



CO-OP Studio
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Tamworth Regional Aquatic Centre

Noise Impact Assessment

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1. Introduction

Octave Acoustics was engaged by CO-OP Studio to provide a noise impact assessment for Stage 1 of the proposed Tamworth Regional Aquatic Centre, to support the Regionally Significant Development Approval. The Aquatic Centre is to be located west of the Tamworth Regional Hockey Centre on Jack Smyth Drive, Hillvue (Subject Site).

Stage 1 of the Aquatic Centre is to include:

- A single storey building with:
 - A 50m pool, warm water pool and spa.
 - Spectator stands for up to 600 people.
 - Changing rooms and amenities.
 - Gym and program rooms.
 - Café.
 - Administration offices.
 - Sporting science and teaching rooms.
 - Plant room sized to fit future extensions.
- Primary carpark with 170 spaces, accessed via Jack Smyth Drive.
- Rear staff carpark and bus bays, accessed via Longyard Drive.

1.1. Site Context

The Subject Site (shown in Figure 1) is zoned SP3 – Tourist, and is abutted by:

- Tamworth Regional Hockey Centre to the east, zoned SP3.
- Jack Smyth Drive to the south, with Tamworth Sports Dome and basketball courts beyond, zoned SP3.
- Residential dwellings on Rodeo Drive located approximately 200m to the south-west, zoned R5 (Large Lot Residential).
- Longyard Golf Course to the west zoned RE2 (Private Recreation), with residential dwellings and residential lots located approximately 350m to the west on Peak Drive, zoned R1 (General Residential).
- Longyard Drive to the north, with residential dwellings beyond on Eureka Place located approximately 200m to the north, zoned R1.



Figure 1 – Site Context

2. Criteria

2.1. Tamworth Regional Development Control Plan 2010

Relevant to noise emissions, the General Development Specifications – Environmental Controls section of the *Tamworth Regional Development Control Plan 2010* states:

The application documentation shall identify any potential environmental impacts of the development and demonstrate how they will be mitigated. These impacts may relate to:

- Noise emissions

Where relevant, applications are to contain information about likely noise generation and the method of mitigation.

The Tamworth DCP does not have specific noise requirements relating to commercial developments or developments zoned SP3.

2.2. NSW Noise Policy for Industry

The NSW EPA *Noise Policy for Industry 2017* (NPfI) sets out requirements for commercial premises relating to noise generated by plant and equipment. The NPfI defines the project noise trigger level, which is the level that, if exceeded, would indicate a potential noise impact on the community and so 'trigger' a management response. The noise trigger level combines the intrusiveness noise levels of the project and the recommended amenity noise levels for the area.

2.2.1. Intrusiveness Noise Levels

Project intrusiveness noise levels apply at residential receivers, and aim to protect against significant changes in noise. The intrusiveness of an industrial source may generally be considered acceptable if the noise level from the source, assessed as $L_{Aeq,15min}$, does not exceed the rating background noise level (RBL) by more than 5 dB. In lieu of background noise monitoring at the Subject Site, the applicable rating background noise levels were estimated from Appendix A of AS 1055.3 *Acoustics – Description and Measurement of Environmental Noise*, conservatively assuming low background levels applying to "areas with negligible transportation". The resulting project intrusiveness levels are presented in Table 1 below.

Table 1 – Minimum Assumed RBLs and Project Intrusiveness Noise Levels

Period	Rating Background Noise Level, dB(A)	Project Intrusiveness Noise Levels, $L_{Aeq,15min}$ dB(A)
Day	40	45
Evening	35	40
Night	30	35

2.2.2. Amenity Noise Levels

Project amenity noise levels aim to maintain amenity for particular land uses. The ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels where feasible and reasonable.

The project amenity level is computed as the recommended amenity noise level minus 5 dB(A). A 3 dB(A) correction is then added to convert the level to a 15-minute assessment interval. Project amenity levels for nearby land uses are summarised in Table 2 below.

Table 2 – Overall and Project Amenity Noise Levels

Receiver	Period	Recommended Amenity Noise Level, L_{Aeq} dB(A)	Project Amenity Level, $L_{Aeq,15min}$ dB(A)
Rural residential	Day	50	48
	Evening	45	43
	Night	40	38
Suburban residential	Day	55	53
	Evening	45	43
	Night	40	38
Active recreation area	When in use	55	53

2.2.3. Project Trigger Levels

The project noise trigger levels for each period are computed as the minimum of the intrusiveness noise level and the project amenity level. Overall project trigger levels are provided in Table 3 below.

