

HUNTER INDOOR SPORTS CENTRE

STAGE 1 & 2

EXTERNAL LIGHTING IMPACT ASSESSMENT



Project Title: Hunter Indoor Sports Centre

Project Number: 23376

Revision History

Rev No.	Date	Description	By	Checked	Approved
A	01.03.24	Draft for Review	RT	JC	JC
B	20.03.24	Final Issue	RT	JC	JC
C	22.03.24	Revised Final Issue	RT	JC	JC
D	23.05.25	Revised Concept Design	RT	JC	JC
E	27/05.25	Revised Concept Design	RT	JC	JC

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

EPA has been commissioned by Basketball Association of Newcastle Limited (BANL) to prepare this report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD- 65595459) for the proposed Hunter Indoor Sports Centre with courts, indoor stadium, amenities and associated civil and landscaping works, at 2 Monash Road and 24 Wallarah Road, New Lambton.

In these requirements, namely item #5 (Environmental Amenity) it is required as part of the SSDA submission for an external lighting plan and lighting impact assessment to be provided to demonstrate compliance with the Australian Standard AS/NZ 4282 – Control of the Obtrusive Effects of Outdoor Lighting.

1.2 PURPOSE

The purpose of this external lighting impact assessment is to present the results and findings of general light level and obtrusive/ spill light calculations to determine compliance or non-compliance with AS/NZS 4282. This report will summarise the requirements of both lighting standards AS/NZS 1158 (for a compliant lighting design) and AS/NZS 4282 (for non-obtrusive lighting design). This report will recommend optimal lighting control strategies to further control any obtrusive effects of the external lighting design. An external lighting plan will be prepared in conjunction with this report.

This external lighting impact assessment report supports the Response to Submissions (RTS) and Amendment Report for State Significant Development Application (SSD- 65595459) for the proposed Hunter Indoor Sport Centre (HISC) at 2 Monash Road and 24 Wallarah Road, New Lambton. SSD-65595459 sought development consent for an indoor stadium, amenities and associated civil and landscaping works.

The Amendment Report seeks changes to the original development proposal SSD-65595459.

The key project amendments include moving the building footprint and carpark west, adding turfed open space near Turton Road, and shifting the access driveway south. The realigned pedestrian promenade within the carpark includes a bridge over the open space.

The height at the south-eastern corner of the building will be increased to provide flexibility to use the upper level of the building for gymnastics and other activities, there are also minor internal reconfigurations to fit the revised footprint.

Within the public domain works include widening the Turton Road footpath, adding pedestrian safety fencing, and retaining the existing cycle/pathway on the south eastern corner of the site. The landscaping and public domain changes mean that four trees on the Turton Road frontage (previously proposed to be removed) can now be retained.

On the southern edge of the site, landscaping elements have been removed. Space is provided for the future expansion of pedestrian / cycleway route along this corridor (works to be delivered by others).

The active recreation area, including a half basketball court, has been deleted from the proposal.

Development consent is sought for the entire proposal, with the flexibility to deliver the project in two construction and operational stages.

1.3 GLOSSARY OF TERMS

For the purpose of this document, the below features accessible definitions of the terms that are commonly used in obtrusive lighting design assessments.

Curfew – Time interval during which stricter requirements for the control of obtrusive light apply.

Environmental Zone – Categorisation of the relative ambient lighting and environmental conditions as relevant to the lighting system or affected property.

Glare – Visual impairment caused by a bright source of light, directly visible or reflected by a surface.

Obtrusive Light – Spill light which, because of quantitative or directional attributes, gives rise to excessive annoyance, discomfort, distraction, or a reduction in ability to see essential information.

Sky Glow – Brightening of the night sky that results from the reflection of radiation (visible and non-visible), scattered from the constituents of the atmosphere, in the direction of observation (by man-made sources such as outdoor lighting).

Spill Light – Light emitted by a lighting installation that falls outside the boundaries of the property for which the lighting installation is designed.

