicate the potential for contamination.

A soil investigation occurred where the Department of Industries (DPI) collected 50 soil samples from Area A to create 2 composite samples for laboratory analysis; Sample A1 and Sample A2. An additional 50 soil samples were taken from Area B to create 2 composite samples for laboratory analysis; Sample B1 and B2. Both areas of assessment are within of the proposed development, details of the Methods and Reports provided by the Client are within Appendix D. The soil samples were tested for OCs/OPs and Heavy Metals. None of the soil samples received results that were above the applicable Health Investigation Levels.

NEO Consulting finds that the site is suitable for the proposed land use, without the need for additional investigations or remediation.

1. Introduction

NEO Consulting Pty Ltd was commissioned by ITP Development ('the client') to undertake a Preliminary Site Investigation (PSI) for the property located at 1599 New England Highway, Kootingal, NSW, 2352 ('the site'). The site is legally identified as Lot 1 / - / DP328265, Lot 1 / - / DP722545 and Lot 97 / - / DP753841 and has a total area of approximately 580298.69m². However, the area of the proposed development ('Site of interest') has an area of 106491 m². The site is currently zoned as RU4 - Primary Production Small Lots.

This PSI was requested by a developer, and the report was aimed to provide a preliminary assessment of potentially contaminating activities which may have impacted the site. The format of this report follows the NSW EPA "*Consultants Reporting on Contaminated Sites*" (2020). In addition, NEO Consulting will provide recommendations if further investigation on site is required.

A site inspection was undertaken on the 23rd March 2021 by NEO Consulting. Reporting and photos were conducted on the day of inspection and with reference to the relevant regulatory criteria. Further information from the inspection is outlined in Section 4 of this report.

2. Scope of Work

The PSI has been prepared in general accordance with the following regulatory framework:

- NSW Environmental Protection Authority (EPA) "*Consultants Reporting on Contaminated Sites*" (2020);
- NEPM (2013), *Schedule B2 – Guideline on Site Characterisation*;
- State Environment Protection Policy 55 (SEPP 55). Remediation of Land Under the Environmental Planning and Assessment Act 1997; and
- National Environmental Protection (Assessment of Site Contamination) Measure – National Environmental Protection Council 2013.

The scope of works required to complete the PSI includes:

- A site inspection for evidence of sources of potential contamination on-site and neighbouring properties;
- Historical investigations relating to the site;
- Information on the current and Historical Certificates of Title;
- Local Council records and planning certificates;
- NSW EPA environmental contaminated lands register;
- Protection of the Environment Operations (POEO) Act public register;
- Dial-Before-You-Dig enquiry for an evaluation into local underground services and assets;
- Review of local geological and hydrogeological information, including an evaluation of the WaterNSW registered groundwater bore database;
- Acid sulphate soils (ASS) data maps;
- Establish whether data gaps may exist within the investigation;
- Development of a Conceptual Site Model (CSM) to identify the connections between potential sources of contamination, exposure pathways, and human/ecological receptors; and
- Recommendations for additional investigations (if any), based on the identified data gaps and findings of the PSI.

3. Site Details

A site investigation was conducted on the 23rd March 2021 by NEO Consulting. The area of the proposed development has an approximate area of 106491m². The entire lot is 580298.69m² and is situated on an L-shape land. The entire lot is vacant and contains a grass groundcover. The proposed development is located within the centre of the lot within a relatively flat surface.

Within a 500m radius, sensitive sites of contamination include vacant lots, Kootingal Hall, The North Shore – Kootingal and Double Dan Horsemanship Pty. The closest water body is Sandy Creek which is located approximately 200m north of the site. The location of the site is shown in **Figure 1** with a detailed site plan shown in **Figure 2**. All figures are located within **Appendix A**.

Table 1: Site Details

Address	1599 New England Highway, Kootingal, NSW, 2352
Deposited Plan	Lot 1 / - / DP328265, Lot 1 / - / DP722545 and Lot 97 / - / DP753841
Zoning	RU4 - Primary Production Small Lots
Locality Map	Figure 1
Site Plan	Figure 2
Area (approx.)	580298.69m ² (Area of the proposed development is approximately 106491m ²)

Table 2: Surrounding Land-Use Adjacent to the Site

Direction from Site	Land-Use
North	Residential Property followed by Sandy Creek
East	Oxley Highway followed by residential properties
West	Vacant Land
South	Residential Property

4. Site Condition

A qualified environmental consultant inspected the site on the 23rd March 2021. Site photographs are provided in **Appendix A**. Observations noted during the inspection are summarised below:

- The site of interest has an area of approximately 106491m² and is located within the middle of the lot.
- Healthy vegetation and thick grass groundcover are located within the site of interest
- The entire lot is mostly composed of vacant grass covered land.
- The shape of the lot is L- Shape
- There is minimal elevation within the site

5. Site History

5.1 History of Region

A documentary review of the owners of the site is summarised within **Table 3**.

Table 3: Land Ownership History of Lot 1 / - /DP328265, Lot 1 / - / DP722545 and Lot 97 / - / DP753841

Year	Tenants
	(Lot 1 DP 328265)
1988 – todate	Michael Keith Bryant Esther Mary Bryant
	(Lot 1 DP 328265 – CTVol 15476 Fol 250)
1987 – 1988	Michael Keith Bryant Esther Mary Bryant
	(Lot 1 DP 328265 – Area 60 Acres – CTVol 8459 Fol's 70 & 71)
1986 – 1987	Michael Keith Bryant Esther Mary Bryant
1963 – 1986	Alwyn Keith Bryant, farmer Beulah Merle Bryant, wife of Alwyn Keith Bryant, farmer
1963 – 1963	Alwyn Keith Bryant, farmer George Alexander Piddington Bryant, farmer
	(Lot 1 DP 328265 – Area 60 Acres – CTVol 4555 Fol 4)
1932 – 1963	George Bryant, farmer

5.2 Section 10.7 (2) Planning Certificate

A Section 10.7 Planning Certificate describes how a property may be used and the restrictions on development. The Planning Certificate is issued under Section 149 of the Environmental Planning and Assessment Act 1979. At the time of reporting, NEO Consulting could not access the Planning Certificate.

5.3 NSW EPA Contaminated Land Register

A search of NSW EPA contaminated land register for the subject site and surrounding area was not found.

5.4 Protection of the Environment Operations Act (POEO) Public Register

A search on the POEO public register of licensed and delicensed premises (DECC) of the subject site were not found. Within the suburb of Kootingal, two (2) results were found.

5.5 SafeWork NSW Hazardous Goods

SafeWork NSW Hazardous Goods was not conducted for this site, based on time constraints.

5.6 Product Spill and Loss History

The site inspection found no evidence to suggest chemical contamination impact on the site (i.e. chemical staining, unhealthy vegetation).

5.7 Dial Before You Dig

A review of assets and services via a Dial-Before-You-Dig request suggests no contamination is expected to impact the site via underground services and assets or act as a portal to transport potential contamination offsite.

6. Site Geology and Hydrology

The Geological Map of Sydney (Geological Series Sheet 9030, Scale 1:100,000, Edition 1, 1991), published by the Department of Minerals and Energy indicates the residual soils within Kootingal is underlain by Quaternary minerals. The Quaternary minerals is mostly composed of alluvium, gravel, sand, silt and clay.

A groundwater bore search was conducted on 27th April 2021 and twelve (8) registered groundwater bores were detected within 500m of the proposed site. The 5 closest groundwater bores are GW902662, GW900521, GW902465, GW013885 and GW012999.

It was beyond the scope of works to study the groundwater flow direction. However, based on regional topography and the nearest surface water source, Sandy Creek, groundwater is expected to flow north.

7. Acid Sulphate Soils

To determine whether there is a potential for ASS to be present at the site, information was reviewed utilising the NSW Office of Environment and Heritage and eSPADE map viewer. The data obtained depicted there was "no known occurrence" of the ASS. This review is indicative only as a detailed investigation into ASS risk at the site was not included as part of the scope of this PSI.

8. Areas of Environmental Concern

Based on the above information, the potential Areas of Environmental Concern (AEC) and their associated Contaminants of Concern (CoC) for the site were identified and summarised in **Table 4** below.

Table 4: Potential Areas and Contaminants of Concern

Potential Areas of Concern	Potentially Contaminating/ Hazardous Activity	Potential CoCs	Likelihood of Site Impact	Comments
Entire site	Historical farming and importation of potential fill material.	OCP/OPP and Heavy Metals	Low	Based on site observations, the presence of imported fill material is unlikely.

9. Conceptual Site Model

A conceptual site model (CSM) has been developed and presented in **Table 5** below, and provides a representation of the potential risks associated with the connections between the following elements:

- Potential contamination sources and their associated CoCs;
- Potential human receptors that may be impacted by the site contamination are current and future site users including occupants to the dwelling/infrastructures onsite, site workers and the general public within the immediate vicinity of the site;
- Potential environmental receptors to the site including but not limited to: groundwater and surface water bodies, residual soils at and/or nearby the site.
- Potential exposure pathways; and
- Whether source-pathway-receptor connections are complete based on current and future suite conditions.

Table 5: Conceptual Site Model

Potential Sources	Potential Receptor	Potential Exposure Pathway	Complete connection	Risk	Justification/Control Measures
Contaminated soil from historical farming practices	Site occupants, workers, general public	Dermal contact, inhalation/ingestion of particulates	Limited (current)	Low	Direct contact with potentially contaminated soils is limited.
			No (future)	Low	If present, impacted soils are likely to be disposed of off-site.
	Sandy Creek	Migration of impacted groundwater and surface water run-off.	No (current)	Low	Sandy Creek is approximately 200m north - east of the site. Unlikely contamination would reach Sandy Creek due to the distance from the site.
			Limited (future)	Low	If present, contaminated soils and groundwater are likely to be remediated. Unlikely contamination would reach Sandy Creek due to distance from site.
	Underlying aquifer	Leaching and migration of contaminants through groundwater infiltration.	Limited (current)	Low	Due to existing un-sealed surfaces, expected shallow bedrock, leachability of CoCs, migration of CoCs is likely to be limited.
			Limited (future)	Low	If present, contaminated soil and/or groundwater is likely to be remediated.

10. Data Gaps

NEO Consulting did not identify any significant Data Gaps.

11. Investigation Methodologies

NEO Consulting conducted the onsite investigation on the 23rd March 2021. NEO Consulting did not undertake the onsite soil sampling, it was undertaken independently by the client. The Methods, and laboratory reports can be found within **Appendix D**. NEO Consulting have compared the results against the applicable assessment criteria.

12. Assessment Criteria

The following soil assessment criteria were adopted for the investigation.

NEPM Health Based Investigation Level D (HILs D)

HILs are Tier 1 risk based generic assessment criteria used for the assessment of potential risks to human health from chronic exposure to contaminants in soil. They are intentionally conservative and based on a reasonable worst-case scenario for generic land use settings including Residential (HILs A/B), Open Space/Recreational (HILs C) and Commercial Industrial (HILs D). HILs D soil assessment criteria have been adopted based on the proposed development of the site.

NEPM Health Screening Levels D (HSLs D)

HSLs are Tier 1 risk based generic soil assessment criteria used for the assessment of potential risks to human health from chronic inhalation exposure of petroleum vapour emanating off petroleum contaminated soils (Vapour Risk). They are intentionally conservative and based on a reasonable worst-case scenario for generic soil types, contamination depth and land use settings including Residential (HSLs A/B), Open Space/Recreational (HSLs C) and Commercial Industrial (HSLs D). HSLs D soil assessment criteria for were adopted on the basis of the proposed development.

HSLs D for direct contact have been adopted from the CRC Care technical note 10.

NEPM Management Limits – Residential, parkland and public open space

Management Limits for petroleum have been developed for prevention of explosive vapour accumulation, prevention of the formation of observable Light Non-Aqueous Phase Liquids (LNAPL) and protection against effects on buried infrastructure. Residential, parkland and public open space limits have been adopted based on the proposed land use.

NEPM Soil Ecological Assessment Levels

Ecological investigation levels (EILs) depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2m of soil. EILs are determined by identifying ambient background concentration (ABC) and adding the added contaminant limits (ACL). The most appropriate land use for assessment is Urban residential and public open spaces.

To confirm the EIL for; CrIII and Pb, the ABC was assumed to be zero as a conservative measure, $EIL = ABC + ACL$.

The EILs for As, on soil type and are taken directly from NEPM Schedule B1, Table 1B(4).

Ecological screening levels (ESLs) for petroleum hydrocarbon materials broadly apply to coarse and fine grained soils and various land uses. They are applicable to the top 3m of soil.

The adopted ESLs were for Commercial and Industrial with clay.

13. INVESTIGATION RESULTS

13.1 Soil Analytical Results

The soil analytical results are summarised below. Soil analytical results are presented in the laboratory reports in **Appendix D**.

Heavy Metals

The site features very low levels of Heavy Metals.

Table 1: Heavy Metal values from each sample.

Chemical	Health Investigation Levels (HIL-D) Commercial/ Industrial	EIL Commercial/ Industrial	Sample	A2	B2
Arsenic	3,000	160		<5	<5
Cadmium	900	-		<0.3	<0.3
Chromium	3,600	660		8.5	9.2
Copper	240,000	-		2.7	4.3
Lead	1,500	1100		6.9	12
Nickel	6,000	-		3.0	3.8
Zinc	400,000	-		8.3	9.6

OCs/OPs

Table 11: No OCs/OPs was detected in the samples taken.

Chemical	Health Investigation Levels (HIL D) Commercial / Industrial	Sample	A1	B1
Mirex	100		<0.1	<0.1
Methoxychlor	2500		<0.1	<0.1
HCB	80		<0.1	<0.1
Endrin	100		<0.2	<0.2
Heptachlor	50		<0.1	<0.1

11. Conclusion

NEO Consulting finds that the site is suitable for the proposed land use, without the need for additional investigations or remediation.

12. Recommendations

Based on the information collected and available during this investigation, the following recommendations have been made:

- Any soils requiring excavation, on-site reuse and/or removal must be classified in accordance with "Waste Classification Guidelines Part 1: Classifying Waste" NSW EPA (2014);
- The demolition of any structures and excavation activity on site be undertaken in accordance with relevant Australian Standards, SafeWork NSW codes of practice and any other applicable requirements;

References

- Geological Survey of NSW Department of Minerals and Energy, Tamworth 1:100 000 Geological Series sheet 9030, (Edition 1) 1991.
- National Environment Protection Measures (2013), Schedule B1 – *Guideline on Investigation Levels for Soil and Groundwater*.
- National Environment Protection Measures (2013), Schedule B2 – *Guideline on Site Characterisation*.
- NSW EPA- Contaminated land register, <https://apps.epa.nsw.gov.au/prclmapp/sitedetails.aspx>, accessed on 27th April 2021.
- NSW Environmental Protection Authority, *Waste Classification Guidelines Part 1: Classifying Waste*, 2014.
- NSW Environmental Protection Authority, *Guidelines for Consultants Reporting on Contaminated Sites*, 2011.
- Protection of the Environment Operations Act (POEO) Public Register, <https://www.epa.nsw.gov.au/licensing-and-regulation/public-registers>, accessed on 27th April 2021.
- SafeWork NSW, *Site Search for Schedule 11 Hazardous Chemical on Premises*.
- State Environment Protection Policy 55 (SEPP 55). Remediation of Land Under the Environmental Planning and Assessment Act.
- Topography – map.com, <https://en-au.topographic-map.com/>, accessed on 27th April 2021.
- WaterNSW, <https://realtimedata.watarnsw.com.au/>, accessed on 27th April 2021.

Limitations

NEO Consulting were provided with paperwork and laboratory results for the site. NEO Consulting have undertaken all necessary processes to confirm the information provided is applicable for this site, however NEO Consulting will not be liable for any misinformation provided in good faith.

The findings of this report are based on the scope of work outlined in Section 2. NEO Consultants performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental consulting profession. No warranties, express or implied are made.

The results of this assessment are based upon the information documented and presented in this report. All conclusions and recommendations regarding the site are the professional opinions of NEO Consultants personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, NEO Consultants assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of NEO Consulting, or developments resulting from situations outside the scope of this project.

The results of this assessment are based on the site conditions identified at the time of the site inspection and validation sampling. NEO Consulting will not be liable to revise the report to account for any changes in site characteristics, regulatory requirements, assessment criteria or the availability of additional information, subsequent to the issue date of this report.

Neo Consulting is not engaged in environmental consulting and reporting for the purpose of advertising sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes.

Neo Consulting Pty Ltd

Prepared by:



Luke Brevia

Environmental Scientist

Reviewed by:



Nick Caltabiano

Project Manager

APPENDIX A

Figures

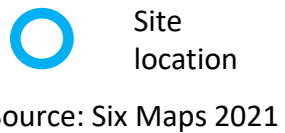
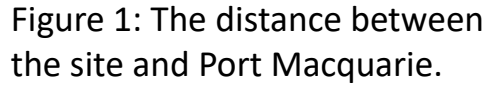


Figure 1	Locality Map
Project	1599 New England Highway, Kootingal, NSW, 2352



Figure 2: The latest image of the site shows that the lot is approximately 580298.69m². The red shaded area is the location of the proposed development.



Figure 2	Site Details of Map
Project	1599 New England Highway, Kootingal, NSW, 2352



Figure 3: Depicts an aerial view of the site and surrounding area within the year 2014. The site is a L – shaped lot that is vacant and contains a grass groundcover. The surrounding area is composed of vacant land and residential properties. The town of Kootingal is located east of the site.



Figure 3	Historical Photograph: 2014
Project	1599 New England Highway, Kootingal, NSW, 2352



Figure 4: Depicts an aerial view of the site and surrounding area within the year 2017. The site and surrounding area is similar to the image taken in 2014.



Figure 4	Historical Photograph: 2017
Project	1599 New England Highway, Kootingal, NSW, 2352



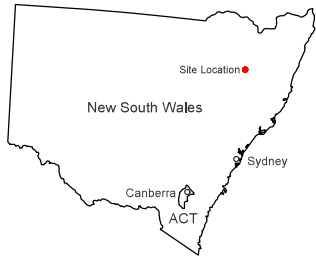
Figure 5: Depicts an aerial view of the site and surrounding area within the year 2021. The site and surrounding area is still similar to the image taken in 2017.



Figure 5	Historical Photograph: 2021
Project	1599 New England Highway, Kootingal, NSW, 2352



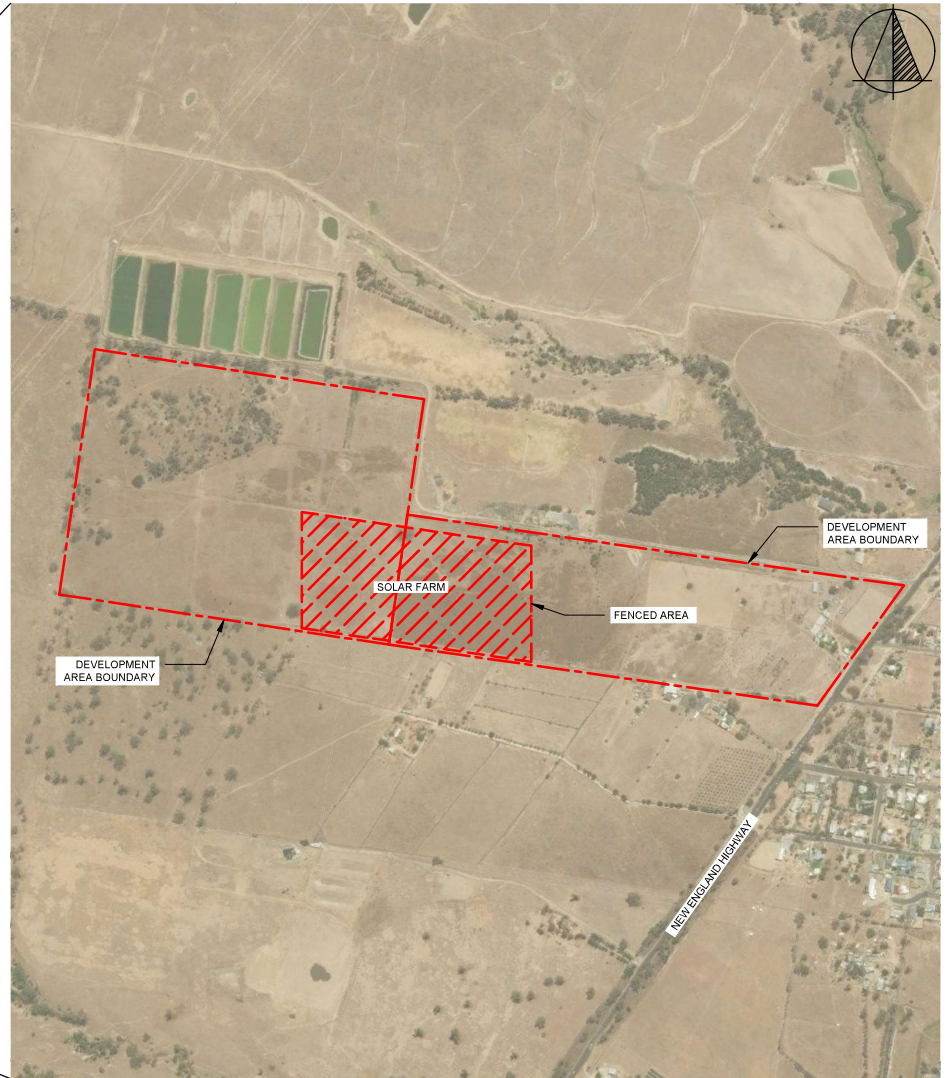
Figure 6	Onsite photos
Project	1599 New England Highway, Kootingal, NSW, 2352



1 STATE MAP
SCALE: NTS



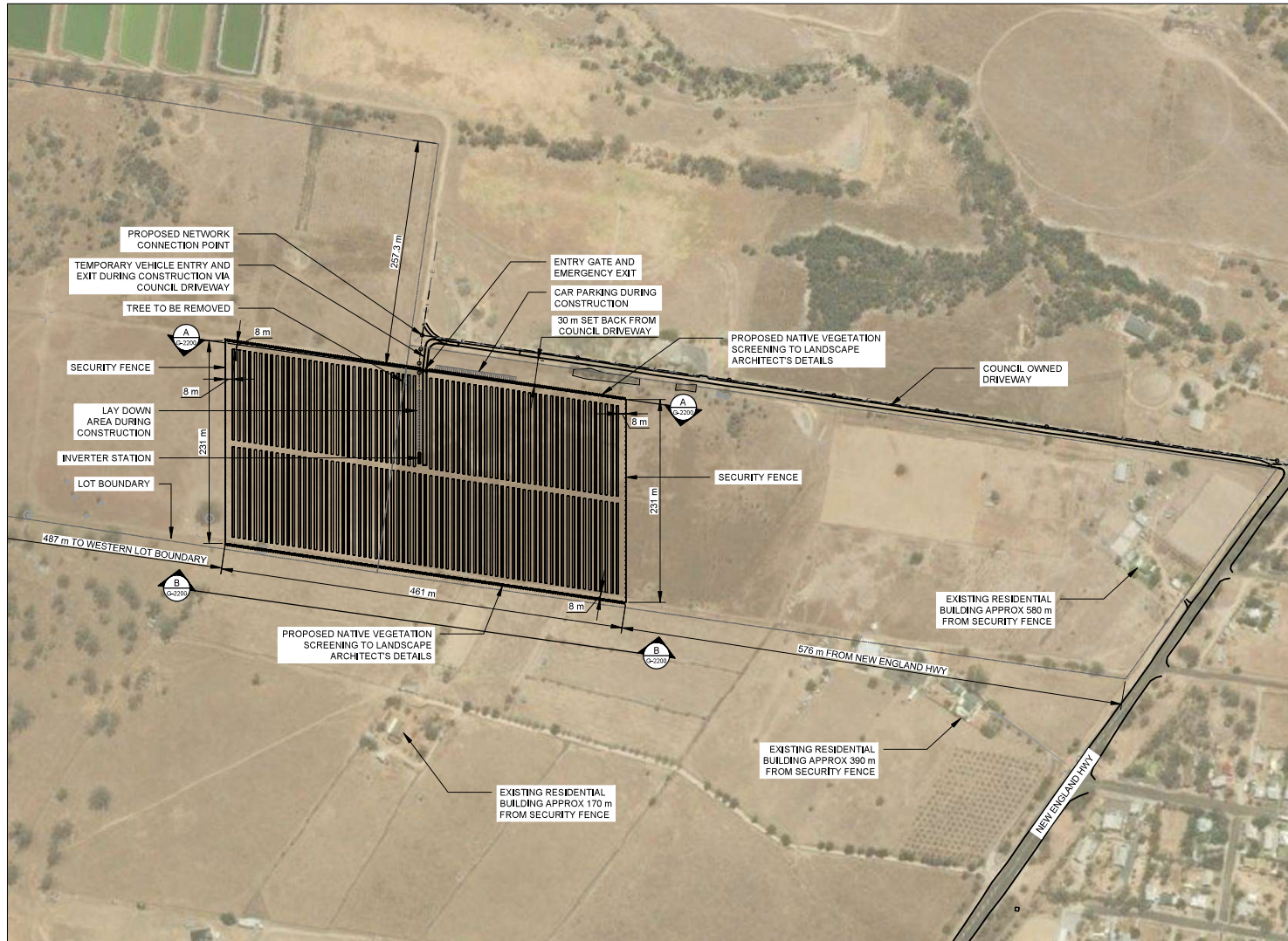
2 LOCATION PLAN
SCALE: NTS



3 SITE PLAN
SCALE: 1:10,000

DEVELOPMENT APPLICATION

NO.	STAGE	DATE	NOTES	PARTNERS	itp RENEWABLES P: +61 2 6257 3511 info@itp.com.au www.itp.com.au	PO BOX 8217 OCCONOR, ACT 2602 AUSTRALIA	DRAWN: MJB CHECKED: PMC APPROVED: SD DO NOT SCALE. ALL DIMENSIONS IN MM UNLESS OTHERWISE STATED. THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.	DRAWING: LOCATION PLAN PROJECT: KOOTINGAL 1C 5MW SOLAR FARM CLIENT: ITP DEVELOPMENT ADDRESS: NEW ENGLAND HWY KOOTINGAL, NSW 2352 DRAWING NO. KOO1C-G-0400	SCALE: AS NOTED SHEET SIZE: A3 ORIG. DATE: 2/12/20 REV. DATE: 19/1/21 REV NO. 2
1	DEVELOPMENT APPLICATION	04/12/2020							
2	DEVELOPMENT APPLICATION (DRAWING LAYOUT UPDATED)	13/01/2021							
3	----	----							
4	----	----							
5	----	----							
6	----	----							



SITE INFORMATION

LOT / DP	1/328285 & 97/753841
ADDRESS	NEW ENGLAND HWY, KOOTINGAL, NSW 2352
LGA	TAMWORTH REGIONAL COUNCIL
LAT / LONG	-31.052485 / 151.040477
ELEVATION	490 m
LOT AREA	58.2 ha
FENCED AREA	10.6 ha
DNSP	ESSENTIAL ENERGY

PROJECT INFORMATION

AC CAPACITY	5.0 MW
INVERTERS	2 x 3.0 MW
TRACKER SPACING (N-S)	MIN. 7 m
ARRAY PITCH	6.25 m
CONNECTION VOLTAGE	11 kV
CONNECTION FEEDER	ESSENTIAL ENERGY KTL3B2
CONNECTION SUBSTATION	ESSENTIAL ENERGY KOOTINGAL ZONE
SECURITY FENCE SETBACK	MIN. 3 m FROM OPTION BOUNDARY
ARRAY SETBACK	MIN. 8 m FROM SECURITY FENCE
ACCESS ROAD WIDTH	4 m

1 GENERAL ARRANGEMENT PLAN

SCALE: 1:5000

DEVELOPMENT APPLICATION

NO.	STAGE	DATE	NOTES	PARTNERS	DO NOT SCALE, ALL REQUIREMENTS IN MM UNLESS OTHERWISE STATED.	DRAWING NO.	GENERAL ARRANGEMENT PLAN
1	ISSUED FOR INFORMATION	09/07/2020					
2	ISSUED FOR DEVELOPMENT APPLICATION	01/12/2020					
3	EAST & WEST SETBACKS ADDED	09/12/2020					
4	LIGHT VEHICLE ACCESS REMOVED	13/01/2021					
5	VEGETATION SCREEN ADDED TO NORTHERN BOUNDARY	19/01/2021					
6							

P: +61 2 6257 3511
info@itp.com.au
www.itp.com.au

PO BOX 8217
O'CONNOR, ACT 2602
AUSTRALIA

DRAWN: MJB
CHECKED: PMC
APPROVED: SD

DO NOT SCALE, ALL REQUIREMENTS IN MM UNLESS OTHERWISE STATED.

THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.

PROJECT: KOOTINGAL 1C 5MW SOLAR FARM
CLIENT: ITP DEVELOPMENT
ADDRESS: NEW ENGLAND HWY KOOTINGAL, NSW 2352

SCALE: AS NOTED
SHEET SIZE: A3
ORIG. DATE: 2/7/20
REV. DATE: 21/1/21
REV. NO.: 5

APPENDIX B

Current and Historical Certificates of Title

ADVANCE LEGAL SEARCHERS PTY LTD

(ACN 147 943 842)

ABN 82 147 943 842

18/36 Osborne Road,
Manly NSW 2095

Telephone: +612 9977 6713

Mobile: 0412 169 809

Email: search@alsearchers.com.au

21st April, 2021

NEO CONSULTING PTY LIMITED

P.O. Box 279

RIVERSTONE NSW 2765

Attention: Oskar Lamperts,

RE:

1599 New England Highway,

Kootingal

Job Reference:

Note 1: Lot 1 DP 328265 (page 1)

Note 2: Lot 97 DP 753841 (page 4)

Note 1:

Current Search

Folio Identifier 1/328265 (title attached)

DP 328265 (plans attached)

Dated 20th April, 2021

Registered Proprietor:

MICHAEL KEITH BRYANT

ESTHER MARY BRYANT

Title Tree
Lot 1 DP 328265

Folio Identifier 1/328265

Certificate of Title Volume 15476 Folio 250

Certificate of Title Volume 8459 Folio's 70 & 71

Certificate of Title Volume 4555 Folio 4

(a)

(b)

CTVol 4210 Folio 24

CTVol 4227 Folio 199

Crown Land

Crown Land

Summary of Proprietor(s)
Lot 1 DP 328265

Year	Proprietor(s)
	(Lot 1 DP 328265)
1988 – todate	Michael Keith Bryant Esther Mary Bryant
	(Lot 1 DP 328265 – CTVol 15476 Fol 250)
1987 – 1988	Michael Keith Bryant Esther Mary Bryant
	(Lot 1 DP 328265 – Area 60 Acres – CTVol 8459 Fol's 70 & 71)
1986 – 1987	Michael Keith Bryant Esther Mary Bryant
1963 – 1986	Alwyn Keith Bryant, farmer Beulah Merle Bryant, wife of Alwyn Keith Bryant, farmer
1963 – 1963	Alwyn Keith Bryant, farmer George Alexander Piddington Bryant, farmer
	(Lot 1 DP 328265 – Area 60 Acres – CTVol 4555 Fol 4)
1932 – 1963	George Bryant, farmer

See Notes (a) & (b)

Note (a)

	(Portion 128 Parish Moonbi – Area 40 Acres – CTVol 4210 Fol 24)
1928 – 1932	William Bryant, grantee George Bryant, grantee
	(Portion 128 Parish Moonbi – Area 40 Acres)
Prior – 1928	Crown Land
(1895 – 1928)	(Conditional Purchase 1895/62 Tamworth)

Note (b)

	(Portion 119 Parish Moonbi – Area 90 Acres – CTVol 4227 Fol 199)
1929 – 1932	William Bryant, grantee George Bryant, grantee
	(Portion 119 Parish Moonbi – Area 90 Acres)
Prior – 1929	Crown Land
(1893 – 1929)	(Conditional Purchase 1893/130 Tamworth)

Note 1:

Current Search

Folio Identifier 97/753841 (title attached)

Crown Plan 1888-1690 (plans attached)

Dated 20th April, 2021

Registered Proprietor:

MICHAEL KEITH BRYANT

ESTHER MARY BRYANT

Title Tree

Lot 97 DP 753841

Folio Identifier 97/753841

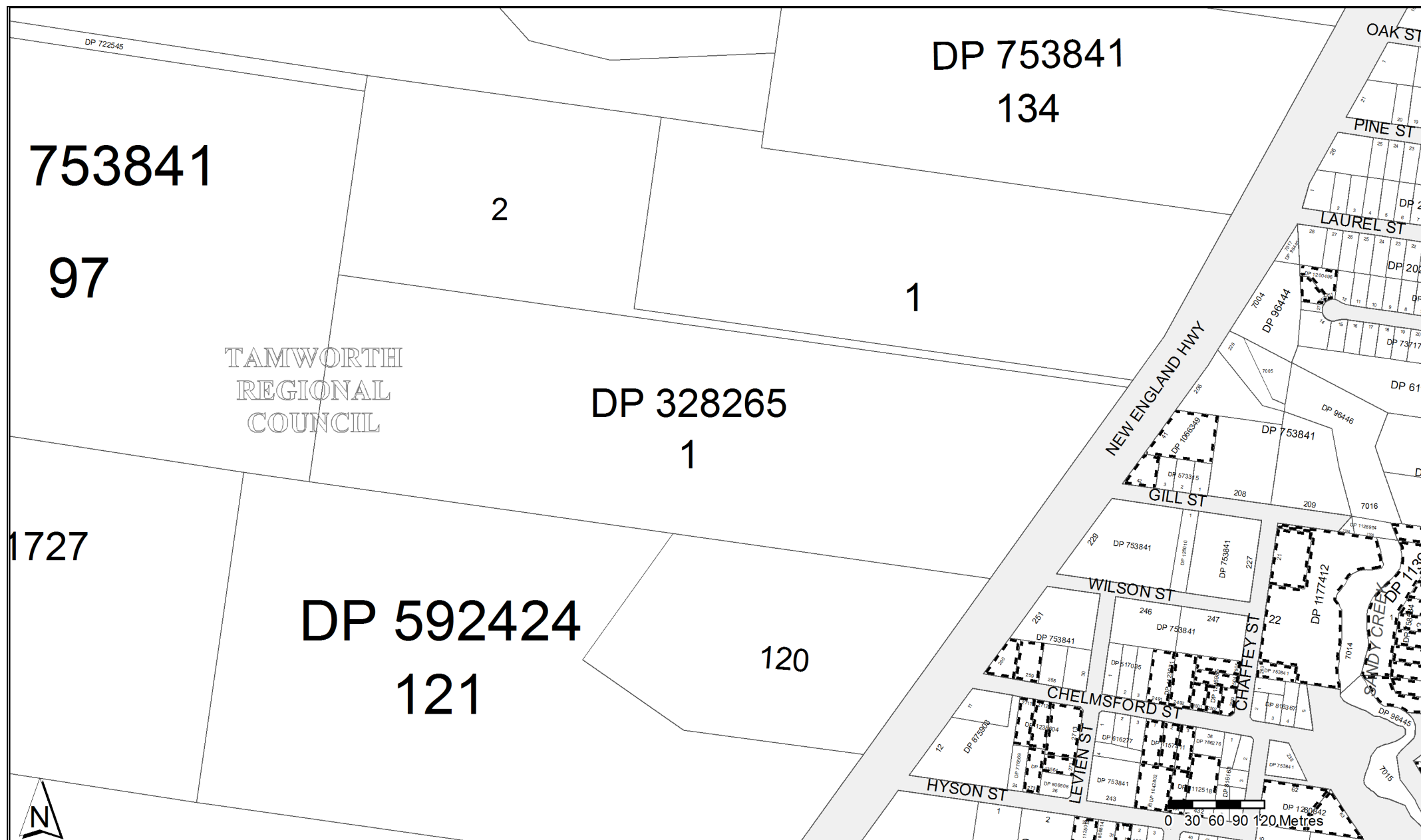
Certificate of Title Volume 9476 Folio 39A & B

Certificate of Title Volume 7430 Folio 243

Crown Land

**Summary of Proprietor(s)
Lot 97 DP 753841**

Year	Proprietor(s)
	(Lot 97 DP 753841)
1986 – todate	Michael Keith Bryant Esther Mary Bryant
	(Portion 97 Parish Moonbi – CTVol 9476 Fol 39A & B)
1986 – 1986	Michael Keith Bryant Esther Mary Bryant
1963 – 1986	Alwyn Keith Bryant, farmer Beulah Merle Bryant, wife of Alwyn Keith Bryant, farmer
1963 – 1963	Alwyn Keith Bryant, farmer George Alexander Piddington Bryant, farmer
	(Portion 97 Parish Moonbi – Area 80 Acres 2 Roods – CTVol 7430 Fol 243)
1958 – 1963	George Bryant, grantee
	(Portion 97 Parish Moonbi – Area 80 Acres 2 Roods)
Prior – 1958	Crown Land
(1926 – 1958)	(Conditional Purchase 1926/8 Tamworth)



	Status	Surv/Comp	Purpose
DP753841 Lot(s): 263			
 NSW GAZ. 17-03-2006 RESERVATION OF CROWN LAND RESERVE NO. 1011408 AFFECTING LOT 263 DP753841			Folio : 1418
Lot(s): 259			
 CA144349 - LOT 259 DP753841			
Lot(s): 260			
 CA144356 - LOT 260 DP753841			
DP758584 Lot(s): 14, 15, 16 Section : 3			
 CA140934 - LOTS 10-16 SECTION 3 DP758584			
Lot(s): 2, 3, 4, 5, 6, 7, 8 Section : 3			
 CA141809 - LOTS 2-9 SECTION 3 DP758584			
Lot(s): 1 Section : 3			
 CA145096 - LOT 1 SECTION 3 DP758584			
Lot(s): 1, 2 Section : 2			
 CA154709 - LOTS 1-2 SECTION 2 DP758584			
DP1042802 Lot(s): 42			
 DP753841	HISTORICAL	COMPILATION	CROWN ADMIN NO.
DP1062816 Lot(s): 1			
 DP862253	HISTORICAL	SURVEY	SUBDIVISION
 DP1062764	UNNECESSARY	SURVEY	SUBDIVISION
DP1066349 Lot(s): 41, 42			
 DP573315	HISTORICAL	SURVEY	SUBDIVISION
DP1112518 Lot(s): 431, 432			
 DP753841	HISTORICAL	COMPILATION	CROWN ADMIN NO.
 DP786276	HISTORICAL	COMPILATION	SUBDIVISION
 DP1042802	HISTORICAL	SURVEY	SUBDIVISION
DP1123031 Lot(s): 2491, 2492			
 DP753841	HISTORICAL	COMPILATION	CROWN ADMIN NO.
DP1125019 Lot(s): 321			
 DP866814	HISTORICAL	SURVEY	SUBDIVISION
DP1139351 Lot(s): 1, 2, 3			
 CA145099 - LOTS 1-3 DP1139351			
DP1143564 Lot(s): 272, 273			
 DP806808	HISTORICAL	SURVEY	SUBDIVISION
DP1157411 Lot(s): 1, 2, 3			
 DP753841	HISTORICAL	COMPILATION	CROWN ADMIN NO.
DP1177412 Lot(s): 21, 22			
 DP753841	HISTORICAL	COMPILATION	CROWN ADMIN NO.
DP1200496 Lot(s): 251, 252			
 DP737175	HISTORICAL	SURVEY	SUBDIVISION
DP1238604 Lot(s): 2711, 2712, 2713			
 DP806808	HISTORICAL	SURVEY	SUBDIVISION
 DP1143564	HISTORICAL	SURVEY	SUBDIVISION
DP1246985 Lot(s): 2501, 2502, 2503, 2504, 2505			
 DP753841	HISTORICAL	COMPILATION	CROWN ADMIN NO.

Caution: This information is provided as a searching aid only. Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For **ALL** **ACTIVITY PRIOR TO SEPTEMBER 2002** you must refer to the RGs Charting and Reference Maps.

DP1260842
Lot(s): 62, 63**Status****Surv/Comp****Purpose**

DP514833

HISTORICAL

SURVEY

SUBDIVISION



DP560953

HISTORICAL

SURVEY

SUBDIVISION

Caution:

This information is provided as a searching aid only. Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For **ALL**

ACTIVITY PRIOR TO SEPTEMBER 2002 you must refer to the RGs Charting and Reference Maps.

Plan	Surv/Comp	Purpose
DP20225	SURVEY	UNRESEARCHED
DP22783	SURVEY	UNRESEARCHED
DP25771	SURVEY	UNRESEARCHED
DP96444	COMPILATION	DEPARTMENTAL
DP96445	COMPILATION	DEPARTMENTAL
DP96446	COMPILATION	DEPARTMENTAL
DP128010	COMPILATION	DEPARTMENTAL
DP328265	SURVEY	UNRESEARCHED
DP332950	SURVEY	UNRESEARCHED
DP401727	COMPILATION	UNRESEARCHED
DP517035	SURVEY	SUBDIVISION
DP573315	SURVEY	SUBDIVISION
DP592424	SURVEY	SUBDIVISION
DP611625	COMPILATION	SUBDIVISION
DP616277	SURVEY	SUBDIVISION
DP722545	COMPILATION	DEPARTMENTAL
DP737175	SURVEY	SUBDIVISION
DP753841	COMPILATION	CROWN ADMIN NO.
DP758584	COMPILATION	CROWN ADMIN NO.
DP776569	SURVEY	SUBDIVISION
DP786276	COMPILATION	SUBDIVISION
DP804438	SURVEY	SUBDIVISION
DP806808	SURVEY	SUBDIVISION
DP816163	SURVEY	SUBDIVISION
DP816367	SURVEY	SUBDIVISION
DP849812	SURVEY	SUBDIVISION
DP866814	SURVEY	SUBDIVISION
DP875903	SURVEY	SUBDIVISION
DP881986	COMPILATION	SUBDIVISION
DP1042802	SURVEY	SUBDIVISION
DP1062816	SURVEY	SUBDIVISION
DP1066349	SURVEY	SUBDIVISION
DP1112518	SURVEY	SUBDIVISION
DP1123031	SURVEY	SUBDIVISION
DP1125019	SURVEY	SUBDIVISION
DP1126954	COMPILATION	CROWN LAND CONVERSION
DP1128168	SURVEY	SUBDIVISION
DP1139351	COMPILATION	LIMITED FOLIO CREATION
DP1143564	SURVEY	SUBDIVISION
DP1143564	UNRESEARCHED	SUBDIVISION
DP1157411	UNRESEARCHED	SUBDIVISION
DP1157411	SURVEY	SUBDIVISION
DP1177412	SURVEY	SUBDIVISION
DP1200496	UNRESEARCHED	SUBDIVISION
DP1200496	SURVEY	SUBDIVISION
DP1238604	SURVEY	SUBDIVISION
DP1246985	UNRESEARCHED	SUBDIVISION
DP1246985	SURVEY	SUBDIVISION
DP1260842	UNRESEARCHED	SUBDIVISION
DP1260842	SURVEY	SUBDIVISION

Caution: This information is provided as a searching aid only. Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For **ALL**

ACTIVITY PRIOR TO SEPTEMBER 2002 you must refer to the RGs Charting and Reference Maps.

Cancels part of I1234 1690 R.



PLAN OF PORTION 97

County of Inglis Parish of Moonbi
Land District of Tamworth Land Board District of Tamworth.
Resumed Area N^o 7^a Moonbi Pastoral Holding Eastern Division.

Applied for under the Section of the Crown Lands Act of 18 by

Within R. 26463 pending completion of Exchange, not 21st August 97 Revoked 26.9.03.

do S.A. 14239 procl^d 22nd Augst 1891, cancelled 26th Sep^r 03

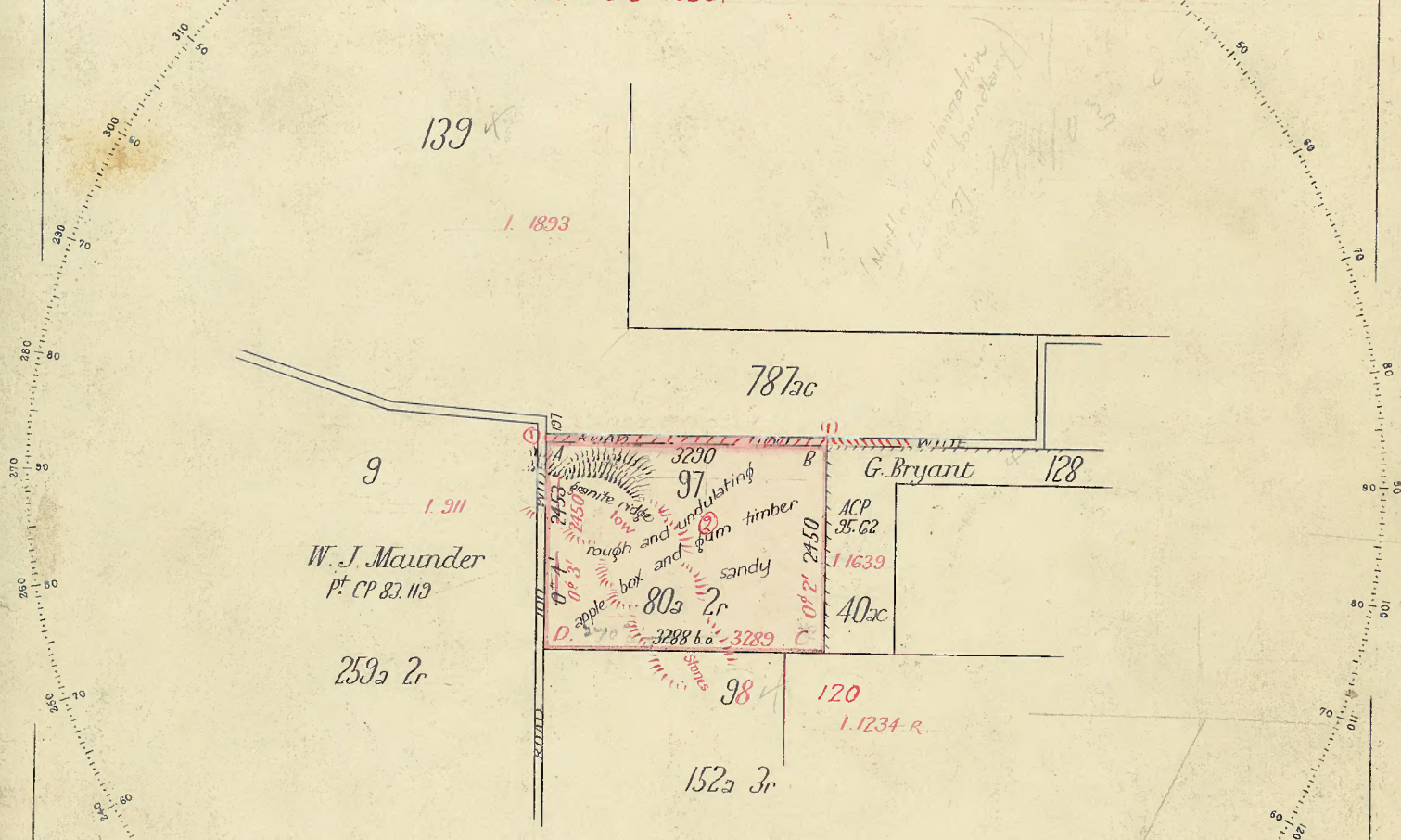
do R. 36891 for Sale or Lse. other than Sp Lse. not 23rd Dec^r 03 Revoked 3.12.26

Sp.L. 04.2 of 11th Jan^y by William Bryant & George Bryant N^o 4121 Gaz. 20th Augst 04 M^{ts} 04.7650

" Term extended in 1.1.24 to 31.12.31 (For Agric & Graz^{ing}) Gaz. 4.4.24.