Table 3 – Project Noise Trigger Levels, $L_{Aeq,15min}$ dB(A)

Receiver	Period ¹	Intrusiveness	Amenity	Project Noise Trigger Levels
Rural residential	Day	45	48	45
	Evening	40	43	40
	Night	35	38	35
Suburban residential	Day	45	53	45
	Evening	40	43	40
	Night	35	38	35
Active recreation area	When in use	-	53	53

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

2.3. NSW Road Noise Policy

The NSW Road Noise Policy (RNP) defines noise criteria with the aim to provide protection inside and immediately around noise sensitive receivers. These noise criteria are consistent with current international practice for managing traffic noise impacts. The criteria applied in the RNP have been set approximately at the point where 90% of residents are not highly annoyed by noise. Table 4 sets out the Traffic Noise Assessment criteria for sensitive land uses affected by additional traffic generated by land use developments. For residential uses, noise levels are to be assessed at the façade of the affected residence.

Table 4 – Road Traffic Noise Assessment Criteria

Land Use	Road Category	Assessment Criteria, dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Residential	Freeway/arterial/sub-arterial roads	L _{Aeq,15 hour} 60	L _{Aeq,9 hour} 55
	Local Roads	L _{Aeq,1 hour} 55	L _{Aeq,1 hour} 50
Open space (active use)	Any	L _{Aeq,15 hour} 60	–

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. As such, the RNP states that where existing noise levels are above the assessment criteria, any increase in the total traffic noise levels at sensitive land uses should be limited to 2 dB above that of the corresponding 'no build option'.

3. Assessment

Assessment has been carried out with respect to the drawing set attached in Appendix B. To calculate noise impacts from the Aquatic Centre, a 3D computer noise model of the Subject Site and surrounds was built within CadnaA software. Calculations were run implementing the ISO9613 algorithms to calculate the propagation of noise between source and receivers. This algorithm takes into account propagation effects associated with:

- Source sound power;
- Geometrical spreading;
- Atmospheric conditions;
- Air absorption;
- Ground absorption ($G=0.7$);
- Topography;
- Reflections from buildings and environment; and
- Barrier effects due to obstructions between noise sources and residential receivers;

3.1. Plant & Equipment

At this early stage of the project, a detailed plant layout and equipment selection is not yet available. Assessment of potential plant noise has therefore been conducted with respect to a preliminary equipment selection, based on advice from the mechanical and aquatic engineers. Sound power levels for indicative roof-mounted plant are shown in Table 5.

Table 5 – Plant Sound Power Levels, dB re 10^{-12} W

Equipment	Quantity		SWL, dB(A)	Octave Band Centre Frequency (Hz)							
				63	125	250	500	1000	2000	4000	8000
Pool heat pump Evo CS-i 250	3		78	-	-	-	-	-	-	-	-
Pool heat pump Evo CS-i 65	1		68	-	-	-	-	-	-	-	-
Pool PAC Air Change ACPP13000	2	Supply air inlet	95	87	84	96	92	87	87	84	86
		Exhaust air outlet	97	83	82	92	90	93	90	86	84
Gym PAC Air Change ACL125RCRTP	2	Supply air inlet	79	69	84	80	74	73	71	69	64
		Exhaust air outlet	87	76	90	86	85	82	78	76	73

It was additionally assumed that the sound pressure levels in the pool filter plant room will be 86 dB(A), based on previous measurements of commercial pool filter and pump plant rooms conducted by Octave Acoustics.

The above plant was included in the 3D noise model and the model was run to calculate noise impacts to the nearest sensitive receivers. The results of calculations indicated that the following measures would be required for compliance with night-time NPfI criteria (and therefore also day and evening period criteria):

- Acoustic screening is installed around large external mounted plant items (appropriate to their size and location and meeting the requirements in Section 3.1.1).
- Acoustic louvres are selected for ventilation at the plant room facade.
- Fresh air inlets and exhausts of the Pool and Gym PAC units are fitted with lined duct or lined duct bends.
 - Required treatment to PAC units may be reduced if units are selected with quiet modes (capable of reducing sound power levels by at least 10 dB) and are set to run on quiet mode at night.

Calculated noise levels with the recommendations in place are presented in Table 6. Calculations assume that PAC units have lined duct bends fitted to the fresh air inlet and exhaust outlet, acoustic screening is installed around roof-mounted plant, and the plant room has 20m² louvre façade area fitted with an acoustic louvre equivalent to Fantech ASB.