Upward Waste Light Ratio – Ratio of the luminous flux of all luminaires that is emitted directly into the night sky, divided by the total flux of all the luminaires, when the luminaires are mounted in their designed positions, and excluding reflected light from surfaces or obstructions.

1.4 SITE AND SURROUNDING AREA DESCRIPTION

The site is located at 2 Monash Road and 24 Wallarah Road, New Lambton, within the Newcastle local government area (LGA). The site comprises multiple parcels of land and is legally described as:

- Lot 2380 DP755247
- Lot 2379 DP755247
- Lot 2378 DP755247
- Lot 2377 DP755247
- Lot 1 DP1304081

The site is identified in Figure 1 below.



Figure 1: Site Context

The proposed project site shares a boundary to the North with Lambton High School and a boundary to the West with Arthur Edden Oval. The South of the site is constrained by the Lambton Ker-rai Creek which manages the flood ways across the region with residences located directly on the opposite side of the creek. Adjacent to Lambton High School to the North is a series of adjoining townhouses.

As a part of this external lighting impact assessment, we will assess obtrusive lighting impacts to the neighbouring residential housing to the South and adjoining townhouses to the North. Obtrusive lighting assessments do not include commercial precincts.

The proximity to neighbouring residential housing to the North and South of the site is outlined and measured in Figure 2 below.