Por. 97 C.P. 26.8 May 12 George Bryant. Approved Sales 26.19340. Sale Completed Ten 54.9728

① Road closed Gaz. 21.12.56 fol. 3768 Rds. 51.864 3a1n Sold to George Bryant under Sec 20 Public Roads Act 1902. See also I. 1893-1690.



Note. Information in Red from Sketch with papers (Amended Survey)

PLAN MICROFILMED

Azimuth taken from por. 139
Field Book Vol. 7613 Folio 38

NO ADDITIONS OR AMENDMENTS TO BE MADE

Certified copy to
Head Office 31.8.03

Reference to Corners

Corner	Bearing	From	Links	N ^o on Tree
A	33° 10'	Box	88 3/4	97
B	3 55 348° 0'	Box do	63 69.1	97. 128
C	722° 45'	do	30.9	97. 128
D	281° 50'	do	33	97. 98

Reference to Traverse

Line	Bearing	Distance

I hereby certify that I in person made and on the 16th Augst 1902 completed the survey represented on this plan on which are written the bearings and lengths of the lines measured by me and I declare that the survey has been executed in accordance with the regulations published for the guidance of licensed Surveyors and the practice of the Department of Lands.

N. Paton Licensed Surveyor

Transmitted to the District Surveyor with my letter of 18th August N^o 02/45

Voucher N^o 03.33 Passed £6.15.2 P.W. 9.7.03

Calculation Book N^o 2053 Folio 32

Checked and Charted J. Thompson 25/5/03

Examined and

Plan approved 9 July 1903
J. Thompson

Value of Improvements

2 1/2 Cts of 6 wire fence @ £20 per mile

Traced for helio 4.8.3

Scale 20 Chains to an Inch.

I. 1888 1690



09476039

G.

NEW SOUTH WALES

For Grant (Title prior to first edition) see description.

CERTIFICATE OF TITLE
PROPERTY ACT, 1900, as amended.



Vol. 9476 Fol. 39A
1st Edition issued 12-7-1963

EH J231697 **CANCELLED** W

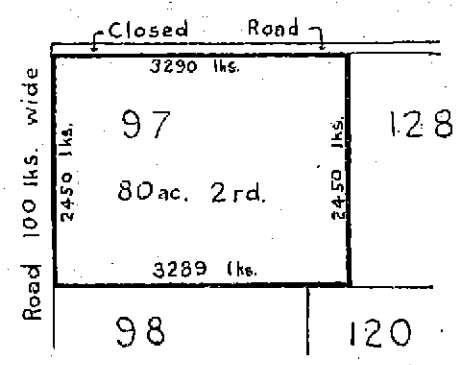
I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Witness *S. Davenport*

J. Watkinson
Registrar-General.



PLAN SHOWING LOCATION OF LAND



Scale: 20 chains to one inch.

ESTATE AND LAND REFERRED TO

Estate in Fee Simple in an undivided one half share in that piece of land in the Shire of Cockburn, Parish of Moonbi, County of Inglis, being Portion 97 granted on 17th February 1958 by Crown Grant Volume 7430 Folio 243. Excepting thereout the minerals reserved by the Crown Grant.

J. Watkinson
Registrar General.

FIRST SCHEDULE (Continued overleaf)

~~ALWYN KEITH BRYANT, of Koolberral, Farmer.~~

J. Watkinson
Registrar General.

SECOND SCHEDULE (Continued overleaf)

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Restrictions on transfer - see Section 272 Crown Lands Consolidation Act 1913.

J. Watkinson
Registrar General.

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

WARNING: THIS DOCUMENT MUST NOT BE REMOVED FROM THE LAND TITLES OFFICE.

(Page 1) Vol. 9476 Fol. 39A

70939 1.62 ST 160P V. C. N. BIGHT GOVERNMENT PRINTER

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT			ENTERED	Signature of Registrar-General
	NATURE	NUMBER	DATE		
Michael Keith Bryant and Esther Mary Bryant ex joint tenants by Transfer N620493. Registered 25-11-1986					
FOLIO CANCELLED - NEW FOLIO IS 97 / 753841					

SECOND SCHEDULE (continued)

INSTRUMENT			ENTERED	Signature of Registrar-General	CANCELLATION
NATURE	NUMBER	DATE			
Mortgage to Bank of New South Wales.	540018	27-8-1963	6-11-1963		
Mortgage to Bank of New South Wales.	2547182		3-11-1978		
Mortgage to State Building Society Limited. Registered 25-11-1986.	W620494				

G.

NEW SOUTH WALES

CERTIFICATE OF TITLE
REAL PROPERTY ACT, 1900, as amended.

TORRENS TITLE
Register Book

For Grant (Title prior to first
edition) see description.



Vol. 9476 Fol. 39
1st Edition issued 12-7-1963

EH J231697

CANCELLED

W

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within
described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

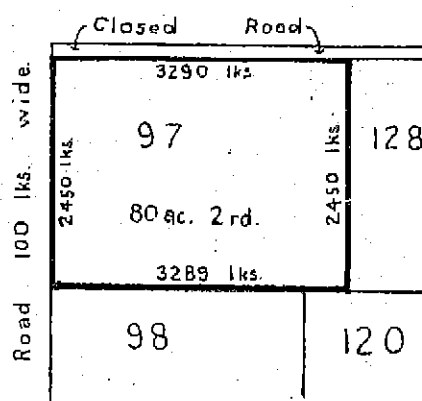
Witness

Davenport

Jawatson
Registrar-General.



PLAN SHOWING LOCATION OF LAND



Scale: 20 chains to one inch.

ESTATE AND LAND REFERRED TO

Estate in Fee Simple in an undivided one half share in that piece of land in the Shire of Cockburn, Parish
of Moonbi, County of Inglis, being Portion 97 granted on 17th February 1958 by Crown Grant Volume 7430
Folio 243. Excepting thereout the minerals reserved by the Crown Grant

Jawatson
Registrar General.

FIRST SCHEDULE (Continued overleaf)

~~GEORGE ALEXANDER PIDDINGTON BRYANT, of Walcha Road, Farmer.~~

Jawatson
Registrar General.

SECOND SCHEDULE (Continued overleaf)

1. Reservations and conditions, if any, contained in the Crown Grant aboveresferred to.
2. Restrictions on transfer - see Section 272 Crown Lands Consolidation
Act 1913.

Jawatson
Registrar General.

68

109456

Vol.

INSTRUMENT		PARTICULARS	ENTERED	Signature of Registrar-General	CANCELLATION
NATURE	NUMBER				
Mortgage	J#60118	27-8-1963	6-11-1963	 	Discharged Discharged
Mortgage	25-49482		3-2-1968	 	
Mortgage	W620494	Mortgage to State Building Society Limited. Registered 25.11.1986.			

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR-GENERAL ARE CANCELLED

CERTIFICATE OF TITLE
PROPERTY ACT, 1900



15476250

NEW SOUTH WALES

Vol. 15476 Fol. 250
EDITION
ISSUED 2 2 1987

First Titles Vol. 4210 Fol. 24
Vol. 4227 Fol. 199

Prior Titles Vol.8459 Fols.70 & 71



I certify that the person named in the First Schedule is the registered proprietor of an estate in fee simple (or such other estate or interest as is set out below) in the land described subject to the recordings appearing in the Second Schedule and to the provisions of the Real Property Act, 1900.

CANCELLED
[Signature]
Registrar General.
SEE AUTO FOLIO



S

LAND REFERRED TO

Lot 1 in DP328265 at Kootingal in the Shire of Parry Parish of Moonbi County of Inglis.

Title Diagram: DP328265.

FIRST SCHEDULE

MICHAEL KEITH BRYANT and ESTHER MARY BRYANT, as Joint Tenants.

W620493

GRM

SECOND SCHEDULE

1. Land excludes minerals and is subject to reservations and conditions in favour of the Crown
- see Crown grants.

~~2. W620494 Mortgage to State Building Society Limited. X898186.~~

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON
(Page 1) Vol. 15476 Fol. 250

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

X19818071
- 24
- 84
R

NOTATIONS AND UNREGISTERED DEALINGS

MW X898187 Mortgage to Westpac Savings Bank Limited. Registered 11.10.1988.
X898188 Mortgage to Westpac Banking Corporation. Registered 11.10.1988.



PARTICULARS
SECOND SCHEDULE (continued)
Registrar General CANCELLATION

CANCELLED

SEE ALSO PG. 25

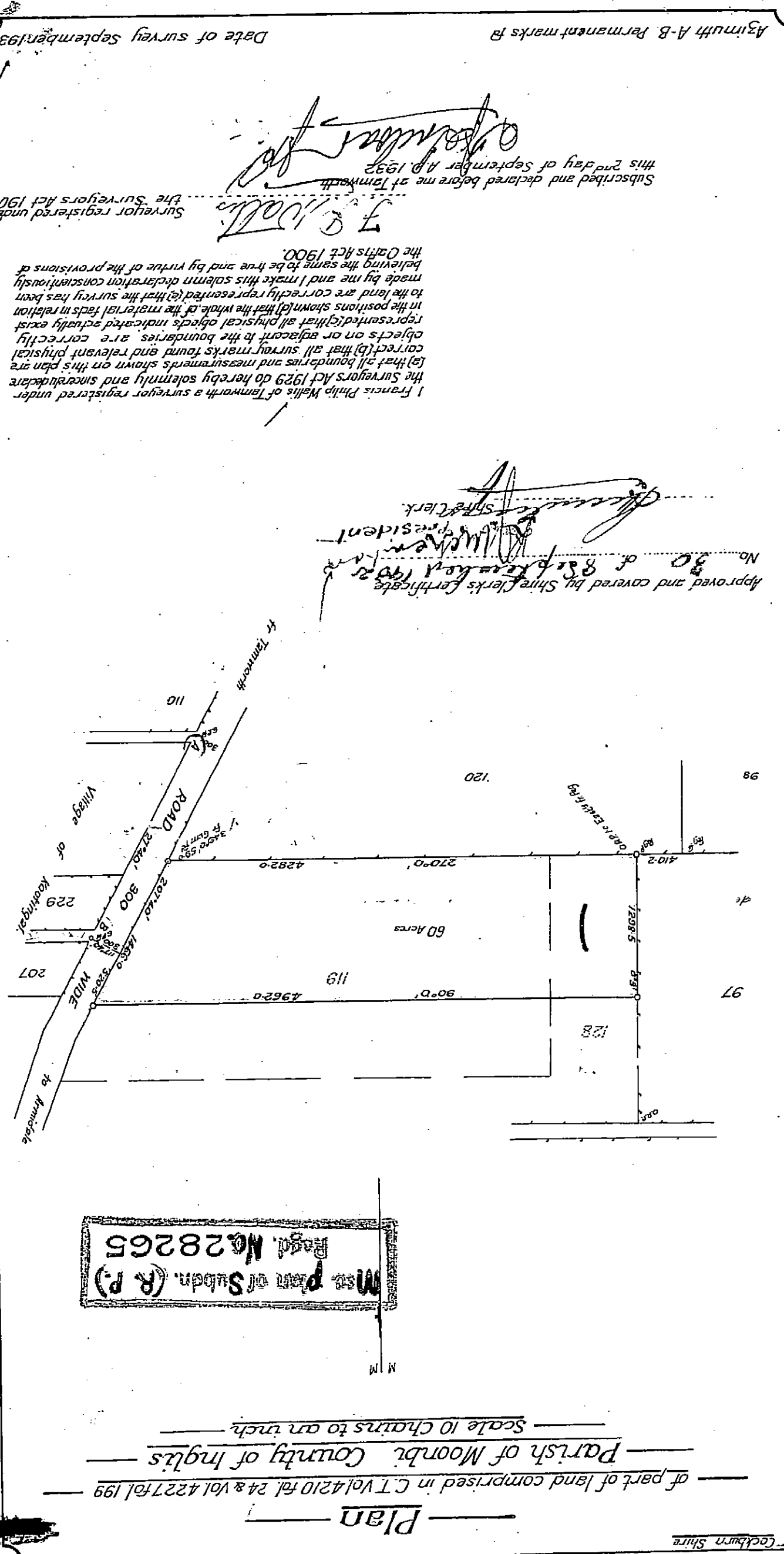
FIRST SCHEDULE (continued)
REGISTERED PROPRIETOR
Registrar General

LINKS	METRES
59	11.869
100	20.117
300	60.330
410.2	82.519
520.5	104.708
1298.5	261.217
1466	294.912
4282	861.401
4962	998.196

AC RD P HA
60 - - 24.28

C 150210

F.P. 328265



This is the plan marked "A" referred to in transfer from William Byrnes and George Byrnes to George Byrnes
Dated 9th September 1932
W. Byrnes
George Byrnes

I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 25th day of May, 1978



NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE

20/4/2021 4:24PM

FOLIO: 1/328265

First Title(s): SEE PRIOR TITLE(S)
Prior Title(s): VOL 15476 FOL 250

Recorded	Number	Type of Instrument	C.T. Issue
21/8/1988		TITLE AUTOMATION PROJECT	LOT RECORDED FOLIO NOT CREATED
28/12/1988		CONVERTED TO COMPUTER FOLIO	FOLIO CREATED CT NOT ISSUED
11/11/1996	2601257	DISCHARGE OF MORTGAGE	
11/11/1996	2601258	MORTGAGE	EDITION 1
3/9/2004	AA924037	DEPARTMENTAL DEALING	
11/11/2006	AC732365	DISCHARGE OF MORTGAGE	EDITION 2

*** END OF SEARCH ***

advlegs

PRINTED ON 20/4/2021



NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE

20/4/2021 4:25PM

FOLIO: 97/753841

First Title(s): VOL 7430 FOL 243

Prior Title(s): VOL 9476 FOL 39

Recorded	Number	Type of Instrument	C.T. Issue
9/12/1986	DP753841	DEPOSITED PLAN	FOLIO CREATED EDITION 1
12/10/1988	X898186	DISCHARGE OF MORTGAGE	
12/10/1988	X898187	MORTGAGE	
12/10/1988	X898188	MORTGAGE	EDITION 2
21/2/1991		AMENDMENT: VOL FOL INDEX	
11/11/1996	2601257	DISCHARGE OF MORTGAGE	
11/11/1996	2601258	MORTGAGE	EDITION 3
26/11/1998	5422264	DEPARTMENTAL DEALING	
3/9/2004	AA924037	DEPARTMENTAL DEALING	
11/11/2006	AC732365	DISCHARGE OF MORTGAGE	EDITION 4

*** END OF SEARCH ***

advlegs

PRINTED ON 20/4/2021



NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 1/328265

SEARCH DATE	TIME	EDITION NO	DATE
-----	----	-----	----
20/4/2021	4:25 PM	2	11/11/2006

LAND

LOT 1 IN DEPOSITED PLAN 328265
AT KOOTINGAL
LOCAL GOVERNMENT AREA TAMWORTH REGIONAL
PARISH OF MOONBI COUNTY OF INGLIS
TITLE DIAGRAM DP328265

FIRST SCHEDULE

MICHAEL KEITH BRYANT
ESTHER MARY BRYANT
AS JOINT TENANTS

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 ***

advlegs

PRINTED ON 20/4/2021



NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 97/753841

SEARCH DATE	TIME	EDITION NO	DATE
-----	----	-----	----
20/4/2021	4:25 PM	4	11/11/2006

LAND

LOT 97 IN DEPOSITED PLAN 753841
AT KOOTINGAL
LOCAL GOVERNMENT AREA TAMWORTH REGIONAL
PARISH OF MOONBI COUNTY OF INGLIS
(FORMERLY KNOWN AS PORTION 97)
TITLE DIAGRAM CROWN PLAN 1888.1690

FIRST SCHEDULE

MICHAEL KEITH BRYANT
ESTHER MARY BRYANT
AS JOINT TENANTS

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 ***

advlegs

PRINTED ON 20/4/2021

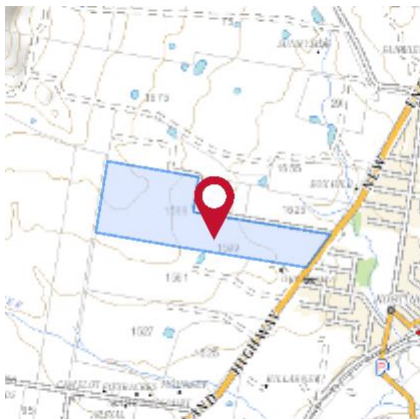
APPENDIX C

Property Report



Property Report

1599 NEW ENGLAND HIGHWAY KOOTINGAL 2352



Property Details

Address: 1599 NEW ENGLAND HIGHWAY
KOOTINGAL 2352

Lot/Section 1/-/DP328265 1/-/DP722545 97/-/DP753841
/Plan No:

Council: TAMWORTH REGIONAL COUNCIL

Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

Local Environmental Plans	Tamworth Regional Local Environmental Plan 2010 (pub. 21-1-2011)
Land Zoning	RU4 - Primary Production Small Lots: (pub. 21-1-2011)
Height Of Building	NA
Floor Space Ratio	NA
Minimum Lot Size	40 ha
Heritage	NA
Land Reservation Acquisition	NA
Foreshore Building Line	NA
Local Provisions	Sewage Treatment Plant

Detailed planning information

State Environmental Planning Policies which apply to this property

State Environmental Planning Policies can specify planning controls for certain areas and/or types of development. They can also identify the development assessment system that applies and the type of environmental assessment that is required.

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)



- State Environmental Planning Policy (Affordable Rental Housing) 2009: Land Application (pub. 31-7-2009)
- State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004: Land Application (pub. 25-6-2004)
- State Environmental Planning Policy (Concurrences and Consents) 2018: Land Application (pub. 21-12-2018)
- State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017: Land Application (pub. 1-9-2017)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004: Land Application (pub. 31-3-2004)
- State Environmental Planning Policy (Infrastructure) 2007: Land Application (pub. 21-12-2007)
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007: Land Application (pub. 16-2-2007)
- State Environmental Planning Policy (Primary Production and Rural Development) 2019: Land Application (pub. 28-2-2019)
- State Environmental Planning Policy No 21—Caravan Parks: Land Application (pub. 24-4-1992)
- State Environmental Planning Policy No 33—Hazardous and Offensive Development: Land Application (pub. 13-3-1992)
- State Environmental Planning Policy No 36—Manufactured Home Estates: Land Application (pub. 16-7-1993)
- State Environmental Planning Policy No 50—Canal Estate Development: Land Application (pub. 10-11-1997)
- State Environmental Planning Policy No 55—Remediation of Land: Land Application (pub. 28-8-1998)
- State Environmental Planning Policy No 64—Advertising and Signage: Land Application (pub. 16-3-2001)
- State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development: Land Application (pub. 26-7-2002)

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)



Property Report

1599 NEW ENGLAND HIGHWAY KOOTINGAL 2352

Other matters affecting the property

Information held in the Planning Database about other matters affecting the property appears below. The property may also be affected by additional planning controls not outlined in this report. Please speak to your council for more information

1.5 m Buffer around Classified Roads	Classified Road Adjacent
Land near Electrical Infrastructure	This property may be located near electrical infrastructure and could be subject to requirements listed under ISEPP Clause 45. Please contact Essential Energy for more information.
Local Aboriginal Land Council	TAMWORTH

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)

APPENDIX D

Previous Reports

Description	Spec
Solar Farm Name	Kootingal 1C Solar Farm
ITP site reference	Kootingal 1C
Lot/DP	1/328265 and 97/753841
Lat/Long	-31.052485, 151.040477
Street Address	"Roseamere", 1599 NEW ENGLAND HIGHWAY, KOOTINGAL
Current Land Use	Unused
Council	Tamworth Regional Council
Site Website URL	
Layout drawing Ref	KOO1C-G-210
Site Area (Total Property)	58.2 ha
Project Area	Approx. 11 ha
Property Location description	Approx. 1km west of Kootingal township
Number of Panels	Approx. 12,100
Number of Rows	140
Length of Rows	Approx. 103 m long
Power (DC)	6.4 MW
Power (AC)	5.0 MW
Hub Height of each Tracker	Approx. 1.50 m
Max Panel Heights	Approx. 2.75 m
Pitch (Spacing Between Rows)	6.25 m
Inverters	2 x 3MW inverters
Length of skid	12.19 m skid
Array Pile Depth	1.5 to 3.5 m
Trenching Depth	600mm for LV and 1200mm HV
Electrical Connection Voltage	11kV
Line Number	KTL3B2
Closest Substation	Kootingal zone substation
Construction Time	3 months
Construction Hours	7am – 4pm Monday to Friday
Number of Construction Workers	50

B-Double Loads of Equipment (Total Project)	45
Temporary cark parks	40 small vehicles
Car park rate per worker	0.8
Maintenance	Maintenance is expected to be carried out quarterly by a crew of 2 to 3 people.
Security fence height	1.8m high with three rows of barbed wire giving a total height of 2.3 m.
Project lifespan	35 years

YOUR DETAILS

Name Zaed Aznam

Company ITP Development ABN 38 633 420 309

Address Level 1, 19 Moore Street,

Suburb Turner State ACT Postcode 2612

Email (for results & invoice) zaznam@itpau.com.au Phone 0473019583

Copy of results to (email) zaznam@itpau.com.au

PAYMENT DETAILS

AUTHORISATION

I am the person authorised to request analysis of the samples and agree to accept all associated charges for such analysis.

Name Zaed Aznam Signature Zaed Aznam Digitally signed by Zaed Aznam
Date: 2021.03.14 18:23:02 +11'00' Date 14/03/21

Invoices will be emailed after results are reported

If the invoice client details are different from those above, please complete the section below

Name Phone 0473019583

Company ABN

Address

Suburb State ACT Postcode 2612

Email (for invoice) Purchase Order No KOO1CLab

Internal Customers - Project Code:

CHAIN OF CUSTODY – Please complete if required

Relinquished by:	Signature:	Date and time:
Received by:	Signature:	Date and time:

Relinquished by:	Signature:	Date and time:
Received by:-	Signature:	Date and time:

LABORATORY USE

SECURITY SEAL: Intact/Broken/None	PRESERVATION: None / Ice / Ice bricks / Acidified / Filtered / Other
TEMPERATURE:	SAMPLE CONDITION:

For advice on test selection, sample submission, additional testing options, please contact our Customer Service
Unit on 02 66261103 or wollongbar.csu@dpi.nsw.gov.au

Your identification of this sample Preferably 10 characters or less, maximum of 20.	Sample type	Type of analysis you require	Lab Number (lab use only)
Area A: Within 5ha with 50 samples to form one composite area.	Sample A1	Pesticides (OCs/ OPs)	1
	Sample A2	Chemistry (Heavy Metals)	2
Area B: Within 5ha with 50 samples to form one composite area	Sample B1	Pesticides (OCs/ OPs)	3
	Sample B2	Chemistry (Heavy Metals)	4

For large batches please include a spreadsheet of sample IDs

ADDITIONAL INFORMATION

Container Return	Container Type: Return (at client expense) Yes ☐ No ☒
Sample Return	Residual (dried & ground sample) can be returned (client expense) if requested Yes ☐ No ☒
Additional Comments	Sample A1 and B1 to be transferred into glass jars at Wollongbar Lab before outsourcing to a different lab for testing.

Send your sample(s) and this form to
Reply Paid 71223
Biosecurity Laboratory Operations
Wollongbar Primary Industries Institute
1243 Bruxner Highway
WOLLONGBAR NSW 2477

For further information contact
Customer Service Unit
Ph: 02 6626 1103
Email wollongbar.csu@dpi.nsw.gov.au



Testing performed by
this laboratory is
accredited by the
National Association
of Testing Authorities
(NATA)

Environmental Laboratory
1243 Bruxner Highway,
WOLLONGBAR NSW 2477



WN210319
19/03/2021

Zaed Aznam

From: DPI Wollongbar CSU Mailbox <wollongbar.csu@dpi.nsw.gov.au>
Sent: Thursday, 11 March 2021 11:40 AM
To: Zaed Aznam
Cc: Mishka Talent
Subject: Re: Fw: Soil testing
Attachments: ALS Suite 12 OC_OP listed.docx; testing-soils-for-residues-of-persistent-chemicals.pdf; Sample Submission Form.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Good Morning Zaed,

The list supplied by the council is helpful in identifying what potential contaminants they want you to analyse for. Below are the tests that i would recommend which covers your list including Organophosphates(OP)

We would need to outsource the Pesticides (OCs/ OPs) and Mercury soil testing to another lab so would supply you with a glass bottle and a plastic bag, please fill both for each soil sample. OC & OP suite is attached.

I have attached a document on Testing soils for residues of persistent chemicals, which has sampling techniques including sampling hotspots, as suggested by council sample soils in cultivated and non-cultivated areas of the land and any areas where the soil appears different eg up a hill, in a gully, it is handy to keep a map of where you sampled for your own reference. Do not mix soils cores from different areas. The bags and bottles need to be clearly identified on samples and written on the sample submission form.

How many samples do you think you will need to collect? I can post the bags and bottles for sampling.

Allow 2-3 weeks for results after we receive the soils.

Please supply this email when submitting your samples together with the Sample Submission form.

Test Name	Price per sample (ex GST)
Dry & grind prep for samples	13.09
20 ICP Elements*	63.00
Outsourcing Fee (1 only per batch)	44.27
OC/OP Pesticides** (ALS Suite 12) (ALS EP068A- OC & ALS EP068B -OP)	66.55

See attached full list of OC & OP	
Mercury Total Recoverable** (ALS EG035T-LL)	12.09
ALS Batch Fee** (1 only per batch)	40.00
Subtotal	239.00
GST	23.90
TOTAL	\$ 262.90
** ICP OES Elements Include: Aluminium, Arsenic, Boron, Calcium, Cadmium, Cobalt, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Phosphorus Potassium Nickel, Sodium, Sulfur, Selenium, Zinc ** Outsource Analysis to ALS (Unground Sample)	

If I can assist further, please let me know.

Regards

Melissa Coughran | Customer Service Officer
 Food Safety| Environmental Laboratory
 NSW Department of Primary Industries | Biosecurity and Food Safety
 1243 Bruxner Highway Wollongbar NSW 2477
T +61 2 6626 1103 | **M** 0437 574 628
E wollongbar.csu@dpi.nsw.gov.au
W <http://www.dpi.nsw.gov.au/labs>



From: Zaed Aznam <zaznam@itpau.com.au>
Sent: Tuesday, 9 March 2021 11:35 AM
To: DPI Wollongbar CSU Mailbox <wollongbar.csu@dpi.nsw.gov.au>
Cc: DPI Wollongbar CSU Mailbox <wollongbar.csu@dpi.nsw.gov.au>; Mishka Talent <mtalent@itpau.com.au>
Subject: RE: Fw: Soil testing

Hi Melissa,

We have received confirmation from the council on the type of . The site was previously used as an orchard. The snippet below is from a document by the EPA with regards to assessing orchards, which includes sampling soils in cultivated and non-cultivated areas of the land and the minimum items to test.

3.6.1 Analytical parameters

As a minimum, soil samples from cultivated areas should be tested for:

- arsenic
- cadmium
- copper
- lead
- mercury
- organochlorine pesticides
- zinc

From the Soil Testing Information document you've sent, could you please advise if the Horticulture Package is the most comprehensive testing that should cover all of the above? The block size we are looking to develop is approximately 11 hectares, and that one sample in a ziplock bag from half a dozen soil cores is enough for the test?

Finally, would you be able to advise the turnaround time for the final report assessment once you receive the sampling?

Regards,

Zaed Aznam | Project Manager - Planning
ITP Development | Consulting | Engineering | Implementation

zaznam@itpau.com.au	Sydney Office:	Head Office:
m +61 473 019 583	Level 3 (Hub)	Physical: Level 1, 19 Moore St,
p +61 2 6257 3511	Customs House	Turner, ACT, 2612
f +61 2 6257 3611	31 Alfred Street	Postal: PO Box 6127,
w www.itpau.com.au	Sydney NSW 2000.	O'Connor, ACT, 2602

From: Mishka Talent <mtalent@itpau.com.au>
Sent: Thursday, 4 March 2021 4:37 PM
To: Zaed Aznam <zaznam@itpau.com.au>
Subject: Fwd: Fw: Soil testing

FYI

Mishka Talent | Solar Farm Portfolio Manager
ITP Development | Consulting | Engineering | Implementation

mtalent@itpau.com.au	Sydney Office:	Head Office:
m +61 403 520 690	Hub Hyde Park	Physical: Level 1, 19 Moore St,
p +61 2 6257 3511	223 Liverpool Street	Turner ACT 2612
w www.itpau.com.au	Darlinghurst NSW 2010	Postal: PO Box 6127,
		O'Connor ACT 2602

ITP DEVELOPMENT PTY LTD | ACN 633 420 309 | part of the IT Power Group

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Thank you for your co-operation

----- Forwarded message -----

From: DPI Wollongbar CSU Mailbox <wollongbar.csu@dpi.nsw.gov.au>

Date: Thu, 4 Mar 2021 at 15:29

Subject: Fw: Soil testing

To: mtalent@itpau.com.au <mtalent@itpau.com.au>

Hi Mishka

As discussed on the phone this morning i have attached a few options when it comes to testing your soil.

I have also attached some reading resources, and a copy of our general soil kit information.

1. Arsenic & OC pesticide only
2. Arsenic & OC/OP pesticides
3. Heavy Metals including Arsenic & Lead plus OC/OP pesticides
4. Information on collecting the soil

I have attached the list of the OC & OP pesticides which are included in the suite of testing.

Please see attached a sample submission form for sending your soil to us for analysis.

If you decide to go ahead with this testing i can post you suitable sample containers for collection. Pesticide sample to be collected in a glass jar, Chemistry (Heavy Metals) sample to be collected in plastic ziplock bag.

Please include your completed submission form and a copy of this email and which testing you require with your sample.

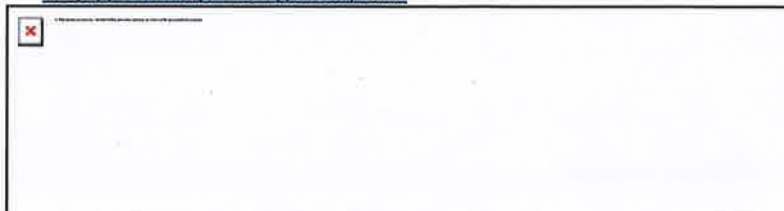
If i can assist further, please let me know.

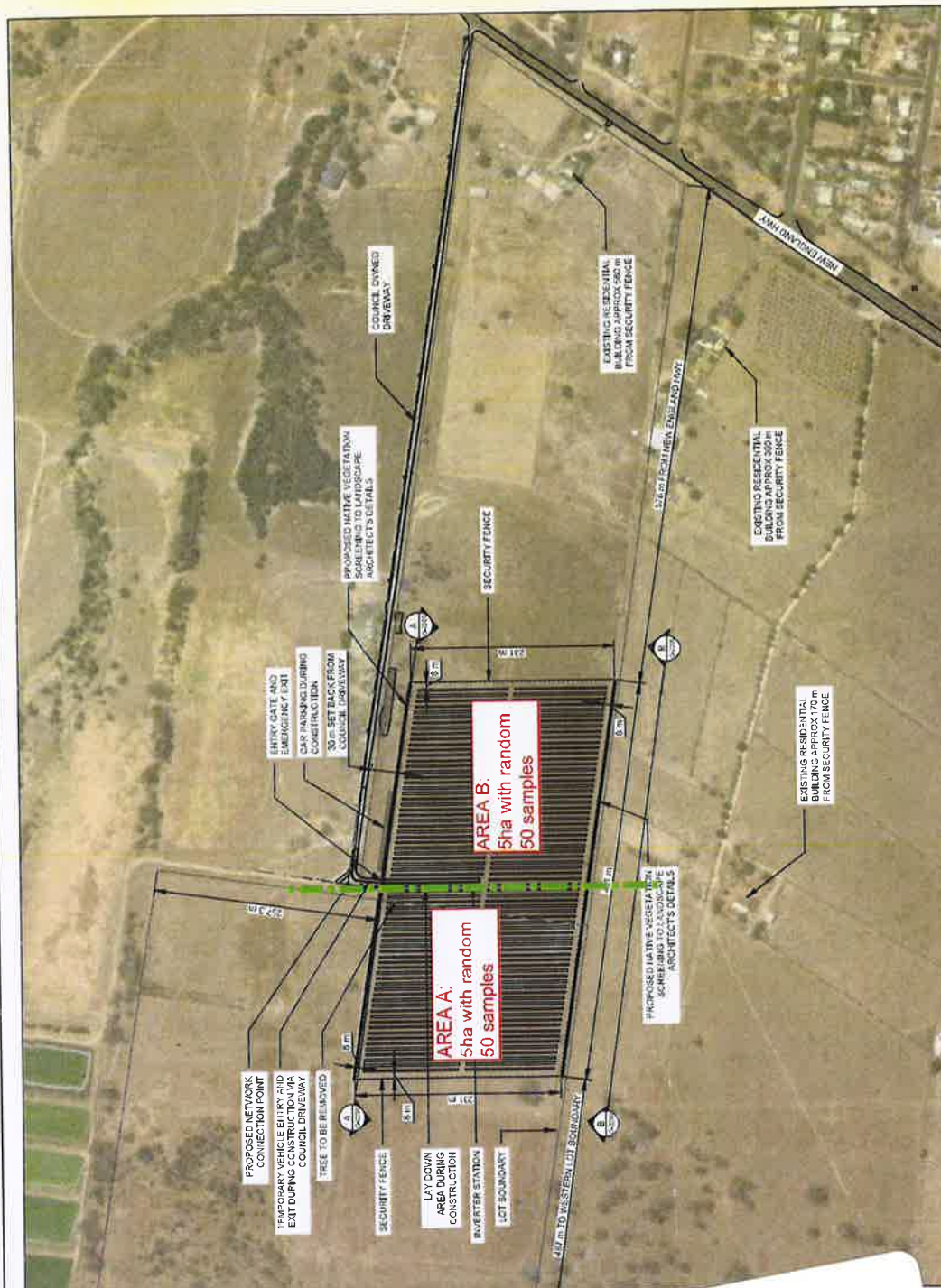
Regards

Melissa Coughran | Customer Service Officer
Food Safety | Environmental Laboratory
NSW Department of Primary Industries | Biosecurity and Food Safety
1243 Bruxner Highway Wollongbar NSW 2477
T +61 2 6626 1103 | M 0437 574 628

WN210319
19/03/2021

E wollongbar.csu@dpi.nsw.gov.au
W <http://www.dpi.nsw.gov.au/labs>





SITE INFORMATION	
LOT / DP	1/2/2025 & 9/1/2034-1
ADDRESS	NEW ENGLAND HWY, KOOTINGAL NSW 2552
LGA	TAMM-NORTH REGIONAL COUNCIL
LAT / LONG	-31.052485 145.1940477
ELEVATION	489 m
LOT AREA	36.2 Ha
FENCED AREA	10.6 Ha
DMS#	ESSENTIAL ENERGY

PROJECT INFORMATION	
AC CAPACITY	50 MW
INVERTERS	2 x 30 MW
TRACKER SPACING (N-S)	MIN. 7 m
ARRAY PITCH	6.25 m
CONNECTION VOLTAGE	11 kV
CONNECTION FEEDER	ESSENTIAL ENERGY KTL062
CONNECTION SUBSTATION	ESSENTIAL ENERGY KNOTTINGHOLM ZONE
SECURITY FENCE SETBACK	MIN. 3 m FROM OPTION BOUNDARY
ARRAY SETBACK	MIN. 6 m FROM SECURITY FENCE
ACCESS ROAD WIDTH	4 m

DEVELOPMENT APPLICATION

[illegible]

WN210319
19/03/2021

Testing soils for residues of persistent chemicals

July 2017, Primefact 320, third edition
Animal Biosecurity and Welfare, NSW DPI

Why test soils?

Past use of persistent organic pesticides, e.g. DDT and dieldrin, means that some agricultural soils are contaminated with chemical residues. In broadacre farming, these chemicals were used directly on soil or applied to crops, contaminating soil via runoff or spray drift.

Similarly, arsenic used in cattle and sheep dip baths has contaminated soils around these facilities.

Pesticide contamination may cause residues in stock or crops raised on affected land.

Soil residue tests determine if pesticides are present and at what levels, so that the risk to livestock or crops can be assessed and managed. The core purpose of managing chemical residues is to minimise risk to the human food chain from grazing animals.

This Primefact describes the process for sampling soils and sending them to the laboratory to be tested for pesticide residues.

Before collecting samples

Contact your Local Land Services Office District Veterinarian. They will provide information on laboratories which provide a testing service for the residues in question.

If your property has been previously identified as having been contaminated and you wish to review its current contamination risk status, your District Veterinarian will assist in sampling and testing.

Submitting samples

1. Include a completed Sample Submission Form identifying each sample and the analysis that you require.

2. Samples should be placed in plastic bags with stick-on labels marked with a waterproof pen. Labels should include sample numbers or similar identification.
3. Place sample bags in a container or cardboard box and send to the laboratory.

Preparation for sample collection

The area of the site and depth of possible residues need to be considered. Samples must be representative of the site to give meaningful information about contamination.

Mapping – for large sites, a site map marked with features e.g. posts, gates, buildings, and the sample locations is helpful to relate the laboratory results to the sampling positions.

Area – Large sites should be divided into blocks or sections. The maximum size of the sampling block is determined by the pesticide application history.

Where there is varied or uncertain application history the block size should be no greater than 2 Ha. In other circumstances block sizes up to 10 Ha will provide sufficient information.

A number of core samples or slices (40 to 50 samples) are taken from each block and pooled into a composite sample as described below.

Depth – The depth of sampling will be determined by cultivation history:

- **Cultivated soil** – Cores or slices should generally be taken down to tillage depth (up to 150 mm).
- **Uncultivated soil** – cores or slices are taken down to a depth of 50 – 80 mm

Hotspots – if an area is suspected of containing high levels of pesticides (drum storage or chemical preparation areas, cattle and sheep dip yards, spray races and orchard packing sheds) then this spot should be sampled separately. The purpose of sampling is to locate the limits of pesticide contamination.

Equipment

Basic equipment required to take soil samples are shown in Figure 1 and includes soil tubes, soil augers, garden trowel or spade and clean buckets or plastic bags

Figure 1. Tools for taking soil samples

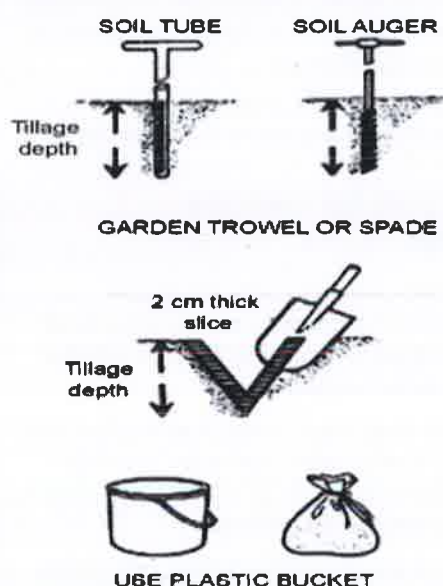
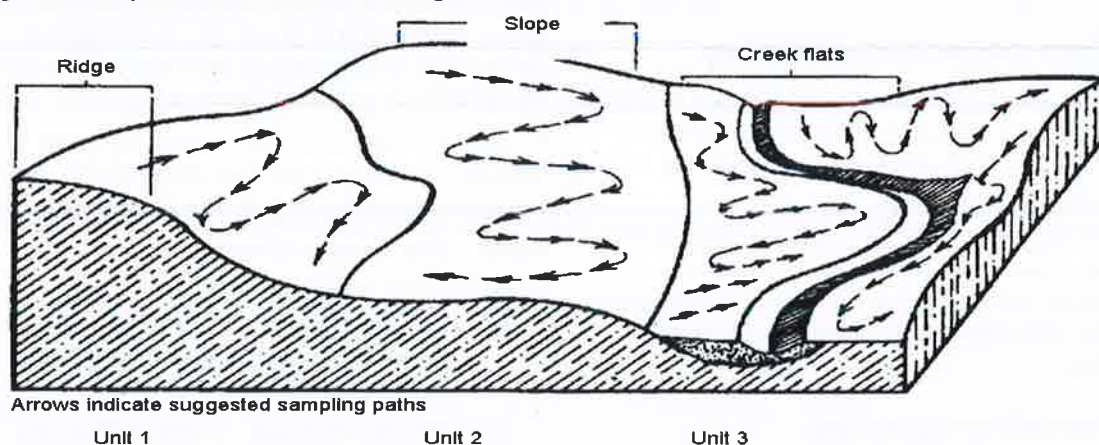


Figure 2. Sample sites for chemical testing



Sample collection

To obtain a representative sample of soil from each block, adopt the following procedures:

- Walk down each block in a zig-zag fashion collecting 40-50 equal sized cores or slices (at least 2cm wide) per block and covering as much of the area as possible.
- Remove the vegetation (grass) to expose the soil underneath before collecting each sample
- Place all cores or slices from the block in a clean bucket or wheelbarrow and mix thoroughly. The mixed or composite sample is considered representative of the area in question.
- Take one kilogram of the mixed sample, place in a clean, strong plastic bag and clearly label for dispatch to the laboratory

Hotspots – use a spade or trowel to take multiple individual samples (of approximately one kilogram) to a depth of 150 mm at increasing distances from the center of the suspect site. Do not pool these samples. The distance between each sampling site and the depth of sampling will be determined by the past pesticide usage and the purpose of the testing. Pesticide contamination can be found up to 2 m or more from livestock dip baths, especially at the sides of the entry point (splash areas) and may extend to a depth of 600 mm.

More information

State Residue Coordinator, Animal Biosecurity,
Department of Primary Industries. Email:
dermot.mcnerney@dpi.nsw.gov.au

Telephone: for general biosecurity inquiries
phone 1800 680 244

For updates go to
www.dpi.nsw.gov.au/factsheets

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (December 2016). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the Department of Primary Industries or the user's independent advisor.

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Biosecurity Laboratory Operations

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Zaed Aznam

ITP Development

Level 1, 19 Moore Street

TURNER NSW 2612

Soil Analysis Report

4 sample(s) of soil received on 19/03/21. Tested as per the following methods.

Testing commenced 19/03/21

Method	Method Description
S021 & M670	Elements by block digest and ICP-AES analysis

** Where shown, indicates NATA accreditation does not cover the performance of this service.

Results relate only to the items tested.

Notes: As requested, testing for OC/OP and Mercury will be performed by ALS.

- When required, samples air dried at 40°C as per Soil Chemical Methods - Australasia (Rayment and Lyons 2011).
- Results are expressed on an air-dry weight basis unless otherwise stated.
- Physical soil testing results calculated on 105°C dry weight
- This report should not be reproduced except in full.
- Samples will be retained for one calendar month from the date of the final report. Samples will then be discarded.
- Clients wishing to recover their samples must contact the laboratory within this period. This laboratory will return residual samples at client expense.

