In the Planning & Environment Court
Appeal No. D13 of 2021
Held at: Maroochydore

Between:	**PAUL ROBINSON and PAUL SCHUBERT**	Appellants
And:	**GLADSTONE REGIONAL COUNCIL (in its role as Assessment Manger)**	Respondent
And:	**GLADSTONE REGIONAL COUNCIL (in its role as development proponent)**	Co-Respondent

NOISE, AIR QUALITY AND LIGHTING AMENITY STATEMENT OF EVIDENCE

Prepared for:
Planning & Environment Court

Prepared by:

Paul King
MWA Environmental

14 October 2021

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1.0 BACKGROUND

1 P&E Appeal No D13 of 2021 relates to an appeal against the decision of the Respondent to approve an application for a Development Permit for a Material Change of Use (Parking Station), made by the Co-Respondent, on land at 5 Agnes Street, Agnes Water.

2 The subject site is more particularly described as Lot 8 on CP910294 has a total area of approximately 3,581 m2 and is in the Mixed Use Zone of the Gladstone Regional Council Planning Scheme.

3 The site location and surrounding land uses are shown on **Figure 1.**

4 The development application as originally lodged was for a new open air off-street bitumen carpark providing 87 spaces. Through the course of the development application the design was amended to provide for 73 carparking spaces. Site access is from Agnes Street on the Eastern side of the site.

5 The development application was approved by the Respondent by Decision Notice dated 8 December 2020.

6 The Appellants lodged Appeal No D13 of 2021 with the Planning and Environment Court by Notice of Appeal dated 20 January 2021. The Appeal includes amenity matters relevant to noise and light impacts.

7 This Statement of Evidence has been prepared by Mr Paul King of MWA Environmental who has been retained to consider noise, air quality and lighting amenity impacts associated with the proposed development.

8 My Curriculum Vitae is included as **Attachment 1**.

1.1 SURROUNDING LAND USES

9 The subject site is located on the western side of Agnes Street. The site is presently vacant of development and has been used for informal carparking. Surrounding land uses comprise:

To the Northeast: Mixed use – Motel and Cafe.

To the East: Agnes Street with low density residential uses beyond

To the Southwest: Private driveway access to Beach Houses Estate, with mixed use development beyond fronting Agnes Street.

To the West and North West: Private dwellings – low density residential dwellings including the Beach House Estate.

1.2 DEVELOPMENT APPROVAL

10 The Council development approval, issued by decision notice dated 8 December 2021 included the following conditions

Approved Documentation

1. *Development is to be carried out generally in accordance with the submitted application including the following plans and supporting documentation except where amendments are required to satisfy the conditions of this approval:*

Drawing Number	***Revision***	***Description***	***Author***	***Date***
R2020043-SK-0004	*1*	*Site Plan*	*Cardno*	*-*

Special Conditions

2. *Prior to the commencement of the use, the Applicant is to install signage which states that overnight parking is not permitted and the site is within a flood area.*

3. *As part of the lodgement for the first application for Operational Works, the Applicant is to provide an Environmental Management Plan to Council for approval. The Environmental Management Plan shall describe the natural environmental values of the rear pond area, how the development may impact on the environment, and any actions required to avoid, minimise or manage impacts.*

11 The approved drawing SK-0004 provides for 73 marked carparking spaces on the site. The approved plan is provided as **Figure 2**.

12 It is identified that the development approval does not include any conditions specifically relevant to noise, air quality or lighting amenity.

1.3 CONSOLIDATED LIST OF ISSUES

13 The Consolidated List of Issues, signed by Gladstone Regional Council on 20 August 2021 included the following relevant to noise and lighting amenity issues:

Amenity Impacts – Noise and Light

13 Whether the proposed development will result in unacceptable amenity impacts on nearby sensitive uses in terms of light, noise and dust.

14 Whether the proposed development complies with the following assessment benchmarks of the Planning Scheme:

Planning Scheme	Provisions
MUZ Code	Overall outcomes (c), (f), (n), PO27, PO32

Relevant Matters

41 Whether the proposed development will not result in a worsening of amenity impacts for nearby residents that cannot be addressed through the imposition of reasonable and relevant conditions.

42 Whether the proposed development will result in improved safety outcomes, having regard to the proposed lighting, and any impacts therefrom can be appropriately mitigated through the imposition of reasonable and relevant conditions.

1.4 PLANNING SCHEME EXTRACTS

14 The relevant Planning Scheme provisions referenced in Section 1.4 above are provided below. I have included yellow highlighting of the matters relevant to this statement of evidence.

6.2.21 Mixed Use

Overall Outcomes

(2) The purpose of the zone will be achieved through the following overall outcomes:

(c) The scale, character and built form of development contributes to a high standard of amenity.

(f) Development creates pleasant living environments that ensure privacy, access to sunlight, open space, ventilation and natural climate control.

(n) Residential development is protected from the impacts of any nearby industrial activities, transport corridors, infrastructure, installations and major facilities.

Table 6.2.21.3.1 – Accepted development subject to requirements and assessable development.

For all assessable development		
Amenity		
	Performance Outcome	***Acceptable Outcome***
PO27	*Development minimises impacts on surrounding land and provides for an appropriate level of amenity within the mixed use centre, having regard to:* *(a) noise* *(b) hours of operation* *(c) traffic* *(d) visual impact* *(e) signage*	*No acceptable outcome is nominated.*

	(f) odour and emissions *(g) lighting* *(h) access to sunlight* *(i) privacy, and* *(j) outlook.*	
Effects of Development		
PO32	*Development responds sensitively to on–site and surrounding topography, coastal foreshores, waterways, drainage patterns, utility services, access, vegetation and adjoining land use, such that:* *(a) any hazards to people or property are avoided* *(b) any earthworks are minimised* *(c) the retention of natural drainage lines is maximised* *(d) the retention of existing vegetation is maximised* *(e) damage or disruption to sewerage, stormwater and water infrastructure is avoided, and* *(f) there is adequate buffering, screening or separation to adjoining development.*	*No acceptable outcome is nominated.*

2.0 NOISE AMENITY MATTERS

2.1 SUMMARY OF ISSUES

15 My review of the various matters identified in Section 1.3 of this Statement of Evidence and my consideration of the proposed development is that matters relevant to my areas of expertise in noise that require consideration include:

- Noise impact of the proposed use of the land as a formal carpark upon the acoustic amenity of surrounding noise sensitive receptors.

16 The following section addresses the above noise matters.

2.2 NOISE CRITERIA

2.2.1 Basis for Criteria

17 The Development Design Code of the Gladstone Regional Council Planning Scheme Section 9.3.2.3 – Assessment Benchmarks, Table 9.3.2.3.1 provides the following:

Acoustic and air quality	
PO16 Development prevents or minimises the generation of any noise or vibration so that: (a) nuisance is not caused to adjoining premises or other nearby sensitive land uses, and (b) desired ambient noise levels in residential areas are not exceeded.	**AO16** Development achieves the noise generation levels set out in the *Environmental Protection (Noise) Policy 2008, as amended.* Note—To achieve compliance, development is planned, designed and managed to ensure emissions from activities to achieve the appropriate acoustic objectives (measured at the receptor dB(A)).

18 The acceptable outcomes AO16 reference the Environmental Protection (Noise) Policy 2008, as amended. The Note to AO16 is particularly relevant in that it identifies emissions from activities are to achieve the appropriate acoustic objectives (measured at the receptor dB(A)).

19 The Environmental Protection (Noise) Policy 2019 has superseded the 2008 Policy. The 2019 Policy, as is the case for the 2008 Policy, in Schedule 1 provides acoustic quality objectives.

2.2.2 Acoustic Quality Objectives

20 The Environmental Protection (Noise) Policy 2008 and 2019 specify Acoustic Quality Objectives for sensitive receptors to enhance or protect acoustic amenity. The applicable Acoustic Quality Objectives from Schedule 1 of the policies are presented in **Table 1** below.

Table 1: Adopted Acoustic Quality Objectives

SENSITIVE RECEPTOR	PERIOD	ACOUSTIC QUALITY OBJECTIVES (MEASURED AT THE RECEPTOR) dB(A)			ENVIRONMENTAL VALUE
		($L_{Aeq,adj,1\text{-}hour}$)	($L_{A10,adj,1\text{-}hour}$)	($L_{A1,adj,1\text{-}hour}$)	
Dwelling (for outdoors)	7am to 10pm	50	55	65	Health and wellbeing
Dwelling (for indoors)	7am to 10pm	35	40	45	Health and wellbeing
	10pm to 7am	30	35	40	Health and wellbeing in relation to the ability to sleep

21 Previous experience with noise measurements conducted for carparking activities demonstrates that the most stringent of the Acoustic Quality Objective parameter for noise sensitive receptors (dwellings) are the LAeq levels for each period of the day.

22 A 7 dBA reduction by the building envelope with windows open, is considered to derive the representative external noise criteria from the respective indoors noise limits[1] .

23 Consideration of the dwelling indoor levels of the acoustic quality objectives with allowance of 7 dB(A) external to internal noise reduction, identifies that the indoor dwelling Acoustic Quality Objective Criteria provide the most conservative criteria for noise assessment as summarised in **Table 2** below:

[1] AS3671 states approximate 10 dB(A) noise reduction through a façade with 10% open area. Thus approximately 7 dB(A) noise reduction through a façade with 20% open area. A large 1200x1800 sliding window relates to approximately 10% open area. A large 2100x2300 sliding glass door represents approximately 20% open area. Thus, 7dB(A) noise reduction is conservatively adopted based upon a large sliding glass door in the affected façade. Openings larger than 20% open area are unlikely to be necessary for ventilation during the night period.

Table 2: Comparison of Noise Criteria (Acoustic Quality Objectives)

SENSITIVE RECEPTOR	PERIOD	ACOUSTIC QUALITY OBJECTIVES (MEASURED AT THE RECEPTOR) dB(A)		
		($L_{Aeq,adj,1\text{-}hour}$)		
Dwelling (for outdoors)	7am to 10pm	**50**		
Dwelling (for indoors adjusted to outdoors)	7am to 10pm	35+7= **42**		
	10pm to 7am	30+7= **37**		

24 As can be seen from the above, adopting the internal noise criteria and adjusting to an external level provides for significantly lower noise limits than the dwelling outdoor criteria. Rather than 50 dB(A) during the day/evening, the adjusted internal limit is applied as 42 dB(A) and the night criterion is 37 dB(A).

2.2.3 Sleep Disturbance (Night 10pm to 7am)

25 In considering operations during the night period (10pm to 7am) it is appropriate to also consider the potential for sleep disturbance at nearby sensitive receptors. Queensland Ecoaccess Guideline: Noise - Planning for Noise Control (2015) indicates that unreasonable sleep disturbance impacts can occur when short duration noise peaks in the range 45 to 50 dB(A) within a bedroom occur more than 10 to 15 times per night.

26 The lower range sleep disturbance noise criterion of 45 dB(A) Lmax noise level within a bedroom due to noise from vehicle movements and car starts / door slams during the night period is considered appropriate for the subject locality. Adopting a typical 7 dB(A) noise reduction through an open window relates to a sleep disturbance criterion of **Lmax 52 dB(A)** external to a bedroom window.

2.2.4 Adopted Noise Criteria

27 The noise criteria adopted for the purpose of the noise assessment are summarised in **Table 3** below:

Table 3: Adopted External Noise Criteria – All Time Periods

SENSITIVE RECEPTOR	PERIOD	ACOUSTIC QUALITY OBJECTIVES (MEASURED AT THE RECEPTOR) dB(A)		
		($L_{Aeq,adj,1-hour}$)	LAmax dB(A)	
Dwelling (for indoors adjusted to outdoors)	7am to 10pm	**42**	-	
	10pm to 7am	**37**	**52**	

2.3 NOISE ASSESSMENT

28 To assess the potential noise impact of the proposed carpark upon surrounding noise sensitive receptors, a computer noise model using the SoundPLAN 8.2 software has been prepared. The model includes inputs of topography and cadastral information to represent the site and surrounds with the location of surrounding buildings input to the model for the purpose of predicting noise criteria at each nearest sensitive use.

29 The model representation includes surrounding buildings to represent whether single, double or three storey construction and predictions made for each level where applicable.

30 The model representation of the site includes the approved carpark footprint and calculation of noise from carparking using the SoundPLAN carpark module. This module represents noise from vehicle movements along with engine starts and car door slams based on hourly turnover of each carparking bay.

31 For the purpose of the assessment, it is has been conservatively assumed that during the time period 7am to 10pm (the day/evening period) each carparking bay will turn over once per hour i.e. one car will arrive and depart from each carparking bay every hour i.e., 73 vehicles arrive and 73 vehicles depart in the one hour. This is considered a highly conservative basis for assessment, with available information suggesting carparking in this area is typically for several hours at a time. On this basis, the noise model is likely overpredicting the actual potential noise impact.

