

## Appendix Seven – Acoustic Assessment

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Tetris Energy  
Hamilton Solar Project  
Noise Impact Report

AC01

Final | 23 September 2021

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It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 278118-01




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# 1 Introduction

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Tetris Energy are seeking Planning Permit for the operation of a 4.99 MW Solar plant with battery energy storage located adjacent to Monivae Subdivision Road, Hamilton, Victoria but addressed as Burgins Road, Hamilton, Victoria (the ‘Subject Site’).

Arup Australia Pty Ltd (Arup) has been instructed by Tetris Energy to prepare a noise impact report suitable for submission to the Responsible Authority. Arup has considered the following documents:

- *Solar Energy Facilities Design and Development Guideline.*
- *Technical Guide: Measuring and Analysing Industry Noise and Music (EPA Publication 1997)*
- *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (EPA publication 1826.4)*

A desktop assessment of the noise impacts from the proposed development to nearest noise sensitive receivers has been conducted. This assessment has been based on manufacturer’s noise levels, Arup’s noise database, and noise calculations and predictions.

Acoustic terminology used throughout this report is provided in Appendix A.

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## 2 Site Description

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### 2.1 Site Surroundings

The Subject Site is currently undeveloped farm land addressed as Burgins Road, Hamilton, Victoria.

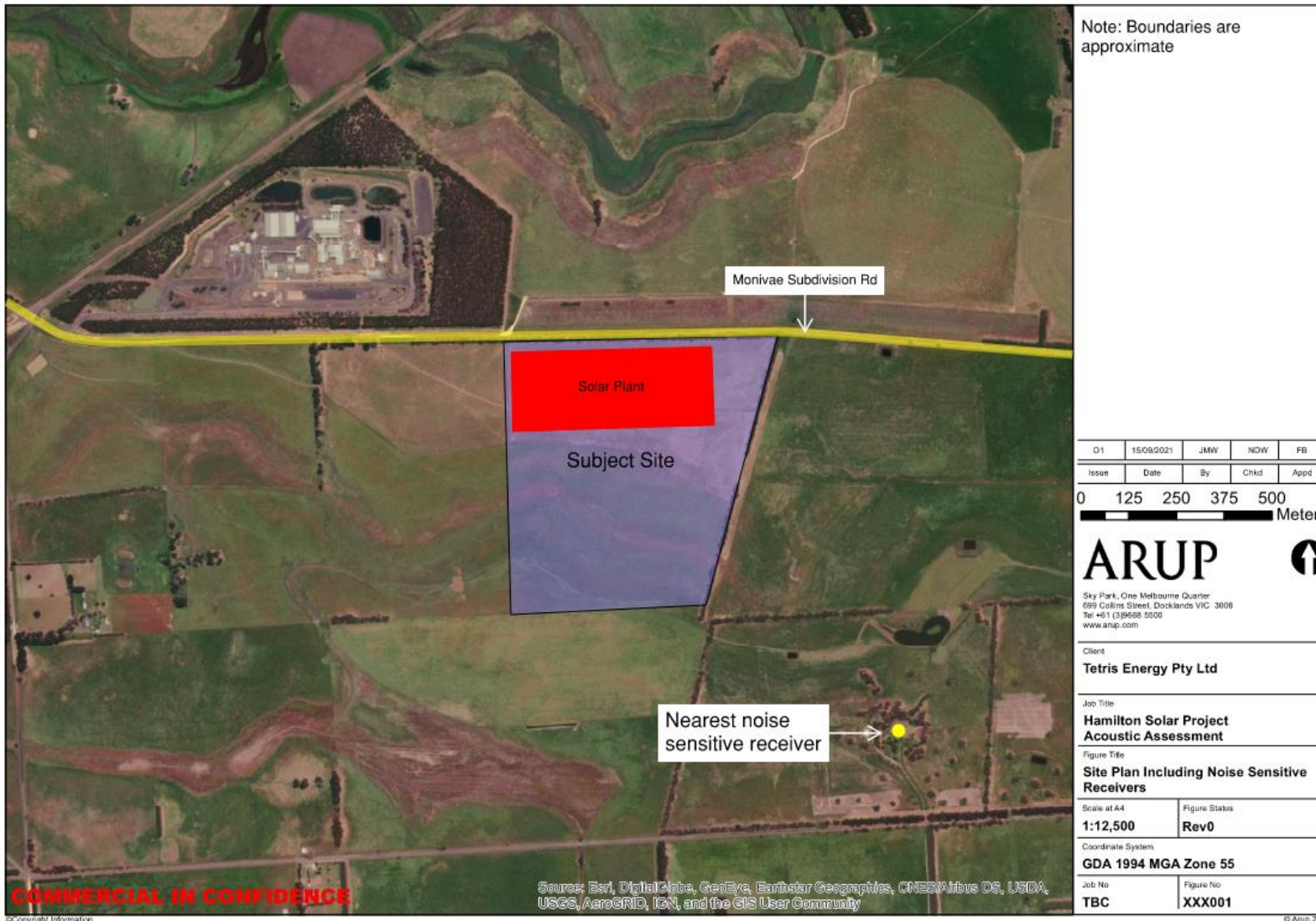
The Subject Site is zoned Farming Zone (FZ). It is bounded by:

- **To the north:** Monivae Subdivision Road with Public Use Zone (PUZ1) beyond. The nearest identified residential receiver to the north is approximately 1.7km north east of the Subject Site. Iluka Hamilton mineral separation plant, a mineral sands processing facility, is located approximately 650 m north-west of the Subject Site.
- **To the south:** Farming Zone (FZ) and Loudon Youngs Road beyond. The nearest identified residential receiver to the south is approximately 960 m south east of the Subject Site. This is the nearest identified receiver (92 Loudon Youngs Road).
- **To the east:** Farming Zone (FZ) and Hamilton-Port Fairy Road beyond. The nearest identified residential receiver to the east is approximately 1 km east of the Subject Site.
- **To the west:** Farming Zone (FZ) and Burgins Road beyond. The nearest identified residential receiver to the west is approx. 1.4 km South West of the Subject Site.

A planning map of the area surrounding the Subject Site is presented in Appendix B. The layout of the site and the location of nearby noise-sensitive receivers are shown in Figure 1.

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Figure 1: Subject Site plan

## 2.2 Site Description

A 4.95 MW solar energy plant is proposed to be installed at the Subject Site. Equipment specification for the plant is presented in Section 5. The solar farm is approximately 10.7 ha (10,700 m<sup>2</sup>).

## 2.3 Operations

The Subject Site is proposed to operate both during and after daylight hours, due to the battery storage. Noise will be assessed for the most sensitive night-time period.

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## 3 Relevant Legislation

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### 3.1 Noise Legislation & Regulation

On July 1, 2021 the new environmental protection (EP) legislation, the *Environment Protection Act 2017* (the Act) as amended by the *Environment Protection Amendment Act 2018*, was commenced. This new Act has superseded the previous *Environment Protection Act 1970*.

The centrepiece of the new EP legislation is the general environmental duty (GED). The GED requires Victorians to understand and reduce the risk of harm to human health and the environment from pollution and waste (including noise) resulting from their actions. Duty holders (in this instance, the Owner) need to comply with the general environmental duty (GED) under Section 25 of the *Environment Protection Act 2017* (the Act).

The Act introduces the concept of ‘unreasonable noise’, *Section 166 – Unreasonable noise*, to provide a legislative control for any noise emitted from a place or premises.

Part 5.3 – Noise of the *Environment Protection Regulations 2020* (the Regulations) prescribes situations which constitute ‘unreasonable noise’ from residential, commercial, industrial and trade premises, entertainment venues and outdoor entertainment events. The objective of the Regulations is to further the purpose of and give effect to the Act.

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## 3.2 Criteria

The relevant noise criteria include:

- *Solar Energy Facilities Design and Development Guideline.*
- Noise levels emanating from the Subject Site must comply with the noise limits calculated using the Rural area method defined in the Regulations.