Date of issue 7/04/21

Laboratory No. Client's ID	Units	Limit of Reporting	1 Area A Sample A1	2 Area A Sample A2	4 Area B Sample B2
Acid Extractable Elements					
Aluminium	%	0.0005	-	0.28	0.31
Arsenic	mg/kg	5.0	-	<5	<5
Boron	mg/kg	4.0	-	<4	<4
Calcium	%	0.0010	-	0.069	0.058
Cadmium	mg/kg	0.30	-	<0.3	<0.3
Cobalt	mg/kg	0.40	-	3.8	6.0
Chromium	mg/kg	0.20	-	8.5	9.1
Copper	mg/kg	0.20	-	2.7	4.3
Iron	%	0.0010	-	0.57	0.74
Potassium	%	0.00040	-	0.076	0.077
Magnesium	%	0.0010	-	0.068	0.069
Manganese	mg/kg	0.10	-	350	590
Molybdenum	mg/kg	1.0	-	<1	<1
Sodium	%	0.00050	-	0.0046	0.0052
Nickel	mg/kg	0.70	-	3.0	3.8
Phosphorus	%	0.0010	-	0.031	0.036
Lead	mg/kg	2.0	-	6.9	12
Sulfur	%	0.00060	-	0.0039	0.0049
Selenium	mg/kg	4.0	-	<4	<4
Zinc	mg/kg	0.80	-	8.3	9.6



CERTIFICATE OF ANALYSIS

Work Order	: ES2110343
Client	: DEPARTMENT OF PRIMARY INDUSTRIES
Contact	: RESULTS ADDRESS
Address	: 1243 BRUXNER HWY, WOLLONGBAR NSW 2477
Telephone	: ---
Project	: WN210319
Order number	: ---
C-O-C number	: ---
Sampler	: ---
Site	: ---
Quote number	: EN/333
No. of samples received	: 4
No. of samples analysed	: 4

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 23-Mar-2021 12:00
Date Analysis Commenced : 25-Mar-2021
Issue Date : 30-Mar-2021 14:10



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	WN210319-1	WN210319-2	WN210319-3	WN210319-4	----
Sampling date / time					23-Mar-2021 00:00	23-Mar-2021 00:00	23-Mar-2021 00:00	23-Mar-2021 00:00	----
Compound	CAS Number	LOR	Unit		ES2110343-001	ES2110343-002	ES2110343-003	ES2110343-004	-----
					Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		10.0	----	9.3	----	----
Moisture Content	----	1.0	%		----	<1.0	----	<1.0	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	----	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		----	<0.05	----	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		----	<0.05	----	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg		----	<0.05	----	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg		----	<0.05	----	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg		----	<0.05	----	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg		----	<0.05	----	<0.05	----
Aldrin	309-00-2	0.05	mg/kg		----	<0.05	----	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg		----	<0.05	----	<0.05	----
^ Total Chlordane (sum)	----	0.05	mg/kg		----	<0.05	----	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg		----	<0.05	----	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg		----	<0.05	----	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg		----	<0.05	----	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg		----	<0.05	----	<0.05	----
4,4'-DDE	72-55-9	0.05	mg/kg		----	<0.05	----	<0.05	----
Endrin	72-20-8	0.05	mg/kg		----	<0.05	----	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg		----	<0.05	----	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		----	<0.05	----	<0.05	----
4,4'-DDD	72-54-8	0.05	mg/kg		----	<0.05	----	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg		----	<0.05	----	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg		----	<0.05	----	<0.05	----
4,4'-DDT	50-29-3	0.2	mg/kg		----	<0.2	----	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg		----	<0.05	----	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg		----	<0.2	----	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		----	<0.05	----	<0.05	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.05	mg/kg		----	<0.05	----	<0.05	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		----	<0.05	----	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		----	<0.05	----	<0.05	----



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				WN210319-1	WN210319-2	WN210319-3	WN210319-4	----
Sampling date / time				23-Mar-2021 00:00	23-Mar-2021 00:00	23-Mar-2021 00:00	23-Mar-2021 00:00	----
Compound	CAS Number	LOR	Unit	ES2110343-001	ES2110343-002	ES2110343-003	ES2110343-004	-----
				Result	Result	Result	Result	----
EP068B: Organophosphorus Pesticides (OP) - Continued								
Monocrotophos	6923-22-4	0.2	mg/kg	----	<0.2	----	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg	----	<0.05	----	<0.05	----
Diazinon	333-41-5	0.05	mg/kg	----	<0.05	----	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	<0.05	----	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg	----	<0.2	----	<0.2	----
Malathion	121-75-5	0.05	mg/kg	----	<0.05	----	<0.05	----
Fenthion	55-38-9	0.05	mg/kg	----	<0.05	----	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	<0.05	----	<0.05	----
Parathion	56-38-2	0.2	mg/kg	----	<0.2	----	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	<0.05	----	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	<0.05	----	<0.05	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	<0.05	----	<0.05	----
Fenamiphos	22224-92-6	0.05	mg/kg	----	<0.05	----	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg	----	<0.05	----	<0.05	----
Ethion	563-12-2	0.05	mg/kg	----	<0.05	----	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg	----	<0.05	----	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg	----	<0.05	----	<0.05	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	----	86.4	----	87.6	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	----	78.5	----	68.3	----



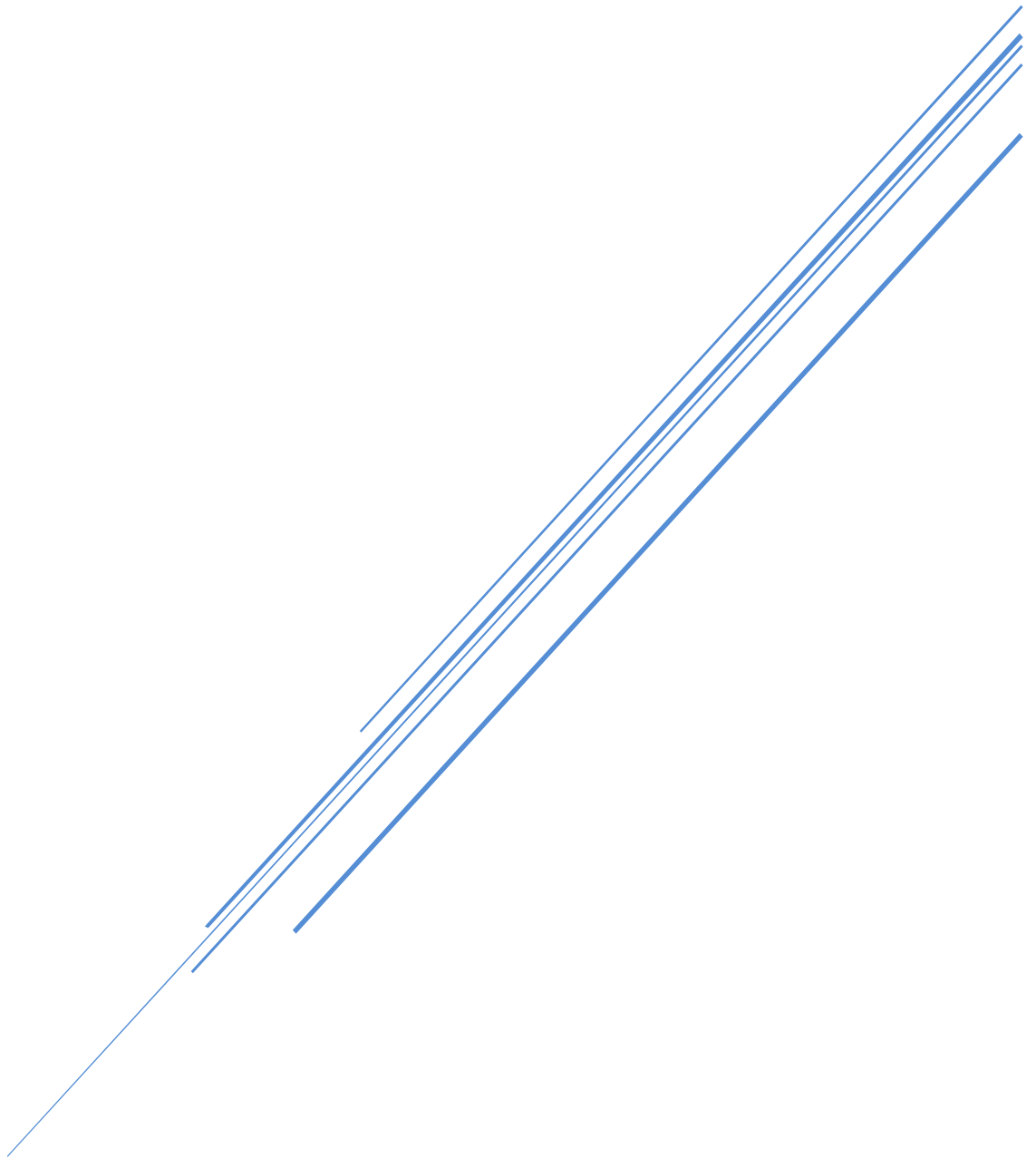
Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143

STATEMENT OF ENVIRONMENTAL EFFECTS

Kootingal Solar Farm

January 2021



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Attachment A: AHIMS Search Results

Document Details & History

Project number	1820
Project title	Kootingal 1C Solar Farm
Document title	Statement of Environmental Effects
Client	ITP (Development) Pty Ltd
Author	Allen Grimwood, Director
ABN	Zenith Town Planning Pty Ltd PO Box 591 Moruya NSW 2537 11 624 467 349
Qualifications	Bachelor of Arts (Honours) UNSW Master of Urban & Regional Planning, USyd  Planning Institute Australia
Version	Draft 26 November 2020
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The report has been prepared using information supplied by the client and other stakeholders. All care is taken to ensure the accuracy and veracity of this information, however, no responsibility is accepted for the interpretation of that information by end users.

EXECUTIVE SUMMARY

This Statement of Environmental Effects supports an application to Tamworth Regional Council to develop a solar farm at Lot 1 DP 328265 and Lot 97 DP 753841, No 1599 New England Highway, Kootingal, NSW, referred to as the Kootingal Solar Farm. The proponent is IT Power (Development) Pty Ltd. The site is located approximately 1 kilometre west of the settlement of Kootingal and occupies 11 hectares of the 58.2 hectare property. The application is for regionally significant development that needs consent and is to be determined by the Northern Regional Planning Panel. It is also integrated development as separate approvals are required to be issued by Transport for NSW under the *Roads Act 1993* and the Department of Industry – Water under the *Water Management Act 2000*.

The proposed development comprises a solar farm and ancillary facilities with a DC capacity of 6.4MWp and an AC output of 5.0MW. There are proposed to be 12,100 solar modules installed in 140 rows running north to south with approximately 6.25 metres spacing centre to centre between each row. The hub height of each tracker is 1.5 metres with the peak of the modules reaching an approximate height of 2.7 metres. Ancillary facilities comprise two 3MW AC inverter stations mounted on a 12.2 metre long skid. Each of these inverter stations incorporates high and moderate voltage switchgear and transformers and connect by way of underground cables to the 11kV feeder line that connects to the electricity grid at the Essential Energy Kootingal Zone substation. The solar modules are to be enclosed within a chain mesh steel security fence topped with three rows of barbed wire to a total height of 2.3 metres. The fence is to be setback a minimum of 30 metres from the northern boundary. Solar arrays are to be setback a further 8 metres. The solar farm will be decommissioned in approximately 35 years from approval.

The development is satisfactory to the objects of the *Environmental Planning & Assessment Act 1979 Act* and applicable environmental planning instruments. The land is zoned RU4 Rural Small Holdings under *Tamworth Regional LEP 2010*. The development is defined as *electricity generating works* which means a building or place used for the purpose of making or generating electricity. The proposed development of Kootingal Solar Farm is permissible under provisions of *SEPP (Infrastructure) 2007* and *Tamworth Regional LEP 2010*. The site is mapped as being within a buffer to sewerage treatment plant located to the north. The development would not be impacted by operations at the STP nor would the solar farm interfere with operating conditions of the plant.

The NSW Government recognizes that the New England region has some of the best natural energy resources in the country and is close to existing high voltage power lines that connect the NSW east coast and Queensland. To capitalize on these benefits, the government is planning an 8,000MW renewable energy zone located in the region and has committed to investing \$78.9

million to support the development of renewable energy. The New England renewable energy zone is expected to generate around \$12.7 billion in private sector investment and provide around 2,000 construction jobs for a decade and around 1,300 ongoing jobs.

The likely impacts of the development have been considered as summarized below. Mitigation measures have been recommended where necessary including preparation of a construction environmental management plan. On balance and having regard to matters for consideration under section 4.15 of the Environmental Planning & Assessment Act 1979 Act, the impacts are considered acceptable.

Biodiversity

The development site is not mapped as affected as ecologically sensitive in *Tamworth Regional LEP 2010*. The development site is not mapped on the biodiversity values map, the clearing of native vegetation is not above the threshold based on minimum lot size, and a test of significance has found that there will be no significant impact on the ecological integrity of the property. The site is not considered key koala habitat and the development would not impact on any local koala population.

Natural hazards

The site is not mapped as being flood prone in *Tamworth Regional LEP 2011*. The development site is not mapped as being bushfire prone land. Infrastructure comprising electricity generating works is not a habitable building and is not listed as a *special fire protection purpose* under section 100B of the *Rural Fires Act 1997*.

Surface and ground waters

Potential adverse surface water-related impacts to the site relate to site accessibility and managing downstream sedimentation. There will be no extraction of groundwater or interference with the groundwater table.

Air quality

The current use of the land for farming involves activities that may create dust and impact on air quality. The construction of the solar farm and delivery of materials using heavy vehicles, may generate dust, however, once operational the change of use of the land from agricultural to solar photovoltaic electricity generation is expected to reduce particulate emissions and lead to an improvement in local air quality.

Noise

Predicted construction noise levels are expected to exceed the NMLs at two receivers due primarily to piling and earthworks. The exceedances would be temporary and of short duration. Operational and road noise levels satisfy the management levels for all assessed receivers.

Electromagnetic radiation

According to the Australian Radiation Protection and Nuclear Safety Agency there is no established evidence of health effects from exposure to electric and magnetic fields from powerlines, substations, transformers or other electrical sources, regardless of proximity. The location of the proposed solar farm and the distance separation between nearby dwellings and the site mean that any impacts on health are mitigated.

Traffic and access

Access to the development is proposed off a private access road which intersects with the New England Highway. The intersection exceeds 333 metres of sight distance in either direction in accordance with the requirements of Austroads Guide to Road Design and Tamworth Regional Council DCP requirements. The development will not cause a decrease in the level of service to either the private access road or the New England Highway. Intersection upgrades are recommended to accommodate the turning path of a B-Doble truck and ensure off-road queuing.

The community and economy

The development of a 5MW solar farm will contribute to the electricity grid in a sustainable manner that reduces greenhouse gas emissions and will assist the transition of our economy from reliance on fossil fuels to renewable sources to decarbonise electricity production, assisting governments to achieve emissions reduction targets.

The solar farm will generate community economic benefits through local employment opportunities during the planning and construction phases as well as limited maintenance and inspection jobs once operational. The development of a solar farm will create a new market for local contractors and expand diversity of income for the land holder.

The land may continue to be used for agriculture and returned to its current condition once the facility is decommissioned.

Heritage

The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* was applied and it was found that there would not be any impacts on Indigenous places or objects. The development site is not located in the vicinity of any of non-indigenous heritage items.

Glare and glint

The impact of glare and glint was analysed for 27 properties and 9 road routes within a 2 kilometre radius of the development site. There are not expected to be any impact of glare or glint on residents or motorists due to distance separation and the presence of vegetation and/or structures that will impede direct vision of the facility.

Landscape character and visual amenity

The landscape of Kootingal west of the New England Highway is characterised by farming, rural uses and infrastructure including roads, sewerage treatment ponds and the council depot. To the east of the highway is urban residential development surrounded by rural residential allotments. The impact of the proposed Kootingal Solar Farm on landscape character has been assessed to range from negligible to low for private property and from low to moderate for the public domain. Overall, the impact is assessed to be low based on a ranking of the magnitude of works and sensitivity to change in landscape character.

The visual impact of the proposed works is assessed to range from negligible to high-moderate for 27 dwellings and 9 roads located within the 2 kilometre visual catchment of the site. The solar farm would be visible to dwellings in elevated positions to the north and north-east of the development site and to Betts Lane and unnamed roads to the north. Distance separation and infrastructure works on intervening land would assist to mitigate the impact to these observation points. Roadside vegetation, built structures and the slope of the development site to the north-north-east would serve to obstruct visibility to most observation points. Screening with vegetation on some or all sides of the array would not improve visual amenity impacts to properties that overlook the development site due to their elevation and distance separation.

Waste management

Estimates of waste materials and proposed management arrangements for each phase of the development project are provided in light of the capacity and functions of local waste management facilities.

Cumulative impacts

The cumulative impacts of the proposed development are minor. There are no other electricity generating works in the locality and the use is suited to a rural location due to the need for a large land area. The immediate area is already used to accommodate infrastructure and the addition of a solar farm to that area would not detract unreasonably from local amenity or the natural environment.

The system is designed to generate in excess of 12.9GWh of energy annually with the system offsetting almost 8.5 thousand tonnes of CO² equivalent emissions (Sources: *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Schedule 1)* and Department of the Environment and Energy) and providing enough energy to power about 2,150 NSW homes.

Electricity generated by the Kootingal Solar Farm will be directed to the settlement via existing electrical infrastructure for use by local households and businesses. Any surplus electricity will be sent to the grid and any deficit will be drawn from the grid. As well as the potential to utilize local contractors to construct the facility, Kootingal will benefit through the ability to power the township with clean energy that is generated adjacent the settlement.

Given the local and regional benefits of renewable energy generation and based on implementation of the recommended mitigation measures to minimize disruption to the existing natural and built environment, the development is considered to be in the public interest.

1. INTRODUCTION

1.1 Overview

The purpose of this Statement of Environmental Effects is to support an application to Tamworth Regional Council to develop a solar farm at Lot 1 DP 328265 & Lot 97 DP 753841 No. 1599 New England Highway, Kootingal, referred to as the Kootingal Solar Farm. The application is for regionally significant development that needs consent and is to be determined by the Northern Regional Planning Panel.

Separate approvals are required to be obtained under section 4.46 of the *Environmental Planning and Assessment Act 1979*. These relate to works on a classified road that need approval from Transport for NSW under the *Roads Act 1993* and works over a watercourse that need approval from the Department of Industry – Water under the *Water Management Act 2000*. The application is therefore integrated development.

This Statement has been prepared having regard to advice provided by Tamworth Regional Council during a site visit on 22 September 2020. Information has also been sourced from the Council's website, the NSW legislation website, SIX Maps, the website of the Department of Planning, Industry & Environment, the Planning Portal and SEED (Sharing and Enabling Environmental Data). All information referenced in this Statement has been sourced from publicly available documents or websites and from expert reports produced to support the application.

The methodology and findings of expert reports that accompany the application are summarised in this Statement. Further information about these matters should be sought from the original documents.

1.2 Scope of the report

The scope of this report is to describe the location and physical characteristics of the site on which the development is proposed, identify relevant provisions of plans and policies applying to the land, and to discuss any potential environmental impacts of the development and proposed servicing arrangements.

The purpose of this report is to assist Council's assessment of the proposal against the matters for consideration listed in section 4.15 of the *Environmental Planning and Assessment Act 1979*.

1.3 The proponent

The proponent for the proposed solar farm is IT Power (Development) Pty Ltd. IT Power (Development) is a private sector organization based in Canberra and Sydney, which was established in 2003. It is part of the IT Power Group which was formed in 1981 in the UK to bring together specialists in renewable energy, energy efficiency and carbon markets. IT Power offers expertise in renewable energy and energy efficiency, including research, development and implementation, managing and reviewing government incentive programs, high level policy analysis (including carbon markets), engineering design and project management.

1.4 Justification

Solar energy is energy created by the heat and light of the sun. Solar power is produced when this energy is converted into electricity or used to heat air, water, or other substances. Australia has the highest average solar radiation per square metre of any continent in the world. Despite uncertainty regarding energy policy, the Commonwealth and NSW Governments have recognized the need to supplement energy derived from fossil fuels with energy generated from renewable sources. Alternative energy supply may be sourced from solar photovoltaic, geo-thermal, solar thermal, wave and tidal action, and wind.

The development of solar photovoltaic power is well underway in NSW and across Australia. This growth in the local solar PV sector continues to provide a significant boost for Australia's regional economy with renewable infrastructure development estimated to create upwards of 2,300 direct jobs plus indirect employment.

According to the Australian Renewable Energy Agency (ARENA), the deployment of household solar PV that generates about 5 kW is expected to continue and at the same time an increase in rooftop solar PV installations on commercial premises generating around (10-100 kW) is expected. Large scale solar PV is also rapidly expanding in Australia with several solar farms being constructed that will have the capacity to generate over 50MW. The proposed solar farm aims to fill the gap in the mid-sized plants. It will generate 5MW of AC power and contribute to renewable energy supply to supplement electricity generation from coal, oil and gas.

The NSW Government recognizes that the New England region has some of the best natural energy resources in the country and is close to existing high voltage power lines that connect the NSW east coast and Queensland. To capitalize on these benefits, the government is planning an 8,000MW renewable energy zone located in the region and has committed to investing \$78.9 million to support the development of renewable energy. The New England renewable energy zone

is expected to generate around \$12.7 billion in private sector investment and provide around 2,000 construction jobs for a decade and around 1,300 ongoing jobs.

The proposed development is in accordance with relevant objects of the *Environmental Planning and Assessment Act 1979* in that it will assist to generate power to be distributed to the residents of NSW thereby promoting the social and economic welfare of the community in a manner that manages and conserves natural resources. The Kootingal Solar Farm will further the goals of sustainability, and the orderly and economic use of land.

2. SITE DESCRIPTION AND CONTEXT

2.1 Description

The site of the proposed Kootingal Solar Farm is described as Lot 1 DP 328265 & Lot 97 DP 753841 No. 1599 New England Highway, Kootingal, NSW. It is known as Roseamere and is located approximately 1 kilometre west of Kootingal township. It is an irregular shape with a total area of 58.2 hectares. The location of the site is shown in Figure 1 below.

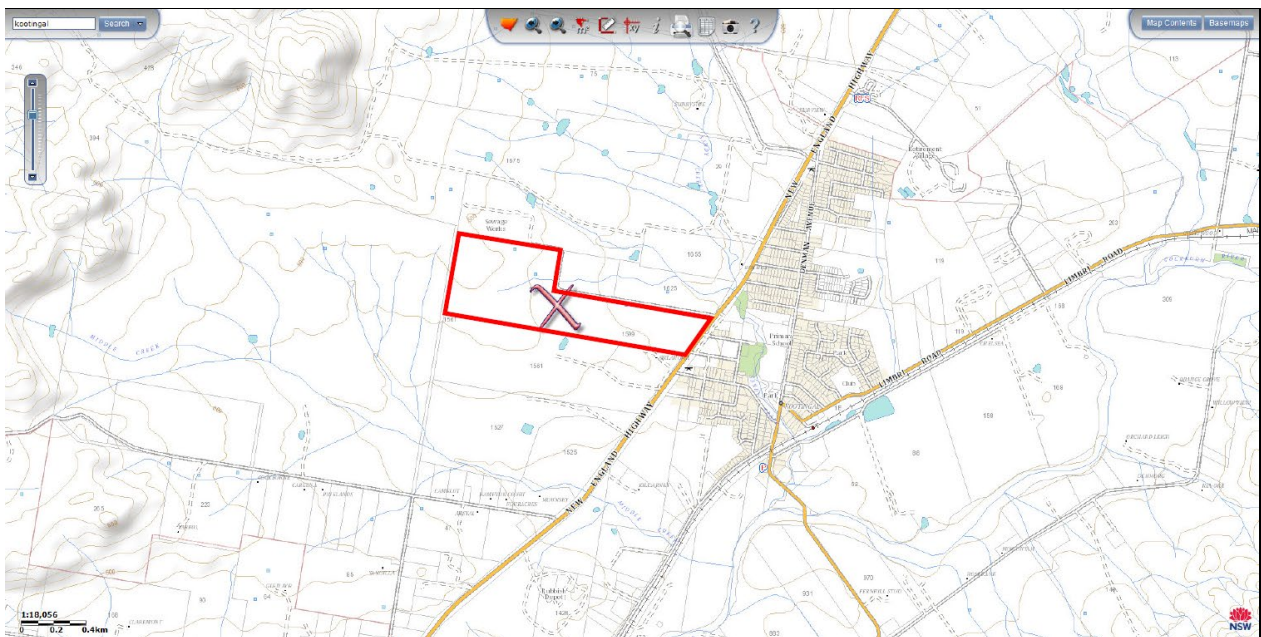


Figure 1: Locality map. Source: SIX Maps, 2020

The site is occupied by a dwelling and a number of farm sheds. The topography of the site is gently undulating with a slight fall to the east. The development site was formerly used as an orchard and for cropping oats until about 20 years ago. It has since been used to graze sheep and cattle and is now fallow with some alpacas and cattle grazing under agistment. Existing ground vegetation comprises mostly exotic grasses and weeds. Current access to the site is by way of a private driveway off the New England Highway which is located approximately 185 metres south of a private access road that leads to a sewerage treatment plant and treatment ponds.

2.2 Context

Surrounding land is predominantly used for agricultural purposes. The urban settlement of Kootingal extends to the south on the eastern side of the New England Highway. The sewer treatment plant and treatment ponds managed by Tamworth Regional Council are located on

adjacent land to the north. An aerial image of the site and surrounding land is shown in Figure 2 below which is dated May 2013.



Figure 2: Aerial image. Source: SIX Maps, 2020

Below is an extract from the topographic map for land in the vicinity of Kootingal. This map shows the location of the settlement, services including transport infrastructure, dams, cadastre and waterways.

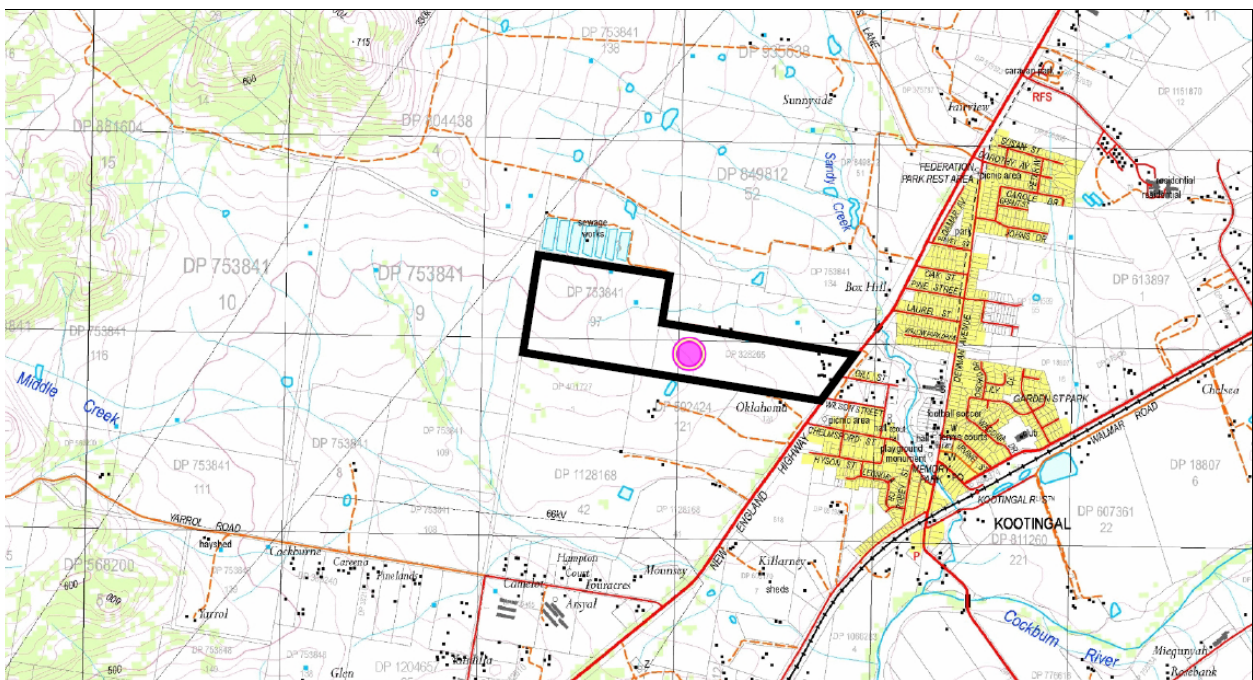


Figure 3: Extract from the topographic map. Source: Land & Property Information 2015

2.3 Climate

Global solar exposure is described on the Bureau of Meteorology website as being the total amount of solar energy falling on a horizontal surface. The daily global solar exposure is the total solar energy for a day. Typical values for daily global solar exposure range from 1 to 35 MJ/m² (megajoules per square metre). The values are usually highest in clear sun conditions during the summer, and lowest during winter or very cloudy days.

Figure 4 below shows average daily solar exposure across NSW for the 12 month period 1 February 2019 to 31 January 2020. Tamworth LGA has received an average of 18 to 20 MJ/m² each day, placing it within the second highest area receiving solar radiation in New South Wales.

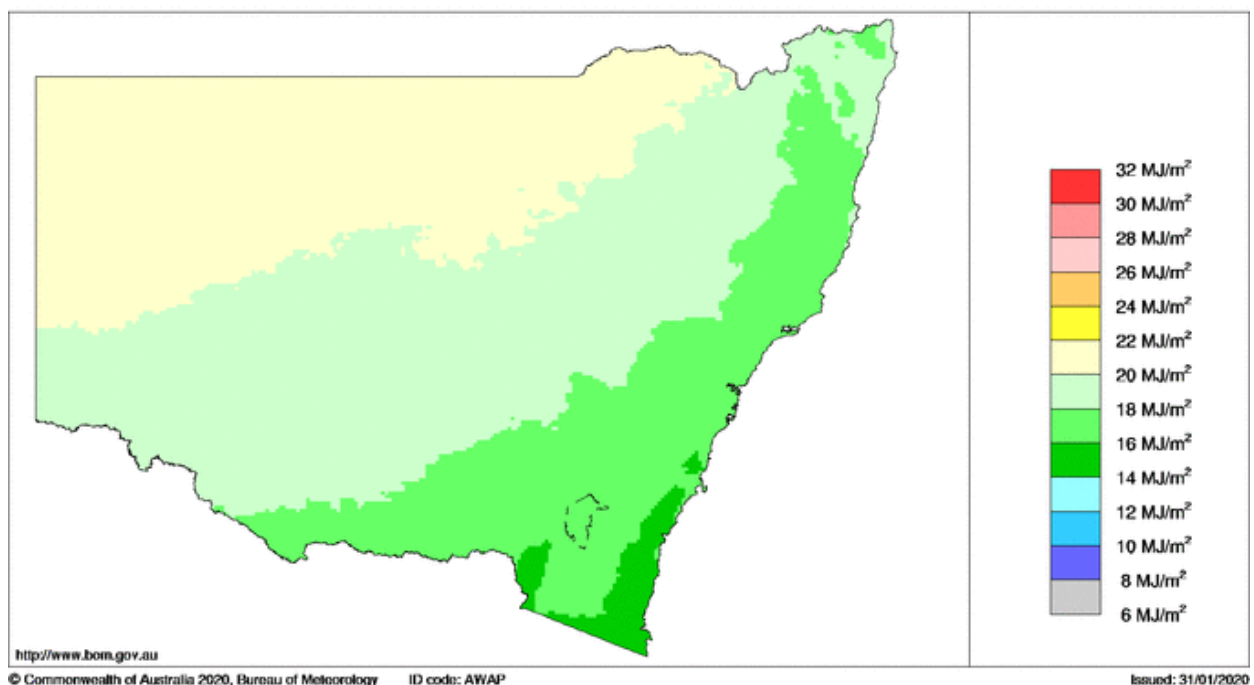


Figure 4: Average daily solar exposure. Source: Australian Bureau of Meteorology

The mean monthly global solar exposure measured at Tamworth Airport (station number 055325), the closest measuring station to the solar farm, site, is given in Table 1 below. The annual mean for 2019 was 19.5MJ/m².

Table 1: Mean monthly global solar exposure at Tamworth Airport, 2019

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly mean	26.5	24.8	19.4	16.7	12.2	10.8	12.4	15.2	18.5	22.6	26.7	28.3

3. DETAILS OF THE PROPOSED DEVELOPMENT

3.1 Overview

The proposed development comprises a solar farm and ancillary facilities with a DC capacity of 6.4MWp and an AC capacity of 5.0MW on approximately 11 hectares of the 58.2 hectare site. The array is proposed to be placed in the centre of the property near the northern boundary.

3.2 The array

There are proposed to be 12,100 photovoltaic modules installed in 140 rows that are 103.5 metres long running north to south. There is approximately 6.25 metres spacing centre to centre between each row.

Each row of PV modules will rotate to track the sun across the sky from east to west each day. The hub height of each tracker is 1.5 metres with the peak of the modules reaching an approximate height of 2.7 metres when the array is fully tilted to 60 degrees from horizontal, i.e. in the early morning and late evening.

The layout of the solar farm is shown on General Arrangement Plan (Drawing No KOO1C-G-210).

3.3 Inverters and ancillary items

Two 3MW AC inverter stations and a transformer will be installed at the solar farm. These inverters are to be located within the array and are each mounted on a 12.2 metre long skid. Each of these inverter stations incorporate high and medium voltage switchgear. Each will connect by way of underground cables to an 11kV feeder to inject power to the electricity grid at the Essential Energy Kootingal Zone Substation. Dial-before-you-dig investigations are carried out prior to commencing all subsurface work.

3.4 Services

Reticulated water and sewer services are not required to be provided to the solar farm as there are no permanent offices or amenities proposed on site. Portaloos for wastewater disposal (see <https://www.kennards.com.au/site-equipment/showers-toilets.html>) and water supply by way of a portable tank or cart (see <https://www.kennards.com.au/site-equipment/water-tank.html>) are proposed to be installed during the construction phase. Maintenance workers would not be required to remain on site. Cleaning of the PV panels would be carried out on an annual basis

to maximise the performance of the system. This is done using water brought into the site and a sponge mop.

The proposed access road is an existing private road off the New England Highway, which provides access to the Tamworth Regional LGA Depot and is constructed with a bitumen sealed pavement width of approximately 4.0m with unsealed shoulders and table drains approximately 0.5m deep either side.

During the initial site establishment phase it is estimated that there will be 6 to 8 light vehicle trips per day and an average 6 to 8 truck and trailer movements. During the construction stage there would be the equivalent of 45 B-Double loads of materials and equipment, with an expected daily maximum of 4 vehicles, accessing the site to deliver PV panels, mounting frame equipment and inverters plus construction machinery to grade the accessways and erect the mounting system.

It is expected that car parking for up to 40 small vehicles will be needed to cater to the 50 construction workers at the rate of 1.2 spaces per vehicle. A temporary car parking and materials laydown area is to be sited at the north centre of the array of panels. An emergency exit gate is to be located in the middle section of the northern part of the solar farm, at the same access point used during the construction phase.

3.5 Construction

The mounting system for the PV panels is constructed on piles that are driven into the ground using a vibrating pile driver. The piles will be driven approximately 1.5 to 3.5 metres into the ground, as to be confirmed by a geotechnical and structural engineer.

During construction there is expected to be 50 personnel on site working from 7.00am – 4.00pm Monday to Friday. The construction is expected to take approximately three months. Should it be necessary to carry out work outside these hours then activities would be limited to those generating low noise emissions. Once operational the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 to 3 people.

3.6 Landscaping

It is proposed to plant a vegetated screen along the northern and southern extent of the arrays. Plants that are endemic to the Kootingal area and that grow to a maximum height of 2.5 to 3 metres would be selected for the northern boundary. Larger plants may be appropriate along the southern boundary as overshadowing of the panels is not likely to occur. The plants would be

spaced 5 metres apart to provide a continuous screen upon maturity. Plantings will be placed on the outer side of security fencing, i.e. within the setback between the boundaries and the security fence.

Land that is disturbed during construction of the solar farm and not to be used for access or other maintenance purposes will be sown with grasses following completion of construction. Planting will also assist to minimise site disturbance and contribute to the rural landscape and character of the immediate area.

Plantings will be maintained and watered by maintenance crew on a regular basis. The planting of plant species endemic to the area will be carried out whilst construction takes place to enable use of the hired portable tank or cart that will provide water supply to the site. Construction will take approximately 3 months so regular watering during that period would ensure the establishment of plants. The use of native plants endemic to the area means that watering requirements once established would be minimal and would be done once every 2 or 3 months by the landowner. There would be nil impact on Council's infrastructure and no augmentation of services would be required. Bore water would be sourced to maintain the plants if available, otherwise water may be brought onto the site in tanks fixed to utility trays.

Regular inspections of the site will be carried out to ensure that grassland is managed to reduce the risk of bushfire to surrounding land and to control weeds. Mowing or slashing between rows of PV panels and in the area immediately surrounding the arrays would be carried out as required. Livestock grazing is being trialled elsewhere and may be carried out around and beneath panels in the future.

A full landscape plan prepared by a qualified landscape architect that contains details of species, pot sizes, maintenance regime and the like would be submitted prior to issue of a construction certificate.

3.7 Security

The solar farm is to be enclosed within a 1.8 metre high security fence setback 30 metres from the northern boundary, 576 metres from the eastern boundary, 3 metres from the southern boundary and 487 metres from the western boundary. Solar arrays are to be setback 8 metres from the security fence. The proposed fence is to be chain mesh steel topped with three rows of barbed wire giving a total height of 2.3 metres similar to that shown in Plate 1 below.

Security lighting is not proposed to be installed.



Plate 1: Example of security fencing

3.8 Decommissioning

The Kootingal Solar Farm is intended to remain in operation indefinitely in order to contribute to the sustainable electricity power supply to the state of NSW. If, however, circumstances change and it is necessary to decommission the farm in around 35 years then all infrastructure, panels, mounting frames including footings, inverters, cabling and other sub-surface materials would be disassembled and removed from the site to enable the site to be re-cultivated for cropping or grazing purposes. All gravel surfacing of accessways would be removed unless required for a future use.

If necessary, a condition of consent may be imposed that requires a decommissioning plan to be prepared and approved prior to the event. Details of the types and quantities of waste materials expected to be generated when the facility is decommissioned are provided in section 5.12 of the Statement and in the Waste Assessment dated 28 July 2020 and submitted with the development application.

4. STATUTORY FRAMEWORK

4.1 Legislation

4.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment (EPA) Act 1979* is the principal piece of legislation governing the use and development of land in NSW. The objects of the Act are:

- (a) *to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,*
- (b) *to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,*
- (c) *to promote the orderly and economic use and development of land,*
- (d) *to promote the delivery and maintenance of affordable housing,*
- (e) *to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,*
- (f) *to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),*
- (g) *to promote good design and amenity of the built environment,*
- (h) *to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,*
- (i) *to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,*
- (j) *to provide increased opportunity for community participation in environmental planning and assessment.*

The objects of the EPA Act are intended to guide land planning and management. Section 4.15 of the Act lists matters for consideration when assessing and determining an application for development.

4.1.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* introduced the *Biodiversity Offsets Scheme* which is used to determine whether the *Biodiversity Assessment Method* is necessary to assess the impacts of a development proposal on threatened species, endangered ecological communities and habitats. Determining whether a *Biodiversity Development Assessment Report* is required under the

Biodiversity Conservation Act 2016 and subsequently whether the *Biodiversity Offsets Scheme* would apply to the proposed works is subject to three steps.

- The first step is to identify whether the site is mapped on the *Biodiversity Values Map*.
- The second step is to estimate whether the extent of native vegetation to be cleared for the proposed development is above the threshold which in this case is 1 hectare.
- The third step is to carry out a test of significance to predict whether impacts on biodiversity are likely to be significant.

Under the *Biodiversity Offsets Scheme* offset obligations may apply whereby the biodiversity assessment finds that the removal of vegetation to facilitate the development will have significant impacts on flora. These offsets are in the form of credit obligations whereby payment is made to a biodiversity conservation fund which enable vegetation removal and provides funds to assist to preserve the same vegetation community elsewhere. Credit obligations also apply to fauna species where particular species are likely to be living in or frequenting the property. These matters are addressed in section 5.1 *Biodiversity* of this Statement.

4.1.3 Water Management Act 2000

The *Water Management Act 2000* includes provisions to control or permit works within 40 metres of the top of a bank of a watercourse or stream. The proposed solar farm does not involve works within 40 metres of the top of the bank of a watercourse, therefore, a *controlled activity approval* is not required to be obtained. Impacts on surface and groundwaters are addressed in 5.3 *Water resources* of this Statement.

4.1.4 Local Land Services Act 2013

The *Local Land Services Act 2013* regulates the clearing of native vegetation on rural land Where an activity is permitted without Council consent. There are two broad categories of land under the LLS Act; Category 1 (Exempt) land and Category 2 (Regulated, Vulnerable or Sensitive) land which are shown on the [Native Vegetation Regulatory Map](#) .

Clearing may be authorised on Category 1 (Exempt) Land but only where the activity is permitted without Consent from Council and when no other permit is required under other legislation. The onus is on the applicant to ensure they are not committing an offense under other legislation. If located on Category 2 (Regulated, Sensitive or Vulnerable) Land, the clearing may be authorised as an Allowable Activity or under the Land Management (native vegetation) Code within the *LLS Act*. If the clearing on Category 2 Land is not an Allowable Activity or is not authorised under the Land Management (native vegetation) Code, the clearing will need to be offset under the

Biodiversity Offset Scheme. This means a Biodiversity Development Assessment Report is needed and the clearing will need to be approved by the Native Vegetation Panel.

The LLS Act does not apply to the proposed solar farm as development consent is required to be obtained to enable the works to proceed.

4.1.5 National Parks and Wildlife Act 1974

The objectives of the *National Parks and Wildlife Act 1974* are to conserve and protect habitat, ecosystems, biodiversity, landforms, landscapes and objects, places or features of cultural value in NSW. Under the NPW Act, it is an offence to knowingly harm or desecrate an Aboriginal object. Harm includes destroy, deface or damage an Aboriginal object or Aboriginal Place, and in relation to an object, move the object from the land on which it has been situated. Aboriginal objects include sites, relics or cultural material such as scar trees, middens and ancestral remains.

The NPW Act can also protect areas of land that have no Aboriginal objects, that is, they may have no physical evidence of Aboriginal occupation or use. These areas can be declared 'Aboriginal places' if they have spiritual, natural resource usage, historical, social, educational or other type of significance.

Anyone who exercises due diligence in determining that their actions will not harm Aboriginal objects has a defence against prosecution for the strict liability offence if they later harm an object. The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* provides a process whereby a reasonable determination can be made as to whether or not Aboriginal objects will be harmed by an activity, whether further investigation is warranted and whether the activity requires an application for an Aboriginal Heritage Impact Permit.

4.1.6 Heritage Act 1977

The aims of the *Heritage Act 1977* are to identify, protect and conserve items of State heritage significance. Provisions of the Heritage Act facilitate the establishment of a State Heritage Register for the listing of items of State significance and the preparation of conservation management plans for these items.

The Heritage Act also sets out the procedures for the approval of works relating to items listed on the State Heritage Register. Impacts on listed heritage items are addressed in section 5.9 *Heritage* of this Statement.

4.1.7 Noxious Weeds Act 1993

The aims of the *Noxious Weeds Act 1993* are to prevent the establishment, reduce the risk of spread and minimise the extent of noxious within NSW. The extent of noxious weeds and procedures to eradicate weed infestation from the development site are addressed in section 3. *Details of the proposed development* in this Statement.

4.1.8 Roads Act 1993

Under section 138 of the Roads Act 1993, consent is required to carry out works in, on or over a public road, remove or interfere with a structure, work or tree on a public road or connect a road to a classified road. The consent of Transport for NSW is required in the case of works relating to a classified road. Traffic impacts are addressed in section 5.7 *Traffic* and access of this Statement.

4.1.9 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* aims to protect nationally and internationally important flora, fauna, ecological communities and heritage places. The approval of the Commonwealth Minister for the Environment is required for actions that may have a significant impact on matters of national environmental significance. The *EPBC Act* also requires Commonwealth approval for certain actions on Commonwealth land.

An assessment of the potential impact of the proposed works on any matters of national environmental significance under the *EPBC Act* and the need for referral to the Commonwealth is provided in section 5.1 *Biodiversity* of this Statement.

4.2 State Environmental Planning Policies

4.2.1 State Environmental Planning Policy No 55 – Remediation of Land

SEPP 55 requires Council to consider whether land is contaminated and to determine whether the proposed use is suitable with or without contamination. Council can require an applicant for development to conduct a preliminary investigation and a subsequent more detailed investigation if warranted. Where contamination exists and remediation is necessary, Council must be satisfied that the remediation will take place before the land is used for the proposed purpose. It is noted that should the preliminary investigation identify contamination on the site then the NSW *Contaminated Land Planning Guidelines* apply to subsequent investigations.

The property has been cleared and farmed for many years and is not known to be listed on a Council register of potentially contaminated land. There has been no known historical usage that would cause the land to be contaminated. NSW Health advise that the use of farm chemicals such as pesticides and fertilisers is not considered to contaminate soils to the extent that mediation is required. It is considered that a preliminary investigation is not required for the development of a solar farm.

4.2.2 State Environmental Planning Policy (Infrastructure) 2007

The aims of *SEPP (Infrastructure) 2007* are to ensure a consistent and flexible planning system to facilitate the delivery of services. The policy identifies environmental assessment categories for types of infrastructure, matters to consider when assessing development adjacent to infrastructure and provides for consultation with relevant public authorities. The policy applies to the whole of NSW.

SEPP (Infrastructure) contains provisions relating to approval processes and assessment requirements for infrastructure proposals according to the type or sector of infrastructure. It outlines land use zones where types of infrastructure are permissible with or without consent and identifies certain works as exempt and complying development.

Part 3 Division 4 of the policy relates to electricity generating works or solar energy systems. Section 35 enables development for the purpose of a solar energy system to be carried out by any person with consent on any land, although this is limited to no more than 100kW in a prescribed residential zone. The proposed development is located in zone RU4 Primary Production Small Lots and is therefore permitted with consent by *SEPP (Infrastructure) 2007*.

Clause 45 of *SEPP (Infrastructure) 2007* requires the consent authority to consult with the electricity supply authority where development occurs near electricity infrastructure. An 11kV power line runs within an easement near the development site, therefore, Council is to consult Essential Energy prior to determination of the application.

Clause 104 - Traffic-generating development also applies. The proposed development will not generate vehicle movements within the threshold required by Schedule 3 to trigger a referral Transport for NSW.

4.2.3 State Environmental Planning Policy (Primary Production and Rural Development) 2019

The aims of *SEPP (Primary Production and Rural Development) 2019* are:

- (a) *to facilitate the orderly economic use and development of lands for primary production,*
- (b) *to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,*
- (c) *to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,*
- (d) *to simplify the regulatory process for smaller-scale low risk artificial waterbodies, and routine maintenance of artificial water supply or drainage, in irrigation areas and districts, and for routine and emergency work in irrigation areas and districts,*
- (e) *to encourage sustainable agriculture, including sustainable aquaculture,*
- (f) *to require consideration of the effects of all proposed development in the State on oyster aquaculture,*
- (g) *to identify aquaculture that is to be treated as designated development using a well-defined and concise development assessment regime based on environment risks associated with site and operational factors.*

The policy applies to *State significant agricultural land*, farm dams and other artificial waterbodies, livestock industries and aquaculture. There is no *State significant agricultural land* listed in the schedule to the policy. It is noted that, separately, the Department of Primary Industries are in the process of preparing mapping of *Important Agricultural Land* in NSW to assist decision-making regarding development on rural land.

4.2.4 State Environmental Planning Policy (State and Regional Development) 2011

Development that is state and regionally significant is identified in *SEPP (State and Regional Development) 2011*. Electricity generating works including solar farms which have a capital investment value of more than \$30 million, or a capital investment value of more than \$10 million and are located in an environmentally sensitive area of State significance, are declared state significant development. Private infrastructure, including electricity generating stations, that have a capital investment value of over \$5 million are declared regionally significant. In this case the proposed development has a CIV of \$ 6.6 million and is regionally significant. The application will be determined by the Northern Regional Planning Panel.

4.2.5 State Environmental Planning Policy (Koala Habitat Protection) 2019

SEPP (Koala Habitat Protection) 2019 commenced on 1 March 2020. This policy aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current

trend of koala population decline. The new policy is implemented through the *Koala Habitat Protection Guideline*. The policy lists 123 feed tree species and applies to Tamworth Regional LGA. The Council has not prepared a koala plan of management for the area, therefore, a Koala Assessment Report is required as the site is greater than 1 hectare.

4.3 Local Environmental Plans

4.3.1 Tamworth Regional Local Environmental Plan 2011

The property is zoned RU4 Primary Production Small Lots under *Tamworth Regional LEP 2011*. The objectives of zone RU4 are:

- *To enable sustainable primary industry and other compatible land uses.*
- *To encourage and promote diversity and employment opportunities in relation to primary industry enterprises, particularly those that require smaller lots or that are more intensive in nature.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

The development is defined as **electricity generating works** which means a building or place used for the purpose of making or generating electricity. This use is permitted with consent in zone RU4.