32 The model was also input to represent activity in 10pm to 7am period (Night) as equivalent to each carparking bay turning over every 4 hours i.e., a lower utilisation rate than the day/evening period.

33 The seven (7) nearest sensitive receptors that have been identified and considered for the purposes of this assessment are the following properties:

R1: Dwelling house 44 Beach House Estate Road (1 Storey).

R2: Dwelling house 43 Beach House Estate Road (1 Storey).

R3-1 Motel 7 Agnes Street -West Block (1 Storey)

R3-2 Motel 7 Agnes Street – East Block (1 Storey)

R4: Dwelling house 12 Agnes Street (1 Storey).

R5: Dwelling house 10 Agnes Street (2 Storey).

R6: Unit Development 3 Agnes Street (3 Storey)

R7: Dwelling house 42 Grahame Colyer Drive (1 Storey).

34 The nominated receptors are shown on an aerial image base on **Figure 3**.

35 The results of the noise modelling are provided in **Tables 4** and **5** below for the proposed carpark as approved.

Table 4: **Predicted Cumulative Noise Levels at Nearest Sensitive Receptors - dB(A)**

Sensitive Receptors	Floor Level	Predicted Noise Level $L_{Aeq,1hr}$ dB(A) Day/Evening (7am-10pm)	Predicted Noise Level $L_{Aeq,\ 1hr}$ dB(A) Night (10pm-7am)
R1	GF	34.9	28.8
R2	GF	37.4	31.4
R3-1	GF	43.4	37.3
R3-2	GF	40.8	34.8
R4	GF	37.3	31.2
R5	GF	39.6	33.6
R5	F 1	39.3	33.3
R6	GF	34.6	28.6
R6	F 1	35.5	29.5
R6	F 2	35.9	29.8
R7	GF	35.8	29.7
CRITERIA		**42**	**37**

Table 5: **Predicted Cumulative Lmax Noise Levels at Nearest Sensitive Receptors - dB(A)**

Sensitive Receptors	Floor Level	Predicted Noise Level L_{Amax} dB(A) Night (10pm-7am)
R1	GF	41.8
R2	GF	46.1
R3-1	GF	58.7
R3-2	GF	56.6
R4	GF	47.6
R5	GF	48.3
R5	F 1	48
R6	GF	42.8
R6	F 1	43.8
R6	F 2	44.1
R7	GF	46.7
	CRITERION	**52 dB(A) L_{Amax}**

36 The above predictions demonstrate noise compliance is achieved at all sensitive receptors other than at the adjacent motel to the northeast.

37 The SoundPLAN model was then used to assess the extent of a noise barrier fence along part of the common boundary of the subject site to the adjacent motel to achieve compliance with the noise criteria.

38 Included as **Figure 4** is a plan identifying the recommended noise barrier of height 1.8 metres above the level of the boundary between the carpark and the motel.

39 The resultant noise predictions with the noise barrier are provided in **Tables 6** and **7** below.

Table 6: **Predicted Cumulative Noise Levels at Nearest Sensitive Receptors - dB(A) – with noise barrier**

Sensitive Receptors	Floor Level	Predicted Noise Level $L_{Aeq,1hr}$ dB(A) Day/Evening (7am-10pm)	Predicted Noise Level $L_{Aeq,\ 1hr}$ dB(A) Night (10pm-7am)
R1	GF	34.9	28.9
R2	GF	37.5	31.4
R3-1	GF	39.1	33.1
R3-2	GF	37.4	31.4
R4	GF	37.7	31.7
R5	GF	40.0	34.0
R5	F 1	39.7	33.7
R6	GF	34.7	28.6
R6	F 1	35.6	29.5
R6	F 2	35.9	29.9
R 7	GF	35.7	29.7
CRITERIA		**42**	**37**

Table 7: **Predicted Cumulative Lmax Noise Levels at Nearest Sensitive Receptors - dB(A) – with noise barrier**

Sensitive Receptors	Floor Level	Predicted Noise Level L_{Amax} dB(A) Night (10pm-7am)
R1	GF	42.1
R2	GF	46.3
R3-1	GF	50.3
R3-2	GF	49.3
R4	GF	48.7
R5	GF	49.2
R5	F 1	49.0
R6	GF	43.0
R6	F 1	44.0
R6	F 2	44.2
R 7	GF	46.8
	CRITERION	**52 dB(A) L_{Amax}**

40 The noise predictions are provided as graphical plots of noise level for day/evening and night period in **Attachment 2**.

41 The above predictions with the noise barrier (**Figure 4**) demonstrate compliance with the adopted noise criteria is achieved at all noise sensitive receptors for all time periods.

2.4 Summary of Noise Outcomes

42 The noise assessment undertaken has identified that resultant noise from use of the carpark on the basis of conservative usage rates will comply with the adopted noise criteria for all time periods with the only physical noise mitigation measure requirement being a 1.8 metre high acoustic barrier fence along part of the common boundary to the adjacent motel as shown in **Figure 4**.

43 The proposed use of the land as a carpark is to provide for formal carparking in addition to existing on-street carparking in the immediate locality. It is noted that carparking and vehicle movements on local streets is an existing ambient noise source in this locality.

44 The design of the carpark in providing separation to surrounding sensitive land uses is such that resultant noise will not result in unacceptable acoustic amenity impacts.

45 In regard to the Amenity Impacts identified in **Section 1.3** the following responses are provided relevant to noise impacts.

Table 8: Response to Noise Amenity Grounds

Consolidated Grounds Reference	Identified Ground	Response – Noise
Paragraph 13	Whether the proposed development will result in unacceptable amenity impacts on nearby sensitive uses in terms of light, noise and dust	On the basis of the assessment undertaken the proposed use will not result in unacceptable noise amenity impacts on nearby sensitive receptors
Paragraph 14	**Mixed Use Zone Code**	
	Overall Outcome (c)	The carpark design, setback to surrounding sensitive uses and the proposed noise barrier will ensure that surrounding uses continue to experience a high level of acoustic amenity.
	Overall Outcome (f)	Not relevant to noise.
	Overall Outcome (n)	The carpark design, setback to surrounding sensitive uses and the proposed noise barrier will ensure that surrounding uses continue to

		experience a high level of acoustic amenity.
	PO27 (a)	The carpark design, setbacks to surrounding sensitive uses and the proposed noise barrier will ensure that surrounding uses continue to experience a high level of acoustic amenity and the noise impact of the use is minimised.
	PO32 (f)	The carpark design, setbacks to surrounding sensitive uses and the proposed noise barrier will ensure that surrounding uses continue to experience a high level of acoustic amenity and the noise impact of the use is minimised with use of screening and buffering.
	Relevant Matters	
Paragraph 41	Whether the development will not result in a worsening of amenity impacts for nearby residents that cannot be addressed through the imposition of reasonable and relevant conditions.	The proposed development will not result in a worsening of acoustic amenity on the basis of the available separation to sensitive land uses and the provision of acoustic barrier on part of the common boundary to the adjacent motel. Appropriate conditions can be imposed to ensure that the acoustic amenity of surrounding uses is protected.
Paragraph 42		Not relevant to Noise

46 It is my opinion that the proposed carpark can be constructed and operated such that the acoustic amenity of surrounding land uses is not adversely impacted.

3.0 AIR QUALITY MATTERS

3.1 SUMMARY OF ISSUES

47 My review of the various matters identified in Section 1.3of this Statement of Evidence and my consideration of the proposed development is that matters relevant to air quality include:

- Air quality is respect to dust, odour and emissions generated by the use of the site as a formal bitumen paved carpark upon the air quality amenity of surrounding noise sensitive receptors.

3.2 AIR QUALITY CRITERIA

3.2.1 Basis for Criteria

48 The Development Design Code of the Gladstone Regional Council Planning Scheme Section 9.3.2.3 – Assessment Benchmarks, Table 9.3.2.3.1 provides the following:

Acoustic and air quality	
PO15 Development minimises potential conflicts with, or impacts on, other uses having regard to odour, dust or other emissions.	**AO15** Development achieves the air quality design objectives set out in the *Environmental Protection (Air) Policy 2008, as amended.*

49 It is relevant to note that the Environmental Protection (Air) Policy 2019 has superseded the 2008 policy. The Environmental Protection (Air) Policy 2019 provides air quality standards for assessment of impact in Queensland.

3.2.2 Relevant Air Quality Criteria

50 The Environmental Protection (Air) Policy 2019 in Schedule 1 provides air quality objectives relevant to particulates (dust), motor vehicle exhaust emissions including Carbon Monoxide and VOC's.

51 In respect of odour, the EPP does not provide specific odour criteria, rather the Queensland Odour Guideline provides numerical odour criteria.

3.2.3 Air Quality Impacts

52 The proposed use is a formal carparking area which will comprise paved (likely bitumen surface) and concrete surface and formal landscaped areas. On this basis, the use has minimal potential to generate dust amenity impact and it is my opinion will not result in any adverse dust amenity impact at surrounding sensitive uses.

53 The proposed development will change the current landform which includes exposed earth areas with dust generation potential to a formed and sealed carparking area

which will effectively remove the potential for adverse dust emission.

54 In regard to odours and emissions, this can only relate to motor vehicle exhaust emissions which are already occurring in the locality and on the basis of my experience, the use of the land for a carpark will not result in any adverse amenity impact at surrounding sensitive receptors nor any emissions that would exceed regulatory air quality standards.

3.3 SUMMARY OF AIR QUALITY IMPACTS

55 In regard to the Amenity Impacts identified in **Section 1.3** the following responses are provided relevant to air quality impacts.

Table 9: Response to Air Quality Amenity Grounds

Consolidated Grounds Reference	Identified Ground	Response – Noise
Paragraph 13	Whether the proposed development will result in unacceptable amenity impacts on nearby sensitive uses in terms of light, noise and dust	The proposed carparking with sealed pavements and formal landscaping will not cause adverse dust impact at surrounding sensitive uses.
Paragraph 14	**Mixed Use Zone Code**	
	Overall Outcome (c)	The carpark design and setback to surrounding sensitive uses will ensure that surrounding uses continue to experience a high level of air quality amenity.
	Overall Outcome (f)	Not relevant to air quality.
	Overall Outcome (n)	The carpark design and setback to surrounding sensitive uses will ensure that surrounding uses continue to experience a high level of air quality amenity.
	PO27 (f)	The carpark design and setbacks to surrounding sensitive uses are such that the use will not result in adverse odours and emissions that will impact upon surrounding sensitive land use amenity.

	PO32 (f)	The carpark design and setbacks to surrounding sensitive uses will ensure that surrounding uses continue to experience a high level of air quality amenity.
	Relevant Matters	
Paragraph 41	Whether the development will not result in a worsening of amenity impacts for nearby residents that cannot be addressed through the imposition of reasonable and relevant conditions.	The proposed carpark will provide pavement areas and formal landscaping which will remove the potential for dust emissions from existing unsealed areas of the site. The use as a carpark will not result in adverse air quality amenity impacts at surrounding land uses.
Paragraph 42		Not relevant to Air Quality.

56 It is my opinion that the proposed carpark can be constructed and operated such that the air quality amenity of surrounding land uses is not adversely impacted.

4.0 LIGHTING AMENITY MATTERS

4.1 SUMMARY OF ISSUES

57 My review of the various matters identified in Section 1.3 of this Statement of Evidence and my consideration of the proposed development is that matters relevant lighting that require consideration include:

- Lighting in respect of amenity impacts of fixed lighting on the site and headlight glare resultant at surrounding residential uses associated with vehicle movements into and out of the site and upon the site.

58 The following section addresses the above lighting matters.

4.2 LIGHTING AMENITY CRITERIA

4.2.1 Basis for Criteria

59 The Development Design Code of the Gladstone Regional Council Planning Scheme Section 9.3.2.3 – Assessment Benchmarks, Table 9.3.2.3.1 provides the following:

Lighting	
PO18 External lighting is provided in urban areas to ensure a safe environment.	**AO18** Technical parameters, design, installation, operation and maintenance of outdoor lighting comply with the requirements of *AS4282 – Control of the Obtrusive Effects of Outdoor Lighting* as amended.
PO19 Outdoor lighting does not cause undue disturbance to any person, activity or fauna because of emission, either directly or by reflection.	**AO19** The vertical illumination resulting from direct, reflected or other incidental light coming from a site does not exceed 8 lux when measured at any point 1.5m outside of the boundary of the property at any level from ground level up.
PO20 Street lighting and signs are provided to ensure the safety of both vehicles and pedestrians, and to facilitate access and movement.	**AO20** Street lighting and signage comply with the requirements of the *Engineering design planning scheme policy*.

4.2.2 Relevant Lighting Standards

60 Relevant to AO18 above, Australian Standard AS/NZS 4282:2019 “Control of the obtrusive effects of outdoor lighting” sets maximum vertical plane illuminance (lux) levels for various environmental zones based upon varying sensitivity in different

zones and ambient lighting environments.