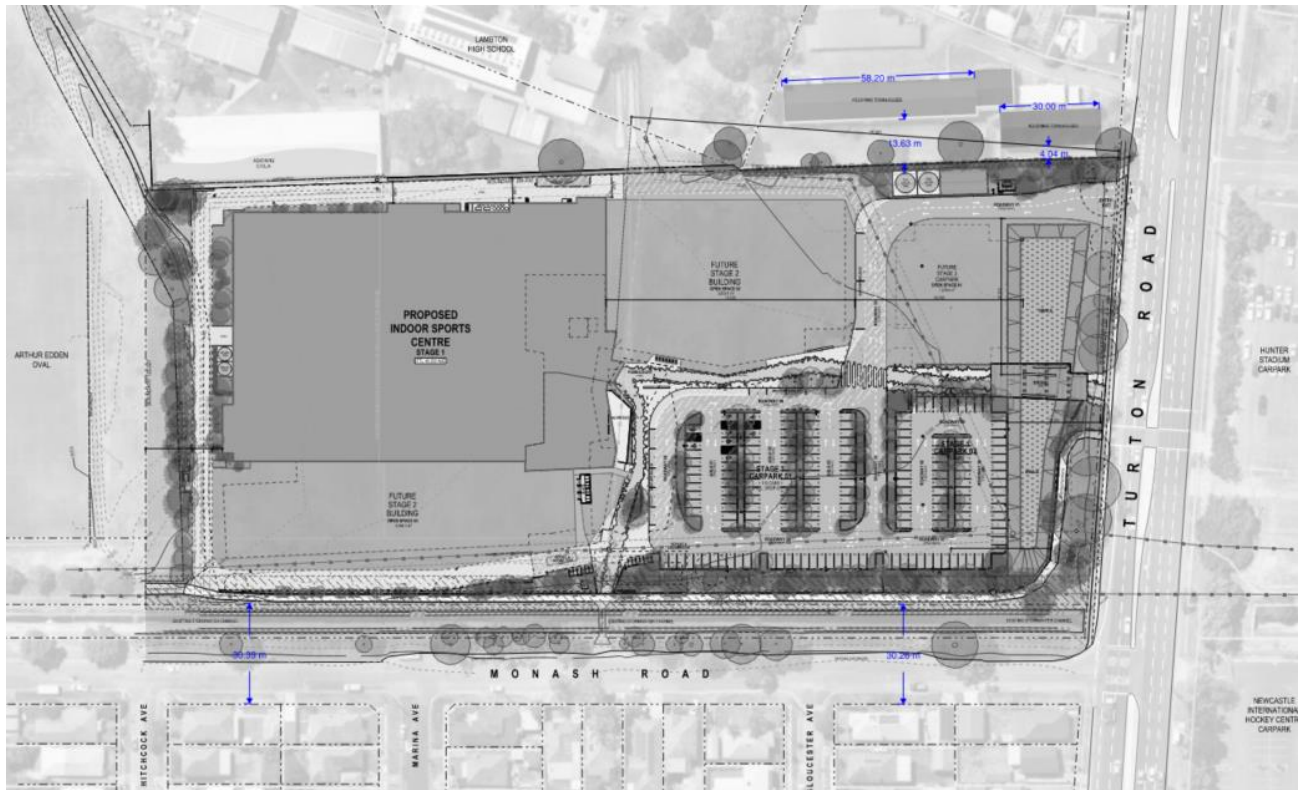


Figure 2: Proximity to Neighbouring Residential Properties

2 REFERENCE INFORMATION

2.1 CLIENT INFORMATION

The following drawings and document files have been provided by EJE Architects:

- 14683-HISC-Updated Plans (22-05-2025) PDF
- A43 PROPOSED OVERALL SITE PLAN CAD
- Appendix B Agency Advice PDF
- SSD-SSI Issued SEARs Cover Letter_22013034_015448 PDF
- SSD-SSI Issued SEARs_22012024_015450 PDF
- Updated Concept Architectural WIP Renders JPG

2.2 PLANNING SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (SEARS)

The Environmental Impact Statement (EIS) must include an environmental risk assessment to identify the potential environmental impacts associated with the development. This includes the following lighting assessment requirements:

Project SSD- 65595459	Section of report
<p>5. <i>Environmental Amenity</i></p> <p><i>Assess amenity impacts on the surrounding locality (both within and outside the site), including lighting impacts, solar access, visual privacy, visual amenity, view loss and view sharing, overshadowing, wind impact and acoustic impacts. A high level of environmental amenity for any surrounding residential land uses must be demonstrated.</i></p>	4
<p><i>Include an external lighting plan and lighting impact assessment which demonstrates compliance with the most recent/applicable version of Australian Standard AS/NZS 4282 Control of the Obtrusive Effects of Outdoor Lighting. The lighting impact and illumination assessment for the proposal should consider the adjoining residential areas, potential light pollution and light overspill, potential impacts to surrounding sensitive receivers, potential impacts on the safety of the road network, cumulative impacts and propose mitigation measures.</i></p>	3, 4, 5

3 DESIGN CRITERIA

3.1 CODES, STANDARDS, SPECIFICATIONS AND STATUTORY REQUIREMENTS

The design will comply to the requirements of the relevant:

- Acts and Regulations
- Australian Standards
- National Construction Code
- Governing authority standards and guidelines
- Client communicated standard, templates and preferences

3.2 LIGHTING PARAMETERS

The following Australian Standards and Guidelines have been used to form the basis of this obtrusive lighting impact assessment:

- AS/NZS 4282 2023 – Control of the Obtrusive Effects of Outdoor Lighting
- AS/NZS 1158 2020 – Lighting for Roads and Public Spaces Series

3.3 AS/NZS 4282 2023 – CONTROL OF THE OBTRUSIVE EFFECTS OF OUTDOOR LIGHTING

Australian standard AS/NZS 4282 - Control of the obtrusive effects of outdoor lighting contains recommendations for the limitation of light spill to adjacent properties. Several aspects of potential obtrusiveness are considered, visibility of light falling on surrounding properties, the brightness of luminaires in the field of view of nearby residents, the effects on astronomical observations, the glare to users of adjacent transport systems, and the impact on environmentally sensitive areas. For control of these effects, limiting light technical parameters have been developed taking account of the following:

- The level of lighting existing in the area.
- The level of lighting consistent with the development zoning approved for the area.
- The time that the proposed lighting is to operate.
- The type of lighting technology available to light the task or activity.

- The use of readily available and easily understood technical data on the lighting systems that can easily be verified at the design and assessment stages.