The following clauses of *Tamworth Regional LEP 2011* apply to the proposed development:

Clause 7.1 Earthworks

The objective of this clause is to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

Development consent is required for earthworks unless the earthworks are ancillary to development for which development consent has been given. In deciding whether to grant development consent for development involving ancillary earthworks, the consent authority must consider:

- the likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development,*
- the effect of the development on the likely future use or redevelopment of the land,*

- (c) *the quality of the fill or the soil to be excavated, or both,*
- (d) *the effect of the development on the existing and likely amenity of adjoining properties,*
- (e) *the source of any fill material and the destination of any excavated material,*
- (f) *the likelihood of disturbing relics,*
- (g) *the proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area.*

Earthworks associated with the development comprise minor excavation to 150mm to install road base for accessways, 750mm footings for the inverters and security fence strainer posts, 1,000mm footings for the access gate and 1,500mm to 3,500mm footings for the panel mounting frames. Cable trenching of 600mm for low voltage cables and 1,200mm deep trenching is also to be carried out. All of these earthworks are ancillary to the development of a solar farm and are not expected to impact adversely on drainage, future use of the land if the facility is decommissioned, relics, the natural environment or adjoining developments.

7.5 Development within a designated buffer area

The objective of this clause is to protect the operational environment of sewage treatment plants, waste disposal facilities and water treatment facilities. This clause applies to the development site as it is land that is partially identified as “STP” on the *Sewage Treatment Plant Map, Waste Disposal Facility Map and Water Treatment Facilities Map*.

Before granting development consent for development on land to which this clause applies, the consent authority must consider:

- (a) *the impact that any noise and other emissions associated with existing land uses would have on the proposed development,*
- (b) *any proposed measures incorporated into the development that limit the impact of such noise and other emissions associated with the existing land use,*
- (c) *any opportunities to relocate the proposed development outside the land to which this clause applies,*
- (d) *whether the proposed development would adversely affect the operational environment of any existing development on the land to which this clause applies.*

The proposed development will involve the construction of a solar farm and the ongoing operation of the facility. Construction would take place over 3 months and involve vehicle movements, trenching and earthworks, piling and assembly of materials. Operational noise would comprise the panel tracking motor, and inverters and transformers. The Noise Assessment prepared by Muller Acoustic Consulting to accompany the DA concludes that compliance with noise

management levels would be achieved for all but two residential receivers during the construction phase. Operational noise would comply with all NMLs for all residential receivers. Neither construction nor operational noise would impact on the operations of the sewerage treatment plant. Once operational maintenance of the solar farm will involve visits by maintenance staff every two to three months. Conversely, the operation of the STP will not impact on the operating solar farm. The site has been selected due to the availability of connecting to a feeder into the Kootingal zone substation and favourable lease conditions. It is not considered necessary to relocate the proposed solar farm to an alternative site.

There are no draft environmental planning instruments that are on exhibition or have been exhibited but not yet published that apply to the site, or that relate to the proposed development of electricity generating works.

4.4 Development Control Plans

4.4.1 Tamworth Regional Council DCP 2010

Tamworth Regional Council DCP 2010 applies to all land within Tamworth Regional LGA which includes Kootingal. The DCP does not contain controls that apply to the development of a solar farm.

The DCP contains environmental controls that apply to all developments. These relate to the consideration of overall environmental effects, soil and erosion control, vegetation, waste management, noise, geology and landscaping. The following controls are relevant to this application:

Soil and erosion control

- Runoff shall be managed to prevent any land degradation including offsite sedimentation.
- Reference shall be made to the NSW Governments *Managing urban stormwater: soils and construction, Volume 1* (available from Landcom), commonly referred to as “The Blue Book”.
- Cut and fill will be minimised and the site stabilised during and after construction.
- Arrangements in place to prompt revegetation of earthworks to minimise erosion.

Vegetation

- Development design shall accommodate the retention of any significant trees and vegetation.

Waste management

- General waste storage and collection arrangements shall be specified.

Noise

- applications are to contain information about likely noise generation and the method of mitigation.

Geology

- The design process must give consideration to the potential impact of erosive soils, saline soils, soils of low wet strength, highly reactive soils and steep slopes and document how these constraints are addressed.

These matters are addressed in section 5. Environmental Effects of this Statement and in supporting reports and studies prepared to accompany the development application.

The DCP also contains site specific development controls for the town of Kootingal. These controls relate primarily to subdivision and address open space, subdivision, drainage, road design and network, and water storage. In relation to road design and network, the DCP requires that development proposals consider traffic impacts and maintain the existing road hierarchy.

4.5 Land use strategies

4.5.1 New England and North West Regional Plan

The *New England North West Regional Plan 2036* was released in August 2017. It establishes a framework for growth over the next 20 years for the New England and North West Region. Tamworth LGA is located at the south-eastern corner of the region. Economic opportunities identified in the plan include a focus on renewable energy generation along with agriculture, horticulture, green industries and tourism.

A series of goals, directions and actions are to guide land use planning priorities and decision-making. Direction 5 is to *grow New England North West as the renewable energy hub of NSW*. It is noted in the plan that the region receives 19 to 20 megajoules of solar exposure making it the second highest solar penetration region in the state and that a strategic and integrated approach will assist to achieve the NSW Government's goal of carbon neutrality by 2050.

Action 5.2 is to *facilitate appropriate smaller scale renewable energy projects using biowaste, solar, wind, hydro, geothermal or other innovative storage technologies*. In the case of the proposed Kootingal Solar Farm, ITP Development have identified the development site as being suitable in terms of existing power infrastructure to enable connection and proximity to the township of Kootingal in order to directly generate power for use by the local community. This complies with the local government narrative for Tamworth Regional Council to *Identify and promote wind, solar and other renewable energy production opportunities*.

4.5.2 Tamworth Regional Blueprint 100 – Local Strategic Planning Statement

Council's Local Strategic Planning Statement is embedded in Tamworth Regional Blueprint 100. The LSPS sets out a vision for the LGA to:

- Facilitate smart growth and housing choices
- Create a prosperous region
- Connect our region and its citizens
- Build resilient communities
- Design with nature
- Celebrate our culture and heritage
- Deliver durable infrastructure

The LSPS is intended to guide state, regional and local policy and decision-making in relation to housing, commerce, the environment, water and transport infrastructure. An action in relation to *Design with Nature* is to investigate the formulation of development controls to address large scale renewable energy proposals. This is ranked as a short to medium term action. At the time of writing of this Statement, *Tamworth Regional Council DCP 2010* is yet to be amended to include development controls for solar farms. The LSPS does not identify any zoning or other policy change to apply to the development site.

4.5.3 Keychange 2017-2027

Keychange 2017-2027 is Tamworth Regional Council's Community Strategic Plan. How to reduce local energy consumption and increase the use of renewable resources is identified as a challenge in the plan. Consultation carried out during preparation of the CSP noted that Council should lead the way in adopting renewable energy and sustainable practices, as well as aiming for a sustainable energy future by phasing out the use of fossil fuels. Reducing energy consumption and switching to green energy is identified in the CSP as a means to ensure the long-term future is secured. The Kootingal Solar Farm would direct renewable energy directly to the village of Kootingal for use by residences and business, contributing to a sustainable future.

4.5.4 NSW Renewable Energy Action Plan

The *NSW Renewable Energy Action Plan* supports the achievement of the national target of 20% renewable energy by 2020. It aims to position NSW to increase the use of energy from renewable sources at least cost to the energy customer and with maximum benefits to NSW. The plan is predicated on the following three goals:

- Attract renewable energy investment and projects
- Build community support for renewable energy
- Attract and grow expertise in renewable energy technology

These goals are supported by 24 actions which include considering a more strategic and integrated approach to assessment of renewable energy projects and promoting NSW as a leader of research and innovation in renewable energy.

The plan notes that the NSW Government is in the process of streamlining the state planning system and advocates new planning legislation founded on the principle of sustainable development that meets the needs of the current generation without compromising the ability of future generations to meet their needs. Renewable energy projects are a good example of sustainable development in action. Streamlining will focus public participation on strategic planning in order to provide greater certainty for applications and the community in development assessment.

5. ENVIRONMENTAL EFFECTS

5.1 Biodiversity

5.1.1 Methodology

A desktop biodiversity assessment has been carried out by Zenith Town Planning Pty Ltd to determine the potential impact on any threatened species and endangered ecological communities that are present on the development site and in the vicinity of the site. This is supported by a site inspection carried out in September 2020.

The following sources of information and data have been used to determine whether any threatened species or endangered ecological communities are likely to occur on or near the site:

- SIX Maps aerial imagery,
- *Tamworth Regional LEP 2012*,
- NSW BioNet Species Sightings records,
- Mapping by the NSW Office of Environment and Heritage (State vegetation type map – Border Rivers Gwydir/Namoi, Native Vegetation Regulatory Map, Biodiversity Values Map)
- Schedules to the *Biodiversity Conservation Act 2016*, and
- Protected Matters Report of the *Environment Protection and Biodiversity Act 1999*.

5.1.2 Flora

The native vegetation map produced by the Department of Planning, Industry and Environment indicates that there is one vegetation community present on the site with the remainder of the property mapped as possessing non-native vegetation. A small patch of PCT 435 White Box-White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion is mapped as present at the north-eastern corner of the site. The vegetation formation is ‘Dry Sclerophyll Forests (Shrub/grass sub-formation)’ and the vegetation class is ‘North-west Slopes Dry Sclerophyll Woodlands’.

PCT 589 White Box-White Cypress Pine-Silver-leaved Ironbark grassy Woodland on mainly clay loam soils on hills mainly in the Nandewar Bioregion is mapped as being present at the south-western corner on the adjoining property to the south. The vegetation formation is ‘Grassy Woodlands’ and the vegetation class is ‘Western Slopes Grassy Woodlands’.

PCT 544 Rough-barked Apple-White Cypress Pine-Blakely’s Red Gum riparian open forest woodland of the Nandewar Bioregion and New England Tableland Bioregion is mapped as being

present on the property to the north of the development site. This site is occupied by Tamworth Regional Council's Kootingal depot. The vegetation formation is 'Grassy Woodlands' and the vegetation class is 'Western Slopes Grassy Woodlands'.

Each of these three vegetation communities are representative of the critically endangered ecological community White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland that is listed in Schedule 2 of the *Biodiversity Conservation Act 2016* and in the *Environment Protection & Biodiversity Conservation Act 1999*.

5.1.3 Fauna

A search of the BioNet Atlas maintained by the NSW Department of Planning, Industry and Environment has also been carried to determine the potential for endangered and vulnerable species to be present within a 100 square kilometre area surrounding the site. Four species listed as endangered and six listed as vulnerable have been recorded in the surrounding area.

The regent honeyeater which is critically endangered in the *Biodiversity Conservation Act* and the *EPBC Act* is likely to occur within the database search area as well as the curlew sandpiper and swift parrot which are both listed as critically endangered in the *EPBC Act*. There are also several species listed as endangered or vulnerable, including the booroolong frog and spotted-tail quoll.

5.1.4 Findings

The development is proposed on cleared and cultivated or grazed farmland, which lacks any habitat connectivity. Clearing will be limited to a single eucalypt tree and approximately 2,000 square metres of ground cover for car parking, the laydown area and accessways. The site would be used only be used as flyover by threatened and migratory bird species and bats. Similarly, frogs and arboreal mammals would only be transiting the site if at all due to the lack of cover. Substantial amounts of superior and connected habitat occurs nearby the site in the forested land to the east and west.

The development site is not mapped as affected as ecologically sensitive in *Tamworth Regional LEP 2010*. The development site is not mapped on the biodiversity values map, the clearing of native vegetation is not above the threshold based on minimum lot size, and a test of significance has found that there will be no significant impact on the ecological integrity of the property. A biodiversity development assessment report is therefore not required and the biodiversity offsets scheme does not apply.

5.1.5 Mitigation measures

It is recommended that the following mitigation measures be implemented:

- any vegetation planted to screen the development be native species endemic to the area
- access to the site is to be limited to that point shown on development plans and within the development footprint
- storage of materials is to be carried out wholly within the development footprint
- the eucalypt tree to be removed be inspected to identify any hollows or any other nesting or habitat that may contain fauna. If any fauna is present then it should be located elsewhere on the property such as in the vegetation patch located at the north-western corner. All branches and trunk sections of 300mm or greater girth should be cut into 6 metre or greater lengths and placed on the ground amongst the vegetation patch located at the north-western corner of the development site to act as fauna habitat

5.1.6 Koala assessment

An assessment of the potential for koalas and their habitat to be present on the site has been carried out by Red-Gum Environmental Consulting. The findings of the assessment are summarized below. Reference should be made to the *Biodiversity Inspection Report* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

Observations

The following observations were made during a site inspection in January 2021:

1. The single large tree (*Angophora floribunda*) is hollow bearing but not considered viable Koala habitat given its declining health (senescent) and isolation from core native vegetation patches in the area,
2. If any threatened native fauna (birds) are present (in particular Grey-crowned Babbler & Superb Parrot) they were not recorded during survey on the site and the nesting period for these species is closed (both typically breed between June and December) meaning that the possibility of harming a fledgling is unlikely,
3. The site is a highly modified grazing paddock with some native grasses present and an obvious history of horticulture,
4. The development will not impact on the high conservation value vegetation in the north west of the site,
5. The site has had obvious disturbance in the form of horticulture pursuits since abandoned, and
6. No koalas, scats or other evidence of use of this zone or the development site were recorded in five hours of survey effort.

Findings

Typical home ranges of koalas are from 2 hectares of connected vegetation to hundreds of hectares. Koalas feed almost exclusively on a few preferred tree species which are of primary and secondary importance. The occurrence of both primary and secondary tree species varies widely on a regional, local and even a seasonal basis, meaning that koalas are unevenly distributed across their range.

In the study area, primary food tree species are River red gum (*E. camaldulensis*) and Coolabah (*E. coolabah*) with secondary food tree species being Bimble box (*E. populnea*), Western grey box (*E. microcarpa*), Blakeley's red gum (*E. blakelyi*) and Yellow box (*E. melliodora*). No viable food sources are present on site.

Importantly, there are numerous core vegetation areas surrounding the site which represent much more viable habitat that Koalas are unlikely to leave to frequent the single large tree in the site that is proposed for removal.

Recommendations

Red-Gum Environmental Consulting recommend that the following mitigative measures be carried out during site preparation and construction:

- i. Clearly identify clearing limits and exclusion zones prior to commencing works,
- ii. Conduct a visual inspection by environmental staff before clearing commences to identify any trees that might contain viable nests. If seen, mark the tree, clear all trees around it and then bump the tree with the excavator. If nothing leaves the nest proceed to pushing the tree. Inspect the nest after felling and if any wildlife is viable, follow DPIE instructions on wildlife catching and handling. For more information see *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*;
- iii. Push all trees over, removing the root ball in its entirety, and drag them outside the works zone. Do not stockpile trees as this makes mulching difficult due to filling with soil. Use of a tub-grinder is recommended, and
- iv. Mulching of regrowth is considered a good 'low-impact' option and it is recommended that the main stem is painted with round-up immediately to prevent epicormic growth in the future.

5.2 Natural hazards

5.2.1 Flooding

The site is not mapped as being flood prone in *Tamworth Regional LEP 2011*. Flood mitigation measures and stormwater management have been considered in section 4.3 *Water resources* of this Statement.

5.2.2 Bushfire

The development site is not mapped as being bushfire prone land. Infrastructure comprising electricity generating works is not a habitable building and is not listed as a *special fire protection purpose* under section 100B of the *Rural Fires Act 1997*.

5.2.3 Mitigation measures

There are no mitigation measures recommended in relation to flooding or bushfire protection.

5.3 Water resources

5.3.1 Assessment of impacts

A *Water Assessment* of potential impacts on groundwater and surface water flows has been carried out by ITP Renewables, dated 1 September 2020. The findings of the assessment are summarized below. Reference should be made to the *Water Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The Water Assessment examines:

- Local hydrology and catchment and water quality data,
- Surface and groundwater quality data,
- Flood-risk potential of the site,
- Hydraulic modelling,
- Impacts of the development against NSW policies and industry standards, and
- Management procedures and mitigation measures for construction and operation.

The development site is located in the Tamworth Regional local government area, to the west of the town of Kootingal. According to spatial data from the Australian Hydrological Geospatial

Fabric, the proposed solar farm is located within a large sub-catchment that includes part of the Cockburn and Peel Rivers.

The development site is within a large valley characterised by steep to moderate hillslopes, with most of the surrounding area being between 410-715m contour values. The centre of the site has an elevation of 475m AHD, with the nearest part of the Cockburn River having an elevation of 415m AHD. The land is mostly cleared of native vegetation and is currently used for farming.

Lyll and Associates published a flood study in 2019 for the town of Tamworth which did not include Kootingal. The study has resulted in Tamworth Regional Council adopting a design flood height of 7.662 meters at the 1% annual exceedance probability and a Flood Planning Map as part of *Tamworth Regional LEP 2010*. The development site is not shown as a Flood Planning Area on the Flood Planning Map. Maps associated with the flood study indicate that the development site is unlikely to flood from the Cockburn River in the direction of Kootingal.

Flood planning maps, modelled flood heights for the Tamworth city area and the topography in the immediate vicinity indicate that the development site is at low risk of flooding from the direction of Kootingal and the Cockburn River. Localized drainage patterns at the site indicate that there is potential for overland flow during rainfall. The water will flow in a south-easterly direction towards the Cockburn River.

Kootingal falls within the Namoi Surface Water Resource Plan Area. The area downriver from Kootingal contains a number of high to very high ecological value instream areas between Boggabri and Pilliga. Groundwater is contained in the unconsolidated sediments along the Namoi River and its major tributaries and is managed in as two resources – Upper and Lower Namoi Groundwater Sources. The alluvium of the Namoi River is by far the most important in the state in terms of groundwater use, providing water for stock use, domestic supplies, irrigation, industry and town water supplies. A Water Sharing Plan for the Peel Regulated, Unregulated, Alluvial and Fractured Rock Water Sources exists, recognising that the water resources of the Peel Valley are linked and would benefit from being managed collectively

A surface water sharing plan is in place for the Peel River catchment which includes surface and ground water. The Cockburn River is one of the five unregulated water sources in the Peel River water sharing plan. The Namoi Unregulated Rivers Extraction Management units have designations for alluvium management zones, including one along the Cockburn River near Kootingal. The proposed development is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby farming districts.

5.3.2 Summary of impacts

Potential adverse surface water-related impacts to the site relate to site accessibility and managing downstream sedimentation. There will be no extraction of groundwater or interference with the groundwater table.

The development has the potential to alter existing water quality conditions within the site. The impervious area of solar facilities is typically only marginally increased owing to associated hardstand and building areas.

However, the panels may impact the nature of vegetation/grass coverage on the site, which has the potential to increase surface runoff and peak discharge. Increased flow concentration off the panels also has the potential to erode soil at the base of solar panels.

Furthermore, as the site has been historically used for farming there is very little natural ground cover vegetation. There is the potential that site runoff will contain sediments and increase turbidity or other water quality parameters in downstream water ways.

5.3.3 Mitigation measures

The following mitigation measures given in Table 2 are recommended to manage downstream sedimentation.

The potential for site accessibility and the potential for inundation issues during flood events should be reviewed and procedure developed to halt construction during heavy rainfall to reduce potential impacts to the development and to increases in downstream sedimentation.

Table 2: Proposed mitigation measures to manage downstream sedimentation

Stage	Measure	Activities/approach
Design	Site drainage and water quality controls	Design Basis - Undertake hydrological assessment of the site's catchment in accordance with relevant methods outlined in Australian Rainfall and Runoff - Determine sediment management targets and drainage control standards in accordance with Managing Urban Stormwater: Soils and Construction Vol 1 (Blue Book) (DECC, 2008).

Stage	Measure	Activities/approach
		- Develop a site erosion and sediment control plan in accordance with the Blue Book. - Develop site drainage design incorporating detention basins and sedimentation management structures where relevant. - Permanent site drainage should coincide with temporary arrangements where possible
Construction and/or demolition	Site drainage and water quality controls	General site works: - Catch drains to be located downslope of any proposed road works. - Install location appropriate sediment fences or other applicable control measures depending on whether the feature is upstream or downstream of a disturbed part of the site or will need to be trafficable. - All stormwater collection points need to have appropriate sedimentation and erosion controls. - Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. - Vibration grids or wash bays at all construction exits. - Level spreaders at locations where concentrated flow is discharged offsite to ensure sheet flow like conditions are maintained. - Flat land erosion control options include erosion control blankets, gravelling, mulching, soil binder, turfing and revegetation
Construction and/or Demolition	Stormwater point source control	In the event of concrete works: - Do not undertake works if chance of heavy rain. - Store rinsate water, if applicable, separately to other water on site and dispose of offsite as appropriate. - Block on site drains in the area of the works and remove any contaminated runoff. In the event that dewatering practices are required:

Stage	Measure	Activities/approach
		- Elevate pump hose intakes for withdrawing water from excavations to minimise sediment pumping and direct hose to a containment area for settling prior to discharge of water. - Limit direct discharge off site (consistent with the design requirements for sediment pond discharge). - Stormwater collected on site should be reused where possible. Controls should be inspected and maintained on a regular basis. All water released from sediment basins should be clear or disposed of off site by vehicle. - Material and waste storage areas should be designed and operated to minimise interaction with surface waters. - Vehicle washdown areas should be located away from water courses

5.4 Air quality

5.4.1 Assessment of impacts

The Department of Planning, Industry and Environment maintain air quality monitoring stations across rural NSW. The nearest monitoring station to the development site is located at Tamworth. The instruments used at most rural network sites are low cost indicative particulate monitors that respond to all aerosols including smoke and fog.

Total Suspended Particles are measured at this station. Total suspended particles are solid particles and liquid droplets 100 micrometres or less in diameter. They come from natural and human-made sources, such as pollen, bushfires and motor vehicle emissions. Dust emissions are also a source of air pollution in the climate of Tamworth and Kootingal and can cause poor air quality. The pollutants measured by the Department are nitrogen dioxide, sulphur dioxide and ammonia, however, levels of these pollutants in the atmosphere are not recorded at Tamworth.

Total suspended particles are measured as PM₁₀ and PM_{2.5}. PM₁₀ are particles less than 10 micrometres in diameter. Sources include crushing or grinding operations and dust stirred up

by vehicles on roads. Particles less than 10 micrometres in diameter were measured as an hourly average reading of 12.2 at Tamworth on Monday 26 October 2020.

PM_{2.5} are fine particles less than 2.5 micrometres in diameter. Sources include all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes. Particles less than 2.5 micrometres in diameter are also measured as an hourly average reading at Tamworth. Total suspended particles had an average hourly reading of 7.3 on 26 October 2020. These are very good readings indicative of the spring climate of Tamworth and the New England region.

Activities that disturb the earth's surface and that is carried out with the use of machinery have the potential to generate dust emissions. This may be exacerbated by wind exposure to an exposed ground surface.

The previous use of the land for farming may have involved regular tilling, sowing and harvesting that may create dust and impact on air quality. Similarly, grazing would generate dust as animals trample the ground surface. The land has been modified for agriculture with the consequent loss of most native vegetation leading to exposed soil surfaces.

The construction of the solar farm will not involve extensive earthworks and only pile driving for footings for the array framework and excavation for ancillary structures will be carried out. Along with the delivery of materials using heavy vehicles, these construction works may generate dust, however, once operational the change of use of the land from agricultural to solar photovoltaic electricity generation is expected to reduce particulate emissions and lead to an improvement in local air quality. Vehicle movements would be restricted to internal access roads and the majority of the site would be revegetated with native or pasture grasses.

5.4.2 Mitigation measures

To minimize dust generation during the construction and operational phases the following mitigation measures are proposed:

During construction:

- Limit vehicle movements to areas necessary to deliver panels, ancillary structures and equipment
- Suppress dust emissions using watering and cease works during dry and windy conditions
- Ensure ground disturbance is limited to areas necessary to place footings or to be used for access

- Ensure minimal handling of excavated materials
- Ensure stockpiles of excavated material is bunded and protected from wind and vehicle movements

During operation:

- Grade and add road base to internal accessways
- Revegetate the site with suitable endemic native groundcover immediately construction works are completed
- Ensure all plant and equipment operates in accordance with specifications

5.5 Noise

5.5.1 Assessment of impacts

A *Noise Assessment* of the impacts of noise emissions has been carried out by Muller Acoustic Consulting, dated 24 August 2020. The findings of the assessment are summarized below. Reference should be made to the *Noise Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The purpose of the *Noise Assessment* is to quantify potential environmental noise emissions associated with the construction and operation of the project. Where impacts are identified, recommendations are made to mitigate and manage noise.

The assessment includes the following key tasks:

- review construction and operating activities to identify key noise generating plant, equipment, machinery or activities proposed to be undertaken as part of the project;
- identify the closest and/or potentially most affected receptors situated within the area of influence to the project;
- establish existing noise levels to determine project-specific construction Noise Management Levels (NMLs), and operational noise criteria;
- undertake 3D noise modelling to predict levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receptors;
- provide a comparison of predicted noise levels against relevant construction NMLs and operational criteria;

- assess the potential noise impacts associated with construction and operational aspects of the project; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where NMLs or operational criteria may be exceeded.

The assessment has been conducted in accordance with the following key policy and guidelines where relevant:

- NSW Department of Environment and Climate Change, NSW Interim Construction Noise Guideline (ICNG), 2009,
- Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017,
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), 2011.
- Australian Standard AS 2436-2010 (R2016) (AS 2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites,
- Australian Standard AS 1055:2018 – Description and Measurement of Environmental Noise,
- Australian Standard AS IEC 61672.1-2004 (AS 61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring, and
- Australian Standard AS IEC 60942-2004 (AS 60942) – Electroacoustics – Sound Calibrators.

Several potential noise sensitive receptors were identified as shown in Figure 6 below. These receptors comprise residential properties.

Construction and operational noise levels were predicted to each assessed receptor assuming receiver heights of 1.5m above ground level for typical construction activities and allowing for road traffic noise.

Predicted construction noise levels are expected to exceed the NMLs at receivers R1 (1581 New England Highway) and R2 (1653 New England Highway) when works are nearest to those locations. The exceedances would be temporary and of short duration. The exceedances would be due primarily to piling and earthworks.

Operational noise levels satisfy the management levels for all assessed receivers. However, recommendations to ensure noise levels are verified have been provided in this report. Additionally, the noise assessment demonstrates that road noise criteria will be satisfied at all receivers on the proposed transport route.

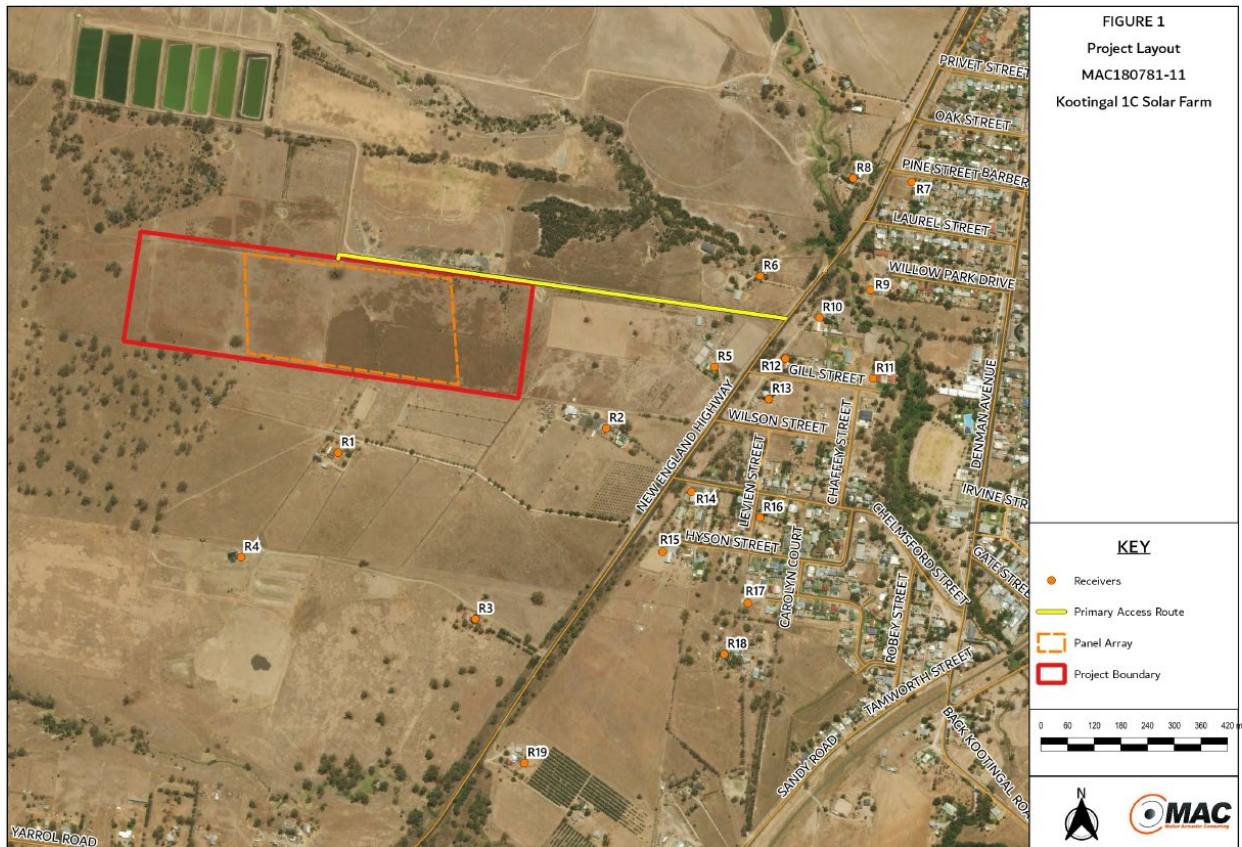


Figure 6: Location of noise sensitive receptors and construction noise affectation area

5.5.2 Mitigation measures

The following mitigation measures are recommended to address noise emissions during the construction phase:

- a construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community,
- where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (e.g. unloading and laydown areas),
- operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations,
- selection of the quietest suitable machinery available for each activity,
- avoidance of noisy plant/machinery working simultaneously where practicable,
- minimise impact noise wherever possible,

- utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm,
- provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities,
- signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site, and
- utilise project related community consultation forums to notify residences within close proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.

It is recommended that noise emissions from the solar farm be minimised when operational. To assist in noise management, it is recommended that a one-off noise validation monitoring assessment be completed to quantify emissions from the site and to confirm that relevant criteria are satisfied.

5.6 Electromagnetic radiation

5.6.1 Potential radiation sources

The information presented in this section has been sourced from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). It includes a description of the type of electromagnetic radiation that may be produced by the generation and distribution of electricity.

The generation, distribution and use of electricity can produce extremely low frequency (ELF) electromagnetic fields (EMF) from electrically charged particles. The electric field is produced by the voltage whereas the magnetic field is produced by the current. The strength of the electric field is measured in units of volts per metre whilst the strength of the magnetic field is expressed in units of tesla (T), microtesla (μ T), gauss (G) or milligauss (mG).

ELF EMF is produced by both natural and artificial sources. Naturally occurring ELF EMF is associated with atmospheric processes such as ionospheric currents, thunderstorms and lightning. Artificial sources are the dominant sources of ELF EMF and are usually associated with the generation, distribution and use of electricity at the frequency of 50 or 60 Hz. The widespread use of electricity means that people are exposed to ELF electric and magnetic fields in the home, in the environment and in the workplace.

According to the Australian Radiation Protection and Nuclear Safety Agency, which maintains continual oversight of emerging research into the potential health effects of the EMF exposure,

there is no established evidence of health effects from exposure to electric and magnetic fields from powerlines, substations, transformers or other electrical sources, regardless of proximity.

5.6.2 Mitigation measures

The location of the proposed solar farm and the distance separation between nearby dwellings and the site mean that any impacts on health are mitigated. No additional mitigation measures are proposed.

5.7 Traffic and access

A *Traffic Assessment Report* of the impacts on traffic and the adequacy of access arrangements has been carried out by Triaxial Consulting, dated 1 September 2020. The findings of the assessment are summarized below. Reference should be made to the *Traffic Assessment Report* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The traffic assessment includes a description of the existing road network and considers expected traffic generation during construction and operation, site access and intersection capacity. The assessment is based on an expected 45 B-double trucks, light vehicles carrying up to 50 workers and a bus service for workers during the construction phase and one light vehicle every 2 to 3 months to carry out maintenance. There is estimated to be 50 vehicle trips per day during construction with work being carried out between the hours 7.00am to 4.00pm Monday to Friday with deliveries by heavy vehicle restricted to between 10.00am and 2.00pm.

5.7.1 Site access

The proposed access road is an existing private road off the New England Highway, which provides access to the Tamworth Regional LGA Depot and is constructed with a bitumen sealed pavement width of approximately 4.0m with unsealed shoulders and table drains approximately 0.5m deep either side. It is noted the road is partially unsealed gravel in places. New England Highway (B56) is a state highway, managed by Roads and Maritime Services, with primary function of providing vehicular access between Tamworth and Armidale. The B56 New England Highway is listed as an approved B-Double Route by Transport for NSW. The proposed site entry location will have in excess of 333 metres of sight distance in either direction in accordance with the requirements of Austroads Guide to Road Design and Tamworth Regional Council DCP requirements.

Tamworth Buslines were contacted to ascertain the location of school bus stops and advised that school buses are able to stop anywhere that is safe to pick up and drop off school students. However, the intersection of the private access road and the New England Highway is never used for that purpose. There is not likely to be any conflict between heavy vehicles accessing the site during the construction period and school buses.

5.7.2 Traffic volumes

Online traffic data was available from Transport for NSW for the location of Benderneer, which is 25 kilometres north-west of Kootingal on the New England Highway. The maximum number of vehicles per hour, during the weekday AM peak hour in any direction is 140. Under the *RTA Guide to Traffic Generating Developments 2002*, the allowable peak flow for Level of Service (LoS) B is 530, which exceeds 140 vehicle movements. It is noted LoS A is the highest possible level of service for two lane rural roads, and a minimum LoS C is desirable for major roads.

It is not expected that an increase in numbers of vehicles per hour in peak times will reduce the level of service of the roadway from LoS A. The peak vehicle trips, being light vehicles transporting workers, will have only a very minor impact on the surrounding road network. It is not envisaged that the development will cause a decrease in the level of service to either the road carriageway along the private access road or the New England Highway.

5.7.2 Mitigation measures

It is recommended that:

- the private access road be utilised as the main site entrance due to the lower traffic count, and the complexity and safety issues associated with constructing an entry directly from the New England Highway may cause (noting that preliminary discussions with Tamworth Regional Council have indicated agreement to the use of the access road for the development)
- the site entry location be constructed in accordance with Triaxial plan TX15007.00-SK01, with a sealed access point from the private access road. The proposed site entrance is designed to accommodate the turning path of a B-Double truck, with a sealed entrance a minimum of 26 metres into the site to minimise disruption to the private access road and ensure that a B-Double is able to queue off the road if required to when accessing the site

- the construction worker site access and parking areas should be constructed in accordance with appropriate safe construction site management principles.
- Depending on the accommodation arrangements made by the successful building contractor in the construction phase of the project, care should be taken to avoid any impacts on the Kootingal town centre. Possible impacts may be mitigated by sourcing accommodation away from the Kootingal town centre, or the provision of a bus service to convey workers to the site.

5.8 The community and economy

5.8.1 The population

The population of Kootingal state suburb in 2016, as defined by the Australian Bureau of Statistics and which includes the development site, the village of Kootingal and rural land surrounding the settlement, was 2,126 persons of which over 90% were born in Australia. The total population of Tamworth Regional local government area in 2016 was 59,663 persons.

Occupied private dwellings accounted for 92.8% of dwellings in Kootingal state suburb and 7.2% or 63 dwellings were unoccupied. 94% of dwellings were separate houses and 4.1% were medium density dwellings.

Unemployment at the time of the 2016 Census of Population and Housing was 4.7% of the labour force comprising persons aged 15 years and over in Kootingal state suburb. Around one-third of the labour force were technicians, trade workers and labourers, followed by one-quarter employed as professionals and community and personal service workers. The top industries of employment were hospitals, road freight transport and supermarket and grocery stores. Employment in the agriculture, forestry and fishing sector was 5.6% for Kootingal state suburb and 9.3% for whole LGA.

5.8.2 Change of use of agricultural land

Kootingal is located in the New England and North West region. According to the Commonwealth Department of Agriculture the gross value of agricultural production in the region in 2017-2018 was \$2.6 billion, which was 20 per cent of the total gross value of agricultural production in New South Wales of \$13 billion. Agricultural land in the region occupies 79,400 square kilometres, or 80 per cent of the region. The most common land use by area is grazing modified pastures, which occupies 39,200 square kilometres or 40 per cent of the region.

The New England and North West region has a diverse agricultural sector. The most important commodities in the region based on the gross value of agricultural production were cotton (\$884 million), followed by cattle and calves (\$679 million) and wheat (\$215 million). These commodities together contributed 67 per cent of the total value of agricultural production in the region. ABS data indicates that in 2016–2017 there were 4,456 farms in the New England and North West region. Beef cattle farms (1,836 farms) were the most common, accounting for 41 per cent of all farms in the region, and 26 per cent of all beef cattle farms in New South Wales.

Figure 7 below shows land capability mapping for the development site and land surrounding Kootingal. Land that is shaded green is class 4 land capability and yellow is class 5. The development site has a land capability class of both of these categories. Class 4 is moderate capability land: Land that has moderate to high limitations for high-impact land uses, which restricts land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology. Class 5 is moderate-low capability land: Land that has high limitations for high-impact land uses, which largely restricts land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation (*The land and soil capability assessment scheme – A general rural land evaluation scheme for NSW, 2nd Approximation*, OEH).

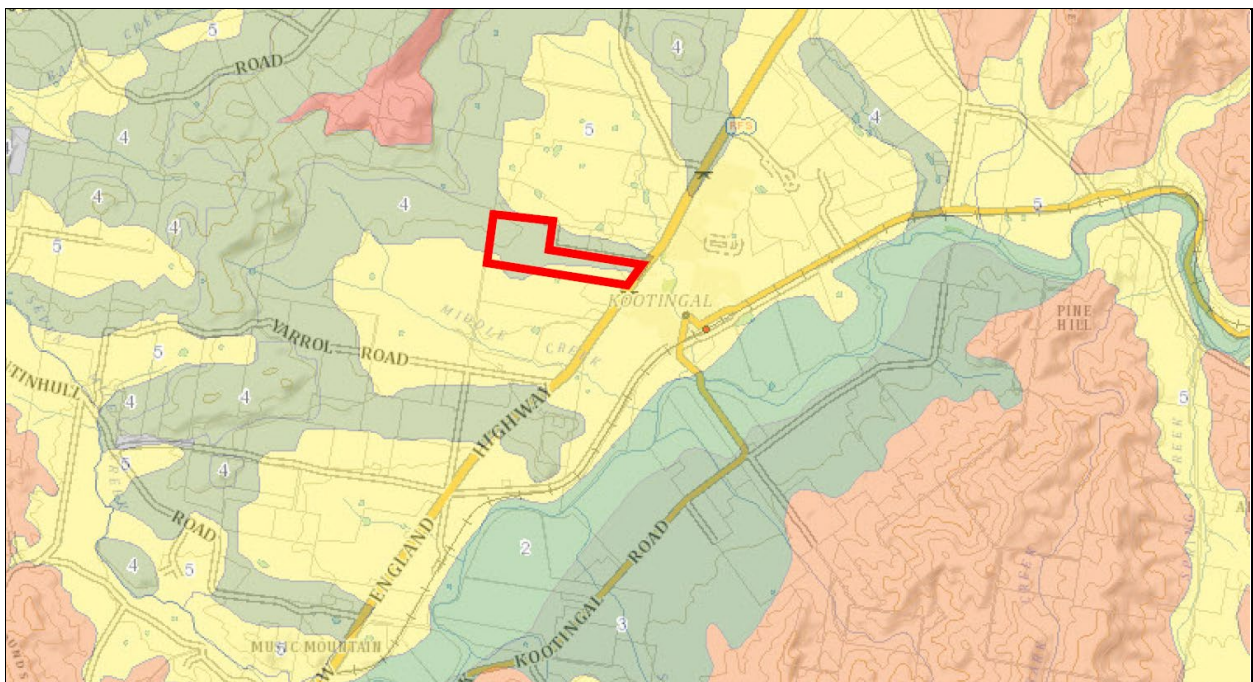


Figure 7: Land capability mapping. Source: OEH 2020

The development site is currently used to graze small numbers of agisted livestock, however, it was previously used to grow fruits and crops. The loss of agricultural land due to the development of the solar farm would be minimal and temporary. It would be offset by the contribution that the solar farm will make to the local economy through direct and indirect employment and expenditure over the short term and through the benefits that renewable energy power supply will bring to the region. The land area to be occupied by the solar farm represents a fraction of the total agricultural land used for livestock grazing.

If necessary and practical in terms of security, the land surrounding panel arrays can continue to be used for farming purposes such as the cultivation of vegetables or flowers, or potentially livestock grazing during the operation of the solar farm. The arrays of panels can be removed once the facility is decommissioned and the land can be returned to agricultural use. It is considered that the impact in terms of loss of productive agricultural land should be seen in the context of the impacts on farmland of other forms of power generation, for example, fracking for coal seam gas, and mining for coal and uranium as well as the infrastructure to support the processing of coal and gas.

5.8.3 Employment

The Kootingal Solar Farm is designed to generate in excess of 12.71GWh of energy annually with the system offsetting almost 8.5 thousand tonnes of CO² equivalent emissions (Sources: *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Schedule 1)* and Department of the Environment and Energy) and providing enough energy to power about 2,150 NSW homes.

The benefit to the community of the solar farm will be through an understanding of sustainable development and by gaining a commitment to greater reliance on renewable energy. Similarly, the clustering of solar power generation would bring regional economic development benefits to the New England and North West region as the area gains a reputation as a suitable location for renewable energy and linked industries. The site of the proposed solar farm at Kootingal is just outside the indicative area of the New England Renewable Energy Zone and would contribute to the generation of power in the zone.

During the initial planning phase ITP (Development) Pty Ltd commissioned local professionals to carry out the land survey of the development site. This initial expenditure generates flow on effects throughout the local economy through income and employment.

It is anticipated that there will be 50 personnel directly involved in construction on site which is expected to take approximately three months. Varying levels of expertise will be required ranging

from labourers to qualified electricians and project managers. In addition, personnel would be involved in transport and delivery of materials to the site. Some of this employment is to be sourced locally. This will bring direct economic benefits to the local economy through wages and salaries and indirect benefits through the need for accommodation and sustenance in the area for non-local employees.

Once operational the site will be unmanned, however, two to three personnel will be necessary to carry out maintenance every quarter or as required.

The skills required to be involved in the construction and ongoing maintenance of the Kootingal Solar Farm may require some personnel to undergo further training and education, leading to an upskilling of the local workforce and enhanced employment opportunities generally.

According to the most recent available visitor accommodation data made available by Destination NSW there were 26 hotels, motels and serviced apartments with 15 rooms or more in 2016 which provided 890 rooms in Tamworth Regional LGA. Occupancy rates ranged over the year from 47.3% in the December quarter to 53.5% in the June quarter.

In addition to these establishments there are bed and breakfasts, short term rentals, 63 unoccupied private dwellings and unregulated accommodation places such as AirBnB and Stayz. It is considered that there is adequate accommodation available to cater to the expected number of construction workers even if all are sourced from outside the Kootingal and Tamworth areas.

5.8.4 Summary and mitigation measures

In summary:

- The development of a 5MW solar farm will contribute to the electricity grid in a sustainable manner that reduces greenhouse gas emissions and will assist the transition of our economy from reliance on fossil fuels to renewable sources to decarbonise electricity production
- The solar farm will assist Commonwealth and NSW Governments to achieve targets and objectives relating to emissions and addressing climate change
- The solar farm will generate community economic benefits through local employment opportunities during the planning and construction phases as well as limited maintenance and inspection jobs once operational. The development of a solar farm will create a new market for local contractors and expand diversity of income for the land holder

- The loss of productive agricultural land is minimal and temporary. The arrays of panels can be removed once the facility is decommissioned and the land can be returned to agricultural use
- If necessary and practical in terms of security, the land surrounding panel arrays can continue to be used for farming purposes such as the cultivation of vegetables or flowers, or the grazing of sheep during the operation of the solar farm
- Any impacts on the natural environment including the scenic quality of the rural landscape are minimal and can be mitigated. Alternatively, the natural environment may benefit such as through the restoration of native grasses in and around panel arrays

It is recommended that labour to construct the solar farm and for ongoing maintenance be sourced from within Tamworth Regional LGA wherever possible. Where labour needs to be brought into the Kootingal area, it is considered that there would be sufficient accommodation options for employees in the LGA for the estimated 50 workers engaged during the three month construction phase. Recent occupancy rates and the level of visitor accommodation available in the local government area suggests that there is adequate accommodation to cater to the volume of workers during the construction period.

There is likely to be negligible effects on the availability of affordable rental over the short construction period as it is not expected that landlords would evict long-term tenants in preference of short term workers. Workers coming to the area would be likely to take up tourist accommodation similar to mine workers across country NSW, however, construction may be limited to the off-peak tourist season if necessary.

It is recommended that advertising be placed in local media and to approach local businesses to determine whether there is the capacity and expertise available in Tamworth, Kootingal and surrounding districts to participate in the construction and ongoing maintenance activities.

5.9 Heritage

5.9.1 Indigenous heritage

The Kamilaroi/Gomeroi people are the traditional custodians of the land in the Tamworth and Kootingal area. There were 6,031 Aboriginal and Torres Strait Islander persons in the Tamworth Regional local government area at the time of the 2016 Census of Population and Housing. This represented about 10% of the total population of the LGA. The proportion was similar for the state suburb of Kootingal.

Aboriginal people used the landscape as both a natural and cultural resource and there is a strong oral history indicating seasonal movement of Aboriginal people through the rugged gorge system between the coastal plains and the New England tablelands. The tablelands were occupied during summer and autumn, communities moving either to the coast or the western river systems for winter. Archaeological evidence suggests the Indigenous communities of the New England tableland traded with groups on the western slopes and that a range of stone tools such as jagged spears, boomerangs and waddies were developed with local and traded stone and local hardwood. Mammals such as kangaroo and possum were used for food, clothing and decoration. The region is also known for ornately carved trees, ceremonial bora grounds and art sites (<https://www.environment.nsw.gov.au/bioregions/NewEnglandTablelandBioregion.htm>).