The *Solar Energy Facilities Design and Development Guideline* states that:

*“A facility should keep its noise impacts at or below the levels in EPA Victoria’s Noise from Industry in Regional Victoria guideline (NIRV).*

NIRV has been superseded by the new EPA Regulations, however the method for calculating noise limits remains effectively unchanged. Compliance with the Regulations is consistent with NIRV compliance.

### 3.2.1 Rural Area Method

Outside of metropolitan and Major Urban Areas, noise emissions from commercial, industrial and trade (CIT) premises is governed by the Regulations, and noise limits are to be calculated using the ‘rural method’. The Regulations supersede the *Noise from Industry in Regional Victoria (NIRV)* Publication 1411.

Both the Subject Site and the nearest residential property are located outside any metropolitan or Major Urban Area, as such the project is assessed in accordance with the rural method.

Applicable time periods from the Noise Regulations are presented in Table 1.

Table 1: Operating time periods

Period	Day of week	Time period
Day	Monday – Saturday	0700-1800hrs
Evening	Monday – Saturday	1800-2200hrs
	Sunday, Public Holidays	0700-2200hrs
Night	Monday – Sunday	2200-0700hrs

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### 3.2.2 Cumulative Noise Levels

The Noise Limits established for a Subject Site apply to all combined industrial noise at the receiver, that is, it is not a single site’s emission limit.

Clause 3.3.1 in the *Technical Guide: Measuring and Analysing Industry Noise and Music (EPA Publication 1997)* outlines guidance on *Noise Sharing*, where the cumulative noise contribution from multiple noise emitters must be taken into consideration and shared equally. In effect this means that when there are multiple significant noise sources, that the emission limits for each site are reduced, so that when combined they do not exceed the noise limit.

Given the very low noise levels predicted at the nearby receivers due to the proposed facility and the significant distances from nearby receivers to other potential noise emitting sites, it is predicted that the cumulative noise levels will be below the noise limits.

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## 4 Project Noise Criteria

The operational noise limits determined for the night-time period at the most critical identified residential properties are presented in Table 2. Note that only the night-time noise limits are presented. Compliance with the most onerous night-time noise levels demonstrates compliance with the noise limits during other time periods.

Noise limits have been determined using the baseline Farming Zone (FZ) levels from the Rural method of the Noise Protocol.

Table 2: Noise limits at most sensitive residential properties during the night-period, dB re 20 $\mu$ Pa.

Time Period	Receiver Address	Noise Limit, $L_{eq}$ dB(A)
Night	92 Louden Youngs Road	36

To comply with the Regulations, relevant noise emissions due to commercial, industry and/ or trade operations within the Subject Site must not exceed the noise limits detailed in the Table 2 at the residential property. Compliance at the nearest sensitive receiver indicates compliance at all other receivers.

It is our understanding that, for control of noise from commercial, industrial and trade premise compliance with the Regulations and Noise Protocol does not guarantee compliance with the GED.

A noise emission risk assessment and consideration of practicable elimination, mitigation and operational controls will need to be undertaken by the duty holder.

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## 5 Noise Assessment

The final equipment selection of the inverters is still being finalised. As such Arup has assessed both options, as described below.

The following noise sources have been assessed:

- A centralised inverter/transformer unit (Sungrow SG4950HV MV inverter/transformer) OR 28 string inverters (ABB PVS-175TL).
- Battery energy storage system (BESS) (3 x Tesla Megapack).
- Tracking solar panel motors (approximately 200 NEXTracker motor units).
- ABB Transformer.

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Noise levels of the proposed plant equipment are provided in Table 3

Table 3: Noise levels of proposed plant

Equipment	L <sub>w</sub> dB(A)	Predicted Sound Power Level, dB re 20 µPa Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Combined Inverter/transformer (each)	89	83	87	93	86	82	78	70	69
String Inverter (each)	73	67	71	77	70	66	62	54	53
BESS (each)	83	88	90	85	80	77	72	65	68
Tracker motors (each)	57	44	47	49	52	52	51	46	38
ABB Transformer	73	76	78	73	73	67	62	57	50

### 5.1 Noise to nearest affected residential properties

Operational noise to the nearest affected residential properties has been considered in accordance with the criteria presented in Section 3.2.