AS/NZS 4282 is predominantly applicable to the adverse effects of outdoor lighting on nearby residential dwellings, transport system users, transport signalling systems, astronomical observations and environmentally sensitive areas. The standard does not apply to the following:

- Lighting for entertainment and festivals that is designed for a performance or an event that operates outside curfew hours, and for a regularly occurring event that operates for an interval or not more than 30 min each night, excluding sports lighting.
- Emergency warning, way finding lights/marker lights, navigation lights, all traffic signals, traffic signage and vehicle headlights.
- Lighting for aviation safety.
- Flags that are required to be lit at night by government protocol.
- Public lighting such as lighting provided for the purposes of safety and security on public roads, cyclist paths, footpaths and pedestrian movement areas within public parks and gardens, including on-road car parking, but not including off-road car parks. (unless the relevant authority deems it necessary).
- Temporary lighting other than entertainment (including temporary sports lighting), operating for less than one month.
- Lighting chains and other small lighting systems and devices, for example budlighting, fairy lights, festoon lighting, where the individual lights emit less than 30 lumens that operates in the non-curfew period.
- The upward light limits for lighting of approved public artworks.
- The upward light limits for lighting of the facades of classified heritage buildings and objects.

General recommendations to reduce external light pollution presented in AS/NZS 4282 includes:

- Switch lights off when not required for safety, security or enhancement of the night-time scene (i.e. apply a curfew switch-off time).
- Wherever possible, direct light downwards, not upwards, to illuminate the target area. If there is no alternative to up-lighting, then the use of glare-shields and baffles will help reduce spill light to a minimum.
- Use specifically designed lighting equipment that once installed, minimises the spread of light near to or above the horizontal.
- Do not 'over' light.
- To keep glare to a minimum, ensure that the main beam of angle of luminaires directed towards a potential observer is kept below 70°. It should be noted that the higher the mounting height, the lower the main beam angle can be.
- In places with low ambient light, glare can be obtrusive and extra care should be taken in positioning and aiming.
- Wherever possible use floodlights with asymmetric beams that permit the front glass to be kept horizontal or near parallel to the surface being lit.

As per the standards, residential developments have stricter restrictions on obtrusive lighting, and the relative brightness of the surrounds must be considered.

Table 3.1 and 3.2 from AS/NZS 4282 2023 (extracts below) show recommended zone classifications and their relative design parameters. The zones and classifications highlighted in blue are applicable to this project.

Table 3.1 — Environmental zones

Environmental zones	Ambient light conditions	Descriptions/ Examples
A0	Intrinsically dark	UNESCO Starlight Reserve. IDA: Dark Sky Parks, Reserves or Sanctuaries Major optical observatories Other accreditations for dark sky places for example astrotourism, heritage value, astronomical importance, wildlife/ecosystem protection Lighting for safe access may be required
A1	Dark	Relatively uninhabited rural areas (including terrestrial, marine, aquatic and coastal areas) Generally roadways without streetlighting through rural areas
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas Generally roadways without streetlighting through suburban, rural or semi-rural areas other than intersections
A3	Medium district brightness	Suburban areas in towns and cities Generally roadways with streetlighting through suburban, rural or semi-rural areas
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas Industrial and Port areas Transport Interchanges
TV	High district brightness	Vicinity of major sport and event stadiums during TV broadcasts

NOTE Zones A0 and A1 would normally have a minimum area of 50 ha.(0.5 km²). There may be smaller environmentally sensitive areas.

Figure 3: AS/NZS 4282 2023 Table 3.1 Environmental Zones

Table 3.2 — Light technical parameter limits

Zones	Maximum vertical illuminance (E_v) lux		Threshold increment (TI)		Upward Light Ratio
	Non-curfew	Curfew	Maximum TI %	Default Adaptation level (L_{ad}) cd/m ²	Maximum ULR _S or ULR _L
A0	0 ^a	0.0	N/A	N/A	0.00
A1	2	0.1	20	0.1	0.00
A2	5	1	20	0.2 ^b	0.01
A3	10	2	20	1	0.02
A4	25	5	20	5	0.03
TV	N/A	N/A	20	10	0.08

^a For A0, E_v shall be as close to zero as practicable without impacting safety considerations.
^b For an internally illuminated sign in a A2 zone, $L_{ad} \leq 0.25$ cd/m²

Figure 4: AS/NZS 4282 2023 Table 3.2 Light Technical Parameters

It is important to note that obtrusive effects of outdoor lighting caused by public lighting (such as roadway lighting) is not within the scope of AS4282, however, light technical parameter limits have been included where relevant authority considers that the extent and level of obtrusive light should be limited. The limits recognise that such lighting is provided to facilitate safety and security for the public at large. The definitions

of public lighting zones are described in Table 4.1 below. The zones and classifications highlighted in blue are applicable to this project.