The generic due diligence process outlined in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* was implemented to ensure that an adequate due diligence process that addresses Aboriginal cultural heritage issues has been carried out. This process follows the following five steps:

1. Will the activity disturb the ground surface?

Earthworks will involve trenching which is required for cabling of each PV array/module to inverters and a substation. Other earthworks would be pile-driving to support module frames, and to enable the placement of concrete slabs and gravel accessways. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

2a. Search the AHIMS database

In accordance with the code, an on-line search was carried out of the *Aboriginal Heritage Information Management Service (AHIMS)* that is maintained by the Office of Environment and Heritage. The search is part of the due diligence process and remains valid for 12 months.

A search of Lot 1 DP 328265 and Lot 97 DP 753841 was performed on 26 October 2020. The search results are:

- There are no Aboriginal sites recorded in or near the selected location, and
- There are no Aboriginal places that have been declared in or near the selected location.

It is noted that surveys for Aboriginal objects have not been carried out in all parts of NSW and Aboriginal objects may exist on a parcel of land even though they have not been recorded in AHIMS. Further, not all known Aboriginal sites are registered on the AHIMS database and not all sites consist of physical evidence or remains, e.g. dreaming and ceremonial sites.

2b. Activities in areas where landscape features indicate the presence of Aboriginal objects

The development area does not possess landscape features that indicate the presence of Aboriginal objects.

3. Can you avoid harm to the object or disturbance of the landscape features

Not applicable as the development area has been disturbed and farmed, does not possess significant landscape features and no known Aboriginal objects are listed in AHIMS.

4. Desktop assessment and visual inspection

The desktop assessment found that no known Aboriginal objects are listed in AHIMS. A site inspection was made on 22 September 2020 and there was no evidence of any artefacts on the surface of the land.

5. Further investigations and impact assessment

Kootingal lies within the area managed by Tamworth Local Aboriginal Lands Council. The LALC has been advised of the plans to develop the solar farm. As not all culturally significant items or places are made public and listed on AHIMS, a request was forwarded to the LALC enquiring as to whether the organization has any knowledge of Indigenous items or place of significance on the property. The LALC has requested that a site inspection be undertaken by a sites officer before any work commences. It is recommended that a condition of consent be imposed to require a site inspection be carried out prior to the issue of a construction certificate.

The report of the survey is appended as Attachment A.

No further action is required. Council may also recommend a condition of consent to comply with provisions of the *National Parks and Wildlife Act 1974* should any evidence of Aboriginal occupation be found during site works. An *Aboriginal Heritage Impact Permit* may be required to be obtained if indigenous heritage objects are found.

5.9.2 Non-indigenous heritage

The first European to visit the New England Tablelands was John Oxley in 1818. Squatters seeking suitable land for grazing began to occupy the area in the 1830s. Cattle grazing was the

dominant land use of the bioregion in the early days of European settlement but by the end of the 1800s sheep grazing was expanded due to improved pastures and better fencing.

The area grew rapidly and townships developed in the mid-1800s with the discovery of gold, tin, silver and copper. Mining for gemstones such as sapphires began in get early 1900s (<https://www.environment.nsw.gov.au/bioregions/NewEnglandTablelandBioregion.htm>).

There are fourteen properties in the town of Kootingal listed as heritage items in Schedule 5 Environmental heritage of *Tamworth Regional LEP 2010*. All of these properties are listed as being of local heritage significance. Details of these properties are given in Table 3 below.

Table 3: Heritage items in Kootingal. Source: Schedule 5 Tamworth Regional LEP 2010

Item name	Address	Property description	Significance	Item no.
Limbri Church	Church Street	Lot 80, DP 791481	Local	I139
Former Limbri Store and Post Office	3 Church Street	Lots 77 and 120, DP 753837	Local	I140
Moonby House, Out House and Graves	52 Churchill Drive, Moonbi	Lot 4, DP 706876; Lots 78 and 79, DP 37123	State	I141
Kootingal Police Station	Denman Avenue	Lot 261, DP 753841	Local	I142
Kootingal School	Denman Avenue	Lots 199 and 210, DP 758584; Lot 283, DP 821670	Local	I143
War Memorial—Memorial Park	Denman Avenue	Lots 1 and 2, Sec 2, DP 758584	Local	I144
St Luke's Uniting Church	Corner Denman Avenue and Sandy Roads	Lot 14, Sec 1, DP 758584	Local	I146
St Andrew's Anglican Church	Corner Gate Street and Denman Avenue	Lots 1 and 2, DP 597443	Local	I147
Kootingal Gate House	Gate Street	Lot 1, DP 814708	Local	I148
Kootingal Hotel	18–20 Gate Street	Lot 41, DP 5695	Local	I149
Limbri Gatehouse	Corner Limbri Road and Mulla Creek Road	Lot 44, DP 846377	Local	I152
Limbri School	Limbri Road	Lot 1, DP 1089996	Local	I155
"Tyrone" Residence	10 Limbri Road	Lots 108–113 and 132–135, DP 753837	Local	I156
"Kissing Gate"	Railway Land—Limbri Village		Local	I154

Clause 5.10 Heritage conservation of *Tamworth Regional LEP 2010* applies to these items, buildings and structures within the conservation area and to development within the vicinity of a heritage item. The relevant objective of clause 5.10 is *to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views*. Clause 5.10 (5) enables a consent authority to require that a heritage management document be

prepared for development in the vicinity of a heritage item or heritage conservation area, that assesses the extent of effects on heritage significance.

The development site is not located in the vicinity of any of these fourteen heritage items. The nearest heritage-listed property to the development footprint is the Kootingal School (item 143) which is located over 1 kilometre to the east. It is considered that the solar farm will not cause adverse impacts on the heritage values of these properties, therefore, a heritage management document is not necessary.

5.10.3 Mitigation measures

It is recommended that a condition of consent be imposed to require a site inspection be carried out by a sites officer of Tamworth Local Aboriginal Lands Council prior to the issue of a construction certificate to determine whether there are any items or places of significance to the Indigenous community on the development site.

There are no recommendations in relation to non-Indigenous heritage.

5.10 Glare and glint

5.10.1 Potential glare and glint

Glare is defined as a continuous source of excessive brightness relative to ambient lighting. Glint is defined as a momentary flash of bright light. Solar photovoltaic (PV) panels are constructed of dark, light-absorbing material and covered with anti-reflective coating. In order to maximise the efficiency, the panels are designed to limit reflection and to absorb around 98% of the light received. The glare generated from solar panels is significantly lower than many other surfaces, including water, however, the glass panels and metal frames have the potential to generate glare and glint. An assessment of the potential glare and glint generated by the proposed solar farm is necessary to ensure visual receptors such as road users, air traffic control towers and pilots are not impacted by the development of solar farms.

In a fixed PV solar array, the angle of incidence varies as the sun moves across the sky, that is, the angle of incidence is at its lowest around noon where the sun is directly overhead and increases in the early mornings and late evenings as the incidence angles increase. The variation of the angle is reduced where the PV array is mounted on a single axis tracking system whereby the panels rotate to remain perpendicular to the sun as proposed in the Kootingal Solar Farm. Therefore, an array mounted on a tracking system has less potential to cause glare whilst it tracks the sun.

A *Glint and Glare Assessment* has been carried out using the Solar Glare Hazard Analysis Tool by ITP Renewables, dated 9 September 2020. The findings of the assessment are summarized below. Reference should be made to the *Glint and Glare Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The assessment is based on identifying the potential sensitive receptors and then assessing the potential glare and glint hazard and impacts on those receptors using the tool. Glare resulting from PV solar farms is analysed at different viewpoints based on the location, orientation and specifications of the solar panels. Mitigation measures are recommended to reduce potential impacts to an acceptable level. This tool is used by the United States Federal Aviation Administration for glare hazard analysis near airports and is also recognised by the Australian Government Civil Aviation Safety Authority (CASA).

The analysis estimates green glare and yellow glare received at each identified potential receptor. Green glare is glare with low potential to cause an after-image when observed prior to typical blink response time, and yellow glare has a higher potential to cause an after-image when observed prior to a typical blink response time. The analysis is on a minute-by-minute basis because sun reflections from solar panels are likely to last at least one minute. Glint is a short-term flash which lasts for less than a minute and is therefore unlikely to occur from the sun, due to the pace at which the sun and panels move. Glint is not considered to be a factor affecting motorists or pilots and is not considered further in this assessment.

Potential visual receptors within 2 kilometres of the development site were identified and are shown in Figure 8 below. A 2 kilometre radius from the site was considered appropriate based on it being highly unlikely for glint and glare impacts at distances greater than this. The heights of the observation points were assumed to be 1.5 m for a motorist and 1.65 m for a standing person. Existing vegetation or structures can affect visual connectivity with solar panels. Similarly, atmospheric conditions such as cloud cover can influence light reflection and the resulting impact on visual receptors. Varying atmospheric conditions have not been accounted for in the analysis. As a result 27 residential and 9 road routes were identified as potential visual receptors.

Observation points were identified as follows:

- Considering the elevation of the site relative to surrounding land to determine land potentially affected,
- Including residential properties and public roads within a 2 km radius of the site. Properties located at greater distances are unlikely to be affected, and

- Excluding any properties where existing structures would act as visual barriers.

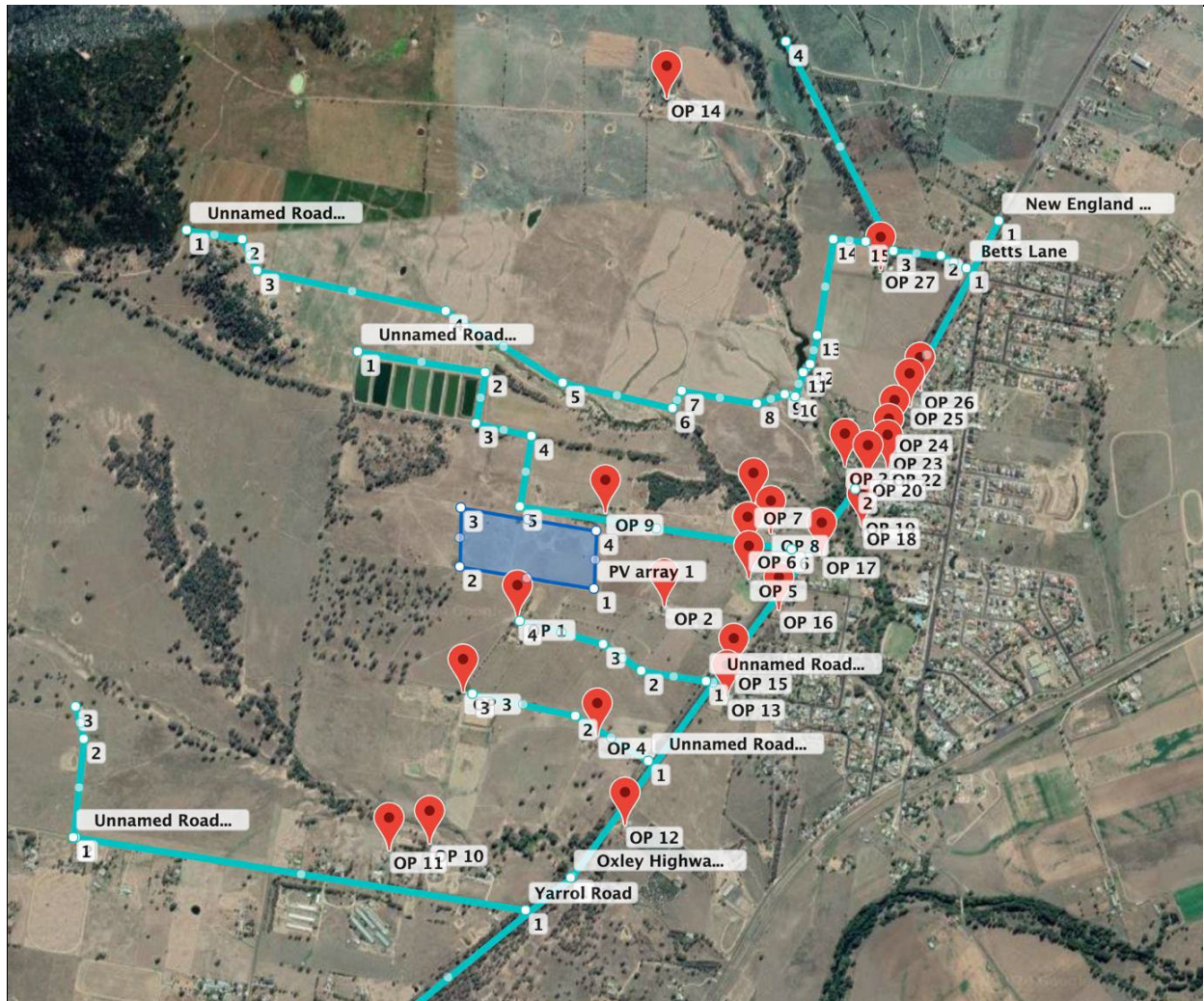


Figure 8: Potential visual receptors

The results of the analysis indicate that persons occupying the selected properties are unlikely to be affected by either green or yellow glare as a result of the proposed solar farm. Many residences will also not have direct view of the solar farm due to visual obstruction from trees and other structures. Existing roadside vegetation and structures are expected to provide a physical obstruction between the solar farm and road users on the major roads at risk of glare (New England Highway, Oxley Highway and Betts Lane), further minimising the visual impact of the project. Road users approaching the solar farm along Yarrol Road and the unnamed roads to the north and south of the site, are also not expected to experience any glare.

5.10.2 Mitigation measures

No mitigation measures are necessary in relation to glare and glint.

5.11 Landscape character and visual amenity

5.11.1 Methodology

Impacts on landscape character and visual amenity of the proposed Kootingal Solar Farm have been assessed by Zenith Town Planning Pty Ltd using the RMS guideline *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment* (EIA-N04 Version 2-0 released on 14 December 2018). The findings of the assessment are summarized below. Reference should be made to the *Landscape Character and Visual Amenity Impact Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The methodology included a site inspection of the location of the proposed works and the surrounding area to identify observation points and the visual catchment, land uses and characteristics of the surrounding area. The assessment estimates the likely impacts on landscape character and viewpoints based on the sensitivity to physical change and the magnitude, or relative size and scale, of the works. The impacts are calculated and ranked according to negligible, low, moderate or high impact based on the RMS guideline.

5.11.2 Description of the landscape

The character of the landscape near the site of the Kootingal Solar Farm is predominantly an open modified agricultural landscape that has been shaped by farming on the western side of the New England Highway and urban residential on the eastern side of the highway. The land is gently undulating and within a valley that is and surrounded by steep vegetated land that provides a backdrop to the township and farms.

Structures within the vicinity of the site comprise mostly rural farm dwellings set amongst primary production land uses with scattered farm outbuildings. Council's Kootingal depot and sewerage treatment ponds are located on the adjoining property to the north. The residential area of Kootingal is in close proximity to the development site but separated by the New England Highway which defines the urban-rural interface. The site itself is rural and located west of the township of Kootingal.

5.11.3 The visual catchment

The visual catchment of the site of the proposed Kootingal Solar Farm is defined by an area within 2 kilometres of the development site from which the works may be visible as shown on the visual catchment map below (Figure 9). This area is the same as that considered in the glare

and glint analysis. The greater the distance from the development site the less clear is the view of the solar farm. The ability to distinguish the type of land use and the actual composition of materials diminishes with distance.

The site itself is mostly cleared and there are no existing structures or vegetation in the development area that would screen the site. However, the fall of the land and the topography of the surrounding countryside provides interference with direct views over the property from most directions. There are 27 dwellings within 2 kilometres of the development site that are shown on SIX Maps imagery dated October 2011. Nine roads including the private access road are also within the 2 kilometre catchment. There are two dwellings within a 500 metre radius of the development area which are residences on properties to the south that are located 170 metres and 390 metres to the south from the security fence as shown on the General Arrangement Plan KOO1C-G-2100. The council depot located immediately to the north of the development site is not considered in this visual analysis as it is essentially an industrial type use that would not be impacted by the presence of a solar farm.

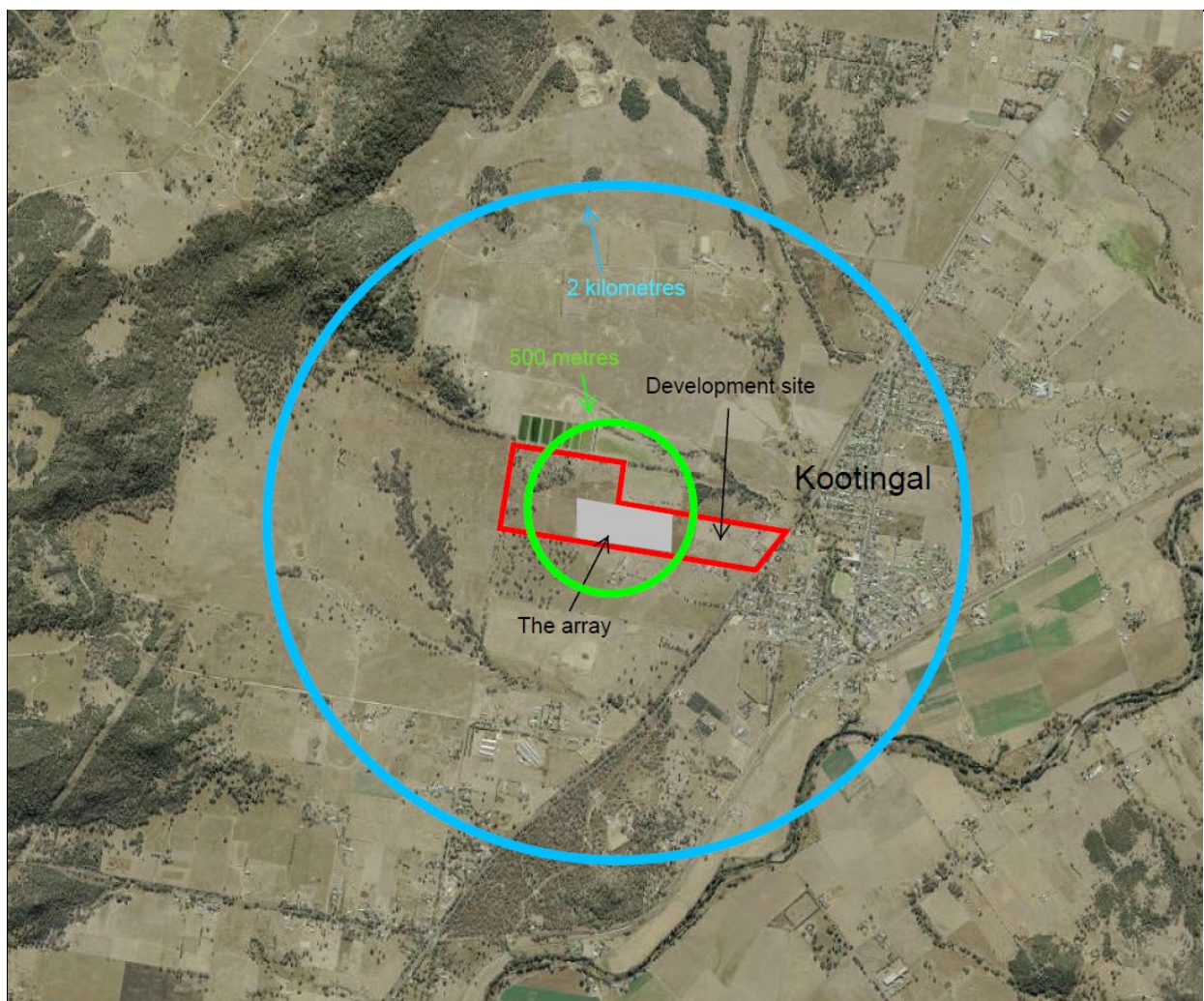


Figure 9: The visual catchment. Source: SIX Maps

5.11.4 Summary of impacts

The landscape of Kootingal is one that has been modified by human activity associated with the agricultural industry and urban development. To the west of the New England Highway it is characterised by a mix of farming, rural uses and infrastructure including roads, sewerage treatment ponds and the council depot. To the east of the highway it is characterized by urban residential development surrounded by rural residential allotments. The impact of the proposed Kootingal Solar Farm on landscape character has been assessed to range from negligible to low for private property and from low to moderate for the public domain. Overall the impact is assessed to be low based on a ranking of the magnitude of works and sensitivity to change in landscape character.

The visual impact of the proposed works is assessed to range from negligible to high-moderate for the observation points identified in this assessment – being 27 dwellings and nine roads. The solar farm would be visible to dwellings in elevated positions to the north and north-east of the development site and to Betts Lane and unnamed roads to the north. Distance separation and infrastructure works on intervening land would assist to mitigate the impact to these observation points. Roadside vegetation, built structures and the slope of the development site to the north-north-east would serve to obstruct visibility to most observation points.

It is considered that visual screening with vegetation on some or all sides of the array would not improve visual amenity to properties that overlook the development site due to their elevation and distance separation.

5.11.5 Mitigation measures

It is proposed to plant a vegetated screen along the northern and southern extent of the arrays. Plants that are endemic to the Kootingal area and that grow to a maximum height of 2.5 to 3 metres would be selected for the northern boundary. Larger plants may be appropriate along the southern boundary as overshadowing of the panels is not likely to occur.

5.12 Waste management

5.12.1 Waste materials and management

Life Cycle Analysis considers the total energy input and annual energy output of the project. This is termed the energy payback time and varies depending upon the project's design and geographic location. For solar projects the general timeframe for energy payback is achieved in less than four years for projects with a 25-30 year operating period (Bhandari et al., 2015;

Department of Industry, Resources and Energy NSW, 2016). Alsema et al (2006) found that PV modules have an energy payback of 1.5-2 years in southern Europe and 2.7-3.5 years for central Europe. Due to the greater solar resource in Australia the energy payback for this project is expected to be at the lower end of these ranges.

The Fraunhofer Institute for Solar Energy Systems (2015) considered the ratio of energy produced by a solar photovoltaic module compared to the energy used to create the module. It was estimated that the PV modules would provide more than 10 times the amount of energy used to make the system.

A *Waste Assessment* of the waste generated during construction and operation of the proposed Kootingal Solar Farm has been carried out by ITP Renewables, dated 28 July 2020, to determine the appropriate means of waste disposal and recycling. The findings of the assessment are summarized below. Reference should be made to the *Waste Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The *Waste Assessment* takes into account the requirements of relevant legislation and policy including the Protection of the Environment Operations (POEO) Act 1997, POEO (Waste) Regulation 2014 and the Waste Avoidance and Resource Recovery Act 2001.

The largest amount of waste will be generated during the construction phase and be classified as general solid waste (non-putrescible). Wastes would include wooden pallets, cardboard, plastics, green waste and domestic waste. Construction of a solar farm would not generate any putrescible waste products. Minimal waste would be generated when the farm is operational other than small amounts of replacement parts and packaging required for maintenance and repair works.

It is expected that the solar farm will be operational for 35 years. Upon decommissioning all infrastructure, including cabling and panels and mounting frames including footings and inverters would be disassembled and removed from the site. There are currently limited opportunities to recycle the components of solar panels, however, it is anticipated that the waste recycling industry will expand and develop new technologies and uses for those components by the time decommissioning occurs.

Tamworth Landfill is located at 123a Forest Road, Tamworth, approximately 18.5 kilometres from the development site. The waste management facility is open every day of the week between 8:00am and 4:45pm. Kootingal Transfer Station is located on the New England Highway. Garbage and recycling materials are collected in large bins and transported back to Tamworth for final disposal or recycling. This site is only suitable for small vehicles and has variable hours of

operation. Paper and cardboard recycling is available at both of these waste management facilities. Both also support recycling of whitegoods, scrap metals and unprocessed timber. Green waste can also be disposed of at Tamworth Landfill.

Estimates of waste materials and proposed management arrangements for each phase of the development project are provided in Table 4 below.

Table 4: Estimated waste materials and waste management arrangements

Phase	Waste material	Proposed management
Construction	• Packaging waste such as cardboard, wood pallets, plastic wrap, scrap metal, general waste including approximately 860 wooden pallets and cardboard packing boxes • Concrete waste during setting of footings and mounts • Electric cable waste and cable reels • Plastic pipe offcuts/scrap • Empty drums and containers (minimal quantities) • Minimal used lubricating oil and filters • Unused or spent chemicals	Waste products will be sorted and stored separately in skip bins located in the materials laydown area in accordance with EPA Waste Classification Guidelines. This will facilitate disposal through appropriate waste streams as follows: Recycling: • Steel and scrap metal (recycled) • Timber/cardboard (recycled) • Recyclable plastics Landfill: • General wastes and plastic (other than where recyclable) All recycling and general waste would be collected and taken to off-site waste management facilities for disposal Fluids would be recycled where possible or taken to off-site waste management facilities for disposal
Operational	• Minimal volumes of domestic wastes such as office consumables, paper, plastics and glass • Waste resulting from maintenance or replacement of equipment	All waste materials would be taken to off-site waste management facilities for recycling or disposal

Phase	Waste material	Proposed management
Decommissioning	• PV modules (12,100 panels) and supporting poles and mounts • Glass for panels (270 tonnes) • Silicon for wafers (40 tonnes) • Inverters / transformers / batteries • PV boxes, skids, scrap metal (860 tonnes) • Electrical cables • Fencing • Storage containers (two 40-foot containers)	The solar farm infrastructure would be dismantled into separate waste products such as metals, glass, plastics and concrete. All products would be sorted on site into recyclable and general waste streams in accordance with the EPA Waste Classification Fencing and storage containers would be removed from the site and reused

It is recommended that a waste management plan be prepared following approval and prior to construction to specify precise volumes of each waste material, classify that waste material and identify appropriate management procedures including means of transport and the destination. Waste management should be predicated on the international hierarchy of waste management to avoid/reduce, reuse, recycle, recover, treat and dispose of waste products to avoid or reduce waste materials where possible, and to re-use, recycle and recover the majority of waste materials generated during each of the construction, operational and decommissioning phases.

5.12.2 Mitigation measures

It is recommended that a waste management plan be developed to provide detailed procedures to manage the waste stream. The plan should contain:

- Strategies to reduce waste during all project phases,
- Recycling, re-use and recovery strategies and opportunities,
- Classification of all waste streams,
- Tracking register and details,
- On site recycling management,
- Allocation of responsibilities for recycling, re-use and disposal,
- Reporting and notification procedures if a waste incident occurs and there is a threat to the environment.

A decommissioning plan is to be prepared and submitted prior to issue of the construction certificate that provides details of the method of removal and disposal of all materials associated with the facility.

6. CONCLUSION

The site is considered suitable for the proposed development of the Kootingal Solar Farm. An 11kV feeder is available to connect to the Essential Energy Kootingal zone substation to transfer power generated by the solar PV panels to the grid.

The development area is relatively flat, is free of constraints and is accessible to large delivery vehicles during the construction phase and utility vehicles for ongoing maintenance.

The likely impacts of the development have been considered in this Statement and supporting documents. Considerations include impacts on biodiversity, natural hazards, visual and scenic amenity, glare and glint, traffic, noise, air quality, waste management, water resources, indigenous and non-indigenous heritage, the community and the local economy. Any impacts on these interests have been found to be acceptable and mitigation measures have been recommended where necessary.

According to the Australian Radiation Protection and Nuclear Safety Agency, which maintains continual oversight of emerging research into the potential health effects of the EMF exposure, there is no established evidence of health effects from exposure to electric and magnetic fields from powerlines, substations, transformers or other electrical sources, regardless of the proximity, causes any health effects. The location of the solar farm and the distance separation between nearby dwellings and the site mean that any impacts on health are mitigated.

Below is a summary of mitigation measures. It is recommended that an environmental management plan be prepared to cover the construction and operational phases. Where necessary Table 5 includes a recommendation as to whether the mitigation measure should be included in the management plan.

Table 5: Summary of mitigation measures

Consideration	Mitigation measures	Environmental Management Plan
Biodiversity	any vegetation planted to screen the development be native species endemic to the area. Access to the site is to be limited to that point shown on development plans and within the development area. Storage of materials is to be carried out wholly within the development area.	Yes, with reference to ongoing site access during both construction and operational phases, and to the storage of materials within the site
	The eucalypt tree to be removed be inspected to identify any hollows or any other nesting or habitat that may contain fauna. If any fauna is present then it should be located elsewhere on the property such as in the vegetation patch located at the north-western corner. All	

	branches and trunk sections of 300mm or greater girth should be cut into 6 metre or greater lengths and placed on the ground amongst the vegetation patch located at the north-western corner of the development site to act as fauna habitat For koala habitat protection: Clearly identify clearing limits and exclusion zones prior to commencing works, Conduct a visual inspection by environmental staff before clearing commences to identify any trees that might contain viable nests. If seen, mark the tree, clear all trees around it and then bump the tree with the excavator. If nothing leaves the nest proceed to pushing the tree. Inspect the nest after felling and if any wildlife is viable, follow DPIE instructions on wildlife catching and handling. For more information see <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i>; Push all trees over, removing the root ball in its entirety, and drag them outside the works zone. Do not stockpile trees as this makes mulching difficult due to filling with soil. Use of a tub-grinder is recommended, and Mulching of regrowth is considered a good 'low-impact' option and it is recommended that the main stem is painted with round-up immediately to prevent epicormic growth in the future.	
Natural hazards	No mitigation measures are proposed	n/a
Water resources	Design – site drainage and water quality controls: • Undertake hydrological assessment of the sites catchment in accordance with relevant methods outlined in Australian Rainfall and Runoff. • Determine sediment management targets and drainage control standards in accordance with Managing Urban Stormwater: Soils and Construction Vol 1 (Blue Book) (DECC, 2008). • Develop a site erosion and sediment control plan in accordance with the Blue Book. • Develop site drainage design incorporating detention basins and sedimentation management structures where relevant. • Permanent site drainage should coincide with temporary arrangements where possible	Yes, for construction and operational phases. Include an erosion & sediment control plan or soil and water management plan
	Construction and/or demolition – site drainage and water quality controls: • Catch drains to be located downslope of any proposed road works. • Install location appropriate sediment fences or other applicable control measures depending on	

	whether the feature is upstream or downstream of a disturbed part of the site or will need to be trafficable. • All stormwater collection points need to have appropriate sedimentation and erosion controls. • Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. • Vibration grids or wash bays at all construction exits. • Level spreaders at locations where concentrated flow is discharged offsite to ensure sheet flow like conditions are maintained. • Flat land erosion control options include erosion control blankets, gravelling, mulching, soil binder, turfing and revegetation	
	Construction and/or demolition – stormwater point source control: In the event of concrete works: • Do not undertake works if chance of heavy rain. • Store rinsate5 water, if applicable, separately to other water on site and dispose of offsite as appropriate. • Block on site drains in the area of the works and remove any contaminated runoff. In the event that dewatering practices are required: • Pump hose intakes for withdrawing water from excavations will be elevated to minimise sediment pumping and directed to a containment area for settling prior to discharge. • Limit direct discharge off site (consistent with the design requirements for sediment pond discharge). • Stormwater collected on site should be reused where possible. Controls should be inspected and maintained on a regular basis. All water released from sediment basins should be clear or disposed off site by vehicle. • Material and waste storage areas should be designed and operated to minimise interaction with surface waters. • Vehicle washdown areas should be located away from water courses	
Air quality	During construction: • Limit vehicle movements to areas necessary to deliver panels, ancillary structures and equipment • Suppress dust emissions using watering and cease works during dry and windy conditions • Ensure ground disturbance is limited to areas necessary to place footings or to be used for access • Ensure minimal handling of excavated materials	Yes, for construction and operational phases

	- Ensure stockpiles of excavated material is bunded and protected from wind and vehicle movements During operation: - Grade and add road base to internal accessways - Revegetate the site with suitable groundcover immediately construction works are completed - Ensure all plant and equipment operates in accordance with specifications	
Noise	The following mitigation measures are recommended to address noise emissions during the construction phase: - a construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community, - where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (e.g. unloading and laydown areas), - operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations, - selection of the quietest suitable machinery available for each activity, - avoidance of noisy plant/machinery working simultaneously where practicable, - minimise impact noise wherever possible, - utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm, - provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities, - signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site, and - utilise project related community consultation forums to notify residences within close proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure. It is recommended that the noise emissions from the solar farm be minimised when operational. To assist in noise management, it is recommended that a one-off noise validation monitoring assessment be completed to quantify emissions from site and to confirm emissions relevant criteria are satisfied.	Yes, for construction and operational phases

Electromagnetic radiation	No mitigation measures are proposed.	n/a
Traffic	- the private access road be utilised as the main site entrance due to the lower traffic count, and the complexity and safety issues associated with constructing an entry directly from the New England Highway may cause (noting that preliminary discussions with Tamworth Regional Council have indicated agreement to the use of the access road for the development - the site entry location be constructed in accordance with Triaxial plan TX15007.00-SK01, with a sealed access point from the private access road. The proposed site entrance is designed to accommodate the turning path of a B-Double truck, with a sealed entrance a minimum of 26 metres into the site to minimise disruption to the private access road and ensure that a B-Double is able to queue off the road if required to when accessing the site - the construction worker site access and parking areas should be constructed in accordance with appropriate safe construction site management principles. - Depending on the accommodation arrangements made by the successful building contractor in the construction phase of the project, care should be taken to avoid any impacts on the Kootingal town centre. Possible impacts may be mitigated by sourcing accommodation away from the Kootingal town centre, or the provision of a bus service to convey workers to the site.	Yes, with reference to site access during the establishment and construction phases
The community & local economy	- labour to construct and maintain the solar farm be sourced from within Tamworth Regional LGA wherever possible - advertising be placed in local media and local businesses contacted to determine whether there is the capacity and expertise available in Kootingal, Tamworth and surrounding districts to participate in the construction and ongoing maintenance activities.	n/a
Heritage	It is recommended that a condition of consent be imposed to require a site inspection be carried out by a sites officer of Tamworth Local Aboriginal Lands Council prior to the issue of a construction certificate to determine whether there are any items or places of significance to the Indigenous community on the development site.	n/a
Visual & scenic amenity	It is proposed to plant a vegetated screen along the northern and southern extent of the arrays. Plants that are endemic to the Kootingal area and that grow to a maximum height of 2.5 to 3 metres would be selected for the northern boundary. Larger plants may be appropriate	n/a

	along the southern boundary as overshadowing of the panels is not likely to occur.	
Glare and glint	No mitigation measures are proposed.	n/a
Waste management	It is recommended that a waste management plan be developed to provide detailed procedures to manage the waste stream. The plan should contain: • Strategies to reduce waste during all project phases, • Recycling, re-use and recovery strategies and opportunities, • Classification of all waste streams, • Tracking register and details, • On site recycling management, • Allocation of responsibilities for recycling, re-use and disposal, • Reporting and notification procedures if a waste incident occur. A decommissioning plan is to be prepared and submitted prior to issue of the construction certificate that provides details of the method of removal and disposal of all materials associated with the facility.	Yes, for construction phase

The proposed development of the Kootingal Solar Farm is permissible under provisions of *SEPP (Infrastructure) 2007* and would assist to generate electricity and at the same time contribute to reducing greenhouse gas emissions and achieving the national targets.

The cumulative impacts of the proposed development are minor. There are no other electricity generating works in the locality and the use is suited to a rural location due to the need for a large land area. The immediate area is already used to accommodate infrastructure and the addition of a solar farm to that area would not detract unreasonably from local amenity or the natural environment.

The system is designed to generate in excess of 12.9GWh of energy annually with the system offsetting almost 8.5 thousand tonnes of CO₂ equivalent emissions (Sources: *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Schedule 1)* and Department of the Environment and Energy) and providing enough energy to power about 2,150 NSW homes.

Electricity generated by the Kootingal Solar Farm will be directed to the settlement via existing electrical infrastructure for use by local households and businesses. Any surplus electricity will be sent to the grid and any deficit will be drawn from the grid. As well as the potential to utilize

local contractors to construct the facility, Kootingal will benefit through the ability to power the township with clean energy that is generated adjacent the settlement.

Given these local and regional benefits of renewable energy generation and based on implementation of the recommended mitigation measures to minimize disruption to the existing natural and built environment, the development is considered to be in the public interest.

Zenith Town Planning
P O Box 591
Moruya New South Wales 2537
Attention: Allen Grimwood
Email: zenithplan@bigpond.com

Date: 26 October 2020

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 1, DP:DP328265 with a Buffer of 0 meters, conducted by Allen Grimwood on 26 October 2020.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette \(http://www.nsw.gov.au/gazette\)](http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Zenith Town Planning
P O Box 591
Moruya New South Wales 2537
Attention: Allen Grimwood
Email: zenithplan@bigpond.com

Date: 26 October 2020

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 97, DP:DP753841 with a Buffer of 0 meters, conducted by Allen Grimwood on 26 October 2020.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

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0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
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- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
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- This search can form part of your due diligence and remains valid for 12 months.



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PROVISION OF CONSULTING ENGINEERING SERVICES

**KOOTINGAL 1C SOLAR FARM
"ROSEAMERE" 1599 NEW ENGLAND HIGHWAY
KOOTINGAL NSW 2352**

TRAFFIC ASSESSMENT REPORT

1 SEPTEMBER 2020

REFERENCE: TX15007.00-01.RPT.RA.S-REV0

SYDNEY | ADELAIDE | BAROSSA | DARWIN | MUDGEE

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1 INTRODUCTION

Triaxial have been engaged by ITP Development to prepare a traffic assessment report. The purpose of this report is to assess the traffic implications of the development proposal. This report is to be included in the development application lodged with Tamworth Regional Council.

The site is currently utilised for grazing and is shown in the photo below:

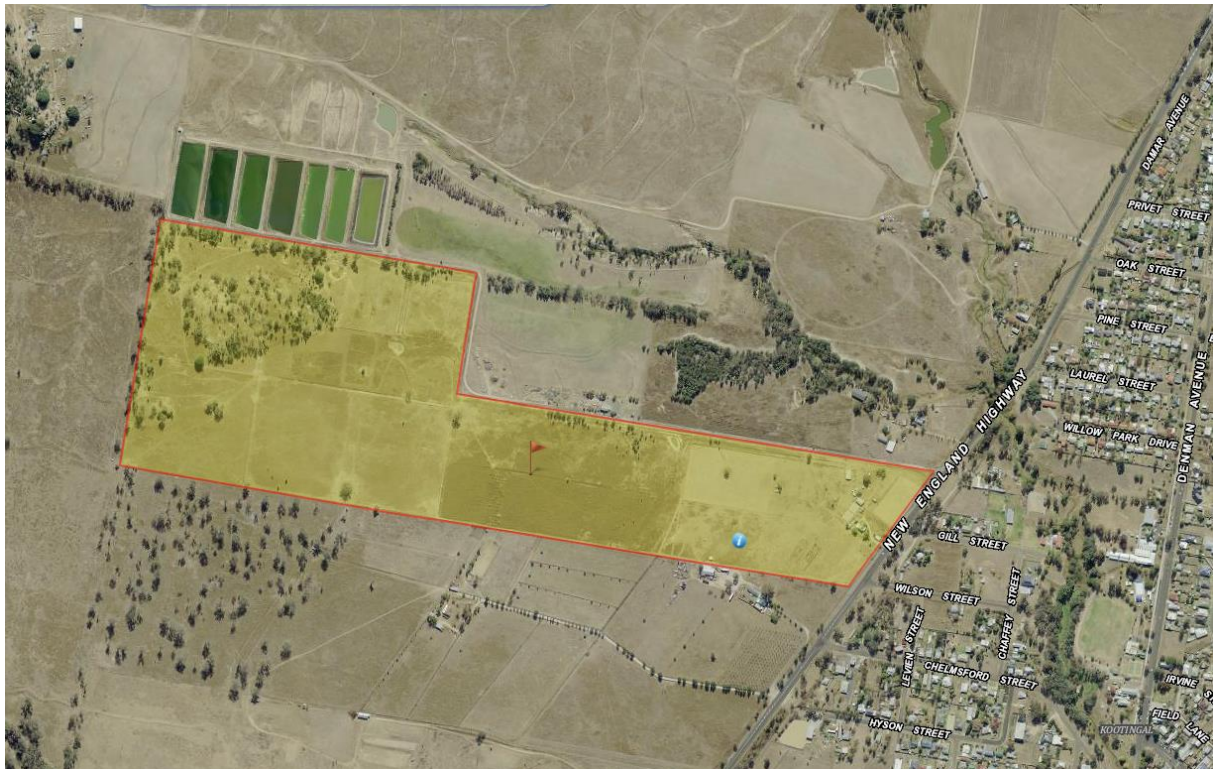


Figure 1: Existing Site

2 PROPOSAL

2.1 DEVELOPMENT SITE

The site is proposed to be utilised by ITP Development for the construction of a 5MW solar farm on an area of approximately 11Ha size (from a total lot size of 58.2Ha) located at 1599 New England Highway, Kootingal.

The proposed development site is located near Kootingal, approximately 500m from the Western edge of the Kootingal township, taken as the Gill Street / New England Highway intersection. The site is currently zoned as RU4 small rural holdings. The proposed site has not been identified as a possible future residential release area in the Tamworth Regional Council Development Control Plan 2010.

The proposed access road is an existing private road off the New England Highway, which provides access to the Kootingal LGA Depot and is constructed with a bitumen sealed pavement width of approximately 4.0m with unsealed shoulders and table drains approximately 0.5m deep either side. It is noted the road is partially unsealed gravel in places.

The Eastern end of the site is located approximately 500m from the Western edge of the Kootingal township, taken as the Gill Street / New England Highway intersection. The private access road continues West, towards Tamworth Regional Council settling ponds / depot, where the road terminates.

3 DESIGN SERVICE VEHICLES

3.1 CONSTRUCTION PHASE 0-3 MONTHS

It is proposed that the following vehicles will access the site during the following stages of the project:

Vehicles accessing the site during construction will consist of:

- 45 B-Double trucks (total number of B-Doubles over the construction phase.
- Light vehicles suitable for transporting up to 50 workers.
- Bus service for workers if required.

3.2 TYPICAL USE DURING OPERATIONAL PHASE

The following list depicts the weekly schedule of vehicles required for the facility to operate.

- Maintenance access vehicles (1 light vehicle) access to the site in 3 monthly intervals.

4 EXISTING TRAFFIC CONDITIONS

4.1 ROAD HIERARCHY – SURROUNDING ROAD NETWORK

The NSW administrative road hierarchy comprises the following road classifications, which align with generic road hierarchy as follows:

- **New England Highway (B56)** is a state highway, managed by Roads and Maritime Services , with primary function of providing vehicular access between Tamworth and Armidale.

The B56 New England Highway is listed as an approved B-Double Route by RMS as shown in Figure 2.



Figure 2: Existing travel conditions. Source: RMS website: <http://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/>

4.2 EXISTING TRAFFIC DATA

At the time of this report the most recent traffic data available from Tamworth Regional Council was unable to be sourced along the New England Highway.

Online traffic data was available from RMS for the location of Benderneer, which is 25km North West of Kootingal on the New England Highway, as shown in Figure 3. It is noted the drop in traffic for 2020 is most likely a result of COVID-19 travel restrictions.

With reference to Figure 4, the maximum number of vehicles per hour, during the Weekday AM peak hour in any direction is 140.

With reference to Table 4.5 of RTA Guide to Traffic Generating Developments 2002 – see Table 2, the allowable peak flow for Level of Service (LoS) B is 530, which exceeds 140 vehicle movements.

It is noted LoS A is the highest possible level of service for two lane rural roads, and a minimum LoS C is desirable for major roads.