61 Table 3.1 of AS/NZS 4282:2019 defines environmental zones, with the residential properties surrounding the subject land best defined as either Zone A2 (Low District Brightness) or Zone A3 (medium district brightness) as follows:

TABLE 3.1

ENVIRONMENTAL ZONES

Zones	Description	Examples
A0	Intrinsically dark	UNESCO Starlight Reserve. IDA Dark Sky Parks. Major optical observatories No road lighting -unless specifically required by the road controlling authority
A1	Dark	Relatively uninhabited rural areas No road lighting - unless specifically required by the road controlling authority
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas
A3	Medium district brightness	Suburban areas in towns and cities
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas
TV	High district brightness	Vicinity of major sports stadium during TV broadcasts
V	Residences near traffic routes	Refer AS/NZS1158.1.1
R1	Residences near local roads with significant setback	Refer AS/NZS 1158.3.1
R2	Residences near local roads	Refer AS/NZS 1158.3.1
R3	Residences near a roundabout or local area traffic management device	Refer AS/NZS 1158.3.1
RX	Residences near a pedestrian crossing	Refer AS/NZS 1158.4

62 Table 3.2 of AS/NZS 4282:2019 sets ‘non curfew’ and ‘curfewed hours’[2] maximum design value for vertical plane illuminance (EV) of 5 lux and 1 lux respectively for the more conservative Zone A2, as follows:

[2] Nominally 11pm to 6am

TABLE 3.2

MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS

Zones	Vertical illuminance levels (E_v) lx		Threshold increment (TI)		Sky glow
	Non-curfew	Curfew	%	Default adaptation level (L_{ad})	Upward light ratio
A0	See Note 1	0	N/A	N/A	0
A1	2	0.1	N/A	N/A	0
A2	5	1	20%	0.2	0.01
A3	10	2	20%	1	0.02
A4	25	5	20%	5	0.03
TV	See Table 3.4	N/A	20%	10	0.08
V	N/A	4	Note 2	Note 2	Note 2
R1	N/A	1	20%	0.1	Note 3
R2	N/A	2	20%	0.1	Note 3
R3	N/A	4	20%	0.1	Note 3
RX	N/A	4	20%	5	Note 4

63 Thus, vertical plane illuminance (e.g., illumination of a habitable room façade) of less than or equivalent to 5 lux pre 11pm and 1 lux after 11pm is deemed to be acceptable.

64 In addition to the above, AO19 above imposes a lighting criterion for spill light to not exceed 8 lux in vertical plane at any point beyond 1.5 metres of the site boundary.

65 In addition to the above amenity standards, as required by AO20, AS 1158.3.1:2020 provides lighting requirements for safety in respect of vehicle movements and pedestrians and requirements for lighting design for outdoor carpark areas with pedestrian movement as Category PC3 and PCD. This sets criteria both in respect of the required level of luminance in the use area but also the level of control of light in terms of spill and glare.

4.3 FIXED LIGHTING

66 The site will likely include fixed lighting for carparking and pedestrian areas of the site. I have been provided with a lighting design prepared for Gladstone Regional Council by Andreson Consulting Engineers “Electrical Services – Lighting Design” Drawing No 20066-S001 Revision B dated March 2021. A copy of the drawing is included as **Attachment 2**. The lighting design proposes use of solar powered LED lighting on vertical poles throughout the carpark.

67 Modern LED lighting provides for luminaires that have a high degree of directional control which is able to contain lighting to the area requiring luminance and with horizontal fittings, minimise visible glare of the fitting when viewed external to the lit area.

68 The existing night lighting environment of the immediate surrounds is primarily impacted by existing street lights, and headlights of vehicles on public roadways.

69 The Lighting Design provided as **Attachment 3** demonstrates compliance with Australian Standard AS/NZS 4282:2019 “Control of the obtrusive effects of outdoor lighting” in that the isolux contours show levels resultant at residential receptors will be less than 0.7 lux and hence comply with the curfew hours 1 lux criterion.

70 It is my professional opinion that compliance with the Australian Standard AS/NZS4822 will ensure that there is no adverse impact of artificial lighting of the site upon surrounding residential uses.

71 Consideration of the lighting design in respect of PO19/AO19 however identifies that to the southwest of the site, the resultant illuminance external the site will be up to 14 lux near light Pole 2. This exceeds the AO19 nominated 8 lux at 1.5 metre beyond the boundary. In my experience, this can be readily made compliant by installation of a glare shield to the luminaire on Pole 2 to reduce rear light emission.

72 The lighting design identifies compliance is achieved with AS1158.3.1 2020 requirements for PC3 and PCD lighting. This thus achieves compliance with PO20/AO20.

73 In summary, the lighting design provided identifies compliance with the relevant lighting amenity and safety standards is achieved other then for a minor exceedance of the 8 Lux limit on the accessway into the Beach Houses Estate. It is my opinion that fitting a light shield to rear of the Pole 2 luminaire will achieve appropriate compliance.

74 It is important to note that the lighting design assessment has not taken account of the shielding effects of any vegetation/landscaping or fencing such as the proposed acoustic barrier. The effect of vegetation/landscaping and fencing is to provide further control of any spill lighting within the carpark footprint.

75 It is my opinion that fixed site lighting can be designed, installed and operated to comply with the relevant amenity and safety standards.

4.4 HEADLIGHT GLARE

76 The use of the carpark during hours of darkness will include the use of headlights on vehicles entering and exiting the carpark and manoeuvring within the carpark.

77 The operation of vehicle headlights in a built-up area is restricted to low-beam.

78 Australian Design Rule 46/00 – Headlamps stipulates requirements for low-beam headlighting on light vehicles, including that:

> *6.2. The passing beam must produce a sufficiently sharp "cut-off" to permit satisfactory adjustment with its aid. The "cut-off" must be a horizontal straight line on the side*

opposite to the direction of the traffic for which the headlamp is intended; on the other side it should be horizontal or within an angle of 15 degrees above the horizontal.

79 Annex 6 of Australian Design Rule 46/00 in conjunction with Clauses 6.2 and 6.3 dictate that:

- At a distance of 25 metres from the headlamp, illumination may only exceed 2 lux[3] up to a height of approximately 375mm above ground i.e., the majority of the illumination is directed downwards, well below the horizontal plane. The maximum width of the zone that can exceed 2 lux is 4.5 metres i.e., 2.25m either side of the vehicle centreline at a distance of 25 metres from the headlamp.
- To the right of the vehicle centreline, illuminance above the horizontal plane[4] must not exceed 0.7 lux[5], which is well below the relevant 2 lux AS/NZS 4282:2019 limit.
- To the left of the vehicle centreline, illuminance of more than 0.7 lux must only occur below the horizontal plane, or within an angle of 15 degrees above the horizontal plane.

80 Thus, in accordance with Australian Design Rule 46/00, the primary illumination from the headlighting must remain below the horizontal and result in only minor illumination up to a height of approximately 750mm to 1 metre above ground at 25 metres from the headlamp.

81 The practical outcome of the above is that the operation of vehicle headlights in a built-up area is restricted to use of Low Beam. The design of vehicle headlights is regulated by Australian Design Rules which limit aiming direction and brightness.

82 Testing of various vehicle headlights over many years identifies that low beam headlights are angled such that the extent of the beam is angled down to meet the ground (on flat terrain) at a distance no greater than 30 metres in front of a vehicle.

83 Having regard to the location of the carpark and surrounding residences, I have prepared a drawing showing the potential extent of headlight beams from vehicles within and entering and exiting the carpark. The drawing has been prepared on the basis of existing vegetative screening identified and the acoustic barrier proposed along the common boundary to the motel as part of the noise assessment. **Figure 5** provides the extent of direct headlight beam travel. **Table 9** below provides details of the receptors considered in the headlighting assessment.

[3] The relevant 2 lux AS/NZS 4282:2019 limit
[4] nominally 750mm as an indicative headlamp height
[5] i.e. no significant illumination

Table 10 Nearby Dwellings

Address	Lowset/Highset/ 2 Storey	Physical Screening
43 Beach Houses Estate Road	Lowset	Existing Vegetation – line of sight in part
44 Beach Houses Estate Road	Lowset	Existing Vegetation – restricted line of sight
Motel 7 Agnes Street West Block	Lowset	Proposed 1.8 m acoustic barrier
Motel 7 Agnes Street East Block	Lowset	Proposed 1.8 m acoustic barrier
12 Agnes Street	Lowset	Landscaping to part frontage
10 Agnes Street	2 Storey	Landscaping to part frontage
2 Jeffery Court	2 Storey	Landscaping to part frontage
3 Agnes Street	3 Storey Units	Hedges to access to Beach Houses Estate
42 Grahame Colyer Drive	Lowset	Existing vegetation part line of sight

84 **Figure 5** demonstrates that no direct headlight wash will occur over residential uses to the north, west or south due to separation distance, existing dense vegetation and the proposed acoustic barrier. There will be some headlight beam wash over houses on the eastern side of Agnes Street however, this would presently occur from vehicles on Agnes Street, turning into Jeffrey Court and out of the existing motel in hours of darkness.

85 It is my opinion that headlighting glare as a result of the proposed carpark will not result in environmental nuisance at existing sensitive uses.

86 It is my recommendation that good design practice would be for low height landscaping to 1.0m in height be provided around the perimeter of the carpark to the west and east to assist in containing car headlight beams.

4.5 SUMMARY OF LIGHTING IMPACTS

87 In regard to the Amenity Impacts identified in **Section 1.3** the following responses are provided relevant to lighting impacts.

Table 11: Response to Lighting Amenity Grounds

Consolidated Grounds Reference	Identified Ground	Response – Noise
Paragraph 13	Whether the proposed development will result in unacceptable amenity impacts on nearby sensitive uses in terms of light, noise and dust	The proposed carparking with appropriate fixed lighting design and formal landscaping will not cause lighting impacts surrounding sensitive uses.
Paragraph 14	**Mixed Use Zone Code**	
	Overall Outcome (c)	The carpark with appropriate fixed lighting design and setback to surrounding sensitive uses will ensure that surrounding uses continue to experience a high level of lighting amenity.
	Overall Outcome (f)	Not relevant to artificial lighting.
	Overall Outcome (n)	The carpark with appropriate fixed lighting design and setback to surrounding sensitive uses will ensure that surrounding uses continue to experience a high level of lighting amenity.
	PO27 (g)	The carpark with appropriate fixed lighting design and setbacks with appropriate landscaping surrounding is such that the use will not result in adverse lighting impact by either fixed lighting or car headlighting at surrounding sensitive land use amenity.

	PO32 (f)	The carpark with appropriate fixed lighting design and setbacks to surrounding sensitive uses coupled with landscaping screening will ensure that surrounding uses continue to experience a high level of lighting amenity.
	Relevant Matters	
Paragraph 41	Whether the development will not result in a worsening of amenity impacts for nearby residents that cannot be addressed through the imposition of reasonable and relevant conditions.	The proposed carpark can be designed, constructed and operated such that lighting from the site by way of fixed lighting and car headlight glare will not result in adverse lighting amenity impacts at surrounding land uses.
Paragraph 42	Whether the proposed development will result in improved safety outcomes, having regard to the proposed lighting, and any impacts therefrom can be appropriately mitigated through the imposition of reasonable and relevant conditions.	The proposed carpark will include fixed lighting that can be designed, installed and operated to achieve compliance with the relevant standards identified in Section 4.2.2 which will provide for a safe area and will improve upon current dark conditions on the site at night. Suitable conditions requiring lighting design to appropriate standards can be imposed in my opinion.

88 It is my opinion that the proposed carpark can be designed, constructed and operated such that the lighting amenity of surrounding land uses is not adversely impacted by way of fixed light spill or glare nor from vehicle headlighting on the land and entering and exiting the land from Agnes Street.

5.0 CONCLUSION

89 The proposed development of a formal sealed carpark comprising 73 spaces has been considered in respect to potential noise, air quality and lighting amenity impacts.

90 My findings in respect to noise, air quality and lighting amenity impacts and the relevant grounds in respect to such are provided below.

Noise Amenity

91 Detailed noise modelling has been conducted to assess the potential noise impact of the proposed use during the day/evening and night periods.

92 Appropriate noise criteria have been derived on the basis of the Planning Scheme and the Environmental Protection (Noise) Policy 2019.

93 The noise assessment has been undertaken on a conservative usage rate basis and has identified that noise compliance will be achieved at all surrounding noise sensitive receptors with the only physical noise mitigation measure required being a 1.8 metre high acoustic barrier fence along part of the northeast boundary of the land to the adjacent motel.

94 In respect of the Assessment Benchmarks identified in Section 1.3, the proposed development can readily comply with appropriate noise amenity standards such that the acoustic amenity of surrounding sensitive uses is not adversely affected.