Table 6 – Mechanical Noise Levels at Sensitive Receivers

Receiver	Time	Sound Pressure Level, L_{eq} dB(A)	Criteria, L_{eq} dB(A)	Complies?
Longyard Golf Course	While in use	36	53	Yes
Hockey Fields	While in use	38	53	Yes
Netball/Basketball Courts	While in use	36	53	Yes
10 Eureka Place	Night	31	35	Yes
46 Peak Drive	Night	26	35	Yes
2 Rodeo Drive	Night	32	35	Yes

Results of assessment indicate that compliance with Noise Policy for Industry criteria is achievable during all periods by incorporating standard acoustic treatments. A detailed acoustic design is to be undertaken when plant selections and layouts are finalised.

3.1.1. Plant Screening

Acoustic plant screens shall be constructed as follows:

- Screens shall be constructed using any solid (non-perforated) cladding such as fibre cement sheeting, lightweight aerated concrete, or profiled metal cladding as long as the selected material (or combined skins) has a surface mass of at least 12 kg/m².
- The screen must extend at least 200mm above the top of the highest item of plant.
- Screens shall have no gaps, holes, or perforations allowing noise to pass through. Any gaps or penetrations shall be fully caulked with a flexible acoustic sealant.
- Screens shall extend hard down to the slab below such that noise will not pass underneath.

3.2. Traffic Generation

In accordance with the NSW Road Noise Policy (RNP), a relative increase assessment is conducted to consider noise impacts associated with additional road traffic volumes resulting from the operation of the Aquatic Centre. Assessment was carried out with respect to traffic volume data and demand estimates provided in the Tamworth Regional Council Traffic Impact Assessment dated 12 March 2024. The estimated traffic generation during a busy day was given as 488 vehicles visiting the centre. This corresponds to a 1.5 dB relative increase in noise level, as shown in Table 7.

Table 7 – Additional Traffic Noise Assessment

Location	Existing Volume (Vehicles/Day)	Post Development Increase	Total Volume (Vehicles/Day)	Percentage Increase	Relative Increase in Noise Level
Jack Smyth Drive	2300	+976	3276	42%	1.5 dB

These results indicate that the increase in traffic noise resulting from the Aquatic Centre will be less than 2 dB and as such, will fall below the relative increase criterion and therefore complies with the applicable requirements of the RNP.

4. Conclusion

Octave Acoustics was engaged to carry out an assessment of noise impacts from the proposed Tamworth Regional Aquatic Centre. To calculate noise impacts to the nearest sensitive receivers, a 3D noise model of the Subject Site and surrounds was developed in CadnaA.

Trigger levels for assessment of noise from plant and equipment were set in accordance with the Noise Policy for Industry, using conservative estimates of background noise levels from Appendix A of AS 1055.3. Assessment of preliminary mechanical plant found that compliance with the Noise Policy for Industry can be achieved during all periods by incorporating acoustic treatments such as acoustic screening, lined duct bends fitted to PAC unit intake and exhaust, and acoustic louvres at the plant room facade. A detailed acoustic design is to be undertaken when mechanical equipment selections and layouts are finalised.

An assessment of additional noise levels generated by traffic visiting the Aquatic Centre found that the relative increase in noise levels will be less than 2 dB, and will therefore comply with the requirements of the NSW Road Noise Policy.

In summary, assessment indicates that overall noise emissions from the Tamworth Regional Aquatic Centre will comply with the relevant requirements of the Noise Policy for Industry and Road Noise Policy.

Appendix A: Glossary of Terms

'A' Frequency Weighting

The 'A' frequency weighting roughly approximates to the Fletcher-Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (LAeq,T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built-environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' (LA90,T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7

days). For a 15-minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

'C' FREQUENCY WEIGHTING

The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of the square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10}(10^{(50/10)} + 10^{(50/10)})$) and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.

dB(A) – See 'A' frequency weighting

dB(C) – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - LAeq) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq level tends to indicate an average which is strongly influenced by short-term, high level noise events. Many studies show that

human reaction to level-varying sounds tends to relate closer to the LAeq noise level than any other descriptor.

'F' (FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LAFmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LASmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE

Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997).

"Offensive Noise means noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure or some other device. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average (LAeq,T) by the formula $LA_{eq,T} = LAE - 10 \log_{10} T$. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (LAE).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m²).

SOUND PRESSURE LEVEL, Lp

The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10}(P_a/P_o)^2$ dB (or $20 \log_{10}(P_a/P_o)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is 20 μ Pa (20×10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A

measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, L_w

The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment. $L_w = L_p + 10 \log_{10} 'a'$ dB,

re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 – 2002.