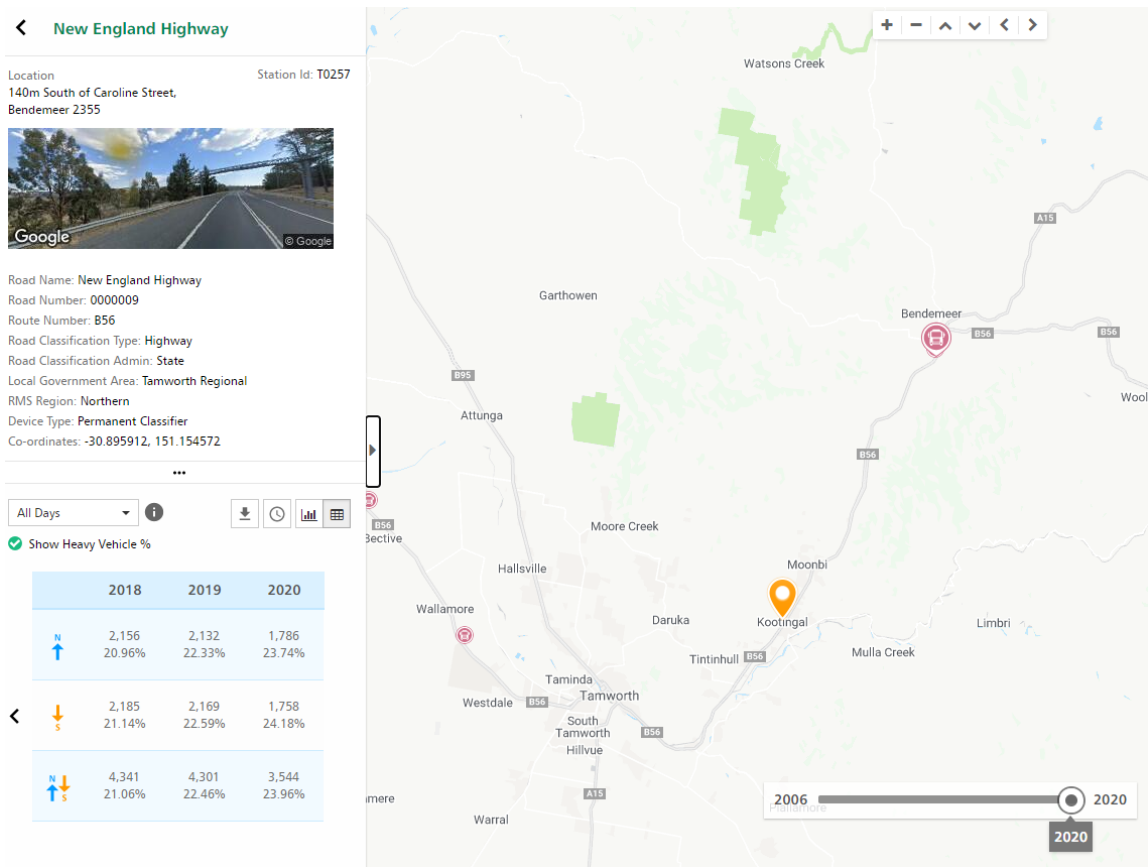


Figure 3: Existing traffic count

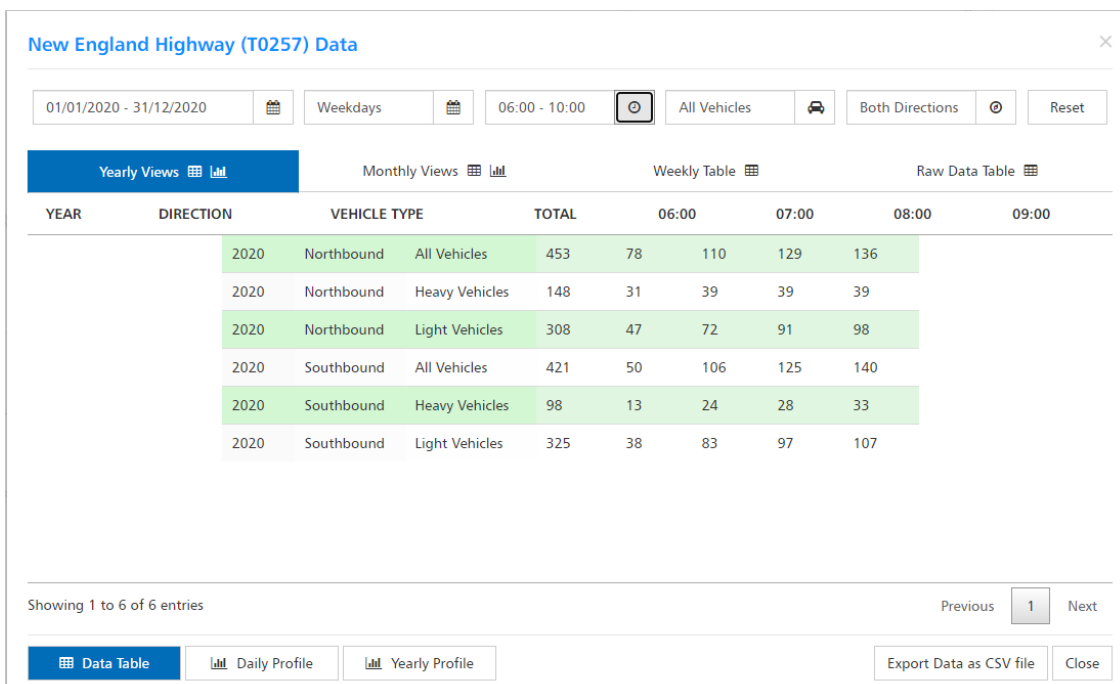


Figure 4: Existing traffic count Weekdays AM

5 PROPOSED TRAFFIC MANAGEMENT PLAN

5.1 PROJECTED TRAFFIC GENERATION POTENTIAL – TOTAL DEVELOPMENT

Based on advice from the client and a review of previous Solar Farm installations the proposed traffic generation for the development is separated into the construction and operational phases of the project as shown below. It is proposed to have 50 workers accessing the site during the construction phase, with work carried out between 7am – 4pm Monday to Friday.

Construction equipment is to be delivered to site via heavy vehicles between 10am – 2pm daily, hence not contributing to the AM or PM peak times.

Construction vehicle average trips per hour:

B-Double	2vtph (out of peak times)
Light vehicle access (workers – worst case)	25vtph
Light vehicle access (workers with bus service)	10vtph
Total Development	30vtph max.

Vehicle average trips per day (vtpd) during construction are listed below:

B-Double	4vtpd
Light vehicle access (workers – worst case)	40vtpd
Light vehicle access (workers with bus service)	10vtpd
Total Development	50vtd max.

No reduction in these rates has been allowed for with pedestrian and cycle access to the facility. It is assumed that if all workers are accessing the site using light vehicles, there will be at least 2 workers per vehicle. Extra daily trips have been allowed for to access Tamworth during the day if required. No weekend trips are expected.

As previously mentioned, the site will be unmanned during the operational phase and is expected to generate only up to two light vehicle trips in every 3-month period.

It is important to note that the greatest interaction with traffic external to the site will be during the peak PM period, estimated to be between 4pm – 5pm. The AM peak period with traffic heading to the site will not generate as many interactions due to the expected peak arrival time of 6am – 7am by the workers.

5.2 PROPOSED SITE ENTRY

We recommend that the site entry location be constructed in accordance with Triaxial plan TX15007.00-SK01, with a sealed access point from the private access road. The proposed site entrance has been designed to accommodate the turning path of a B-Double truck, with a sealed entrance a minimum of 26 metres into the site to minimise disruption to the private access road and ensure that a B-Double is able to queue off the road if required to when accessing the site.

Refer Appendix B – Triaxial Plan TX15007.00-SK01

The proposed site entry location will have in excess of 333m of sight distance in either direction in accordance with the requirements of Austroads Guide to Road Design and Tamworth Regional Council DCP requirements.

Refer Appendix A – Photos 1 and 2

5.3 IMPACT ON SURROUNDING ROAD NETWORK

We recommend that the private access road be utilised as the main site entrance due to the lower traffic count, complexity and safety issues that constructing an entry directly from the New England Highway may cause.

Up to date traffic counts along New England Highway were unable to be sourced from Tamworth Regional Council.

During a site visit by Triaxial Consulting staff on 26 August 2020 a traffic count of 21 total cars was recorded along private access road for a 10-minute period between 8am – 9am with a total of 7 heavy vehicles during this time.

It is not expected that an increase of 25 vehicles per hour in peak times will reduce the level of service of the roadway from Level A as it is well below the limits shown in Table 4.5 of RTA Guide to Traffic Generating Developments as shown in Table 2 below:

**PEAK HOUR FLOW ON TWO-LANE RURAL ROADS
(VEHICLES PER HOUR)
(DESIGN SPEED OF 100KM/HR)**

Terrain	Level of Service	Proportion of Heavy Vehicles			
		0%	5%	10%	15%
Level	A	<630	<590	<560	<530
	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290

Source Table 4.5 RTA Guide to Traffic Generating Developments October 2002

Table 2: Carriageway Level of Service limits

The peak vehicle trips as listed in this report will have only a very minor impact on the surrounding road network. It is not envisaged that the development will cause a decrease in the level of service to either the road carriageway along the private access road or the New England Highway.

5.4 CONSTRUCTION WORKER SITE ACCESS

As the site is located on the Western side of Kootingal and easily accessible via the New England Highway, the construction worker site access and parking areas should be constructed in accordance with appropriate safe construction site management principles.

Depending on the accommodation arrangements made by the successful building contractor in the construction phase of the project, care should be taken to avoid any impacts on the Kootingal town centre. Possible impacts may be mitigated by sourcing accommodation away from the Kootingal town centre, or the provision of a bus service to convey workers to site.

6 SUMMARY

In summary, the proposed construction of the solar farm will cause no major long-term effects to the surrounding road network due to the unmanned operation of the site requiring only minimal regular maintenance by a small number of staff.

We note preliminary discussions with Tamworth Regional Council have indicated they are receptive to the use of the access road for the development and willing to provide a letter of support for the project.

Construction traffic appropriately managed with either a bus service for workers and/or out of peak hour deliveries to the site, combined with the construction of a new appropriate site entry catering for B-Double access will ensure traffic impacts are minimised during the short construction phase of the project.

APPENDIX A - SITE PHOTOS



Photo 1
Proposed site entry
location looking North
along the New England
Highway

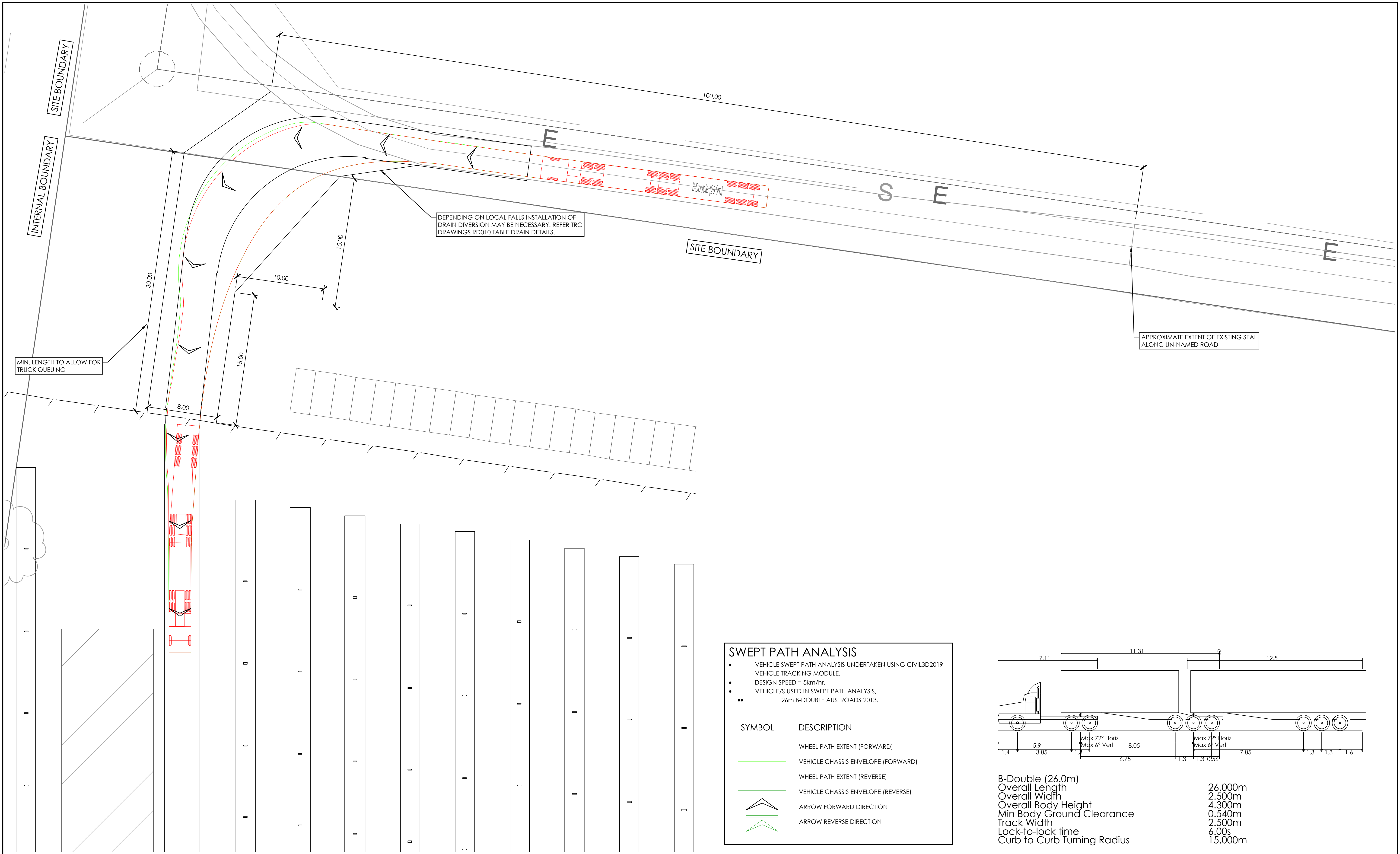
Photo 2
Proposed site entry
location looking South
along the New England
Highway



APPENDIX B – TRIAXIAL PLAN TX15007.00-SK01

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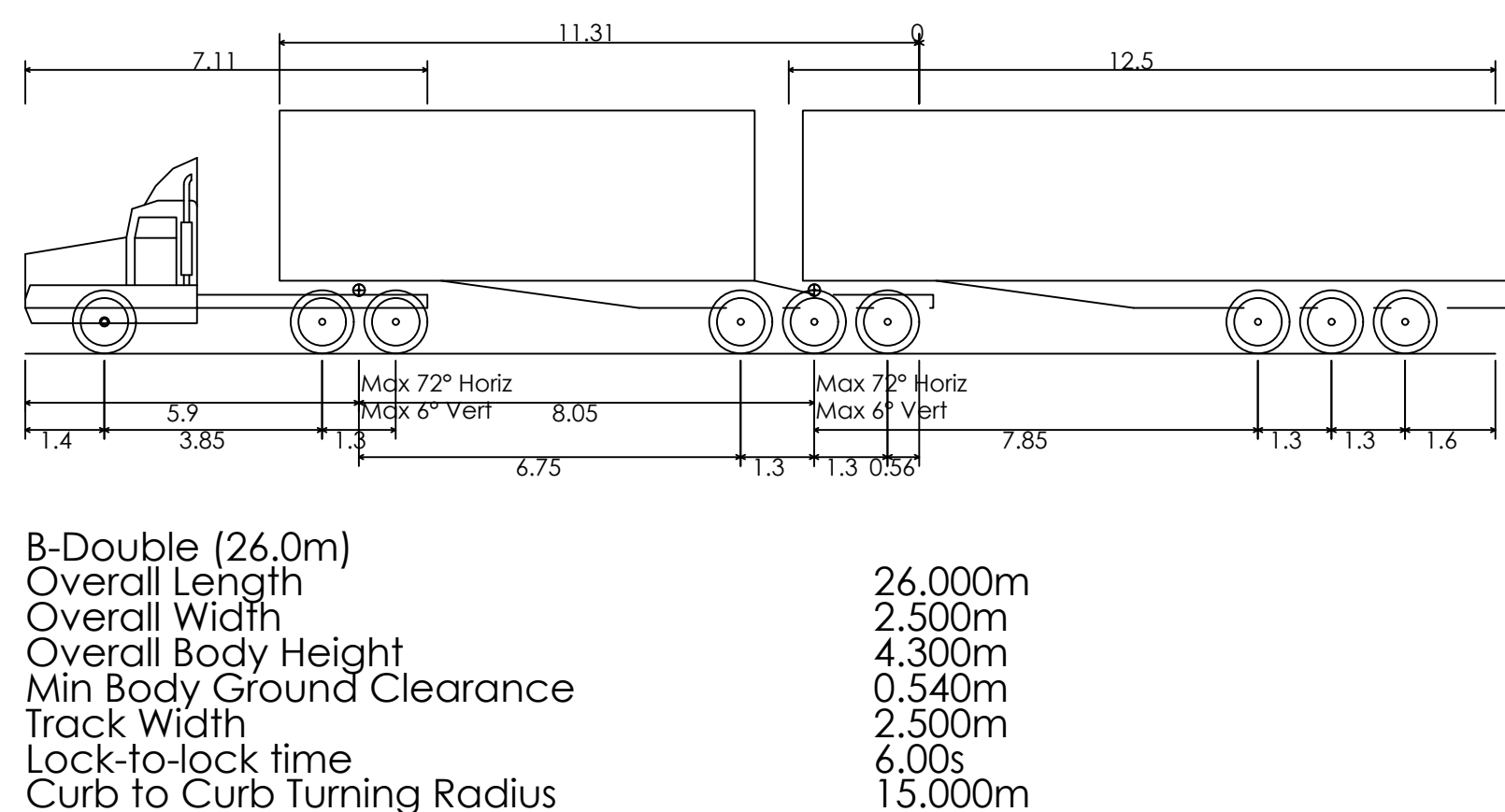
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SWEPT PATH ANALYSIS

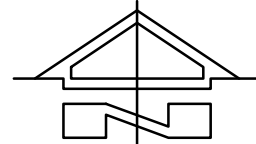
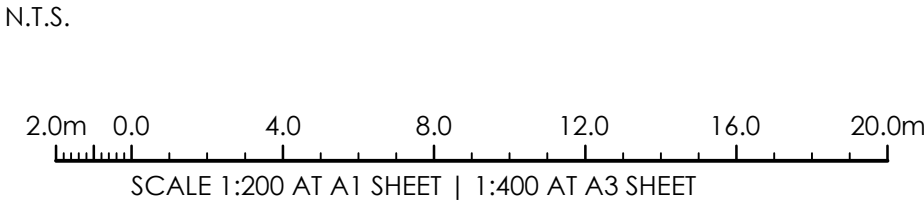
- VEHICLE SWEEP PATH ANALYSIS UNDERTAKEN USING CIVIL3D2019
- VEHICLE TRACKING MODULE.
- DESIGN SPEED = 5km/hr.
- VEHICLE/S USED IN SWEEP PATH ANALYSIS, 26m B-DOUBLE AUSTRROADS 2013.

SYMBOL	DESCRIPTION
	WHEEL PATH EXTENT (FORWARD)
	VEHICLE CHASSIS ENVELOPE (FORWARD)
	WHEEL PATH EXTENT (REVERSE)
	VEHICLE CHASSIS ENVELOPE (REVERSE)
	ARROW FORWARD DIRECTION
	ARROW REVERSE DIRECTION



B-Double (26.0m)
Overall Length 26.000m
Overall Width 2.500m
Overall Body Height 4.300m
Min Body Ground Clearance 0.540m
Track Width 2.500m
Lock-to-lock time 6.00s
Curb to Curb Turning Radius 15.000m

VEHICLE PROFILE



VEHICLE SIMULATION PLAN - SHEET 1
SCALE 1:200 AT A1



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PROVISION OF CONSULTING ENGINEERING SERVICES

**KOOTINGAL 1C SOLAR FARM
"ROSEAMERE" 1599 NEW ENGLAND HIGHWAY
KOOTINGAL NSW 2352**

TRAFFIC ASSESSMENT REPORT

22 JULY 2021

REFERENCE: TX15007.00-01.RPT.RA.S-REV1

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1 INTRODUCTION

Triaxial have been engaged by ITP Development to prepare a traffic assessment report. The purpose of this report is to assess the traffic implications of the development proposal. This report is to be included in the development application lodged with Tamworth Regional Council.

The site is currently utilised for grazing and is shown in the photo below:

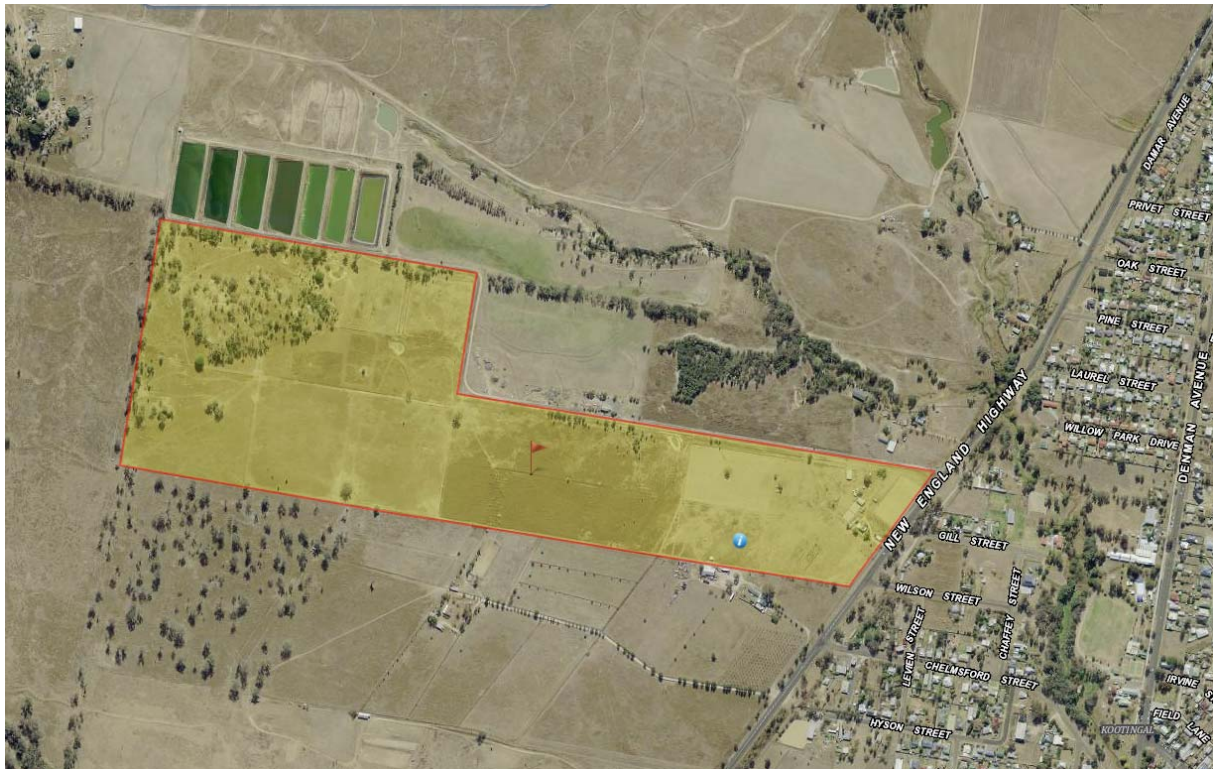


Figure 1: Existing Site

2 PROPOSAL

2.1 DEVELOPMENT SITE

The site is proposed to be utilised by ITP Development for the construction of a 5MW solar farm on an area of approximately 11Ha size (from a total lot size of 58.2Ha) located at 1599 New England Highway, Kootingal.

The proposed development site is located near Kootingal, approximately 500m from the Western edge of the Kootingal township, taken as the Gill Street / New England Highway intersection. The site is currently zoned as RU4 small rural holdings. The proposed site has not been identified as a possible future residential release area in the Tamworth Regional Council Development Control Plan 2010.

The proposed access road is an existing private road off the New England Highway, which provides access to the Kootingal LGA Depot and is constructed with a bitumen sealed pavement width of approximately 4.0m with unsealed shoulders and table drains approximately 0.5m deep either side. It is noted the road is partially unsealed gravel in places.

The Eastern end of the site is located approximately 500m from the Western edge of the Kootingal township, taken as the Gill Street / New England Highway intersection. The private access road continues West, towards Tamworth Regional Council settling ponds / depot, where the road terminates.

3 DESIGN SERVICE VEHICLES

3.1 CONSTRUCTION PHASE 0-3 MONTHS

It is proposed that the following vehicles will access the site during the following stages of the project:

Vehicles accessing the site during construction will consist of:

- 13 B-Double trucks (total minimum number of B-Doubles required over the construction phase).
- Light vehicles suitable for transporting up to 50 workers.
- Bus service for workers if required.

3.2 TYPICAL USE DURING OPERATIONAL PHASE

The following list depicts the weekly schedule of vehicles required for the facility to operate.

- Maintenance access vehicles (1 light vehicle) access to the site in 3 monthly intervals.

4 EXISTING TRAFFIC CONDITIONS

4.1 ROAD HIERARCHY – SURROUNDING ROAD NETWORK

The NSW administrative road hierarchy comprises the following road classifications, which align with generic road hierarchy as follows:

- **New England Highway (B56)** is a state highway, managed by Roads and Maritime Services, with primary function of providing vehicular access between Tamworth and Armidale.

The B56 New England Highway is listed as an approved B-Double Route by RMS as shown in Figure 2.

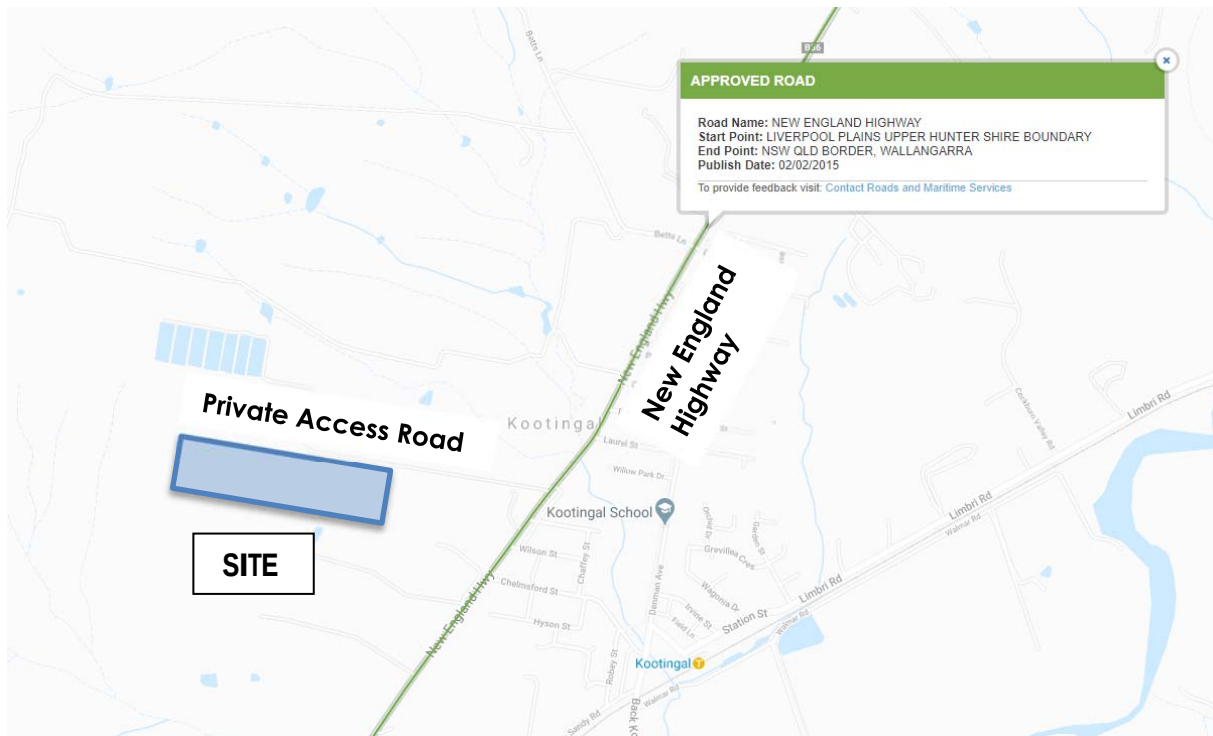


Figure 2: Existing travel conditions. Source: RMS website: <http://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/>

4.2 EXISTING TRAFFIC DATA

At the time of this report the most recent traffic data available from Tamworth Regional Council was unable to be sourced along the New England Highway.

Online traffic data was available from RMS for the location of Bendemeer, which is 25km North West of Kootingal on the New England Highway, as shown in Figure 3. It is noted the drop in traffic for 2020 is most likely a result of COVID-19 travel restrictions.

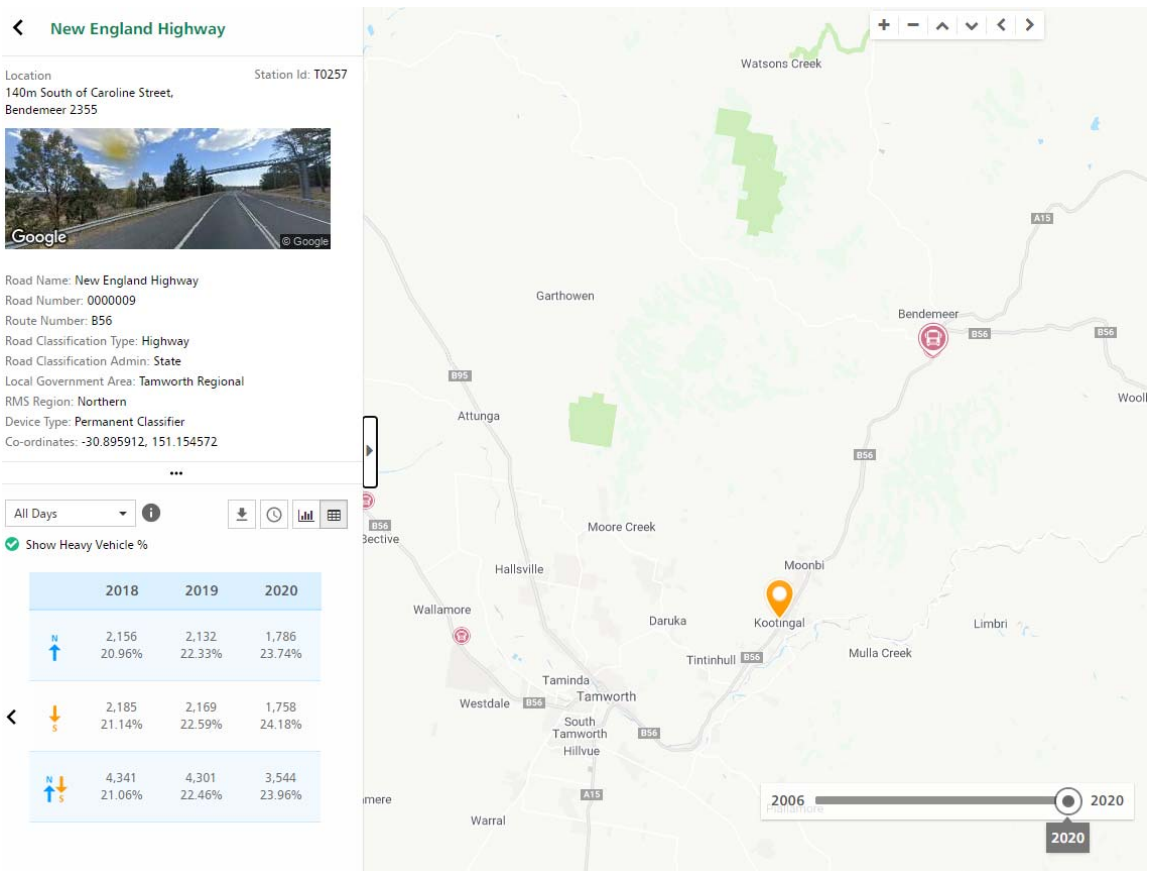
With reference to Figure 4, the maximum number of vehicles per hour, during the Weekday AM peak hour in any direction is 140.

Information supplied by Tamworth Regional Council indicates that a more suitable location for obtaining traffic information may be South of the site along the New England Highway near Nemingha. Last available non-covid related traffic data obtained in 2018 indicates that daily traffic count in that location was 6663 vehicles. Peak hour data was not available for this site.

Using the same percentage of peak hour traffic as the Bendemeer location estimates the total peak hour traffic at 215 vehicles per hour.

With reference to Table 4.5 of RTA Guide to Traffic Generating Developments 2002 – see Table 2, the allowable peak flow for Level of Service (LoS) A is 530, which exceeds 215 vehicle movements. Based on the figures obtained for the Bendemeer counting station we have assumed that the percentage of heavy vehicles will be in the >15% category.

It is noted LoS A is the highest possible level of service for two lane rural roads, and a minimum LoS C is desirable for major roads.



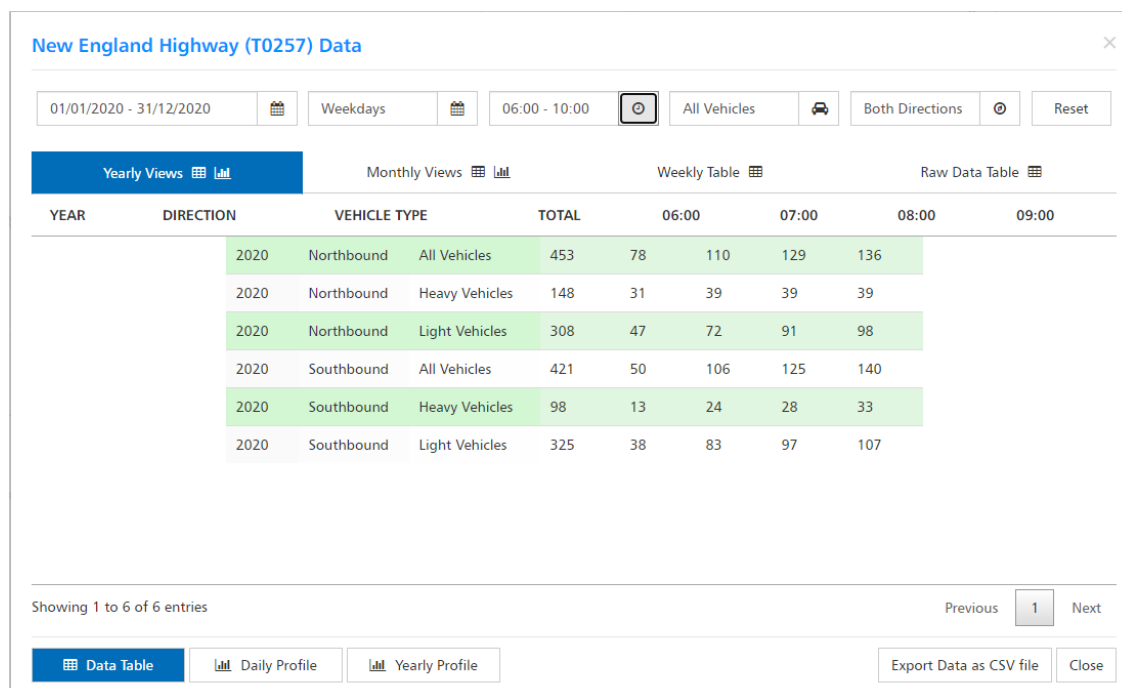


Figure 4: Existing traffic count Weekdays AM

5 PROPOSED TRAFFIC MANAGEMENT PLAN

5.1 PROJECTED TRAFFIC GENERATION POTENTIAL – TOTAL DEVELOPMENT

Based on advice from the client and a review of previous Solar Farm installations the proposed traffic generation for the development is separated into the construction and operational phases of the project as shown below. It is proposed to have 50 workers accessing the site during the construction phase, with work carried out between 7am – 4pm Monday to Friday. All construction workers are proposed to travel to site in light vehicles.

Construction equipment is to be delivered to site via heavy vehicles between 10am – 2pm daily, hence not contributing to the AM or PM peak times.

Information obtained from ITP Solar confirms that there will be a total of 12100 solar modules to be constructed on the development site. It is proposed to deliver these modules to site using a B-Double truck. The B-Double truck will have capacity for 32 pallets each containing 31 modules, giving a capacity delivery of 992 solar modules. A total of 13 B-Doubles will be required for the total solar panel delivery. As a conservative estimate for the purposes of this report, we have indicated a maximum of 2 B-Double vehicles per day that will access site out of peak hour times.

Construction vehicle average trips per hour:

B-Double	2vtph (out of peak times)
Light vehicle access (workers – worst case)	25vtph
Light vehicle access (workers with bus service)	10vtph
Total Development	30vtph max.

Vehicle average trips per day (vtpd) during construction are listed below:

B-Double	4vtpd
Light vehicle access (workers – worst case)	40vtpd
Light vehicle access (workers with bus service)	10vtpd
Total Development	50vtpd max.

No reduction in these rates has been allowed for with pedestrian and cycle access to the facility. It is assumed that if all workers are accessing the site using light vehicles with at least 2 workers per vehicle. Extra daily trips have been allowed for to access Tamworth during the day if required. No weekend trips are expected.

As previously mentioned, the site will be unmanned during the operational phase and is expected to generate only up to two light vehicle trips in every 3-month period.

It is important to note that the greatest interaction with traffic external to the site will be during the peak PM period, estimated to be between 4pm – 5pm. The AM peak period with traffic

heading to the site will not generate as many interactions due to the expected peak arrival time of 6am – 7am by the workers.

5.2 PROPOSED SITE ENTRY

The proposed site entry location along the existing Kootingal wastewater treatment facility access road from the New England Highway has in excess of 333m of sight distance in either direction in accordance with the requirements of Austroads Guide to Road Design and Tamworth Regional Council DCP requirements.

Refer Appendix A – Photos 1 and 2

The proposed access along the wastewater treatment road will be accessed during the construction phase of the project by construction vehicles only, including light vehicles for staff travel and B-Double deliveries for the solar farm components.

Due to the relatively short time frame for the construction phase of the project we recommend that in order to safely manage the site access by the proposed B-Double vehicles, the following recommendations are adhered to:

- During deliveries, a construction Traffic Control Plan should be implemented that provides traffic control on the New England Highway to safely allow a B-Double to decelerate and enter the access road without any interaction between existing traffic. Rather than relying on upgrading the site access for a short period of time to cater for the B-Double entry, a suitable traffic control plan will adequately address safety concerns during the temporary construction period.
- Access to the site by B-Double vehicles should be limited to the Northern approach, as analysis of the turning path indicates that due to the approach angle from the South, a B-Double vehicle from this direction would track over the existing edge of bitumen and drainage infrastructure. An approach from the North is more amenable and would ensure the vehicle swept path stays within the existing constructed site entry. Turning paths of the vehicle entry over the site detailed survey are included in Appendix A.

Refer Appendix B – Triaxial Plan TX15007.00-C10.1

We recommend that the site entry to the solar farm from the existing access road be constructed in accordance with Triaxial plan TX15007.00-C10.0, with a sealed access point. The proposed site entrance has been designed to accommodate the turning path of a B-Double truck, with a sealed entrance a minimum of 26 metres into the site to minimise disruption to the private access road and ensure that a B-Double is able to queue off the road if required to when accessing the site.

Refer Appendix B – Triaxial Plan TX15007.00-C10.0

5.3 IMPACT ON SURROUNDING ROAD NETWORK

ITP solar have confirmed acceptance by Tamworth Regional Council to use the Kootingal Wastewater Access Road during the construction phase of the project.

We recommend that the existing private access track to number 1599 New England Highway be utilised as the main site entrance during the operational phase of the project due to the lower traffic count, complexity and safety issues that constructing an entry directly from the New England Highway may cause.

During a site visit by Triaxial Consulting staff on 26 August 2020 a traffic count of 21 total cars was recorded along private access road for a 10-minute period between 8am – 9am with a total of 7 heavy vehicles during this time. Peak hour vehicle movements adopted as previously described are 215 vehicles per hour with greater than 15% of these heavy vehicles.

It is not expected that an increase of 25 vehicles to a total of 240 vehicles per hour in peak times will reduce the level of service of the roadway from Level A as it is well below the limits shown in Table 4.5 of RTA Guide to Traffic Generating Developments as shown in Table 2 below:

**PEAK HOUR FLOW ON TWO-LANE RURAL ROADS
(VEHICLES PER HOUR)
(DESIGN SPEED OF 100KM/HR)**

Terrain	Level of Service	Proportion of Heavy Vehicles			
		0%	5%	10%	15%
Level	A	<630	<590	<560	<530
	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290

Source Table 4.5 RTA Guide to Traffic Generating Developments October 2002

Table 2: Carriageway Level of Service limits

The peak vehicle trips as listed in this report will have only a very minor impact on the surrounding road network. It is not envisaged that the development will cause a decrease in the level of service to either the road carriageway along the private access road or the New England Highway.

5.4 CONSTRUCTION WORKER SITE ACCESS

As the site is located on the Western side of Kootingal and easily accessible via the New England Highway, the construction worker site access and parking areas should be constructed in accordance with appropriate safe construction site management principles.

Depending on the accommodation arrangements made by the successful building contractor in the construction phase of the project, care should be taken to avoid any impacts on the Kootingal town centre. Possible impacts may be mitigated by sourcing accommodation away from the Kootingal town centre, or the provision of a bus service to convey workers to site.

6 SUMMARY

In summary, the proposed construction of the solar farm will cause no major long-term effects to the surrounding road network due to the unmanned operation of the site requiring only minimal regular maintenance by a small number of staff.

We note that Tamworth Regional Council have provided confirmation of the ability to use the existing wastewater treatment access road, and that the most appropriate method of ensuring the ongoing safety of road users along the New England Highway would be to implement a suitable Traffic Control Plan during the construction phase of the project that would limit large vehicle access to the Northern approach and provide suitable protection for when B-Double deliveries are made to the site.

Construction traffic appropriately managed with either a bus service for workers and/or out of peak hour deliveries will ensure traffic impacts are minimised during the short construction phase of the project.

APPENDIX A - SITE PHOTOS



Photo 1
Proposed site entry
location looking North
along the New England
Highway

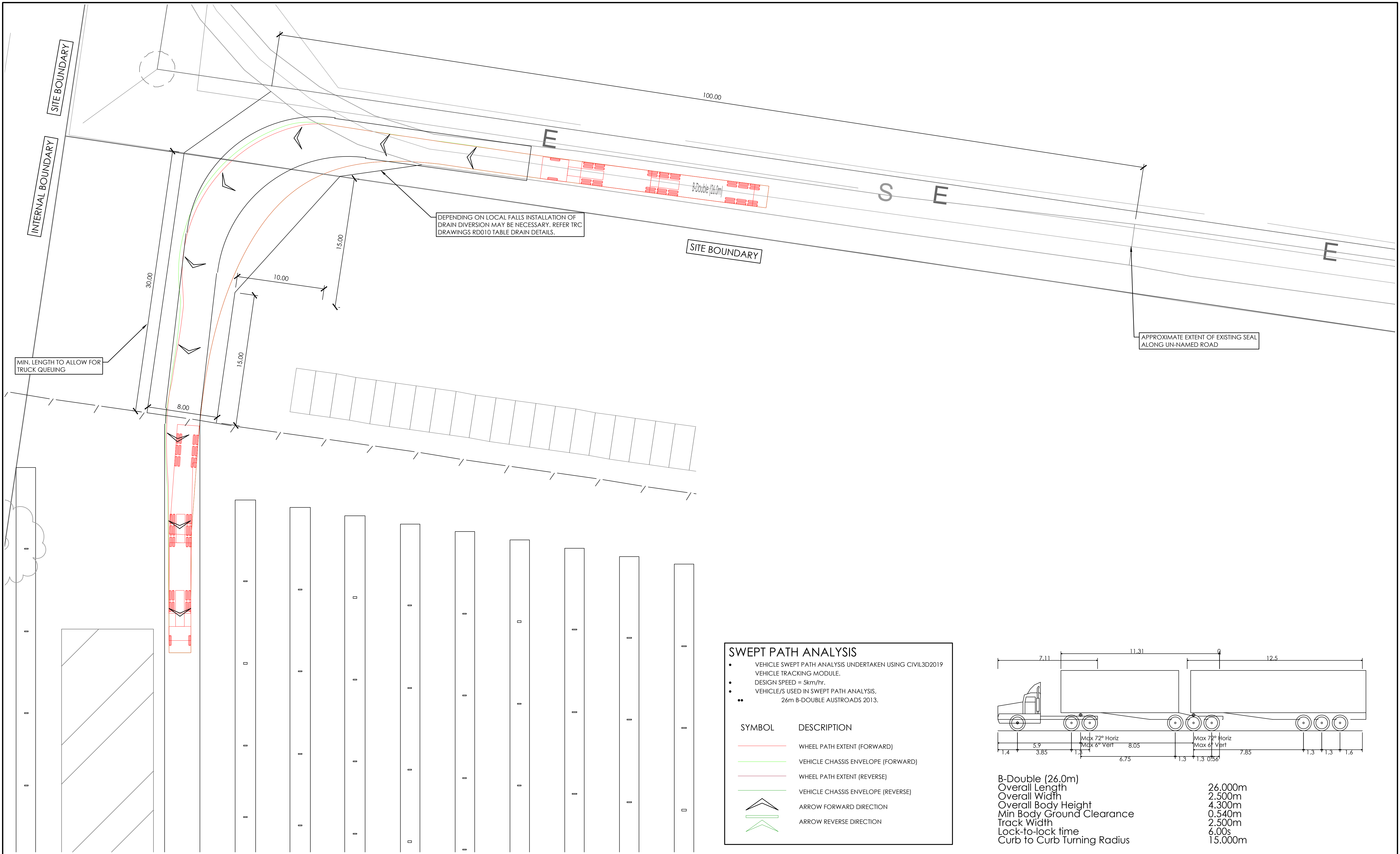


Photo 2
Proposed site entry
location looking South
along the New England
Highway

APPENDIX B – TRIAXIAL PLANS TX15007.00-C10.0 + C10.1

SYDNEY | ADELAIDE | BAROSSA | DARWIN | MUDGEE

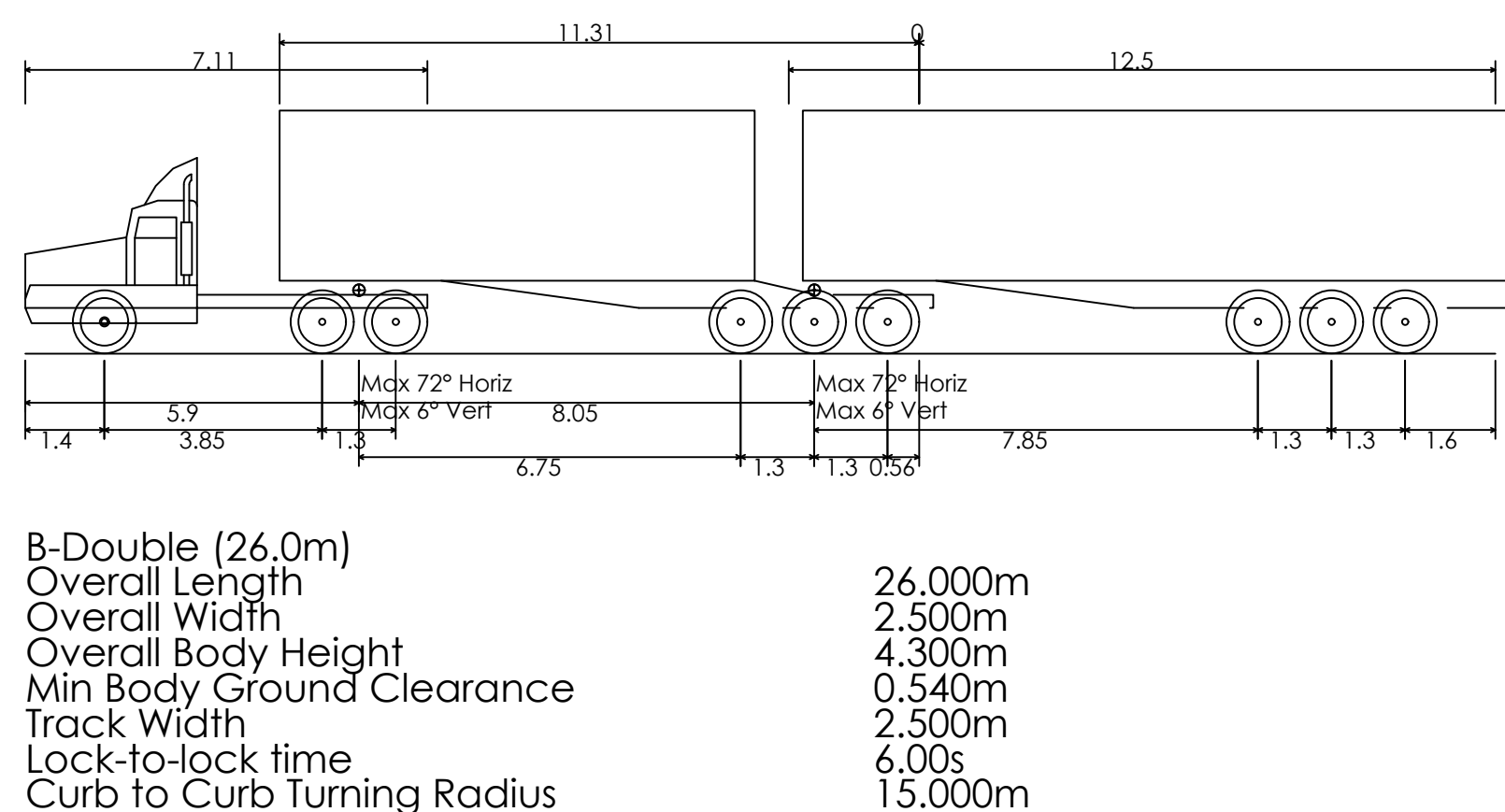
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SWEPT PATH ANALYSIS

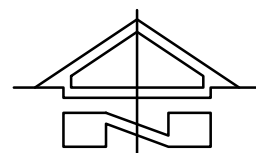
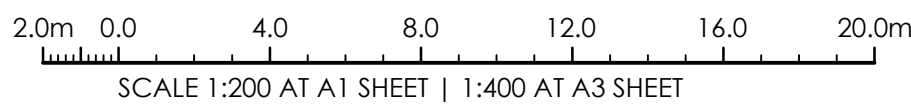
- VEHICLE SWEPT PATH ANALYSIS UNDERTAKEN USING CIVIL3D2019
- VEHICLE TRACKING MODULE.
- DESIGN SPEED = 5km/hr.
- VEHICLE/S USED IN SWEPT PATH ANALYSIS, 26m B-DOUBLE AUSTRROADS 2013.