95 In respect of the Relevant Matters identified in Section 1.3, the development will not result in a worsening of acoustic amenity on the basis that appropriate conditions can be imposed to protect amenity including:

(i) Design and operate the use to comply with the noise standards of the Environmental Protection (Noise) Policy 2019; and
(ii) Erect and maintain a 1.8 metre high acoustic barrier along part of the northeast boundary of the land to the adjacent motel. The noise barrier is to be constructed from suitable materials to achieve a minimum surface density of 12.5 kg/m^2.

Air Quality

96 It is my opinion that the use of the site for a formal paved carpark with appropriate landscaping will not result in adverse air quality impact by way of dust, odours or emissions.

97 In respect of the Assessment Benchmarks identified in Section 1.3, the proposed development can readily comply with appropriate air quality standards such that the air quality amenity of surrounding sensitive uses is not adversely affected.

98 In respect of the Relevant Matters identified in Section 1.3, the development will not

result in a worsening of air quality amenity on the basis that appropriate conditions can be imposed to protect amenity including:

(i) Design and operate the use to comply with the air quality objectives of the Environmental Protection (Air) Policy 2019.

Lighting

99 In respect of lighting impacts of the use, this relates to potential light spill and glare associated with fixed lighting for the carpark for safety purposes and potential car headlight glare from cars on the site and entering and exiting the site to Agnes Street.

100 It is my conclusion that lighting impacts from both fixed lighting and headlight glare will not results in adverse amenity impact and that the use can operate 24 hours per days, 7 days per week without adverse lighting impact.

101 In respect of the Assessment Benchmarks identified in Section 1.3, the proposed development can readily comply with appropriate lighting amenity standards such that the lighting amenity of surrounding sensitive uses is not adversely affected.

102 In respect of the Relevant Matters identified in Section 1.3, the development will not result in a worsening of lighting amenity and safety on the site will be improved on the basis that appropriate conditions can be imposed including:

(i) Prepare and submit to Council for approval a detailed fixed lighting design assessment report which provides lighting design to achieve compliance with the requirements of AS/NZS 4282:2019 “Control of the Obtrusive Effects of Outdoor Lighting”; and

(ii) Provide suitable landscaping to the perimeter of the carpark to provide screening to car headlights on the site.

103 In summary, it is my opinion that the proposed development can comply with the relevant Assessment Benchmarks and in my opinion lawful relevant conditions can be imposed to protect surrounding amenity in respect of noise, air quality and lighting.

Paul King
14 October 2021

6.0 STATEMENT TO THE COURT

In the Planning and Environment Court Appeal No 795 of 2021

Between:	**PAUL ROBINSON and PAUL SCHUBERT**	Appellants
And:	**GLADSTONE REGIONAL COUNCIL (in its role as Assessment Manger)**	Respondent
And:	**GLADSTONE REGIONAL COUNCIL (in its role as development proponent)**	Co-Respondent

I, ***Paul Anthony King*** have read, understand and discharged the duties of experts in the Planning and Environment Court Rules 2018 and Section 428 of the Uniform Civil Procedures Rules 1999.

I have been instructed by McCullough Robertson to investigate the noise, air quality and lighting amenity aspects of the proposed development. No instructions have been given or accepted to adopt or reject a particular opinion in preparing this report.

In preparing the report, I have:

- made all the enquiries which I believe are desirable and appropriate and that no matters of significance which I regard as relevant have, in my knowledge, been withheld from the Court; and
- considered the development application and the documents disclosed by the parties to the proceeding.

The factual matters stated in this report are, as far as I know, true and correct. The opinions I state in this report are genuinely held by me.

All analyses and assessments referred to in this report were undertaken by me. The report contains reference to all matters I consider are significant.

My qualifications and experience are contained in my curriculum vitae. Documents relied upon include those provided in the briefing documents from McCullough Robertson.

Signature:

Name: **Paul Anthony King**
Date: **14 October 2021**

FIGURES

LEGEND

SITE LOCATION

DRAWING REFERENCE

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DNRME LAND AND SPATIAL INFORMATION
IMAGERY QLDBASE AERIAL.

N

0 10 20 30 40m

CLIENT
GLADSTONE REGIONAL COUNCIL
C/- McCULLOUGH ROBERTSON

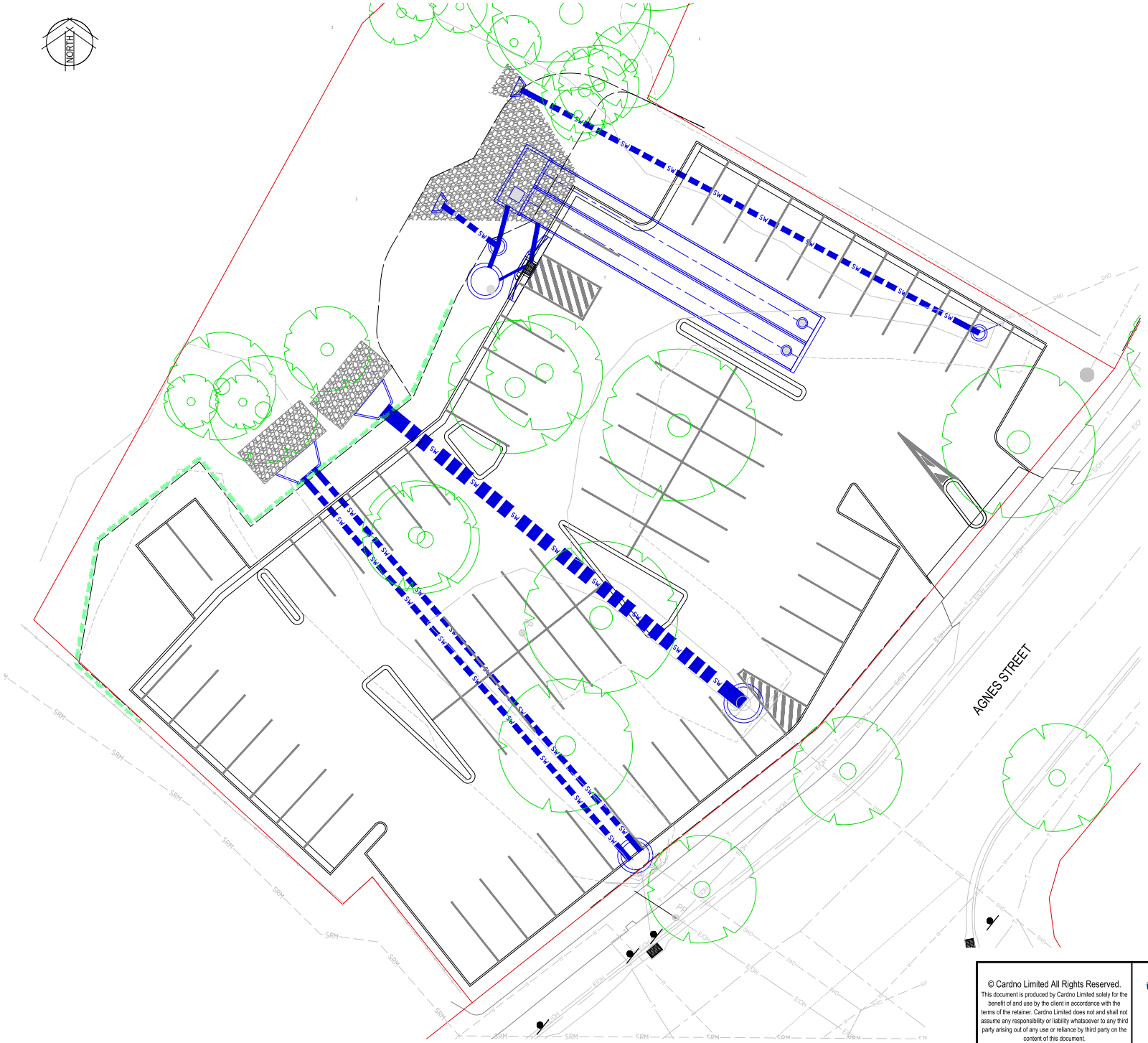
PROJECT
NOISE AND LIGHTING ASSESSMENT
P&E APPEAL 13 OF 2021
PROPOSED PARKING STATION
5 AGNES STREET
AGNES WATER QLD

TITLE
SITE LOCATION AND SURROUNDING LAND USES

JOB	AGNES WATER	**FIGURE 1**
JOB NO.	21-129	
DATE	07/10/21	DWG NUMBER
SCALE	1:1250 (A4)	**21-129-1**
REV.		

mwa ENVIRONMENTAL

Max Winders & Associates Pty Ltd tas MWA Environmental
Level 15, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 F 07 3002 5588 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084



CLIENT
GLADSTONE REGIONAL COUNCIL
C/- McCULLOUGH ROBERTSON

PROJECT
NOISE AND LIGHTING ASSESSMENT
P&E APPEAL 13 OF 2021
PROPOSED PARKING STATION
5 AGNES STREET
AGNES WATER QLD

TITLE
PROPOSED CARPARK PLAN

JOB	AGNES WATER	**FIGURE 2**
JOB NO.	21-129	
DATE	07/10/21	DWG NUMBER
SCALE	1:400 (A4)	**21-129-2**
REV.		

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Level 15, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 F 07 3002 5588 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084

CARPARKS	
TOTAL	DIMENSIONS
73	5.40m x 2.70m (PERP)

LEGEND

- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING SEWER MAIN AND MANHOLE
- EXISTING OVERHEAD ELECTRICAL CABLE AND POWER POLE
- EXISTING EXISTING WATER MAIN
- EXISTING STORMWATER MAIN
- EXISTING UNDERGROUND TELSTRA CABLE
- RP BOUNDARY
- EXISTING FENCE
- TREE
- PROPOSED STORMWATER
- NEW DIAMOND BLOCK RETAINING WALL (OR APPROVED EQUIVALENT)

Cardno (Qld) Pty Ltd | ABN 57 051 074 992
101 High Street
North Rockhampton, QLD 4701
Tel: 07 4924 7500 Fax: 07 4926 4375
Web: www.cardno.com.au

GLADSTONE REGIONAL COUNCIL
AGNES ST AND JEFFERY CRT, AGNES WATERS
CARPARK WORKS - COMMUNITY CONSULTATION
AGNES ST CARPARK - OPTION 1

Datum	Date	Scale	Size
AHD		N.T.S.	A1

Drawing Number: R2020043-SK-0004 | Revision: 1

LEGEND

SITE BOUNDARY

R7 NEAREST SENSITIVE RECEPTORS R1-R7

DRAWING REFERENCE

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- CARDNO (QLD) PTY LTD, AGNES WATER CARPARK WORKS - COMMUNITY CONSULTATION AGNES ST CAR PARK - OPTION 1, PLAN R2020043-SK-0004 REV 1.

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0 10 20 30m

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C/- McCULLOUGH ROBERTSON

PROJECT
NOISE AND LIGHTING ASSESSMENT
P&E APPEAL 13 OF 2021
PROPOSED PARKING STATION
5 AGNES STREET
AGNES WATER QLD

TITLE
SENSITIVE RECEPTOR LOCATIONS

JOB	AGNES WATER	FIGURE 3
JOB NO.	21-129	
DATE	07/10/21	DWG NUMBER
SCALE	1:1000 (A4)	21-129-3
REV.		