Table 4.1 — Public lighting zones

Public lighting zones	Ambient light conditions	Description
V	Traffic routes	Residences near Major Roadways with streetlighting (e.g. subcategory V public lighting scheme as per AS/NZS 1158.1.1)
R1	Local roads with significant setback	Residences near Local roads with streetlighting (e.g. subcategory PR public lighting scheme as per AS/NZS 1158.3.1) where the window line is greater than 10 m from the property boundary
R2	Local roads	Residences near Local roads with streetlighting (e.g. subcategory PR public lighting scheme as per AS/NZS 1158.3.1) where the window line is at or less than 10 m from the property boundary
R3	Roundabout or local area traffic management device	Residences near roundabouts or local area traffic management device with streetlighting (e.g. subcategory PR public lighting scheme as per AS/NZS 1158.3.1) where the window line is at or less than 10 m from the property boundary
RX	Pedestrian crossing	Residences near a pedestrian crossing with lighting (e.g. a subcategory PX public lighting scheme as per AS/NZS 1158.4) where the window line is at or less than 10 m from the property boundary

Figure 5: AS/NZS 4282 2023 Table 4.1 Public Lighting Zones.

AS/NZS 4282 allocates public lighting zones to public lighting schemes from AS/NZS 1158.3.1 as follows:

- Sub-category PR shall use public lighting zones R1-R3 limits, as applicable
- Sub-category PP and PC where part of a road reserve shall use public lighting zones R1-R3 limits, as applicable
- Sub-category PP (where not part of a road reserve) shall use environmental zone A0-A4 limits as applicable
- Sub-category PA and PE shall use environmental zone A0-A4 limits as applicable.

Table 4.2 below shows the maximum limits for light technical parameters of public lighting. The zones and classifications highlighted in blue are applicable to this project.

Table 4.2 — Public lighting — Maximum values of light technical parameters

Zones	Maximum vertical illuminance (E_v) lux		Threshold increment (TI)		Upward light ratio
	Non-curfew	Curfew	Maximum TI %	Default Adaptation level (L_{ad}) cd/m ²	Maximum ULR
V	N/A	4	As specified in AS/NZS 1158.1.1		
R1	N/A	1	20	0.1	As specified in AS/NZS 1158.3.1
R2	N/A	2	20	0.1	
R3	N/A	4	20	0.1	
RX	N/A	4	As specified in AS/NZS 1158.4		

Figure 6: AS/NZS 4282 2023 Table 4.2 Public lighting maximum values of light technical parameters

3.4 AS/NZS 4282 2023 DESIGN REQUIREMENTS FOR HUNTER INDOOR SPORTS CENTRE

With reference to table 3.1 above, the Hunter Indoor Sports Centre falls under environmental zone A4 – High district brightness for residential areas abutting commercial areas and must comply with the below light technical parameters.

LIGHT TECHNICAL PARAMETERS

A4 High District Brightness; Residential areas abutting commercial areas and local road ambient light conditions.

<u>Non-curfew:</u>	<u>Curfew:</u>	<u>Public Lighting Zone R2:</u>
Vertical illuminance: 25 lux	Vertical illuminance: 5 lux	Vertical illuminance: 2 lux
Threshold Increment – 20%	Threshold Increment – 20%	Threshold Increment – 20%
Adaption level – 5	Adaption level – 5	Adaption level – 0.1
Upward Waste Light Ratio – 0.03	Upward Waste Light Ratio – 0.03	Upward Waste Light Ratio – 0.01

3.5 AS/NZS 1158.3.1 2020 – LIGHTING FOR ROADS AND PUBLIC SPACES SERIES

The main purposes of the P-Category lighting assessments are to assist pedestrians to orientate themselves and detect potential hazards of the area they are in and to discourage fear of crime while protecting the integrity of the nighttime environment through control of light spill and glare.