STATISTICAL NOISE LEVELS, L_n

Noise which varies in level over a specific period of time 'T' (standard measurement times are often 15-minute periods) may be quantified in terms of various statistical descriptors with some common examples:

The noise level, in decibels, exceeded for 1% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF1,T}$. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.

The noise level, in decibels, exceeded for 10% of the measurement time period, when 'A' frequency

weighted and 'F' time weighted is reference to as $L_{AF10,T}$. In most countries the $L_{AF10,T}$ is measured over periods of 15 minutes, and is used to describe the average maximum noise level.

The noise level, in decibels, exceeded for 90% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF90,T}$. In most countries the $L_{AF90,T}$ is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

WEIGHTED SOUND REDUCTION INDEX, R_w

This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall R_w+C ratings are frequency weighted to simulate insulation from human voice noise. The R_w+C is similar in value to the STC rating value. External walls, doors and windows may be R_w+C_{tr} rated to simulate insulation from road traffic noise. The spectrum adaptation term C_{tr} adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1-2004: 'Electroacoustics – Sound level meters – Specifications'.

Appendix B: Architectural Drawings

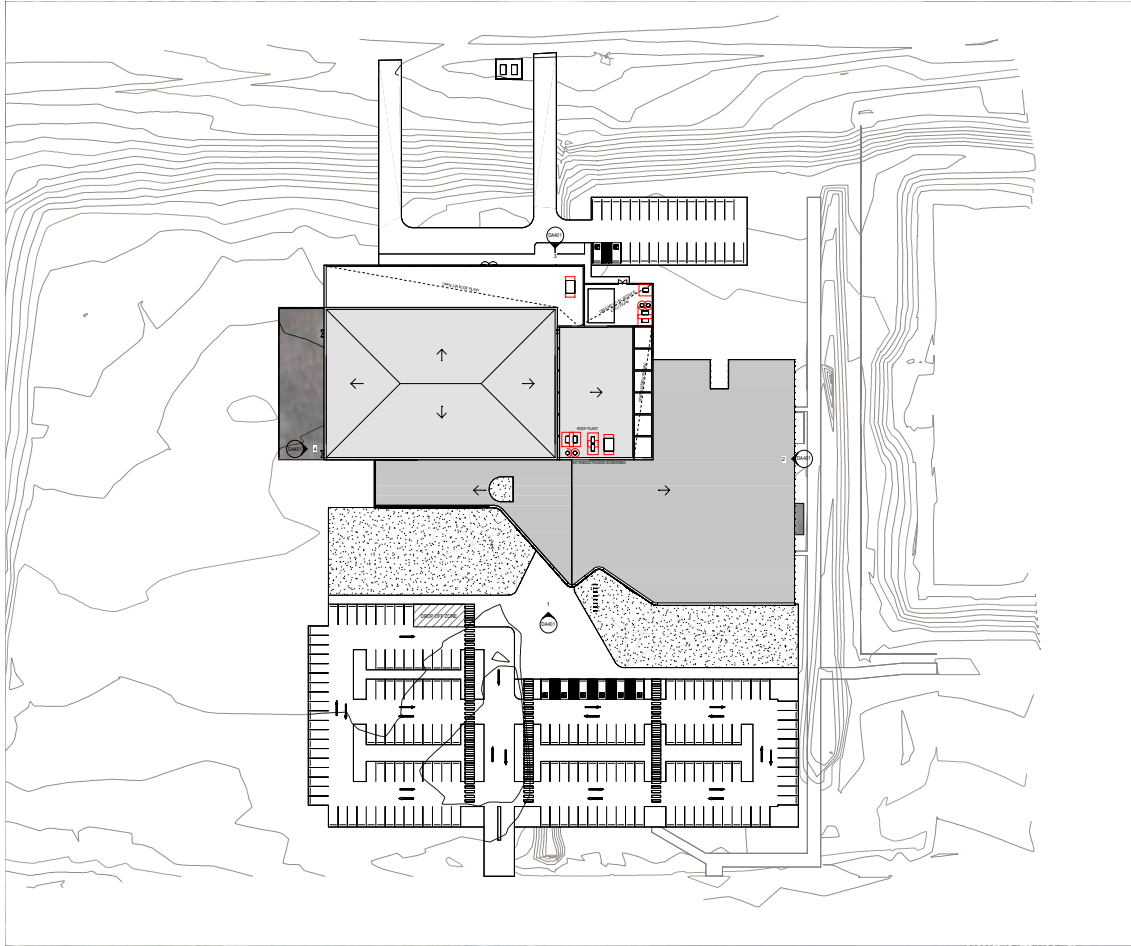
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PROJECT