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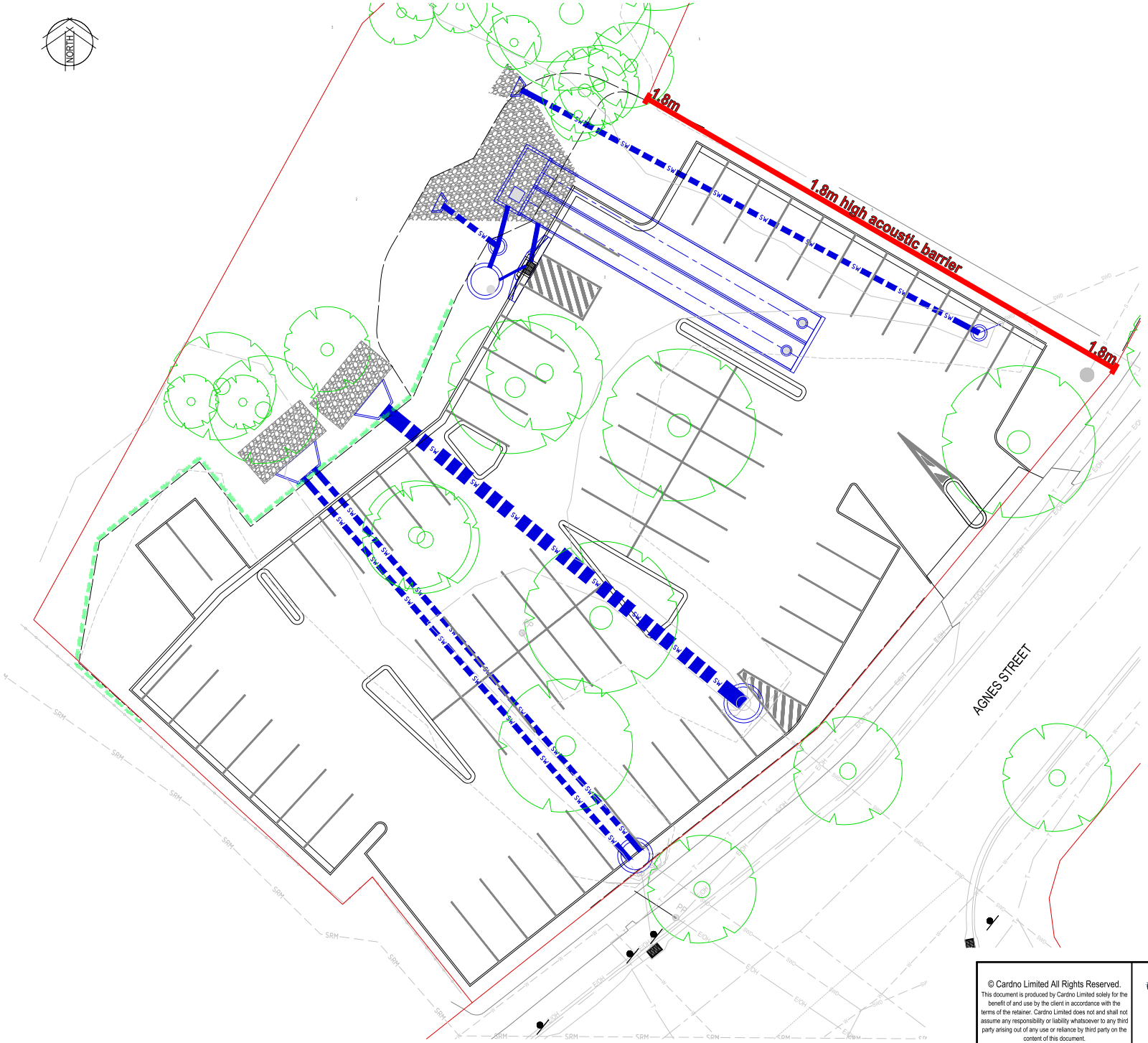
Level 15, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 F 07 3002 5588 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084



LEGEND

1.8m BARRIER HEIGHT
ACOUSTIC BARRIER

CLIENT
GLADSTONE REGIONAL COUNCIL
C/- McCULLOUGH ROBERTSON

PROJECT
NOISE AND LIGHTING ASSESSMENT
P&E APPEAL 13 OF 2021
PROPOSED PARKING STATION
5 AGNES STREET
AGNES WATER QLD

TITLE
ACOUSTIC BARRIER LOCATION

JOB	AGNES WATER	FIGURE 4
JOB NO.	21-129	
DATE	07/10/21	DWG NUMBER
SCALE	1:400 (A4)	21-129-4
REV.		

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Level 15, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 F 07 3002 5588 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084

CARPARKS	
TOTAL	DIMENSIONS
73	5.40m x 2.70m (PERP)

LEGEND

- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING SEWER MAIN AND MANHOLE
- EXISTING OVERHEAD ELECTRICAL CABLE AND POWER POLE
- EXISTING EXISTING WATER MAIN
- EXISTING STORMWATER MAIN
- EXISTING UNDERGROUND TELSTRA CABLE
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AGNES ST AND JEFFERY CRT, AGNES WATERS CARPARK WORKS - COMMUNITY CONSULTATION
AGNES ST CARPARK - OPTION 1

Datum	Date	Scale	Size
AHD		N.T.S.	A1

Drawing Number: R2020043-SK-0004 | Revision: 1

LEGEND

- SITE BOUNDARY
- SCREENING
- POTENTIAL HEADLIGHT BEAM EXTENT
- 1.8m BARRIER HEIGHT ACOUSTIC BARRIER / WALL

DRAWING REFERENCE

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- OPTION 1, PLAN R2020043-SK-0004 REV 1.

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CLIENT
GLADSTONE REGIONAL COUNCIL C/- McCULLOUGH ROBERTSON

PROJECT
NOISE AND LIGHTING ASSESSMENT
P&E APPEAL 13 OF 2021
PROPOSED PARKING STATION
5 AGNES STREET
AGNES WATER QLD

TITLE
CAR HEADLIGHT ASSESSMENT

JOB	AGNES WATER	**FIGURE 5**
JOB NO.	21-129	
DATE	07/10/21	DWG NUMBER
SCALE	1:1000 (A4)	**21-129-5**
REV.		

Max Winders & Associates Pty Ltd tas MWA Environmental
Level 15, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 F 07 3002 5588 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084

ATTACHMENT 1
Curriculum Vitae – Paul King

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CURRICULUM VITAE

PAUL KING

PRINCIPAL ENGINEER

QUALIFICATIONS

Bachelor of Engineering (Mechanical) Queensland University of Technology, 1988

TECHNICAL EXPERTISE

Environmental and Architectural acoustics including
- Traffic, rail and aircraft noise
- Industrial Noise
- Entertainment Noise
- Design of Internal Spaces to meet defined acoustic requirements
- Use of Applied computer modelling and scientific analysis to provide design solutions to environmental engineering related matters

Environmental Assessments
Environmental Audits and Management Plans including
- Environmental Management Plans
- Stormwater Quality Management Plans

Air Quality Assessments including
- Air quality monitoring, use of computer modelling to predict airborne pollutant transport including odour and particulates.
- Field odour assessment and mitigation measure design.

Lighting Impact Assessments
Breeze Amenity assessments
Expert Witness in Planning and Environment Court, Magistrates Court, Liquor Appeals Tribunal, Land Court.

PROFESSIONAL EXPERIENCE

Engineer, Max Winders & Associates Pty Ltd tas MWA Environmental
(1988 to present)

Engineer responsible for environmental assessment, acoustics and air quality. Role includes co-ordination of projects through approvals processes, liaison with government departments and officers to progress development approvals and to resolve conflicts with respect to environmental matters. Specific duties include:

- Road traffic noise studies using computer modelling in conjunction with detailed field noise measurements to design acceptable acoustic controls for new roads and for new sensitive land uses. Assessments of noise from car parking and traffic movements associated with developments including retail, commercial and industrial development.
- Rail traffic noise studies using computer modelling in conjunction with detailed field noise measurement to design acceptable acoustic controls for new sensitive land uses in proximity to rail corridors including Marshalling Yards, freight depots and rail line corridors.
- Aircraft noise assessment including use of regulatory methods to assess land use suitability in aircraft noise affected areas, detailed field noise measurements, consideration of land uses in proximity to airports and design of appropriate acoustic controls in residences to satisfy regulatory design criteria.

- Industrial noise assessment for proposed and existing industry to obtain development approvals and to resolve noise complaints and excess noise emissions using engineering methods. Detailed noise measurement and analysis using computer models and precision monitoring equipment are used to determine noise emissions and to assess required noise control works. Industrial and commercial sources investigated include quarries, sand and gravel processing plants, underground mine ventilation plant, concrete plants, feed mills, air-conditioning and refrigeration plant and mining operations.
- Detailed acoustic design for residential, commercial, educational, medical and industrial uses of internal building use areas. Provision of acoustic outcomes for speech intelligibility in educational and commercial facilities by way of acoustic design of internal spaces. Residential projects include compliance design with Building Code Sound Isolation Provisions, acoustic design of external facade elements to account for external acoustic environment, mechanical plant noise assessment and acoustic control design.
- Combined studies on noise, light and air quality aspects for developments such as shopping centres, fast food restaurants and service stations.
- Lighting impact assessments including illuminated LED signage, lighting safety in workplace situations, nuisance light and glare from commercial development signage and lighting.
- Noise and air quality studies for a range of extractive industry including quarries, sand extraction and processing and coal mine projects.
- Air quality studies to determine the impact of atmospheric emissions from industrial plants, extractive industry (quarries, mines, sand extraction) and odour sources such as cattle feedlots, abattoirs, poultry farms and sewage treatment plants.
- Breeze amenity assessments for multi level residential projects.
- Transportation generated pollutant load investigations to determine impact upon sensitive land uses including childcare centres.
- Noise and air quality studies for cruise ship terminal, noise and air quality assessments boat building facilities, environmental audits marina maintenance facilities.
- Entertainment noise investigations for proposed and existing venues utilising amplified entertainment including Licensed Clubs and Hotels and for proposed residential development in proximity to such development. Studies involve detailed noise measurement, computer noise modelling and assessment to determine appropriate design solutions.
- Environmental Impact Assessments for commercial and industrial developments are prepared for developments including retail shopping centres, chemical manufacturing plants, paper tissue manufacturing facility, meat processing, cattle feedlots, concrete batching plants, mines, quarries and related industry.
- Environmental management plans are prepared for the construction and operational phase of developments including areas of noise, air quality, stormwater quality and related fields.
- Flooding studies for minor and major watercourses have been conducted with his input including computer modelling, hydrological and hydraulic calculations.
- Involvement in community consultation and liaison to progress development projects for both private developers and local authorities. Presentations to community groups and interested parties regarding environmental aspects of development approvals.
- Provision of specialist expert evidence in Court appeals for a range of developments for over 20 years, acting for both private developers, local and state government departments and private land holders. Court matters including Planning and Environment Court, Magistrates Court, Liquor Appeals Tribunal and Land Court.

RELEVANT PROJECTS

Road Traffic Noise Studies

- Delfin Property Group – Forest Lake, Springfield Lakes
- Australand – Glendora Estate McDowall; Carindale Hills, Carindale; Dandenong Rd, Mt Ommaney

Rail Traffic Noise Studies

- Melton Road, Northgate;
- Parklands Roma Street

Aircraft Noise Studies

- SEQ Properties – Mudjimba Subdivision;
- Benin Pty Ltd Oxley Ridge Golf Course Estate, Blunder Road, Oxley;
- Bellvista Caloundra
-

Residential Acoustic Design

- Riva Apartments, Indooroopilly
- Viva Apartments, Fortitude Valley
- Kelvin Grove Urban Village
- Parklands, Roma Street
- London Woolstore, Teneriffe
- Leftbank Apartments, West End
- Drift Apartments, Casuarina Beach
- Numerous townhouse and unit developments adjacent major transport corridors including railway lines, major roads and aircraft flight paths.

Commercial/Educational Acoustic Design

- Anglican Church Grammar School – Science Block, Sports Hall, Morris Hall, Centenary Library.
- Stuartholme – Joigny Centre – Large auditorium, library, class rooms music and drama rooms.
- Logan West Regional Library
- Numerous office tenancies in Brisbane CBD – acoustic privacy and plant noise issue resolution.
- Hillbrook Anglican College – Auditorium, Chapel, Library, Classrooms
- QUT Kelvin Grove – Health II facilities
- Southbank Institute of TAFE – Major redevelopment
- QUT Gardens Point – teaching and office area acoustic rectifications
- Retail centres – internal fitouts, acoustic design.

Industrial Noise Assessments

- Karreman Quarry, Mt Cotton
- Peterson Corporation Withcott Quarry;
- Astec Asphalt – Yatala Asphalt Plant;
- Gympie Gold – Eldorado Gold Mine and Lewis Decline, Gympie;
- Darwalla Milling – Mt Cotton Feedmill and Poultry Growing Sheds;
- Cleveland Power Biomass Power Station, Mt Cotton
- Transport Depots, Moolabin, Port Curtis, Berrinba, Brisbane

Noise, Air Quality and Light Studies

- McDonalds Family Restaurants – Mt Gravatt, Windsor, Newmarket, Coorparoo, Casino, Port Douglas, Indooroopilly, Brisbane, Cairns, Northern New South Wales
- Supermarkets and Retail Developments– Newmarket, Gladstone, Townsville, Queen Street Central, Westfield Carindale, Capalaba Park
- Service Stations- Windsor, Aspley, Cannon Hill, Taigum, Yamanto, Loganlea
- Lighting Assessments – Planning and Environment Court – LED Advertising Sign Bundall, Shopping Centres South East Queensland, Service Stations.
- Lighting assessments – workplace environments – transport depots Queensland.