SYMBOL	DESCRIPTION
	WHEEL PATH EXTENT (FORWARD)
	VEHICLE CHASSIS ENVELOPE (FORWARD)
	WHEEL PATH EXTENT (REVERSE)
	VEHICLE CHASSIS ENVELOPE (REVERSE)
	ARROW FORWARD DIRECTION
	ARROW REVERSE DIRECTION

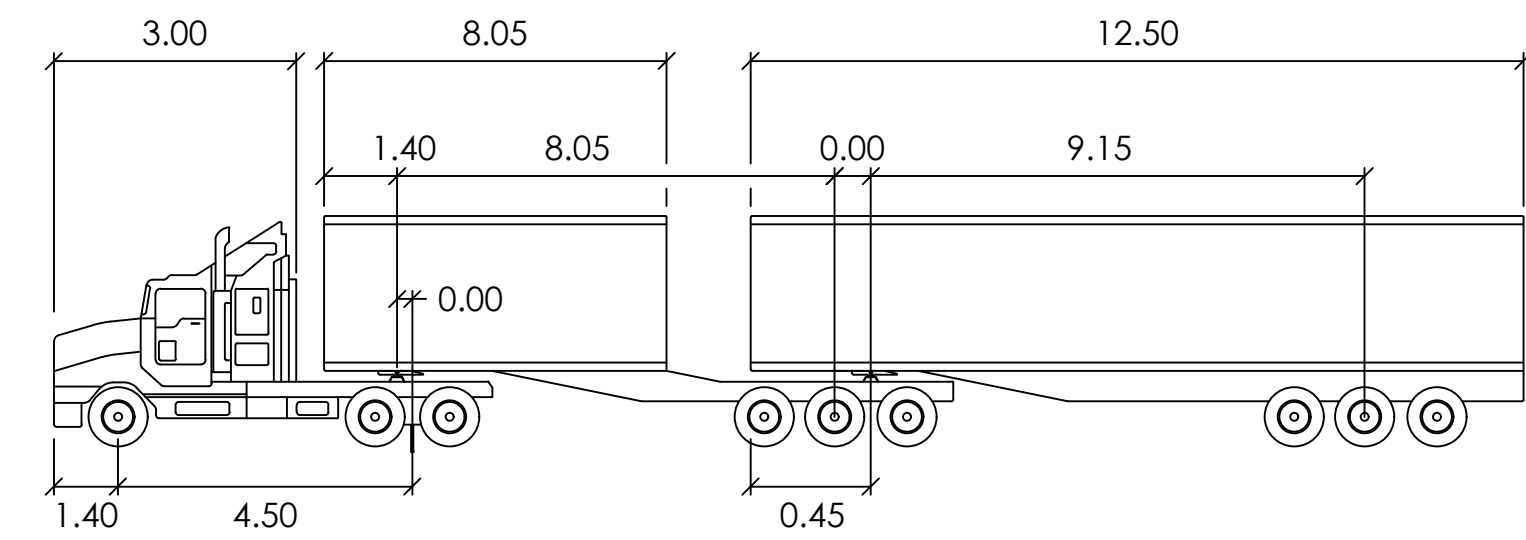
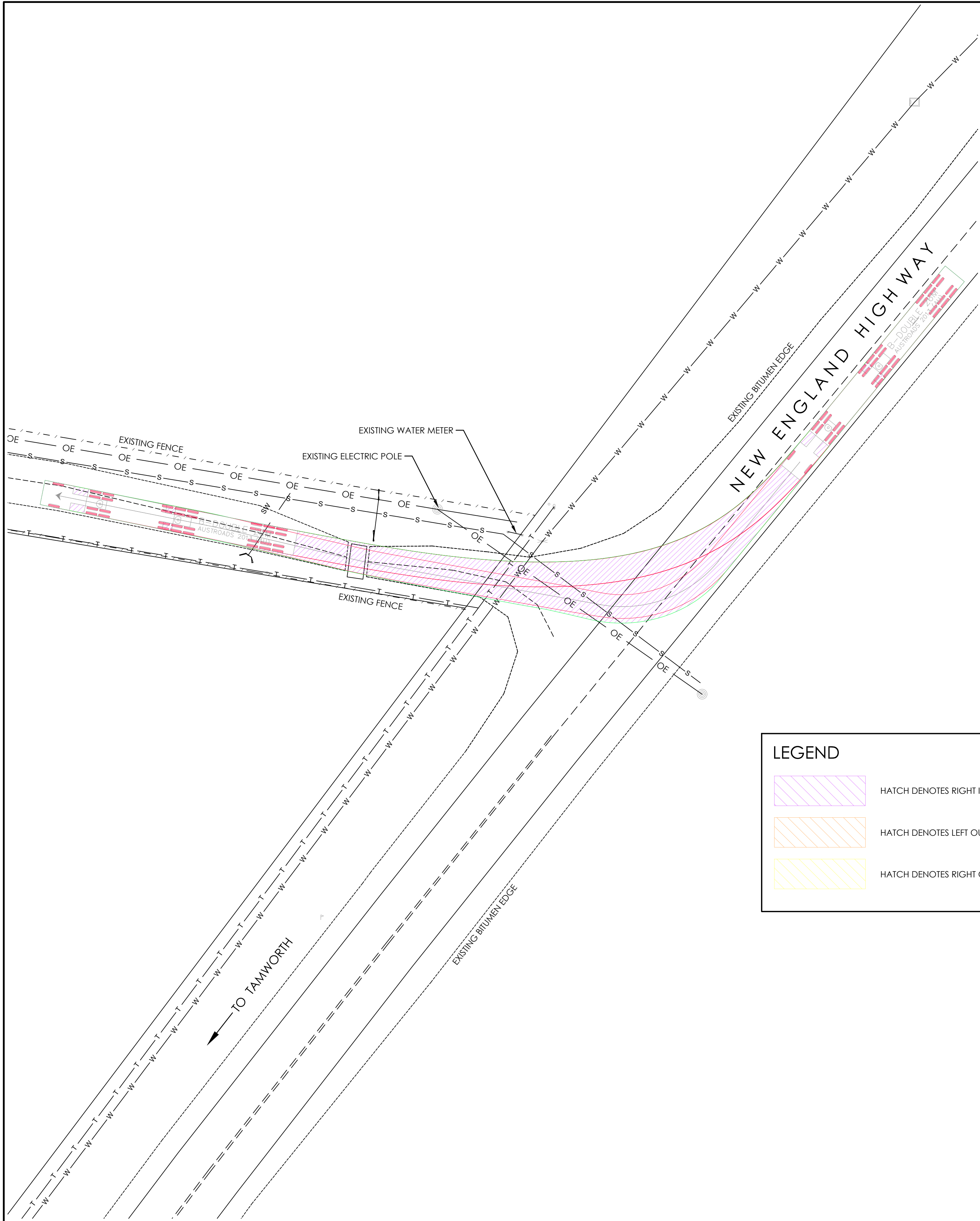


B-Double (26.0m)
Overall Length 26.000m
Overall Width 2.500m
Overall Body Height 4.300m
Min Body Ground Clearance 0.540m
Track Width 2.500m
Lock-to-lock time 6.00s
Curb to Curb Turning Radius 15.000m

VEHICLE PROFILE



VEHICLE SIMULATION PLAN - SHEET 1
SCALE 1:200 AT A1



B-DOUBLE 26M

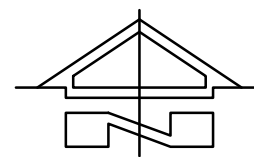
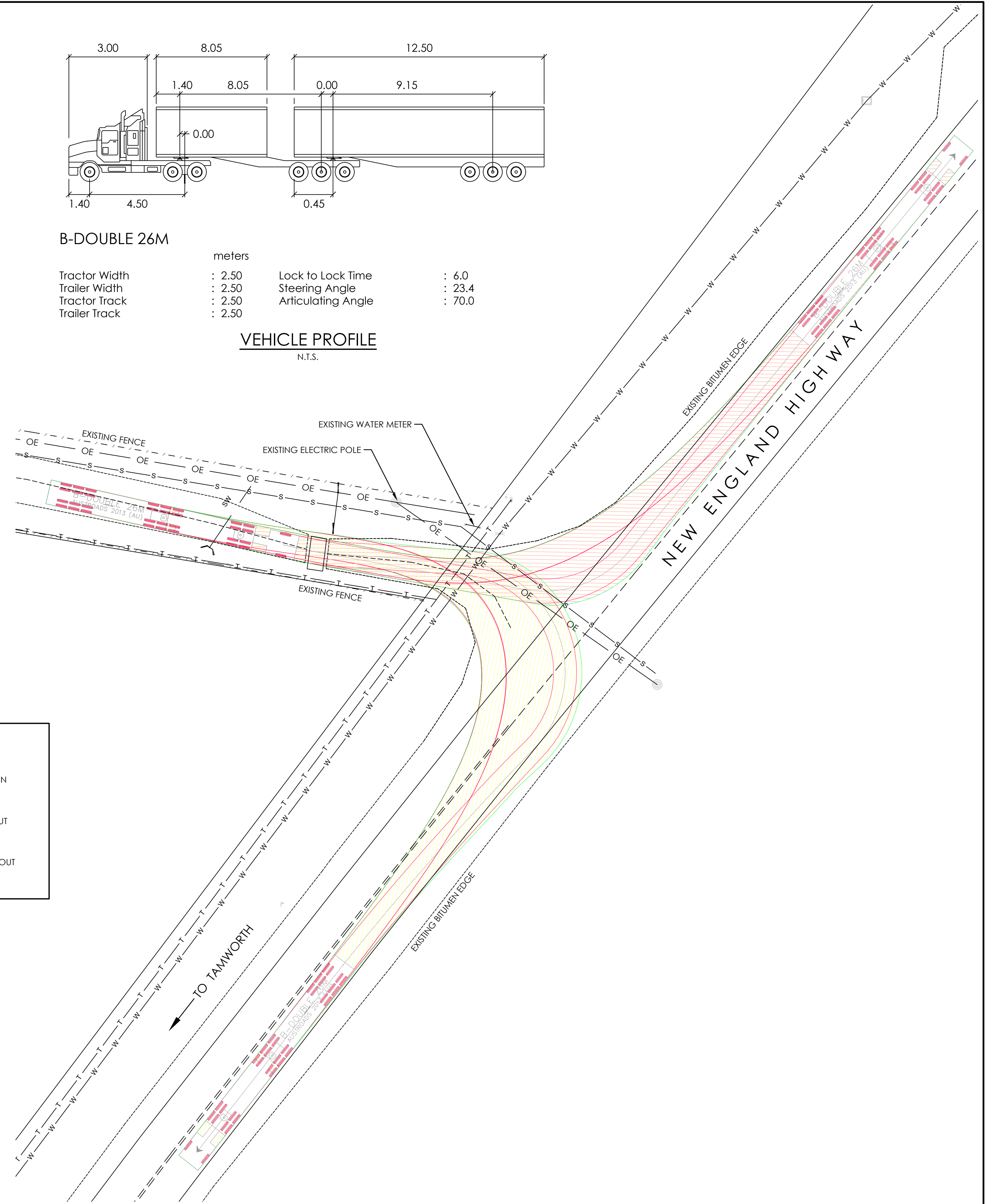
Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 23.4
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

VEHICLE PROFILE

N.T.S.

LEGEND

	HATCH DENOTES RIGHT IN
	HATCH DENOTES LEFT OUT
	HATCH DENOTES RIGHT OUT



VEHICLE SIMULATION PLAN - SHEET 2

SCALE 1:250 AT A1

2.5m 0.0 5.0 10.0 15.0 20.0 25.0m

SCALE 1:250 AT A1 SHEET | 1:500 AT A3 SHEET

ISSUED FOR
AMENDMENTS

..... A ...
DATE ISSUE BY

NOT FOR CONSTRUCTION

CLIENT
ITP DEVELOPMENT

PROJECT
KOOTINGAL 1C 5MW SOLAR FARM
NEW ENGLAND HWY
KOOTINGAL NSW 2352

DESIGNED
J.I.D.

DRAWN
J.O.M.

DATE
JUL 21

SIZE
A1

CAD REF
TX15007.00 - C01



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VEHICLE SIMULATION PLAN -
SHEET 2

PROJECT No.
TX15007.00 - C10.1 A

DRAWING No.
C10.1 A

ISSUE



Waste Assessment

Kootingal Solar Farm



DOCUMENT CONTROL

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Waste Assessment of the Kootingal Solar Farm July 2020

ii



ABOUT ITP RENEWABLES

ITP Renewables (ITP) is a global leader in renewable energy engineering, strategy, construction, and energy sector analytics. Our technical and policy expertise spans the breadth of renewable energy, energy storage, energy efficiency and smart integration technologies. Our range of services cover the entire spectrum of the energy sector value chain, from technology assessment and market forecasting right through to project operations, maintenance and quality assurance.

We were established in 2003 and operate out of offices in Canberra (Head Office), Sydney, North Coast NSW, Adelaide and Auckland, New Zealand. We are part of the international ITP Energised Group, one of the world's largest, most experienced and respected specialist engineering consultancies focussing on renewable energy, energy efficiency, and carbon markets. The Group has undertaken over 2,000 contracts in energy projects encompassing over 150 countries since it was formed in 1981.

Our regular clients include governments, energy utilities, financial institutions, international development donor agencies, project developers and investors, the R&D community, and private firms.

ABBREVIATIONS

AC	Alternating current
EPA	Environmental Protection Agency
Ha	hectare
ITP	ITP Renewables
LCA	Life cycle analysis
MW	Megawatt, unit of power (1 million Watts)
MWp	Megawatt-peak, unit of power at standard test conditions used to indicate PV system capacity
NSW	New South Wales
POEO	Protection of the Environment Operations (Act)
PV	Photovoltaic
WMP	Waste management plan

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1 INTRODUCTION

The proposed Kootingal Solar Farm (referred to as the Project) is located on the New England Highway approximately 1km west of the town of Kootingal and 17km north east of Tamworth NSW (Figure 1). ITP Renewables (ITP) is proposing to construct a solar farm with a DC capacity of 6.4 MW and AC output of 5 MW and occupies 11 ha on an approximately 58.2 ha site. This report provides a waste assessment to support the Development Application for the project. It provides a:

- Desktop review of resource use, waste generation type and quantity expected and Life Cycle Analysis (LCA) during construction and operation.
- Desktop review of waste generation against the Protection of the Environment Operations (POEO) Act 1997, POEO (Waste) Regulation 2014 and Waste Avoidance and Resource Recovery Act 2001.
- Desktop review of waste disposal options (local approved waste disposal facility), during construction and operation.
- Desktop impact assessment against NSW policies and referenced industry standards for solar photovoltaic systems.
- Desktop management assessment with mitigation measure recommendations for construction and operation.

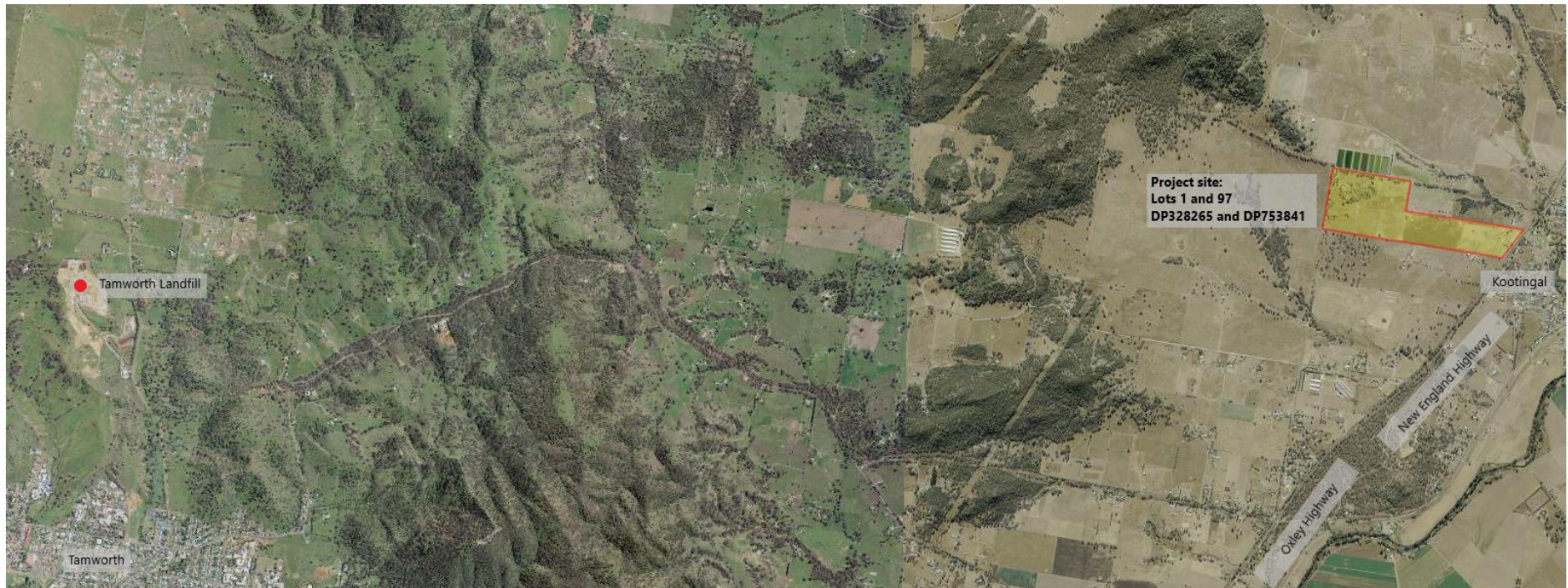


Figure 1 - Proposed solar farm site and surrounding farm area

2 PROJECT DESCRIPTION

ITP is proposing to construct a solar farm with a DC capacity of 6.4 MW and AC output of 5 MW on an approximately 11 ha site that is currently unused.

There are to be approximately 12,100 solar modules installed on around 140 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The spacing between each row is 6.25m. The hub height of each tracker is around 1.5m, with the peak of the modules reaching a height of approximately 2.75m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm and the array tracker details are shown in drawing KOO1C-G-210.

The solar farm will also include two 3 MW inverter stations. The stations are to be located within the array, mounted on a single 40-foot skid. Each of these inverter stations incorporates the high/medium voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing KOO1C-G-210.

The mounting system is constructed on piles that are driven into the ground. During construction there is expected to be 50 personnel on site working from 7 am – 4 pm Monday to Friday. The construction is expected to take approximately 3 months. Once operational the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 – 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site will be returned to the pre- development land use of agriculture.

3 LEGISLATIVE CONTEXT

Waste management is an integral part of the construction, operation and decommissioning phases of a project. There are several acts and guidelines that relate to the assessment of waste and ongoing management during project operation.

3.1 Protection of the Environment Operations (POEO) Act 1997

The POEO Act aims to protect and restore and enhance the quality of the environment in NSW, while still having regard to ecologically sustainable development.

With relevance to waste management, the Act aims to reduce risks to human health and to prevent degradation of the environment by promoting pollution prevention and the reduction in the use of materials and the re-use, recovery or recycling of materials. The Act contains the requirements for the management of waste and also the offences that relate to pollution. Section 148 requires that any pollution incidents or those that threaten material harm to the environment must be notified to the relevant authority (e.g. NSW Environment Protection Authority).

Section 143 of the POEO Act requires waste to be transported to a place that can lawfully accept it. It is an offence under Section 115 to negligently dispose of waste that may cause harm to the environment, unlawfully transport and deposit waste (e.g., if waste is transported to a place that cannot be used as a waste facility for the waste).

The waste classification definitions are also provided in the Act, and more information is provided in the EPA Waste Classification Guidelines (EPA, 2014) (Section 3.4).

Wastes that may be generated as part of construction and demolition activities, including 'building and demolition waste' as defined in the Act and includes unsegregated material that results from the demolition, erection, construction, refurbishment or alteration of buildings. Materials such as bricks, concrete, paper, plastics, glass and metal, and timber are included in this category.

3.2 Protection of the Environment Operations (Waste) Regulation 2014

The POEO Waste Regulation aims to protect human health and the environment and provides the framework for the waste industry in NSW, including the details of the licencing, reforms and the waste levy system.

The POEO Waste Regulation prescribes the wastes (hazardous waste, restricted solid waste etc) which are automatically deemed to be land pollution and the person is guilty of an offence if the waste is illegally dumped.

3.3 Waste Avoidance and Resource Recovery Act 2001

The Waste Avoidance and Resource Recovery Act 2001 aims to encourage the efficient use of resources and to reduce environmental harm. Waste management for the project must be

conducted in accordance with the Act. The projects' waste management program needs to consider the hierarchy outlined in the Act:

- i. Avoidance of unnecessary resource consumption;
- ii. Resource recovery (including reuse, reprocessing, recycling and energy recovery); and
- iii. Disposal.

ITP has an obligation to minimise material harm to the environment as a result of the construction, operation and decommissioning of the project. Details of the project waste management and minimisation can be found in Section 6.

3.4 EPA Waste Classification Guidelines

The EPA Waste Classification Guidelines (EPA, 2014) comprise four parts:

1. Part 1: Classifying waste;
2. Part 2: Immobilisation of waste;
3. Part 3: Waste containing radioactive material; and
4. Part 4: Acid sulfate soils.

Part 1 of the guidelines provide details on each of the classes of waste that are defined in clause 49 of Schedule 1 of the (POEO Act):

- Special waste;
- Liquid waste;
- Hazardous waste;
- Restricted solid waste;
- General solid waste (putrescible); and
- General solid waste (non-putrescible).

Classification of the projects' waste is discussed in more detail in Section 4.

3.5 Tamworth Local Environmental Plan 2010

The Tamworth Local Environmental Plan 2010 aims to make local environmental planning provisions for land in the Tamworth Regional Council area in accordance with the relevant standard environmental planning instrument. The Plan does not provide specific management requirements for waste as it relates mostly to urban planning and conflicting land use management. The Plan provides additional provisions for earthworks to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

The Plan provides the prohibited and permitted types of development within the local area. Some types of development are also regulated by specific state environmental planning policies.

3.6 State Environmental Planning Policy (Infrastructure) 2007

Division 4 of the State Environmental Planning Policy (Infrastructure) 2007 relates to 'Electricity generating works or solar energy systems'. The policy relates to the approval process for solar energy systems, and there are no specific details required for waste management. The policy generally states that for infrastructure projects waste materials must be sorted and must be disposed of at a waste or resource management facility.

4 PROJECT WASTE

Waste will mostly be generated during the construction phase of the project, and at the decommissioning phase (after 35 years of operation). The wastes are likely to include construction materials waste (e.g., wood pallets, cardboard), green waste and domestic waste. There will be no putrescible waste as a result of the project. The waste types generated from the project are likely to be classified as general solid waste (non- putrescible) class under the POEO Act.

The operating phase will not generate waste streams unless there is maintenance, repairs or replacement of equipment required.

Table 1 provides the details of the waste generation types and quantities expected during construction, operation and decommissioning. It also provides the options for disposal and management. Section 6 provides further details on the disposal and management options for the waste material. These quantities are estimates based on other solar projects and the actual waste from the project may vary depending on the packaging options from the PV supplier.

Table 1 - Waste Materials and Disposal and Management Options

Activity	Waste Material	Disposal and Management
Construction	Packaging waste such as cardboard, wood pallets, plastic wrap, scrap metal, general waste including approximately 860 wooden pallets and cardboard packing boxes.	Laydown area to contain a skip bin to allow segregation of solid wastes into the following categories, for appropriate recycling/disposal as indicated: - Steel and scrap metal (recycled) - Timber/cardboard (recycled) - General wastes and plastic (landfill).
	Concrete waste (minimal quantities)	
	- Electric cable waste and cable reels - Plastic pipe offcuts/scrap	
	Empty drums and containers (minimal quantities)	Collected and disposed at offsite waste facilities.
	- Minimal used lubricating oil and filters - Unused or spent chemicals	Fluids recycled where possible. Where not possible, disposed of at offsite waste facilities.
Operation	Minimal volumes of domestic wastes such as office consumables, paper, plastics, glass.	Taken offsite to appropriate recycling/disposal.

	Waste as a result of maintenance or replacement of equipment.	
Decommissioning	• PV panels (12,100 panels) and supporting poles and mounts • Glass for panels (270 tonnes) • Silicon for wafers (40 tonnes) • Inverters / transformers / batteries • PV boxes, skids, scrap metal (860 tonnes) • Electrical cables	Taken offsite to appropriate recycling/disposal for PV panels.
	• Fencing • Storage containers (two 40-foot containers)	Removed from site and reused.

5 WASTE DISPOSAL FACILITIES

Tamworth Landfill is located at 123a Forest Road, Tamworth, approximately 19 minutes' drive (18.5 km) from the project site (see Figure 1). The site is open every day of the week between 8:00am and 4:45pm.

There is also a Kootingal Transfer Station located on New England Highway where garbage and recycling is collected in large bins and transported back to Tamworth for final disposal or recycling. This site is only suitable for small vehicles. Its hours of operation vary according to the day, as shown in Table 2.

Table 2 – Kootingal Transfer Station hours of operation

Day	Hours of Operation
Monday	CLOSED
Tuesday	9:00 – 12:00
Wednesday	CLOSED
Thursday	CLOSED
Friday	13:00 – 16:00
Saturday	13:00 – 16:00
Sunday	13:00 – 16:00

Paper and cardboard recycling is available at both of the sites above. Both sites also support recycling of whitegoods, scrap metals and unprocessed timber. Green waste can also be disposed of at Tamworth Landfill.

6 WASTE MANAGEMENT AND MINIMISATION

Waste management and minimisation for the project should be in accordance with the POEO Act.

The waste management hierarchy is an internationally and nationally accepted guide for waste management practices with the objective of achieving optimal waste management outcomes. This hierarchy promotes waste avoidance and reduction and encourages resource recovery and efficiency and specifies the preferred order of practices, ranked from most to least preferred. This hierarchy is shown in Figure 2 and described below:

- AVOID or REDUCE unnecessary resource consumption and waste generation.
- RE-USE waste resources without further manufacturing.
- RECYCLE waste resources to make the same or different products.
- RECOVER waste resources, including the recovery of energy.
- TREAT waste before disposal, including reducing the hazardous nature of waste.
- DISPOSE of waste only if no viable alternative.

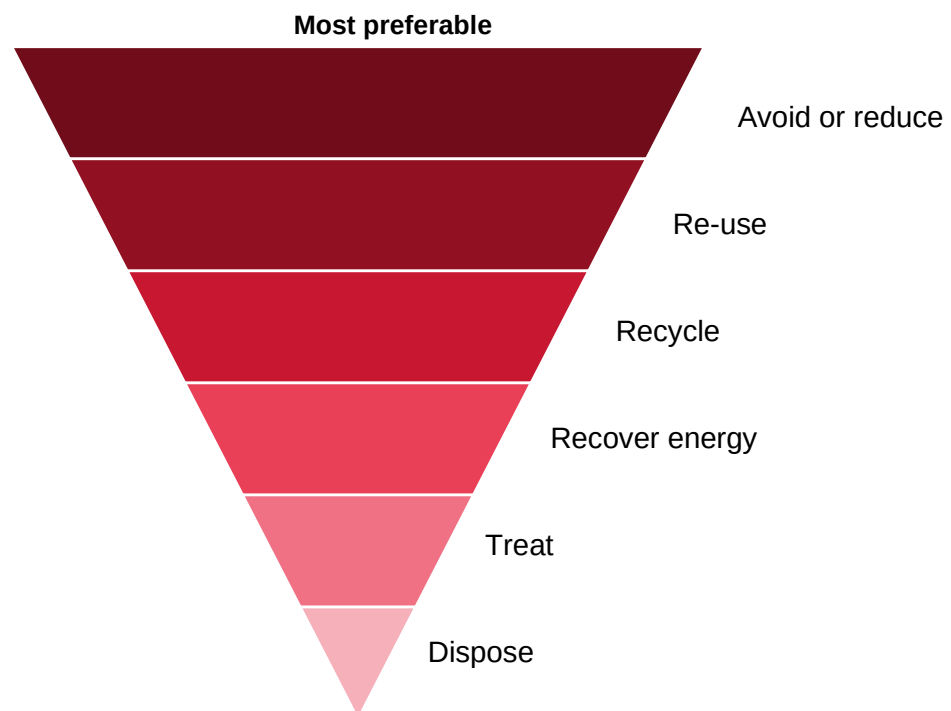


Figure 2 - Waste Management Hierarchy

6.1 Reduce

The project should aim to reduce waste where possible when purchasing goods for construction and during the operation phases. Inductions and staff education should include waste management and recycling procedures, particularly for the construction phase.

6.2 Resource Recovery (Reuse, Recycle, Recover)

If vegetation clearance is required during construction activities, the cleared vegetation should be re-used for mulch and soil erosion control where possible.

At the end of the 35 year life of the solar products the site will be decommissioned. Decommissioning should consider recycling where possible. Recycling of solar PV modules is becoming more common in Australia (Energy Matters, 2012 and Renew Economy, 2016).

There are companies who specialise in providing a drop off location or collection of modules. The decommissioned PV panels are then reclaimed and recycled into other products (Reclaim PV Recycling, 2018). The general steps in the recycling process done by specialist companies are:

- Remove aluminium frames, junction boxes and cables;
- Remove glue, recover glass, aluminium, solar cells and contacts;
- Separate out glass (crushed into small pieces) and other products for re-use in other new products; and
- Remove other materials for use in new models or other products.

6.3 Dispose

If no viable alternative exists for the waste product it will require disposal to a suitable waste facility. The waste should be separated during construction into different bins or skips for different waste streams (separate reusable and recyclable from non-reusable and non-recyclable waste).

The waste should be classified on site according to the EPA Waste Classification Guidelines and then stored and handled on site in accordance with its classification. All waste should be removed as soon as practicable and then sent to an appropriately licenced facility for disposal.

Waste should be classified and logged in a register and then tracked to ensure it reaches its destination offsite. The tracking process should include classification, a description of the waste, volume of the waste, date the waste is transported from site and the destination. An example of a waste tracking register is in Table 3.

If transported by a third party, the details of the company transporting the waste should also be recorded. The EPA have an online waste tracking system for hazardous waste. This should be used if disposal of hazardous waste is required (EPA, 2018).

Table 3 - Waste Register Example

Date	Description of Waste	Classification	Volume	Tracking	Transport Details	Destination
1 Dec 2018	Cardboard	General solid waste (non-putrescible)	1 tonne		Example transport company	Recycled at waste disposal location

6.4 Waste Management Plan

Prior to operation of the project, a Waste Management Plan (WMP) should be developed. This will build on what is proposed in this report and provide detailed procedures regarding management, minimisation, recycling, record keeping and tracking and disposal of waste.

The WMP should contain:

- Strategies to reduce waste during all project phases;
- Recycling, re-use and recovery strategies and opportunities;
- Classification of all waste streams;
- Tracking register and details;
- Recycling management onsite;
- Responsibilities for recycling, re-use and disposal; and
- Reporting and notification procedures if a waste incident occurs where there is a threat to the material harm of the environment.

7 LIFE CYCLE ANALYSIS

A Life Cycle Analysis (LCA), also called a Life Cycle Assessment, is an approach that considers all aspects of a project's resource use. It is an environmental accounting and management approach that considers all the aspects of resource use and environmental releases associated with a system from cradle to grave. The LCA assessment considers raw materials, material processing, manufacturing, operational/use phase, decommissioning and provides an estimate of energy and emissions based on the total life of the project (Wu et al, 2017).

Construction materials and energy used for solar panels includes purification of silicon, production of PV frames and cabling. The construction of each of these uses energy and creates waste products. Energy consumption and use of resources is greatest in the production of the PV panels and silicon (Alsema et al, 2006). The Department of Industry, Resources and Energy NSW (2016) states that during plant operation, PV modules emit no pollution, produce no greenhouse gases and use no finite fossil-fuel resources.

Müller, et al (2005) reviewed the environmental impacts of recycling processes for crystalline silicon modules. The findings indicated that energy consumption during the recycling process of PV panels can be substantial. However, overall the recycling solar components is worthwhile. This is mostly due to the potential reuse of recovered component in future projects.

For solar projects the LCA considers the total energy input and annual energy output of the project. This is termed the 'Energy Payback Time'. The energy payback time varies depending on the project's design and geographic location. For solar projects the general timeframe for energy payback is achieved in less than four years for projects with a 25-30 year operating period (Bhandari et al, 2015, Department of Industry, Resources and Energy NSW, 2016). Alsema et al (2006) found that PV panels had an energy payback of 1.5 – 2 years in southern Europe and 2.7 – 3.5 years for middle Europe. Due to the greater solar resource in Australia the energy payback for this project is expected to be at the lower end of these ranges.

The Fraunhofer Institute for Solar Energy Systems (2015) considered the ratio of energy produced by a solar PV compared to the energy used to create the module. It was determined that the PV panels would provide more than 10 x the amount of energy used to make the system.

8 SUMMARY

The project will generate the most waste during the construction and decommissioning phases. To comply with the NSW legislation and policies, the waste should be recycled or re-used where possible and only disposed of if no alternative is available.

Cardboard, scrap metal and wood from the construction phase can be recycled. Plastics and general waste will require disposal at the local waste facilities. Decommissioning of the project is likely to occur in 35 years' time. Technology for recycling of PV panels is likely to be more advanced and readily available. Options for recycling of PV panels should be reviewed as the project progresses.

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Water Assessment

Kootingal Solar Farm

July 2020

ENGINEERING | STRATEGY | ANALYTICS | CONSTRUCTION



DOCUMENT CONTROL

Report Title		Water Assessment – Kootingal Solar Farm			
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We were established in 2003 and operate out of offices in Canberra (Head Office), Sydney, North Coast NSW, Adelaide and Auckland, New Zealand. We are part of the international ITP Energised Group, one of the world's largest, most experienced and respected specialist engineering consultancies focussing on renewable energy, energy efficiency, and carbon markets. The Group has undertaken over 2,000 contracts in energy projects encompassing over 150 countries since it was formed in 1981.

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1 INTRODUCTION

1.1 Overview

This report, which provides a desktop water assessment to support the Development Application for the project, includes a:

- Desktop review of local hydrology and catchment and water quality data.
- Desktop review of surface and groundwater quality data.
- Desktop review of the flood risk potential against the Local Environmental Plan.
- Desktop impact assessment against NSW policies and referenced industry standards for solar arrays.
- Desktop management assessment with mitigation measures recommended for construction and operation.

1.2 Limitations of Assessment

The assessment is based on publicly available information and data and does not include a site inspection, sampling, or any additional hydrological and/or hydraulic modelling.

2 PROJECT DESCRIPTION

2.1 Solar Farm

ITP Development (ITP) is proposing to develop the Kootingal Solar Farm (also referred to as the Project), as described in the solar farm summary sheet for this proposal (see Table 1). The site is located approximately 1 kilometre west of the town of Kootingal and 17km north east of Tamworth, NSW (see Figure 1). Details of the layout are contained in the drawing KOO1C-G-210.

Table 1 - Site Information

Parameter	Description
Site name	Kootingal Solar Farm
Lot/DP(s)	1/328265 and 97/753841
Street address	"Roseamere", 1599 New England Highway, Kootingal
Council	Tamworth Regional Council
AC capacity	5 MW
DC capacity	6.4 MW
Project area	11 ha

ITP is proposing to construct a solar farm with a DC capacity of 6.4 MW and AC output of 5 MW and occupies 11 ha on an approximately 58.2 ha site that is currently used for grazing and cropping.

There are to be approximately 12,100 solar modules installed on around 140 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The spacing between each row is 6.25m. The hub height of each tracker is around 1.5m, with the peak of the modules reaching a height of approximately 2.75m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm and the array tracker details are shown in drawing KOO1C-G-210.

The solar farm will also include two 3 MW inverter stations. The stations are to be located within the array, mounted on a single 40-foot skid. Each of these inverter stations incorporates the high/medium voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing KOO1C-G-210.

The mounting system is constructed on piles that are driven into the ground. During construction, there is expected to be 50 personnel on site working from 7 am – 4 pm, Monday to Friday. The construction is anticipated to take approximately 3 months. Once operational

the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 – 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site can then be returned to the pre-development land use.

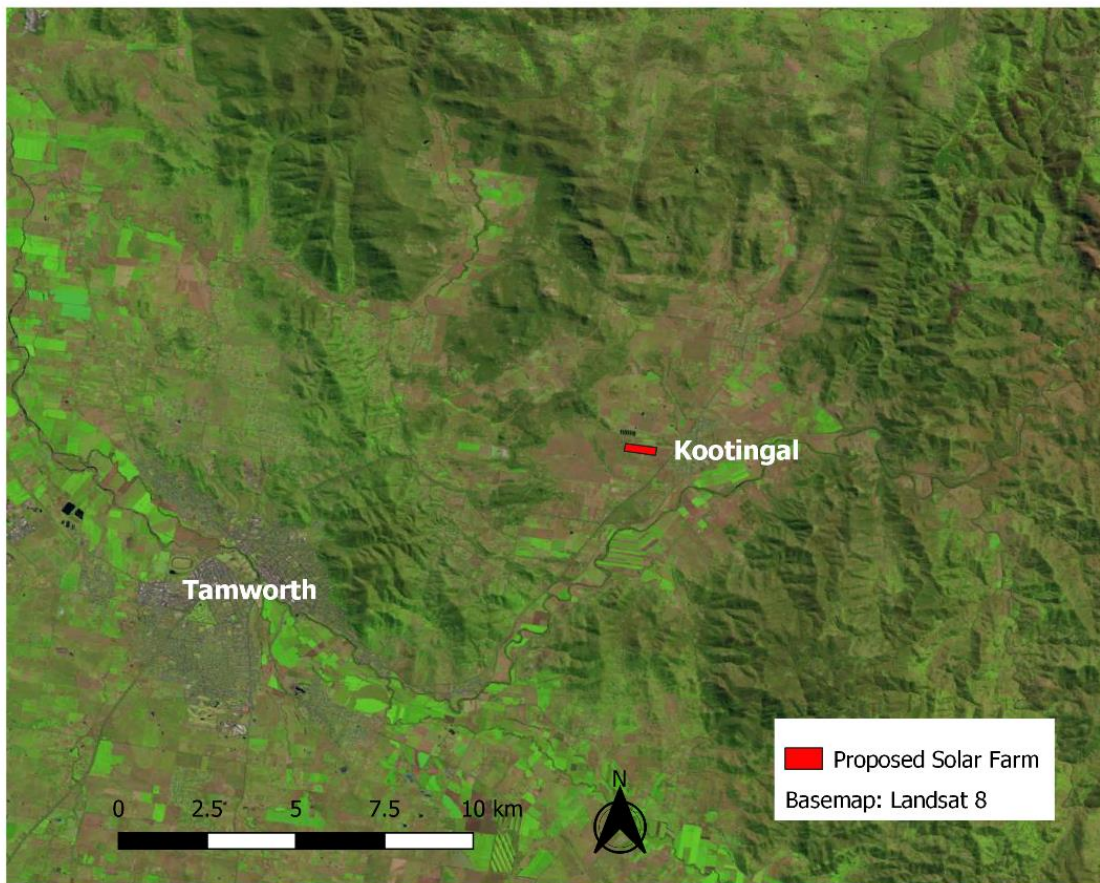


Figure 1 - Proposed solar farm site and surrounding area

2.2 Hydrology, climate and topographic conditions

The project area for the Kootingal Solar farm is within the Tamworth Regional Council Area in NSW.

Kootingal (436m AHD) is located in the eastern part of Namoi Water Resource Plan Area, with Tamworth being the nearest large town (404m AHD), approximately 11 kilometres to the southwest. The town of Kootingal is situated on the Cockburn River, one of multiple tributaries that feed into the Peel River which in turn flows in a westerly direction from steep ranges to its confluence with the Namoi River, approximately 40 kilometres downstream of Tamworth (Water NSW, 2019). The Peel River catchment covers approximately 11% of the Namoi Catchment with the Cockburn River being one of several narrow valleys within the upper reaches of the Peel before it broadens into wide alluvial floodplains below Tamworth (Green

et al., 2011). The Cockburn River rises in the Moonbi Range near Limbri, moving southwest Kootingal and Nemingha, where it meets the Peel River near Tamworth (ACF, 2018). The majority of the upper Namoi, including the Peel River Catchment, is used for agricultural purposes with cattle and sheep grazing being the dominant land use. The region is a significant producer of grain crops, both dryland and irrigated, with irrigation occupying a small area (about 3%) of the catchment. The Chaffey Dam constitutes the major storage in Tamworth area, with a current upgrade increasing capacity to capacity to 100 GL (MDBA, 2020).

3 LEGISLATIVE CONTEXT

NSW has a comprehensive legislative and policy framework for the management of floodplain risk and flood prone areas of the state with clear areas of responsibility, as outlined below in Figure 2.

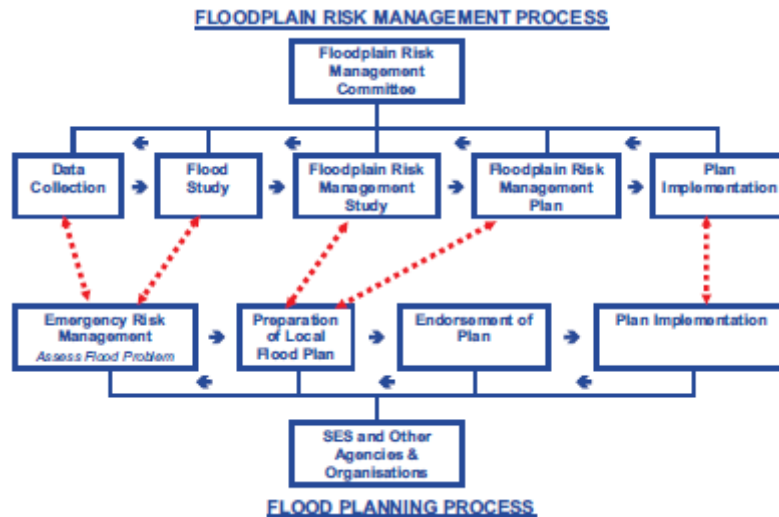


Figure 2 - Floodplain risk management and planning process

3.1 Local Government Act 1993

The Local Government Act provides the legal framework for the system of local governments of the state of NSW. Specific to this project is Section 733, which exempts councils from liability in relation to flood prone land under the provision that they have undertaken substantial assessments in accordance with the latest approval manual.

The 2005 gazetted Floodplain Development Manual is the current approved manual and supports section 733 and the NSW Government's Flood Prone Land Policy. Both the manual and the policy provide councils with the framework to implement processes, and sustainable strategies to manage the floodplain risks that specifically impact human occupation.

3.2 Environment Planning and Assessment Act 1979

This is an Act to instate an environmental planning system and assessment arrangement for NSW. In 2017, there were major amendments passed with a view to improving the planning system through simpler processes, improved strategic planning and community participation, in order to enable more balanced and transparent decision making. Section 3.43 makes provision for the preparation of development control plans by relevant authorities (outlined further in Section 3.4.1).

3.3 Water Management Act 2000

The Act offers sustainable and integrated management of the state's water sources for the benefit of both present and future generations. Water management principles are intended to

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guide decision-making under the Act in relation to floodplain management. They require the existing and future risk to human life and property, arising from occupation of the floodplain, to be minimised.

3.4 Tamworth Regional Environmental Plan (LEP) 2010

The Tamworth Regional Local Environmental Plan (LEP) 2010 (current version for 17 April 2020) aims to make local environmental planning provisions for land in the shire in accordance with the relevant standard environmental planning instrument. The regional area includes specific information for residents in the town of Kootingal.

The Plan provides the prohibited and permitted types of development within the local area. Some types of development are also regulated by specific state environmental planning policies. The Plan (Part 7.2) does provide specific management requirements for flood planning, which applies to land at or below the flood planning level (1 in 100 ARI plus 0.5m freeboard). It requires that development consent cannot be granted unless the proposed development is compatible with the flood hazard of the land, will not cause significantly adverse impacts to other developments, the environment and the community, and incorporates measures to manage risk to life. The site is shown in relation to the Tamworth Regional Local Environmental Plan 2010 Flood Planning Map for Kootingal ((see Figure 3). It can be seen that the site is not within the spatial extent of the nearest flood planning area (i.e. a 1:100 ARI (average recurrent interval) flood event plus 0.5 metres freeboard) within the town of Moonbi. A current flood risk map, showing the 100 year flood contour is not available for the town of Kootingal. The Tamworth Regional Council is currently undertaking a Flood Risk Management Study (Tamworth Council, 2020). However, figure 4 shows the site in relation to the January 1984 flooding event in Tamworth, one of the most significant flooding events in the town's history. While the estimated flood level mapping does not extend to the study site, it would seem that localised flooding within Kootingal is possible on either side of the Cockburn River in the event of a major flood. Given that the proposed site is located on a steep hill approximately 1.1 kilometres from the Cockburn River (see site topography in figure 6 below), it would seem that there is limited potential for substantial flooding of the area flooding from this direction.