A 2 dB(A) penalty has been applied to account for any tonality present in the noise from the operation of the transformer and/or inverter.

#### 5.1.1 Predicted Noise Levels

The predicted noise levels at the nearest affected residential receivers with the solar farm operating at full capacity are presented in Table 4.

Table 4: Predicted noise levels

Time Period	Receiver Address	Noise Limit, L <sub>eq</sub> dB(A)	Predicted Noise Level dB(A)	Complies?
Night	92 Louden Youngs Road	36	<20	✓

Arup's assessment demonstrates that operational noise from the Subject Site is predicted to comply with the noise limits at the nearest affected residential properties. Note that the above noise prediction includes the assessment of both inverter options.

Compliance with the night-time noise-limits demonstrates compliance with the daytime and evening time noise limits. While operating at full capacity the solar farm is expected to be compliant with noise limits for all time periods.

## 5.2 Discussion

It is assumed that there is no significant difference in noise emissions between the day, evening, and night periods. Note that the predicted noise levels have been based on plant noise levels provided by the manufacturers, or from secondary sources as required. Should final selection of plant or location of plant differ significantly from the assumptions stated in this report, the assessment of compliance may be revised.

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## 6 Summary

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Arup has completed a desktop noise assessment to establish noise limits for noise emitted from the Subject Site. Noise limits have been determined through use of Noise Protocol Commercial Industrial and Trade rural assessment methodology.

The proposed operation of the solar plant at the Subject Site is predicted to comply with rural night-time noise limits. As the night-time represents the most noise-sensitive time period, demonstrating compliance with the night-time noise limits demonstrates compliance with other time periods.

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# Appendix A

## Acoustic Terminology

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## A1 Acoustic Terminology

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### Ambient Noise Level

The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a city building is being investigated, the ambient noise level is the noise level from all other sources without the fan running. This would include sources such as traffic, biRoads, people talking and other nearby fans on other buildings.

### Background Noise Level

The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects.

### Decibel

The decibel scale is a logarithmic scale which is used to measure sound and vibration levels. Human hearing is not linear and involves hearing over a large range of sound pressure levels, which would be unwieldy if presented on a linear scale. Therefore a logarithmic scale, the decibel (dB) scale, is used to describe sound levels.

An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.

### dB(A)

dB(A) denotes a single-number sound pressure level that includes a frequency weighting (“A-weighting”) to reflect the subjective loudness of the sound level.

The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).

Some typical dB(A) levels are shown below.

Sound Pressure Level dB(A)	Example
130	Human threshold of pain
120	Jet aircraft take-off at 100 m

Sound Pressure Level dB(A)	Example
110	Chain saw at 1 m
100	Inside nightclub
90	Heavy trucks at 5 m
80	Kerbside of busy street
70	Loud stereo in living room
60	Office or restaurant with people present
50	Domestic fan heater at 1m
40	Living room (without TV, stereo, etc)
30	Background noise in a theatre
20	Remote rural area on still night
10	Acoustic laboratory test chamber
0	Threshold of hearing

## L<sub>90</sub>

The L<sub>90</sub> statistical level is often used as the “average minimum” or “background” level of a sound level that varies with time.

Mathematically, L<sub>90</sub> is the sound level exceeded for 90% of the measurement duration. As an example, 45 dB L<sub>A90,15min</sub> is a sound level of 45 dB(A) or higher for 90% of the 15 minute measurement period.

## L<sub>eq</sub>

The ‘equivalent continuous sound level’, L<sub>eq</sub>, is used to describe the level of a time-varying sound or vibration measurement.

L<sub>eq</sub> is often used as the “average” level for a measurement where the level is fluctuating over time. Mathematically, it is the energy-average level over a period of time (i.e. the constant sound level that contains the same sound energy as the measured level). When the dB(A) weighting is applied, the level is denoted dB L<sub>Aeq</sub>. Often the measurement duration is quoted, thus L<sub>Aeq,15 min</sub> represents the dB(A) weighted energy-average level of a 15 minute measurement.

## Frequency

Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as “pitch”. Sounds towards the lower end of the human hearing frequency range are perceived as “bass” or “low-pitched” and sounds with a higher frequency are perceived as “treble” or “high pitched”.