Air Quality Studies

- Quarries – Levitt Road, Upper Coomera, Withcott, Gatton, Mt Cotton
- Concrete Batching Plants; Windsor, Caboolture, West End, West Burleigh
- Cattle Feedlots Coominya, Jondaryan, Acland, Wambo, Proston, Kilkivan
- Abattoirs – Coominya, Kingaroy, Cannon Hill, Beenleigh, Kilcoy, Gympie
- Poultry Growing Narangba, Redland Bay, Mt Cotton, Waterford, Gatton
- Sewage Treatment Plants Emerald, Bucasia Beach, Redcliffe
- Cooking Exhaust Odour/Particulates – Assessment, design and specification of mitigation measures – Fortitude Valley, Surfers Paradise, Mackay, Chinchilla.
- Fast Food restaurant air quality studies – McDonalds Australia, KFC
- Coal Mining Projects – Wandoan, Collinsville, Blackwater, Moranbah
- Gas Turbine Power Stations Golden Plains, Mt Stuart
- Biomass Power Station Mt Cotton

Transportation Air Pollutant Studies

- Childcare Centres – Acacia Ridge, Kenmore, Tingalpa, Morningside, Wishart, Middle Park, Mango Hill, Mitchelton, Strathpine
- Drive through Restaurants – Palm Beach, Indooroopilly

Marine Based Use Assessments

- Hamilton – Portside Wharf Cruise Terminal – noise and air quality studies of cruise ships berthing at wharf adjacent multi level residential towers.
- Sanctuary Cove – environmental audit of marina work area
- Toorbul - noise and air quality studies of slipway, boat repair facility
- Molendinar, Coomera -noise and air quality studies of fibreglass boat building facilities
- Gold Coast - noise and vibration assessment – motor yacht

Entertainment Noise Assessments

- Fortitude Valley – Empire Hotel, The Beat, Warner Street, Jubilee Hotel,
- Brisbane City – Fridays, City Rowers, Victory Hotel, Port Office Hotel, Gilhooleys, HSW
- Cheers Taverns – Aspley, Spring Hill, Sunnybank
- Various Hotels, Taverns and Clubs throughout Queensland

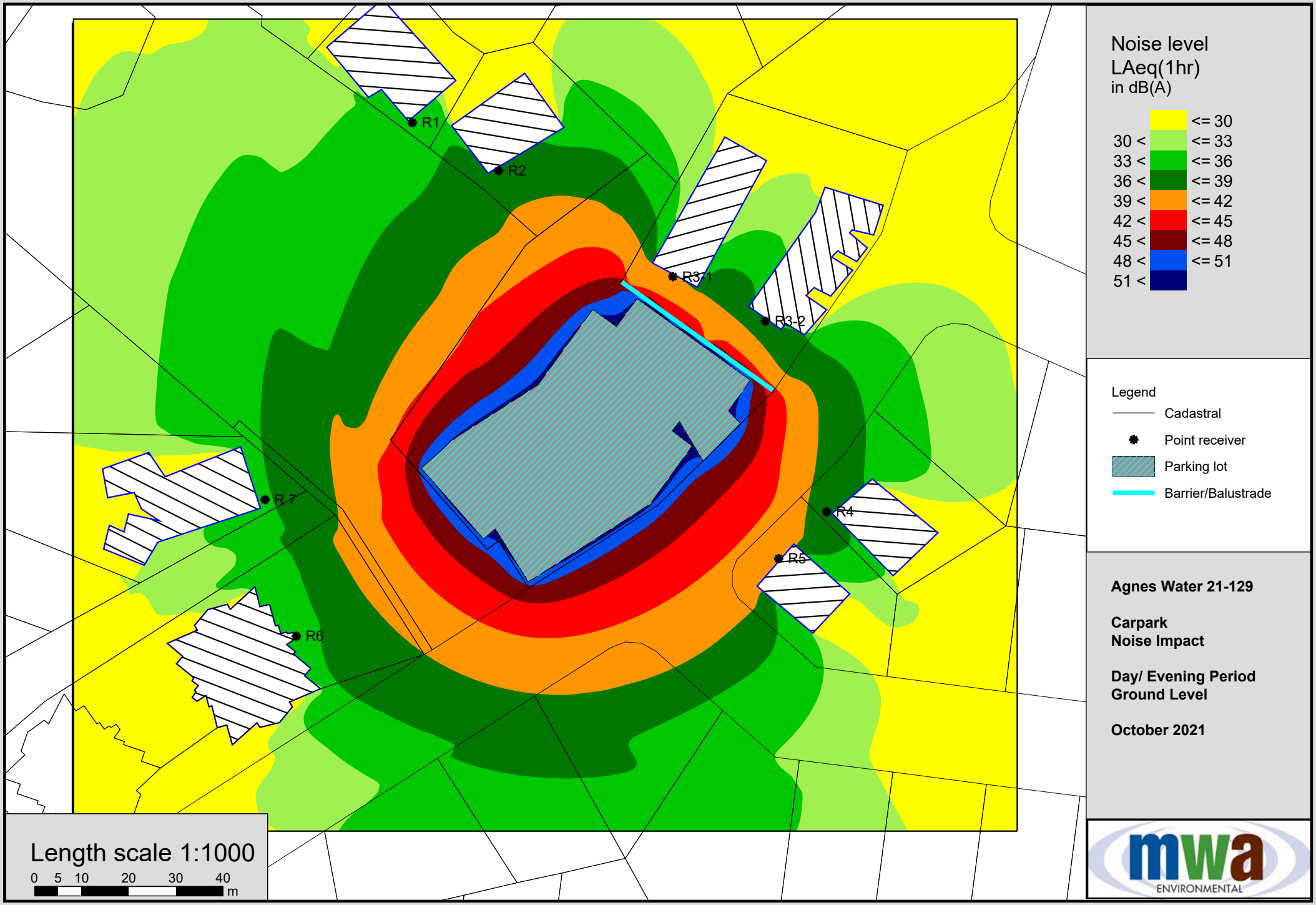
Planning and Environment Court

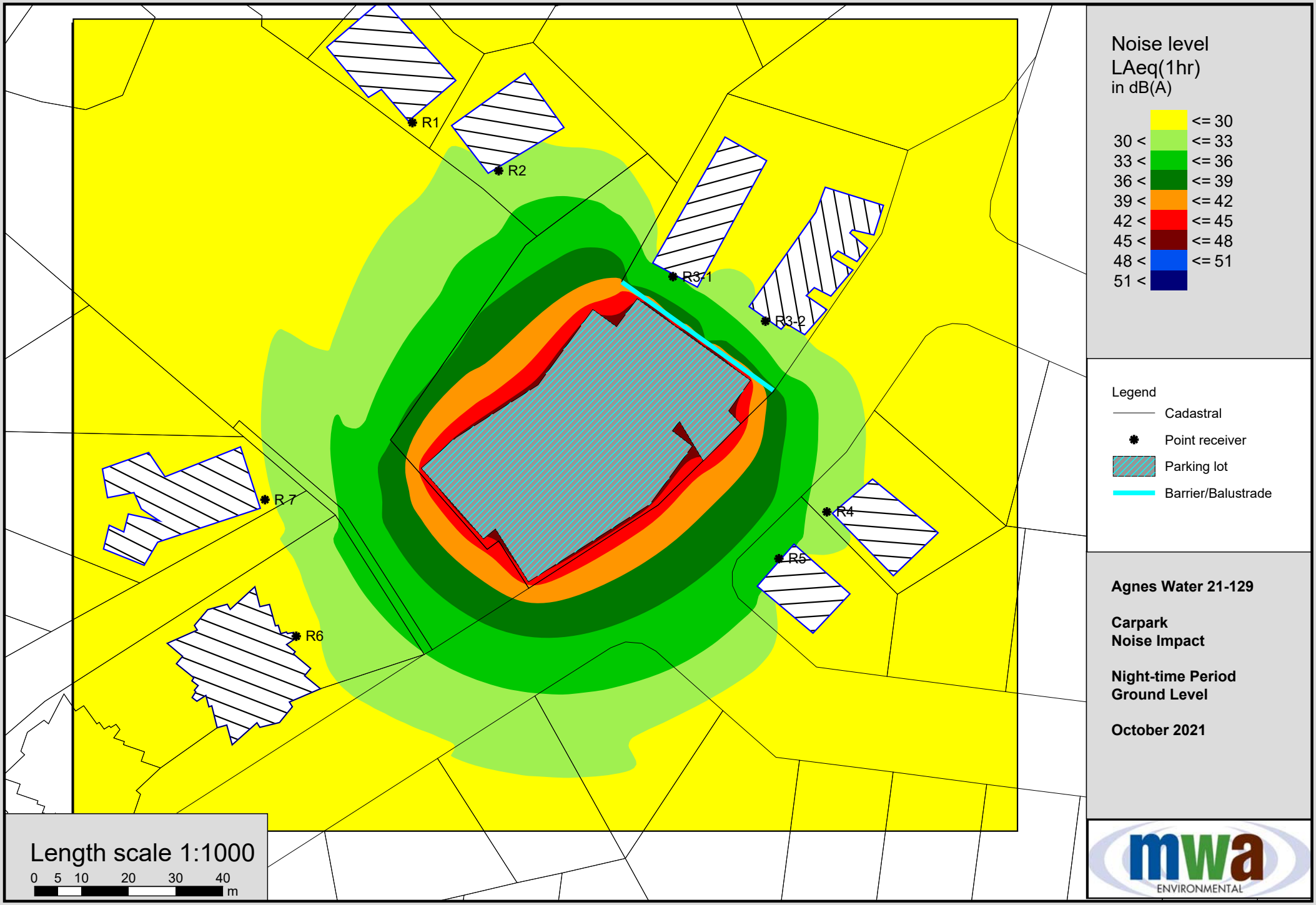
- Shopping centre appeals throughout Queensland (noise, lighting, air quality)
- Service Station and fast food (noise, lighting, air quality)
- Childcare centres (noise and air quality)
- Residential subdivisions and unit projects
- Cattle feedlot, piggery and abattoirs
- Quarries, sand extraction, concrete batching plants
- Dog boarding kennels
- Poultry Farming
- Power station projects
- Composting projects
- Waste transfer station and waste disposal facilities
- Sewerage Treatment Plants
- Breeze Amenity Assessment – Multi Unit Residential
- Illuminated Advertising Signage – nuisance and glare assessment
- Turtle Nesting – Lighting Control – Yaroomba