Tamworth RAC

PROJECT NUMBER:

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SITE PLAN

SCALE 1 : 500 (A0)



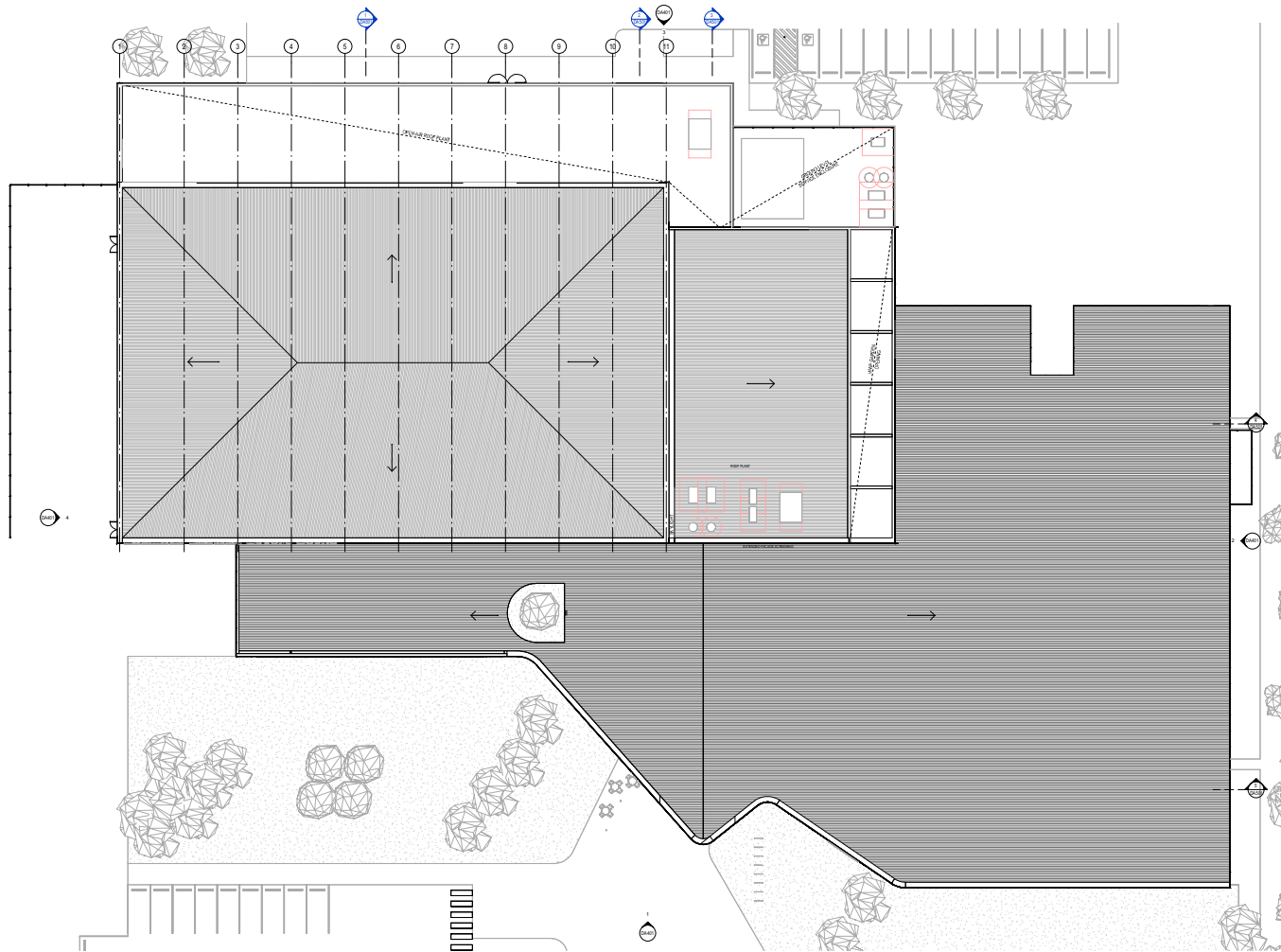
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PROJECT

Tamworth RAC

PROJECT NUMBER

100358

DRAWING

ELEVATIONS

SCALE 1" = 200' @ A0



DRAWN BY Author

PRELIMINARY
NOT TO BE USED DURING CONSTRUCTION

DRAWING NO. REVISION

DA401