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## Sound Power and Sound Pressure

The sound power level ( $L_w$ ) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level ( $L_p$ ) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

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## Appendix B

### Planning Map

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## B1 Planning Zone Map

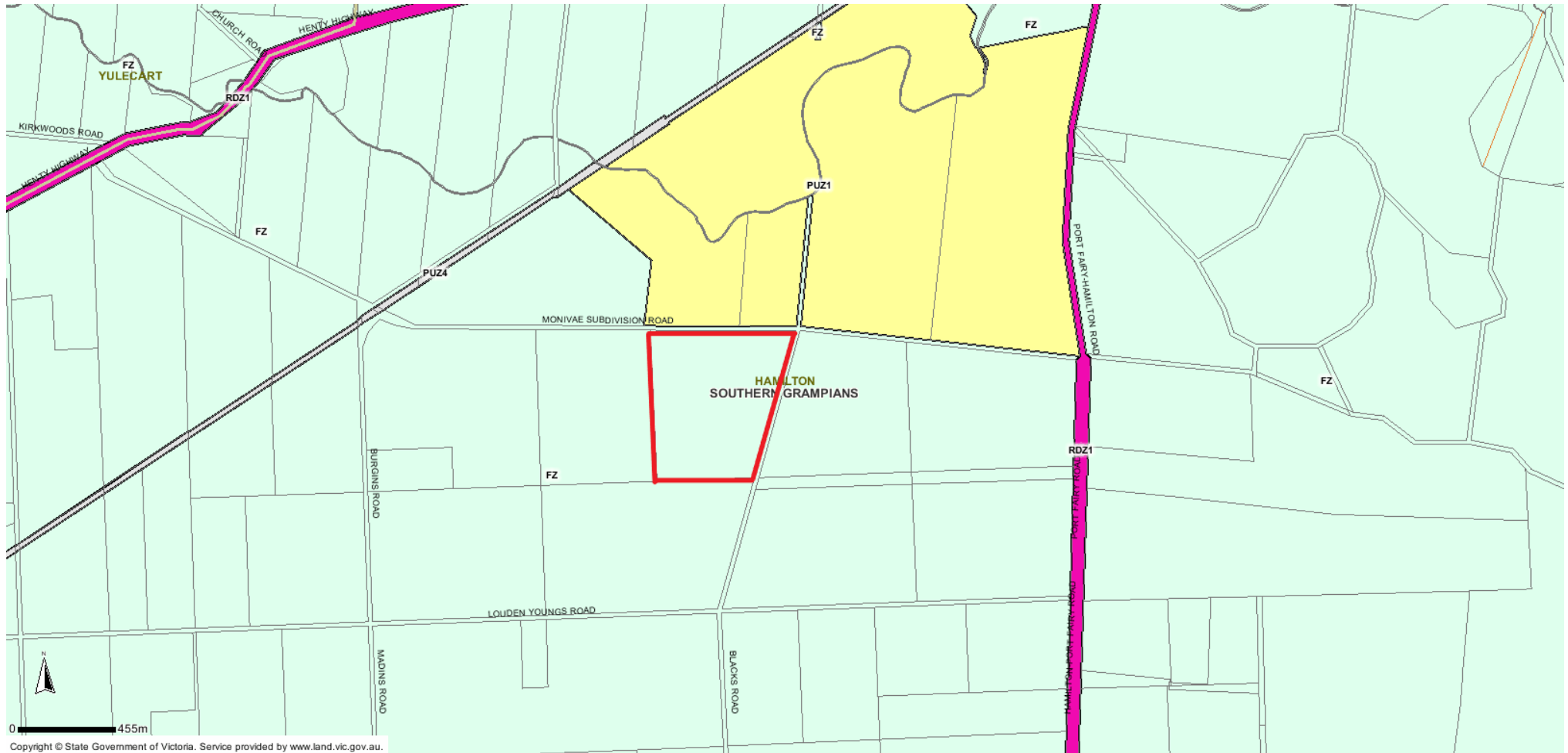


Figure 2: Planning zone map showing Subject Site (red) and surrounds