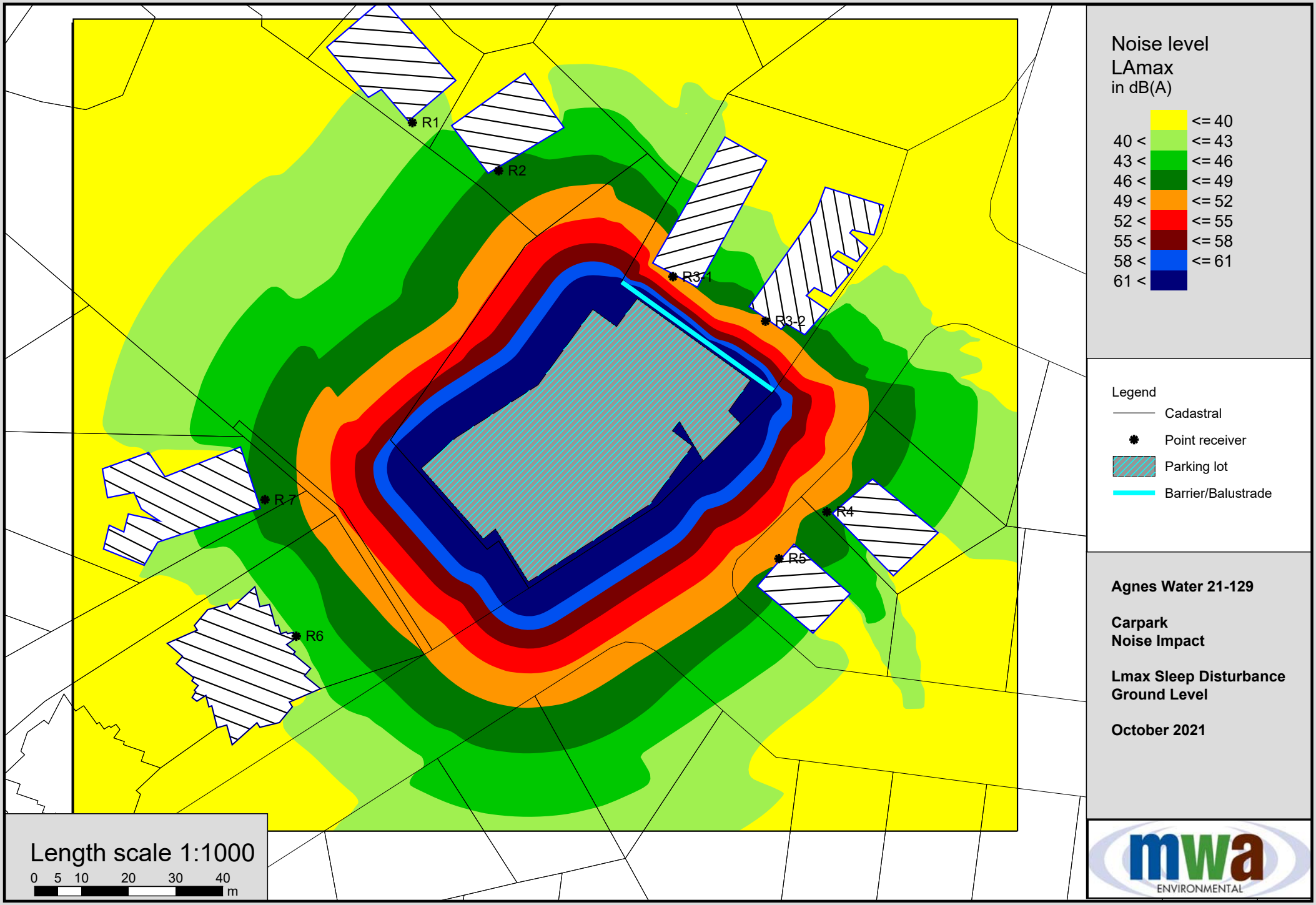
Land Court

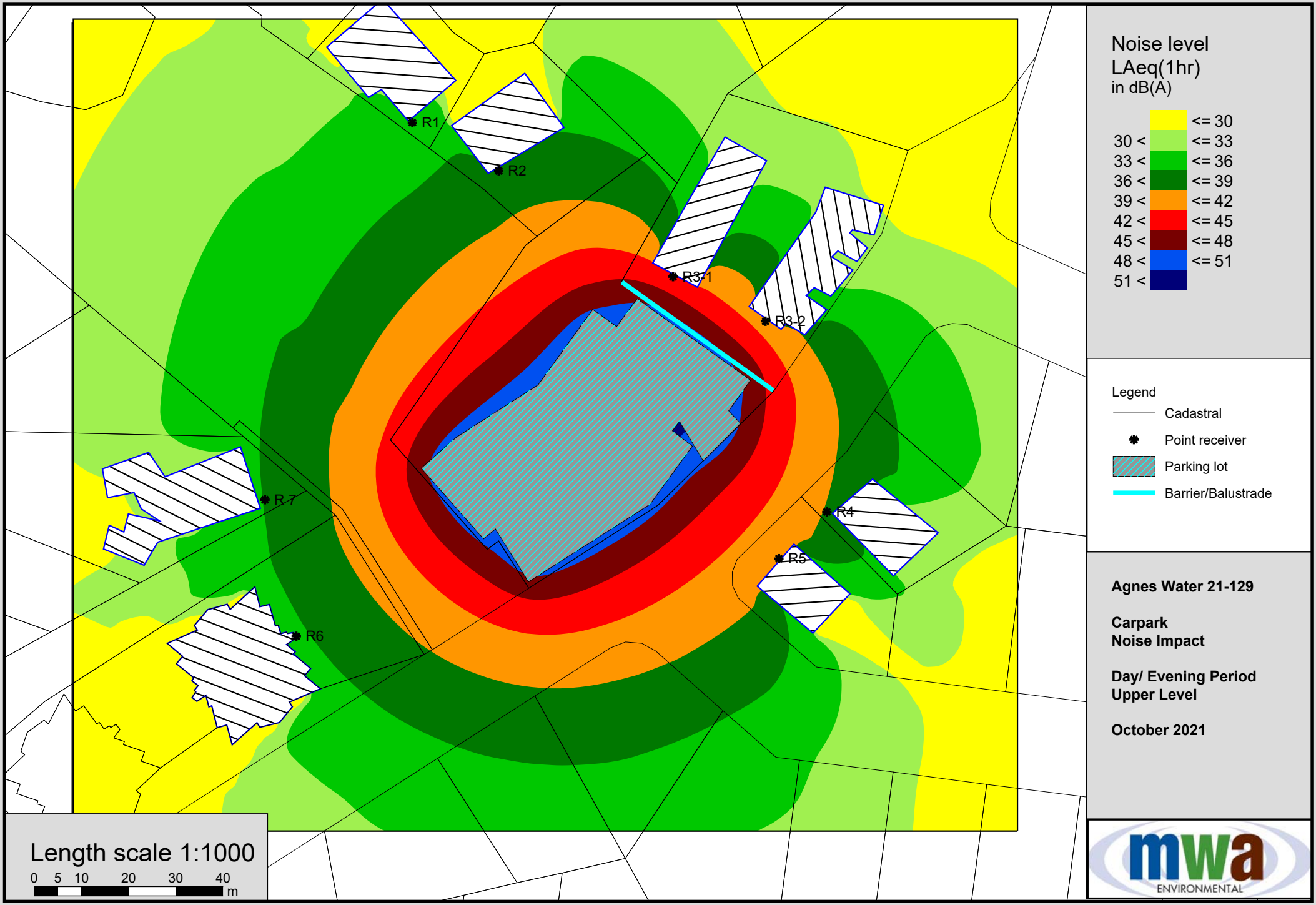
- Land resumption matters
- Coal mining projects, Wandoan, Collinsville, Blackwater, Moranbah, Central Qld
- Limestone mining Warwick

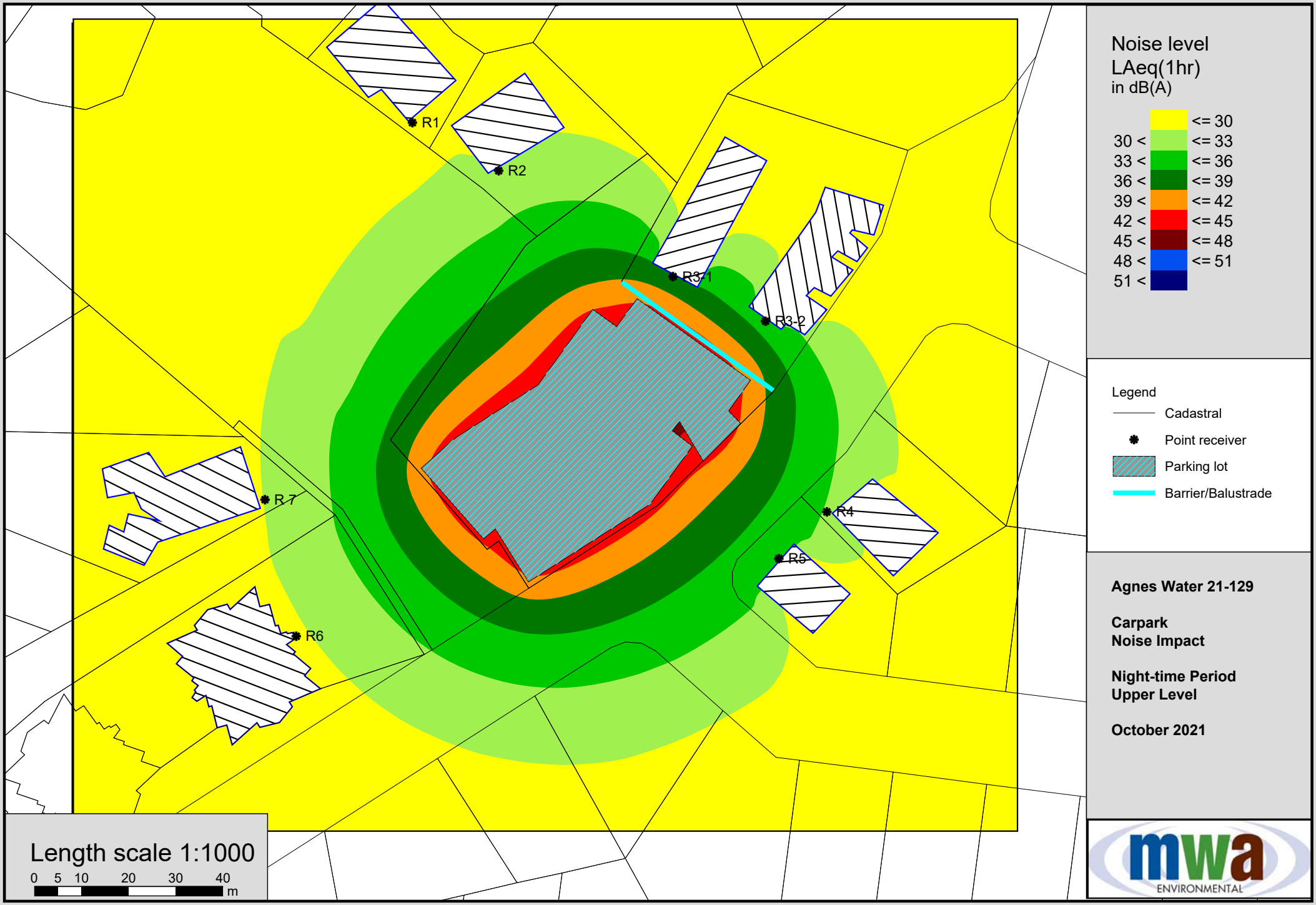
ATTACHMENT 2
Noise Contour Prediction Plots

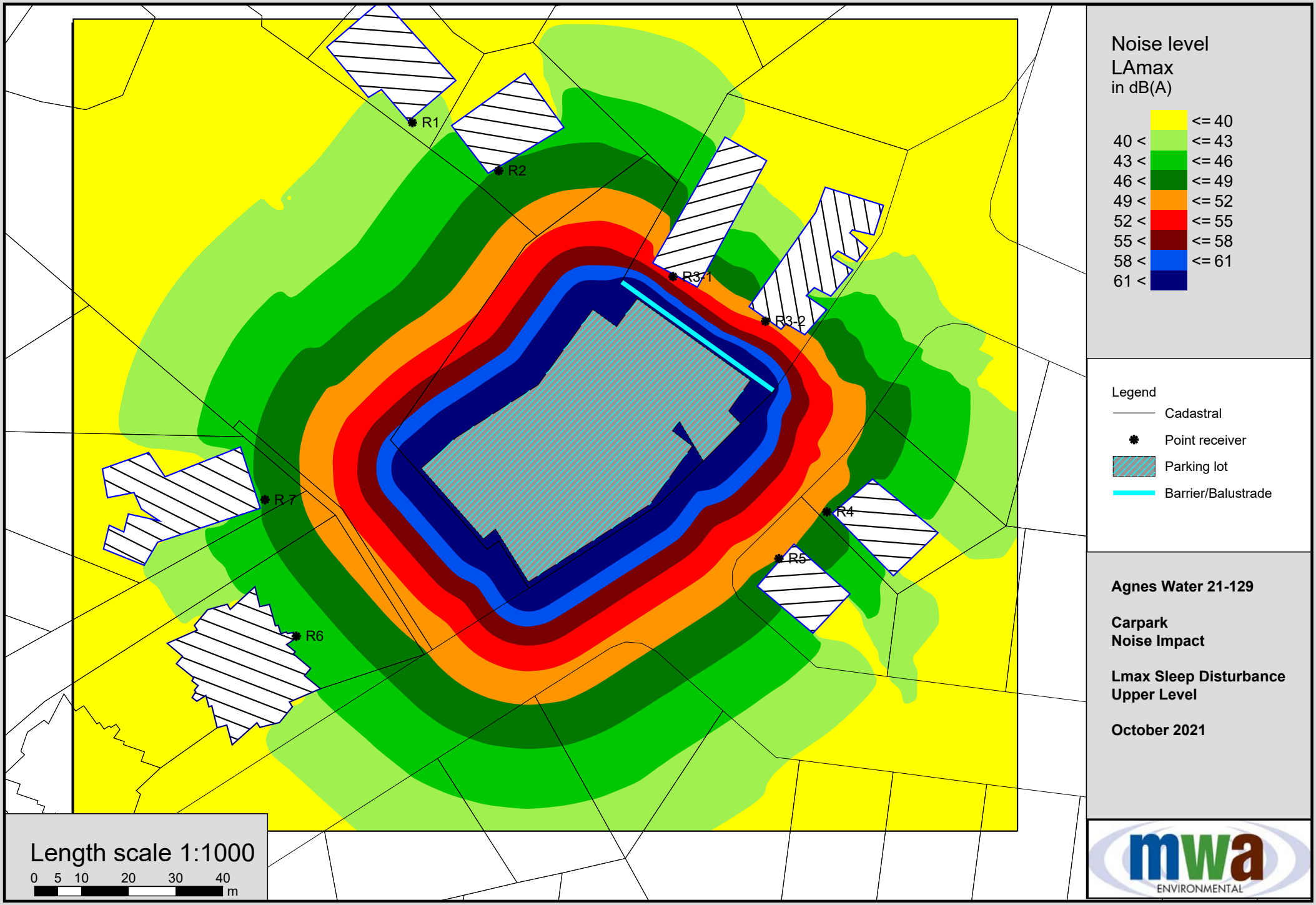

R1
R2
R3-1
R3-2
R4
R5
R6
R7
Noise level
LAeq(1hr)
in dB(A)
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 < <= 51
51 <
Legend
Cadastral
Point receiver
Parking lot
Barrier/Balustrade
Agnes Water 21-129
Carpark
Noise Impact
Day/ Evening Period
Ground Level
October 2021
Length scale 1:1000
0 5 10 20 30 40
m
mwa
ENVIRONMENTAL