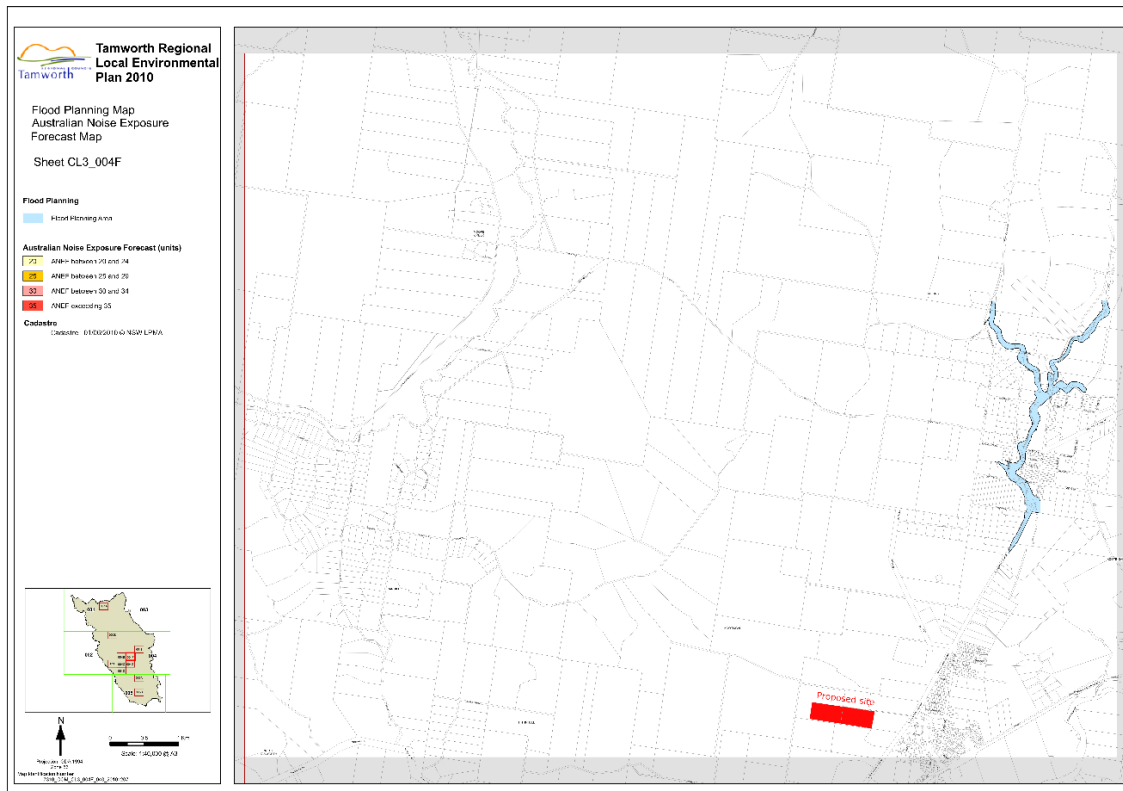
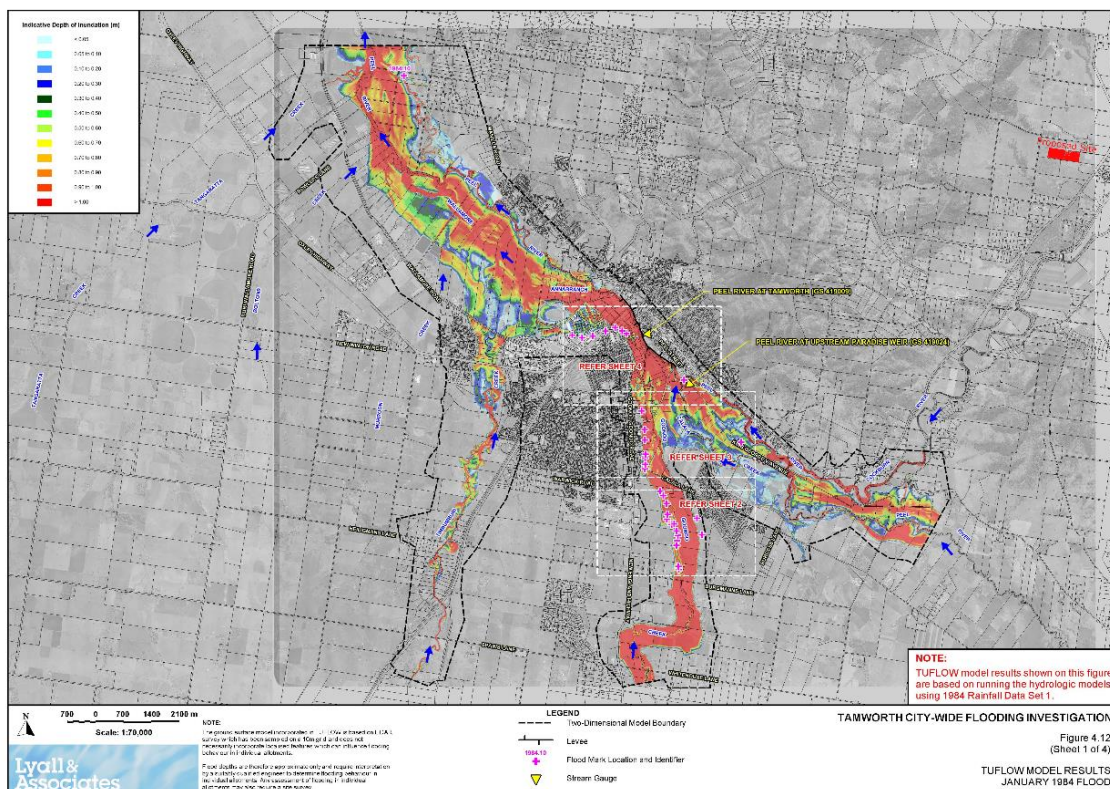


Figure 3 - Site in relation to the Flood Planning Map for Kootingal (source: NSW Legislation, 2010).



3.4.1 Tamworth Regional Development Control Plan 2010

The Tamworth Regional Council Development Control Plan (DCP) 2010 provides guidance for developments and the statutory planning controls of the Tamworth Regional Local Environmental Plan (LEP) 2010 (NSW Legislation, 2020). The guidance provides proponents assistance with criteria to address in development applications.

The guidance on flood protection states that the consent authority must be satisfied on a number of points regarding developments, including that the development:

- a. Is compatible with the flood hazard of the land, and
- b. is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and
- c. incorporates appropriate measures to manage risk to life from flood
- d. is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and
- e. is not likely to significantly adversely affect the environment or
- f. cause avoidable erosion, siltation, destruction of riparian
- g. vegetation or a reduction in the stability of river banks or watercourses,

Development Control Plans typically state that planning restrictions will apply to development on land below the ‘flood planning level’ of watercourses. The ‘flood planning level’ refers to the flood level established by the 1% Annual Exceedance Probability (AEP) flood (commonly referred to as the ‘1 in 100-year flood’) plus 0.5 metres freeboard” (NSW Legislation, 2012, page 44).

NSW local government DCPs also typically provide guidance on stormwater drainage systems for rural lots and large residential lots, which are relevant to the proposed solar farm site. Guidelines typically suggest that, where drainage easements over downstream properties is required, consent from the owners of the downstream properties is to be submitted with the development application. The Tamworth Regional DCP states that measures to control stormwater flow and water quality are required including “...must be designed to prevent stormwater damage to the built and natural environment and ensure acceptable levels of health, safety and amenity” (Tamworth Regional Council 2010, section 1.30).

3.4.2 Tamworth Regional Council Community Strategic Plan 2017-2027

The Tamworth Regional Council Community Strategic Plan 2017-2027 is planned and executed under key themes identified through extensive community consultation (Tamworth Regional Council, 2017). Key outcomes identified for the ten years of the plan include:

- **A Spirit of Community:** recognition that ‘spirit’ is the essence of the heart and soul of the region with key objectives focussed on maintaining and further developing active, healthy communities, developing the region’s heritage and culture and safety;

- **A prosperous region:** recognition that if ‘spirit’ is the essence of the heart and soul of our region, prosperity is our ‘lifeblood’. Key objectives are focussed a strong and diverse economic base, promoting the region as a place to live and work, quality education and development of Tamworth as the next major freight centre in regional NSW.
- **An accessible region:** recognition of the need to have sure that our communities have access to the services and facilities that make our region ‘liveable’.
- **A region for the future:** an emphasis on sustainability - acting and living now in a way that doesn’t risk the needs of the future with a key objective being to promote sustainable living to protect and support our environment, heritage and resources.
- **A region of progressive leadership:** recognition of the need for governance, leadership and good planning.

The only theme that specific mentions flood or water management aspects is a region for the future (Tamworth Regional Council, 2017: 22-23): “[Maintain] Sound asset management planning – [measured by] ... Condition of stormwater network” and “Better care of our rivers and waterways”. However, also implicit within the themes above, is the need for strategies that minimize the impact on the environment from development activities and to maintain and manage water quantity and quality.

3.5 State Environmental Planning Policy (Infrastructure) 2007

Part 3, Division 7 of the State Environmental Planning Policy (Infrastructure) 2007 relates to ‘Flood Mitigation Work’. This policy provides details on the types of works which may be required for land that is susceptible to flooding by the probable maximum flood event, also known as flood liable land. The policy states that consultation with the relevant council is required if the proposal will alter flood patterns other than to a minor extent, and their response must be taken into consideration.

The Project area is not within the mapped flood planning area under the Local Environmental Plan and does not require additional flood mitigation work.

3.6 Protection of the Environment Operations (POEO) Act 1997

The POEO Act aims to protect, restore and enhance the quality of the environment in NSW, while still having regard for the ecologically sustainable development.

With relevance to the site, the Act aims to reduce risks to human health and avoid degradation of the environment by promoting pollution prevention, through the reduction of materials used and advocating the re-use, recovery or recycling of materials. The Act contains the requirements for the management of water discharges and the offences that relate to pollution. Section 148 requires that any pollution incidents, or those that threaten material harm to the environment, must be notified to the relevant authority (e.g., NSW Environment Protection Authority).

3.7 Soil Conservation Act 1938

This Act makes provisions for the conservation of soil resources and mitigation of erosion. The Act allows the Minister for Primary Industries ¹ to issue soil conservation notices, declare areas to be sites of erosion hazard, proclaim works in catchment areas and outlines specific regulations regarding the Rural Assistance Act 1989.

Of general relevance to this project is the promotion of sustainable use and prevention of loss of soil resources from a site.

¹ Except Parts 2A, 3 and 4, and sections 15 and 30A insofar as they relate to Parts 2A, 3 and 4, jointly with the Minister for the Environment.

4 CATCHMENT AND FLOOD HISTORY

The Project is located in the Tamworth Regional Council, to the northwest of the town of Kootingal. According to spatial data from the Australian Hydrological Geospatial Fabric (Geofabric), the proposed facility is located within a large sub-catchment that includes part of the Cockburn and Peel Rivers (see Figure 5 below). The project site is within a large valley characterised steep to moderate hillslopes, with most of the surrounding area being between 410-715m contour values (Figure 6). The centre of the site has an elevation of 475m (AHD), with the nearest part of the Cockburn River having an elevation of 415m (AHD) ². The land is mostly cleared of native vegetation and is currently used for farming.

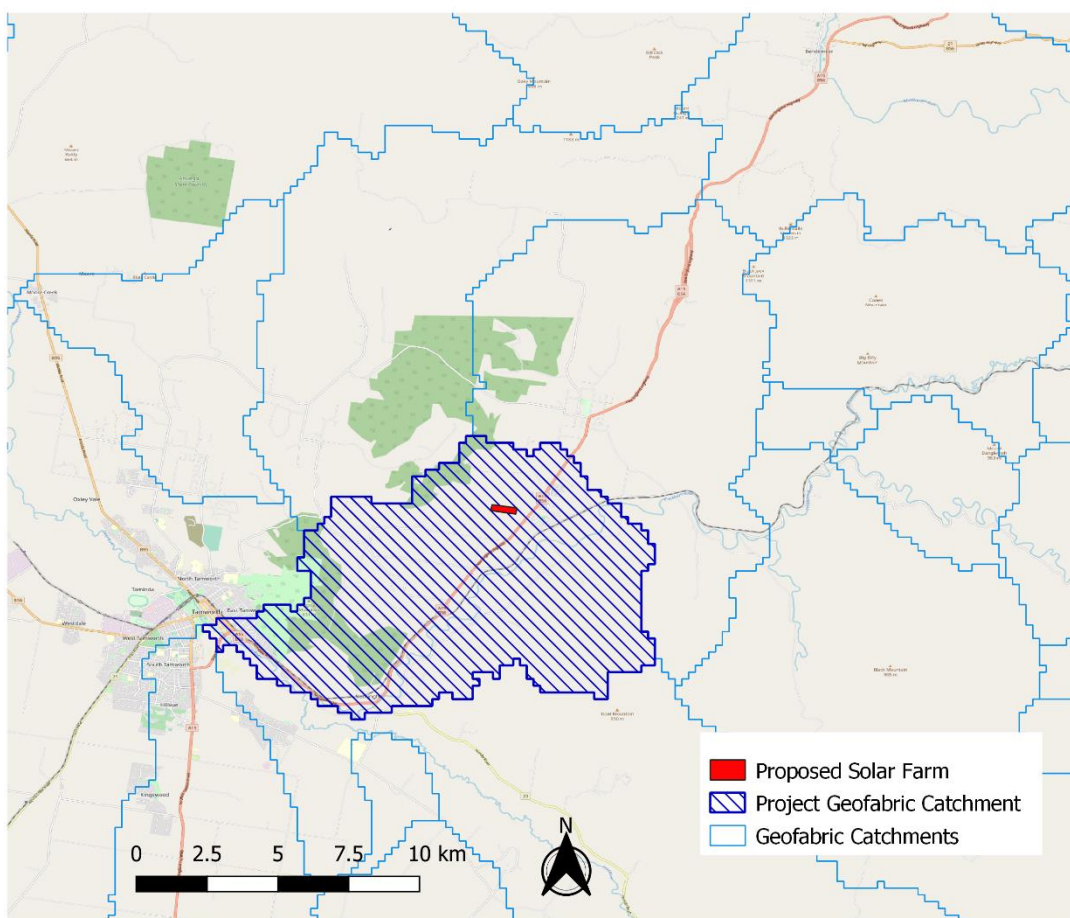


Figure 5 - Catchment of the project area identified in Geofabric

² Elevation values sourced from ELVIS - Elevation and Depth - Foundation Spatial Data (locations: -31.05242 ° / 151.03908 ° and -31.06489 ° / 151.05202 °)

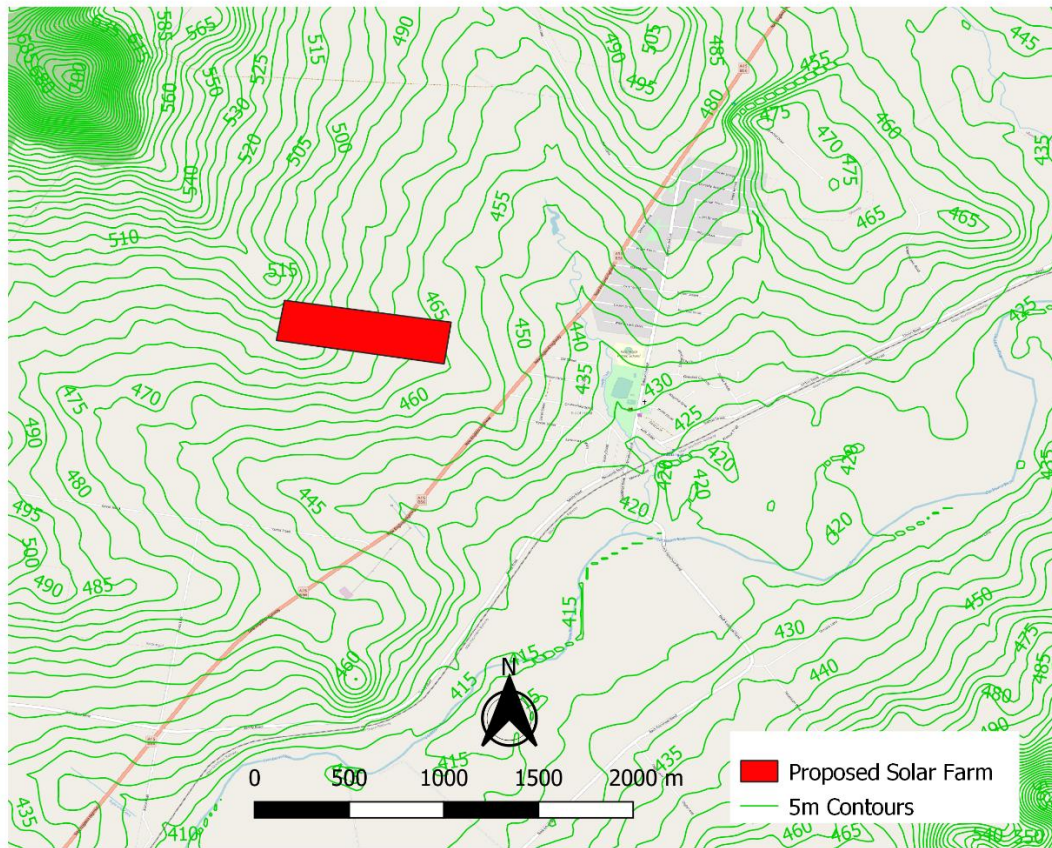


Figure 6 - Site topography

4.1 Tamworth city wide flooding investigation (2019)

Lyll and Associates (2019) published an in-depth flooding investigation at the city-wide scale for Tamworth. While this doesn't cover the area of Kootingal (there are no currently available flood plain risk studies that do), key elements of the study are pertinent. The report notes that, historically, Tamworth has been subject to two major floods in 1864 and 1910, prior to the time when water level records were kept. Since 1925, there were been major flooding events in 1955, 1962, 1971, 1974, 1976, 1984, 2000 and 2008. The water level in the Peel River the 1955 flood events reached 7.16m. The study site in relation to the most extensive TUFLOW Modelling which estimates indicative depth of inundation (m) is shown in figure 4. The Tamworth City Council as adopted a design flood height of 7.662 meters (1% AEP) as part of the Tamworth regional local flood plan. (NSW SES, 2013)

Figures 3 and 4 (above – Section 3.4) provide an indication of the location of the project site in relation to flood planning levels. These maps indicate that the project site is unlikely to flood from the Cockburn River in the direction of Kootingal.

5 AVAILABLE DATA

Climatic data and water quality and quantity monitoring information is available in the region as outlined in the following sections.

5.1 Rainfall for selected stations

The Bureau of Meteorology (BOM, 2020) has a station at the Mulla Crossing (Cockburn River - station number 055321). Table 2 outlines the average annual and maximum daily, monthly and annual rainfall for the Mulla Crossing (Cockburn River) station another selected station (i.e., station number 055160 - Nemingha (Cressfield)). Average monthly values for these rainfall stations are provided in Table 3.

Table 2 - Rainfall

Station Number	Station Name	Period of Record	Rainfall (mm)			
			Average Annual	Highest Annual	Maximum Daily	Highest Monthly
055321	Mulla Crossing (Cockburn River)	1936- 2020	670.8	933.0	99.4	193.2
055160	Nemingha (Cressfield)	1958 - 2020	705.5	950.7	139.42	281.2

Table 3 - Average Monthly Rainfall

Station Number	Rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
055321	65.0	77.3	53.4	27.4	15.1	46.2	43.1	26.6	33.7	48.2	84.6	95.9
055160	67.0	59.4	35.1	28.4	34.8	35.4	43.3	40.7	43.7	66.0	77.3	90.2

Flood-producing weather systems across the region include inland troughs, cold fronts, and thunderstorms. Consequently, each rainfall event is a function of the prevailing meteorological conditions. Therefore, the rainfall data provides useful information about expected seasonal rainfall in the area.

5.2 Streamflow

There is a government surface water monitoring site located on the Cockburn River at Kootingal, 1.6 km of the site. Streamflow records (Table 4) for this site are available for this location from the WaterNSW Real-time portal. Another water monitoring site near Kootingal (419114) is listed as having only watercourse level and discharge data.

Table 4 - Stream Gauging Stations

Station Number	Station Name	Available/Relevant Data	Distance from project area
419099	Cockburn @ Kootingal	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	1.6 km southeast
419114	Cockburn D/S Weir	Watercourse Level, Watercourse Discharge	1.5 km southeast

Generally, data from the available stream gauges do not provide specific information on local site flooding but are more useful in the context of assessing major regional flooding events that may impact on-site access. Information is publicly available from WaterNSW Real-time data portal and could be incorporated into site management plans.

5.3 Groundwater and Hydrogeological Conditions

Kootingal falls within the Namoi Surface Water Resource Plan Area (SWRPA) as shown in Figure 7 below. The area downriver from Kootingal contains a number of high to very high ecological value instream areas between Boggabri and Piliga (NSWDPI, 2019: 30). The geology of the Namoi SWRPA is characterised by young volcanics and extensive alluvial floodplains which have very productive heavy black and grey clays that are sought after for farming and irrigation (NSWDPI, 2019b: 8). Groundwater is contained in the unconsolidated sediments along the Namoi River and its major tributaries and is managed in as two resources – Upper and Lower Namoi Groundwater Sources. The alluvium of the Namoi River is by far the most important in the state in terms of groundwater use, providing water for stock use, domestic supplies, irrigation, industry and town water supplies (NSWDPI, 2019b: 17). A Water Sharing Plan for the Peel Regulated, Unregulated, Alluvial and Fractured Rock Water Sources exists, recognising that the water resources of the Peel Valley are linked, and would therefore benefit from being managed collectively (NSWDPI, 2019b: 26; also see figure 9 below). Groundwater quality for the SWRPA varies (see figure 8 below), with the western part of the catchment being mostly saline (7,000 – 14,000 TDS mg/L). The eastern part of the catchment in the Tamworth and Kootingal area is moderate to fresh (0 – 500 TDS mg/L). There are groundwater dependent ecosystems along the Peel and Namoi Rivers of moderate to high potential (see Figure 10 below). The project catchment site does not fall within areas groundwater vulnerability of according to Environmental Planning Instrument (EPI) data (see Figure 11 and NSW Government, 2020).

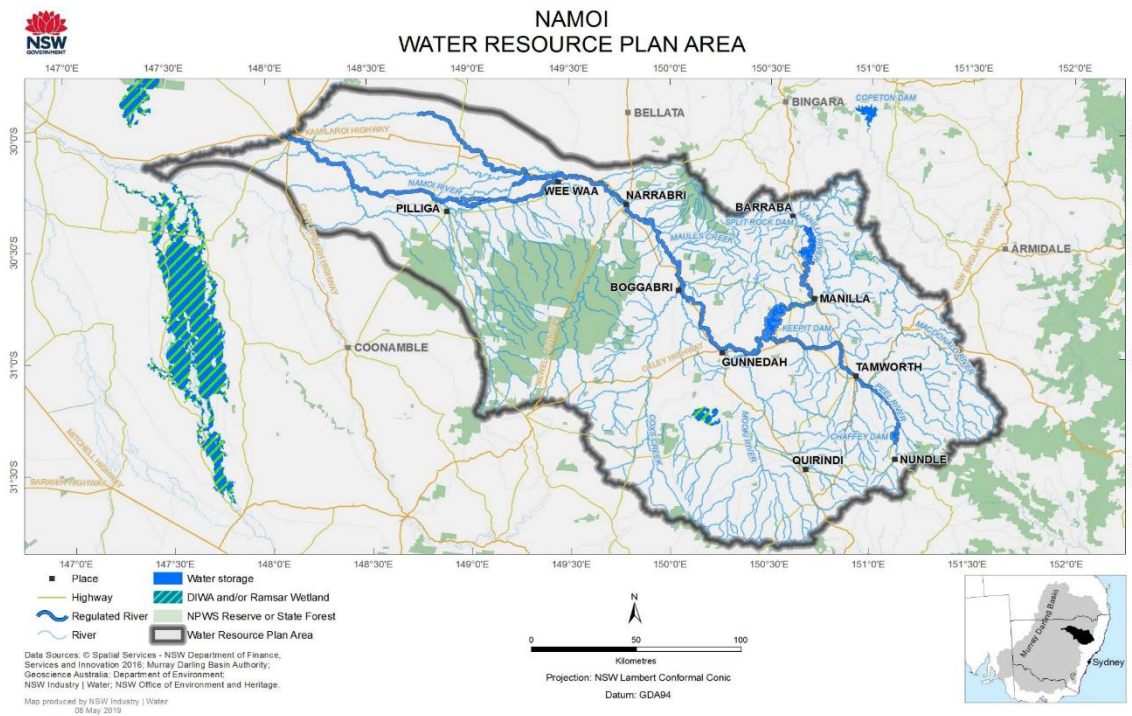


Figure 7 - The location of the site within the Namoi SWRPA (source: NSW DPI, 2019: 10)

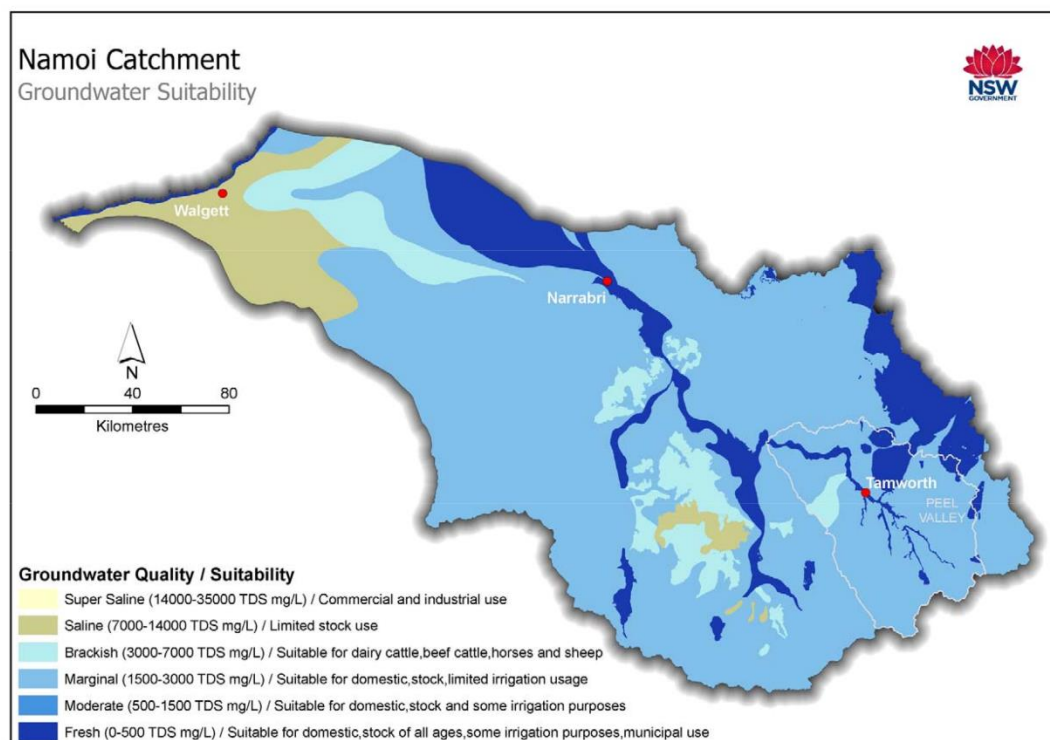


Figure 8 - Groundwater quality and suitability in the Namoi catchment (source: NSW DPI, 2019b: 19)

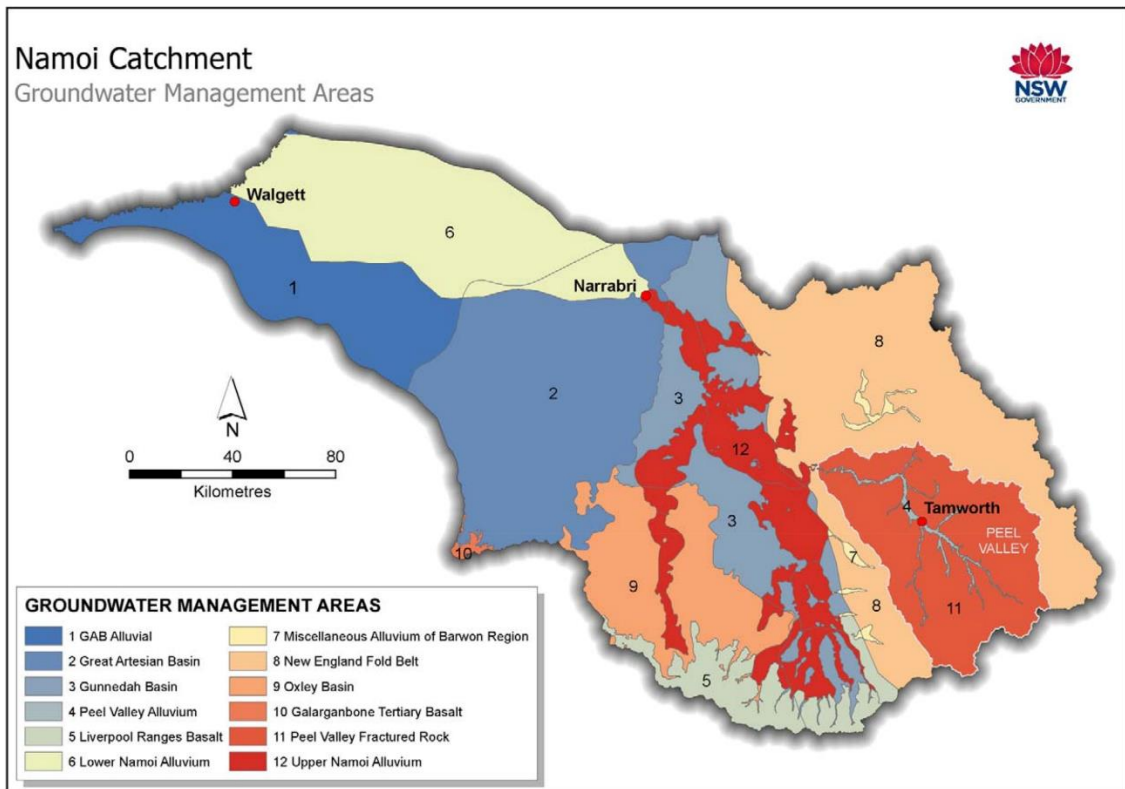


Figure 9 - Groundwater management areas for the Namoi catchments (source NSWDP, 2019b: 18)

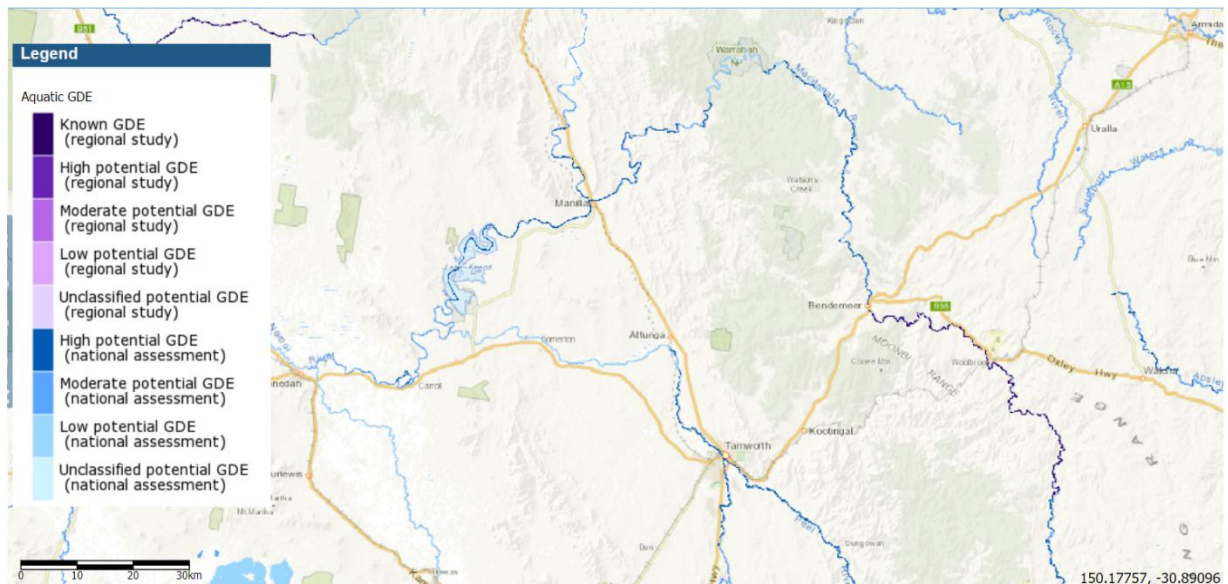


Figure 10 - Groundwater dependent ecosystems near Kootingal (source: BOM, 2020b)

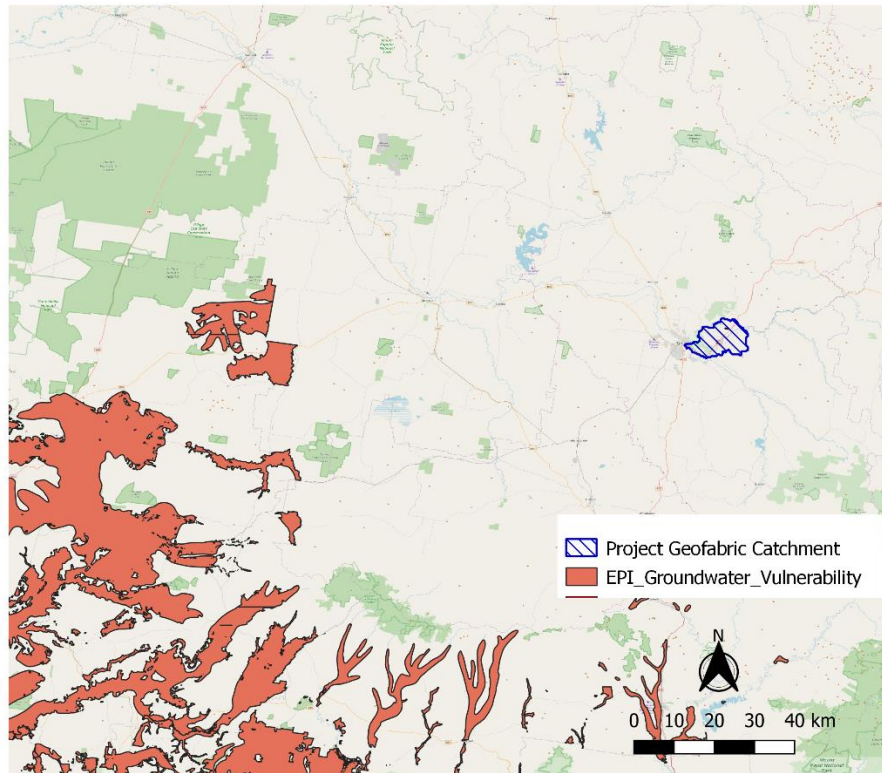


Figure 11 - The Project Geofabric Catchment and EPI Groundwater vulnerability areas

5.4 Surface Water and Riparian Conditions

A surface water sharing plan is in place for the Peel River catchment which includes surface and ground water. NSW DPI (2019b) summarizes key characteristics of surface flow characteristics for the Namoi and Peel River catchments:

- The Namoi River flows in a westerly direction from its headwaters in the Great Dividing Range. Its main tributary, the Peel River, joins the Namoi near Gunnedah;
- The Peel is regulated by Chaffey Dam which provides water for irrigation as well as supplementing the water supply for the city of Tamworth;
- The Cockburn River is one of the five unregulated water sources in the Peel River water sharing plan;
- The aquatic and terrestrial environments of the Namoi catchment provide habitat for a large number of threatened species and ecological communities that are protected under the Threatened Species Conservation Act 1995;
- There are 28 threatened plant species, with 11 of these being listed as endangered. There are also 66 threatened animal species found within the catchment, including four species of amphibians, nine bats, 37 birds, 11 mammals and five reptiles.
- Four aquatic species that previously occurred within the Namoi catchment are listed as threatened

- under the NSW Fisheries Management Act 1994. These are the river snail, silver perch, purple spotted gudgeon, and the olive perchlet,

The Namoi Unregulated Rivers Extraction Management units have designations for alluvium management zones, including one along the Cockburn River near Kootingale (see Figure 12 below). These zones recognize the high connectivity between alluvial management zones and their corresponding surface water sources and should have the same accounting rules as they are managed as connected resources (NSW Office of Water, 2012: 133).

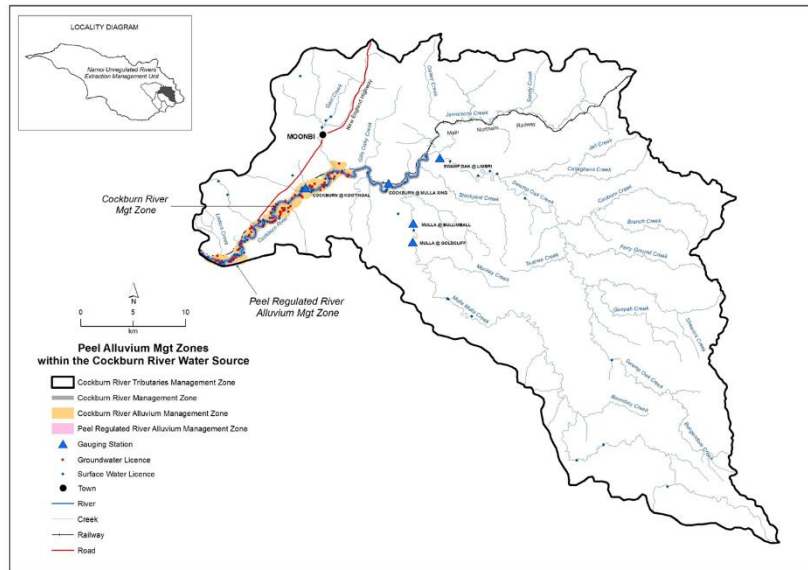


Figure 12 – Peel River Alluvial Management Zone within the Cockburn River (source: NSW Office of Water, 2012: 92) Potential Impacts

The proposed site activity is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby farming districts.

Based on the current available information, potential adverse surface water-related impacts to the site include:

- Site accessibility and inundation.
- Managing downstream sedimentation.

As there will be no extraction of groundwater or interference with the groundwater table during project activities, potential for impacts have not been considered further.

5.5 Flooding

Flood planning maps, modelled flood heights for the Tamworth city area and the topography in the immediate vicinity (see figures 3, 4 and 6 above) indicate that the of the project site is at low risk of flooding from the direction Kootingale and the Cockburn River. Localized drainage patterns at site indicate that there is potential for overland flow during rainfall. The water will flow in a south-easterly direction towards the Cockburn River.

5.6 Water quality and erosion

The project has the potential to alter existing water quality conditions within the site. The impervious area of solar facilities is typically only marginally increased owing to associated hardstand and building areas. However, the panels may impact the nature of vegetation/grass coverage on the site, which has the potential to increase surface runoff and peak discharge. Increased flow concentration off the panels also has the potential to erode soil at the base of solar panels (Cook & McCuen, 2013).

Furthermore, as the site has been historically used for farming there is very little natural ground cover vegetation. The eSPADE resource (NSWDPIE, 2020), provides a Soils Profile Report (id: 1003613) for a site approximately 2.3 kilometres to the east of the proposed solar site (see figure 14 and table 5 below). Site 1003613 indicates a soil type that is moist with Basic Lithic Bleached-Leptic Tenosol (ASC), Earthy Sand (GSG) of sand loam texture. The site is characterized by native pasture. There is the potential that the proposed solar site runoff will contain sediments and increase turbidity or other water quality parameters in downstream water ways.

Table 5 - Site details for eSPADE site 1003613

SOIL DESCRIPTION

Layer 0

0.00 - 0.00 m

Layer 1 Horizon: A1

0.00 - 0.20 m

Texture: sandy loam
 Colour: colour not recorded with no recorded mottles
 Structure: massive (fabric is earthy)
 Soil fauna: Activity is nil
 Cracks/Macropores: Cracks are nil, macropores are nil
 Moisture/Consistence: moderately moist,
 Field chemical tests: Field pH is 6.0 (Raupach),

Layer 2 Horizon: A2e (conspicuously bleached)

0.20 - 0.60 m

Texture: clayey sand
 Colour: colour not recorded with no recorded mottles
 Structure: massive (fabric is earthy)
 Soil fauna: Activity is nil
 Cracks/Macropores: Cracks are nil, macropores are nil
 Moisture/Consistence: moderately moist,
 Field chemical tests: Field pH is 6.5 (Raupach),

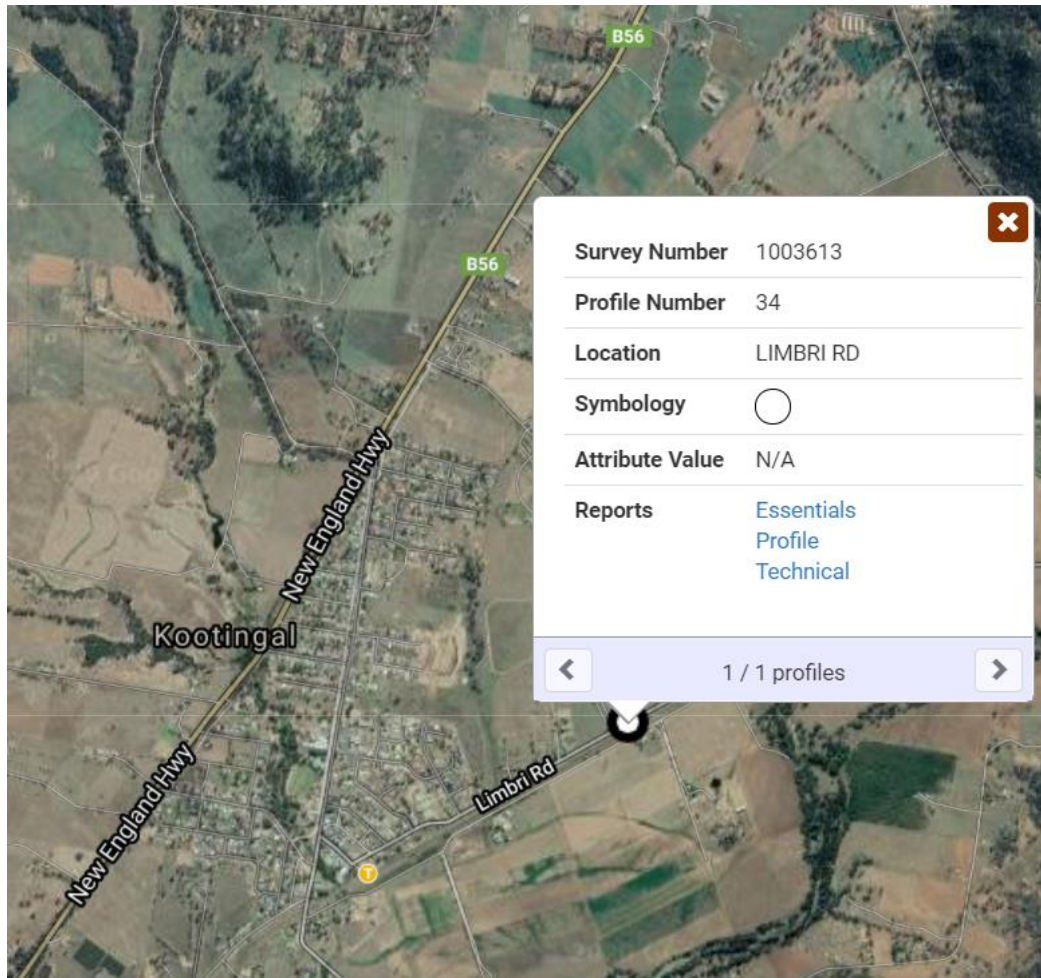


Figure 13 - The location of the eSPADE site 1003613 (source: espade.environment.nsw.gov.au © State of NSW and Office of Environment and Heritage 2020)

6 PROPOSED MITIGATION MEASURES

6.1 Site accessibility and inundation

The site accessibility and potential for inundation issues may be managed in the project's risk management register(s) owing to the regional nature of the events and the potential to impact whole of site works. There should be procedures in place to halt construction during heavy rainfall to reduce impacts to the project construction and to increase sedimentation downstream.

6.2 Downstream sedimentation

Impacts associated with erosion and sedimentation resulting from construction activities can be minimised by undertaking works in accordance with provisions of the NSW government's best practice sediment and erosion control series, Managing Urban Stormwater: Soils and Construction (DECC, 2008).

Proposed mitigation measures associated with managing downstream actionable nuisance (sedimentation) are outlined in Table 6.

Table 6 – Proposed Mitigation Measures

Stage	Measure	Activities/Approach
Design	Site drainage and water quality controls	Design Basis • Undertake hydrological assessment of the site's catchment in accordance with relevant methods outlined in Australian Rainfall and Runoff. • Determine sediment management targets and drainage control standards in accordance with Managing Urban Stormwater: Soils and Construction Vol 1 (Blue Book) (DECC, 2008). • Develop a site erosion and sediment control plan in accordance with the Blue Book. • Develop site drainage design incorporating detention basins and sedimentation management structures where relevant. • Permanent site drainage should coincide with temporary arrangements where possible.
Construction and/or Demolition	Site drainage and water quality controls	General site works: • Catch drains to be located downslope of any proposed road works. • Install location appropriate sediment fences or other applicable control measures, depending on whether the feature is upstream or downstream of a disturbed part of the site or will need to be trafficable.

		• All stormwater collection points need to have appropriate sedimentation and erosion controls. • Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. • Vibration grids or wash bays at all construction exits. • Level spreaders at locations where concentrated flow is discharged offsite to ensure sheet flow-like conditions are maintained. • Flat land erosion control options include erosion control blankets, gravelling, mulching, soil binder, turfing and revegetation.
Construction and/or Demolition	Stormwater point source control	In the event of concrete works: • Do not undertake works if chance of heavy rain. • Store rinsate³ water, if applicable, separately to other water on site and dispose of offsite as appropriate. • Block on site drains in the area of the works and remove any contaminated runoff. In the event that dewatering practices are required: • Pump hose intakes for withdrawing water from excavations will be elevated to minimise sediment pumping and directed to a containment area for settling prior to discharge. • Limit direct discharge offsite (consistent with the design requirements for sediment pond discharge). • Stormwater collected on site should be reused where possible. Controls should be inspected and maintained on a regular basis. All water released from sediment basins should be clear or disposed of offsite by vehicle. • Material and waste storage areas should be designed and operated to minimise interaction with surface waters. • Vehicle washdown areas should be located away from water courses.

³ A dilute solution of chemical resulting from washing the container and equipment with water, as defined by NSW EPA accessed 20 December 2018 <https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/authorised-officers/glossary#r>
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