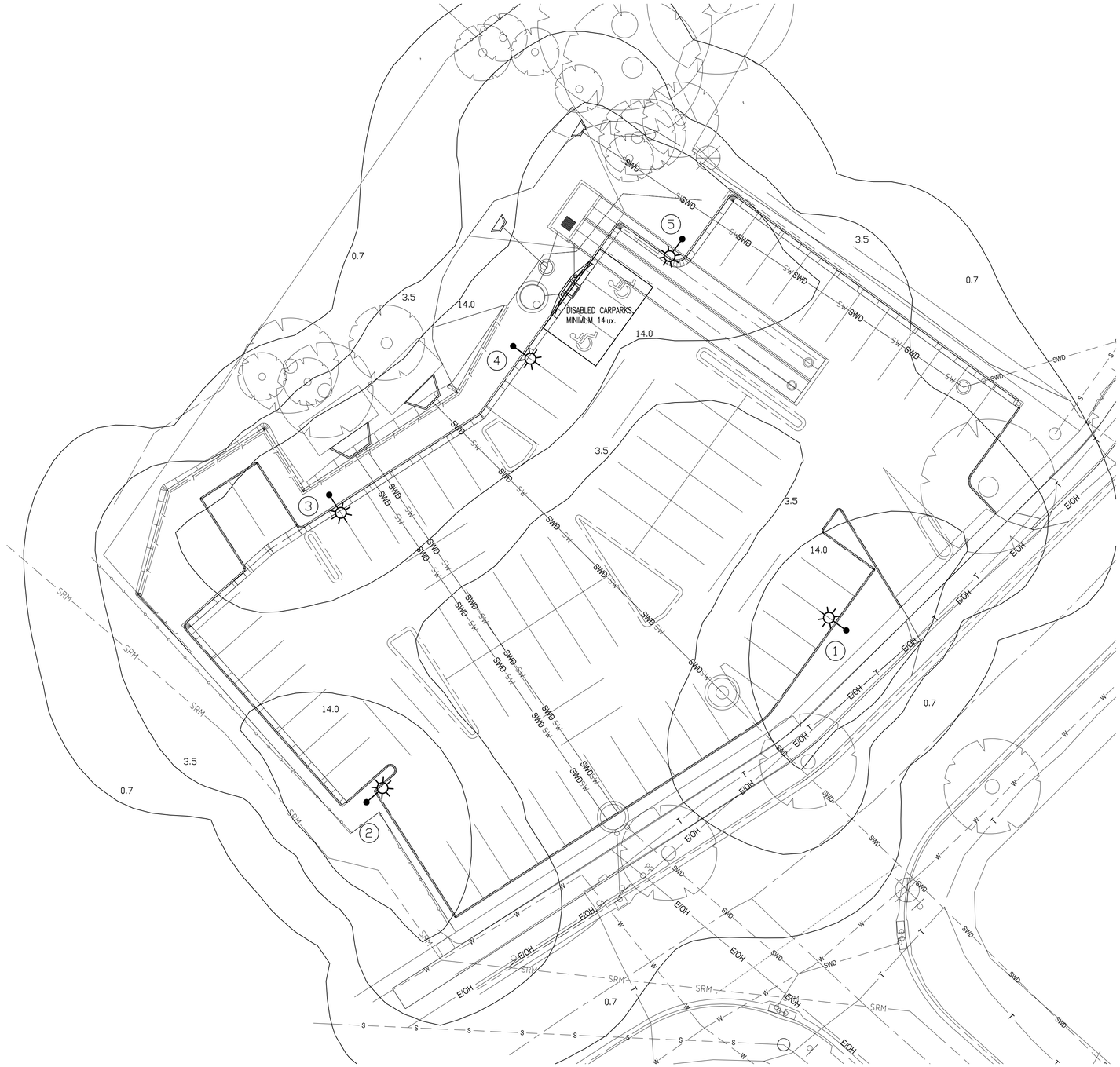

R1
R2
R3-1
R3-2
R4
R5
R6
R7
Noise level
LAmax
in dB(A)
<= 40
40 < <= 43
43 < <= 46
46 < <= 49
49 < <= 52
52 < <= 55
55 < <= 58
58 < <= 61
61 <
Legend
Cadastral
Point receiver
Parking lot
Barrier/Balustrade
Agnes Water 21-129
Carpark
Noise Impact
Lmax Sleep Disturbance
Ground Level
October 2021
Length scale 1:1000
0 5 10 20 30 40
m
mwa
ENVIRONMENTAL


R1
R2
R3-1
R3-2
R4
R5
R6
R7
Noise level
LAeq(1hr)
in dB(A)
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 < <= 51
51 <
Legend
Cadastral
Point receiver
Parking lot
Barrier/Balustrade
Agnes Water 21-129
Carpark
Noise Impact
Day/ Evening Period
Upper Level
October 2021
Length scale 1:1000
0 5 10 20 30 40
m
mwa
ENVIRONMENTAL





ATTACHMENT 3
Lighting Design – Anderson Consulting Engineers



SITE PLAN
SCALE 1:200

CERTIFICATE OF COMPLIANCE

Lighting Category
(AS/NZS 1158.3.1 2020 Table 2.5 & 3.7) PC3 & PCD.

Installation Arrangement/ Geometry
- Mounting Height (H) = 8.8m
- Upcast = 0°

Luminaire/Lamp Details
- Luminaire Identification = Green Frog Systems GFS 400 Solar Street Light, Type 3 optic. 3000°K.
- Luminaire Wattage = 75W
- IP Rating = IP65
- Initial Lamp Flux = 14.025klms
- Lamp Flux used for Design = 10.519klms
- Lighting Ownership = Rate 3 Owned and maintained by Council

Illuminance Criteria

AGNES STREET AGNES WATER CARPARK

	LIGHTING CATEGORY	Average (Eh) (Lx)	Minimum (Eph) (Lx)	Maximum Up EMax/Eav
REQUIRED	PC3	3.5	0.7	8.0
ACHIEVED	PC3	11.79	0.74	3.72

Computer Program Details:
- Name of Computer Program = Lighting Reality PRO V2.1
- Source of Program = Lighting Reality Limited
- Compliance = Complies with the requirements of AS/NZS 1158
- Spacing = Varies

Maintenance Details:

Maintenance Factor: The maintenance factor is as follows:
(1) IP Rating GFS 400 SOLAR = IP65 Optical Chamber
(2) Cleaning Interval = 48 months
Pollution Category = Medium
Luminaire Maintenance Factor = 0.84
Lamp depreciation = 0.89
Total maintenance factor = 0.75

Schedule of Maintenance: This lighting design is based on the following maintenance schedule:
(1) Bulk luminaire maintenance carried out at 48 months intervals. At this time the following shall also occur.
- All optical surfaces, both internal and external, of the luminaire shall be cleaned if applicable.
- All gaskets shall be checked for deterioration and replaced where necessary.
- Damaged/weathered visors shall be replaced.
- All accessible screws, nuts etc. shall be checked for tightness.
- A visual check shall be made of the electrical components and wiring for signs of overheating.
- If required, the luminaire shall be realigned/adjusted to the design specification.

(2) It is recommended that inspection patrols provide spot luminaire replacements or rectification such that the maximum level of luminaire outages at any one time is not greater than 5% of the luminaire population e.g. Service availability should be at least 95%.
(3) Where luminaires are replaced the new luminaire shall be of an equivalent type such that the integrity of the road lighting design is maintained.
(4) All failed luminaires to be fixed or replaced within 2 weeks.
(5) A failed lighting circuit has to be rectified within 24hrs.

Designed: JOHN MCBRYDE

Certified: GRANT ANDERSON

RPEQ Number: 4383

ANDERSON
CONSULTING ENGINEERS
RPEQ 4383

LIGHTING SCHEDULE

LOCATION	STATION NUMBER	ASSET ID	LIGHTING COLUMN	ROAD LIGHTING LUMINAIRE	CUSTOMER	OUTREACH BRACKET (m)	MOUNTING HEIGHT (m)	ORIENTATION (DEGREES FROM EAST)	LOCATION	REMARKS
AGNES STREET (CNR JEFFREY COURT), AGNES WATER. CARPARK.	1	LGT183288	9.0m BPM	NEW GREEN FROG SYSTEMS GFS 400 SOLAR STREET LIGHT 75W AT 0° UPCAST. T3 (STANDARD) OPTIC.	GRC	3.0	8.8	144°	X CO-ORD 388850.85; Y CO-ORD 7322020.53. USE CO-ORDINATES AS A GUIDE ONLY.	3000°K.
	2	LGT183290	9.0m BPM	NEW GREEN FROG SYSTEMS GFS 400 SOLAR STREET LIGHT 75W AT 0° UPCAST. T3 (STANDARD) OPTIC.	GRC	3.0	8.8	41°	X CO-ORD 388810.96; Y CO-ORD 7322006.25. USE CO-ORDINATES AS A GUIDE ONLY.	3000°K. PROVIDE BACK SPILL SHIELD. COORDINATE WITH GREEN FROG SYSTEMS.
	3	LGT183291	9.0m BPM	NEW GREEN FROG SYSTEMS GFS 400 SOLAR STREET LIGHT 75W AT 0° UPCAST. T3 (STANDARD) OPTIC.	GRC	3.0	8.8	303°	X CO-ORD 388807.87; Y CO-ORD 7322031.80. USE CO-ORDINATES AS A GUIDE ONLY.	3000°K. PROVIDE BACK SPILL SHIELD. COORDINATE WITH GREEN FROG SYSTEMS.
	4	LGT183292	9.0m BPM	NEW GREEN FROG SYSTEMS GFS 400 SOLAR STREET LIGHT 75W AT 0° UPCAST. T3 (STANDARD) OPTIC.	GRC	3.0	8.8	324°	X CO-ORD 388823.15; Y CO-ORD 7322044.17. USE CO-ORDINATES AS A GUIDE ONLY.	3000°K. PROVIDE BACK SPILL SHIELD. COORDINATE WITH GREEN FROG SYSTEMS.
	5	LGT183293	9.0m BPM	NEW GREEN FROG SYSTEMS GFS 400 SOLAR STREET LIGHT 75W AT 0° UPCAST. T3 (STANDARD) OPTIC.	GRC	3.0	8.8	234°	X CO-ORD 388837.22; Y CO-ORD 7322053.07. USE CO-ORDINATES AS A GUIDE ONLY.	3000°K. PROVIDE BACK SPILL SHIELD. COORDINATE WITH GREEN FROG SYSTEMS.

FOUNDATION DETAILS TO BE CONFIRMED BY POLE MANUFACTURER TO SUIT SOIL AND LOCATION (WIND REGION ETC.).
POLES SHALL HAVE DUAL-COAT MARINE PAINT SYSTEM WITH 7 YEAR GUARANTEE IN COASTAL LOCATION.

CONTROL REQUIREMENTS

LUMINAIRES AND SYSTEM SHALL BE COMPLETE WITH CONFIGURABLE TIMER SETTINGS FOR ON/OFF. INITIALLY SET TO SWITCH OFF AT 11.00pm.

NOTE:

LIAISE WITH COUNCIL TO ENSURE SIGNAGE IS PROVIDED TO ADVISE PUBLIC OF CARPARK LIGHTING TURN OFF TIME.

NEW SOLAR LED CARPARK LUMINAIRE, OUTREACH AND POLE

STATION NUMBER

LEGEND OF SYMBOLS
NOT TO SCALE

FOR APPROVAL

GENERAL NOTES:

Do not scale from this drawing. Take measurements on site prior to commencing work.

NOTES:
1. PROVIDE AND AFFIX STAINLESS STEEL ASSET ID LABELS AND FASTENERS TO GRC REQUIREMENTS. LIAISE WITH GRC.
2. PROVIDE FORM 16 FOR INSTALLATION ON COMPLETION.

Date	Rev	Details	App
20/04/21	B	ASSET ID ADDED.	

GLADSTONE REGIONAL COUNCIL

ANDERSON
CONSULTING ENGINEERS
43 Denison Street, Rockhampton, Q. 4700
P.O. Box 27, Rockhampton, Q. 4700
Phone: (07) 4927 2077
Facsimile: (07) 4927 2882
ACN 112 066 529 ABN: 98 112 066 529

Project:
AGNES STREET & JEFFREY COURT

AGNES WATER.
CAR PARK. SOLAR LIGHTING.

Title:
ELECTRICAL SERVICES
LIGHTING DESIGN.

Drawing No:	Rev:
20066-S001	B

Scale: 1:200	Approved: GA
Drawn: CG	Designed: JPM
Date: MARCH 2021	No: 1 Of: 1 A1