The P-Category assessments are implemented so that the lighting design can enhance the prestige and amenity of the location but should also be designed to minimise any obtrusive effects.

The principal design objectives for P-Category lighting are to provide the following:

- Illuminance and uniformity of illuminance over the designated area.
- Glare control to a specific level.
- Limitation of upward light from luminaires to a specified level.
- Limitation to a specified level of the light spilled into properties that abut the lit area.
- Limitation to a specified level of the light spilled into environmental habitats or migratory pathways of wildlife.
- A maintenance regime such that the lighting scheme complies at all times during each maintenance cycle over the life of an installation.
- Minimising energy consumption.

The following tables are extracts from AS 1158 2020 and show recommended lighting categories and associated design criteria.

TABLE 3.3
VALUES OF LIGHT TECHNICAL PARAMETERS
FOR ROADS IN LOCAL AREAS

1	2	3	4
Lighting subcategory	Light technical parameters (LTP)		
	Average horizontal illuminance ^{a,b} (\bar{E}_h)	Point horizontal illuminance ^{a,b} (E_{Ph})	Illuminance (horizontal) uniformity ^c Cat. P (U_{E2})
	lx	lx	
PR1	7	2	8
PR2	3.5	0.7	8
PR3 ^e	1.75	0.3	8
PR4 ^{d,e}	1.3	0.22	8
PR5 ^{d,e}	0.85	0.14	10
PR6 ^d	0.7	0.07	10

Figure 7: AS/NZS 1158 2020 Table 3.3 Parameters for Roads in Local Areas

This table is assigned for mixed vehicle and pedestrian traffic on collector or non-arterial roads which collect and distribute traffic in an area as well as serving abutting properties and local roads or streets used primarily for access to abutting properties (such as residential precincts).

TABLE 3.4
VALUES OF LIGHT TECHNICAL PARAMETERS
FOR PATHWAYS AND CYCLIST PATHS

1	2	3	4	5
Lighting subcategory	Light technical parameters (LTP)			
	Average horizontal illuminance ^{a,b} (\bar{E}_h)	Point horizontal illuminance ^{a,b,d} (E_{Ph})	Illuminance (horizontal) uniformity ^c Cat. P (U_{E2})	Point vertical illuminance ^{a,b} (E_{Pv})
	lx	lx		lx
PP1	10	2	5	1
PP2	7	1	5	0.3
PP3	3	0.5	5	0.1
PP4	1.5	0.25	5	0.05 ^e
PP5	0.85	0.14	5	0.02 ^e

Figure 8: AS/NZS 1158 2020 Table 3.4 Parameters for Pathways

This table is assigned to pedestrian and cycle-oriented pathways such as footpaths (including those along local and arterial roads), walkways, lanes, park paths and cyclist paths.

TABLE 3.7
VALUES OF LIGHT TECHNICAL PARAMETERS FOR OUTDOOR
CAR PARKS (INCLUDING ROOF-TOP CAR PARKS)

1	2	3	4	5
Lighting subcategory	Light technical parameters (LTP)			
	Average horizontal illuminance ^{a,b} (\bar{E}_h) lx	Point horizontal illuminance ^{a,b} (E_{Ph}) lx	Illuminance (horizontal) uniformity ^c Cat. P (UE_2)	Point vertical illuminance ^{a,b} (E_{Pv}) lx
PC1	14	3	8	3
PC2	7	1.5	8	1
PC3	3.5	0.7	8	—
PCD ^d	—	≥ 14 and $\geq (\bar{E}_h)^d$	—	—
PCX ^e	21	5	8	—

Figure 9: AS/NZS 1158 2020 Table 3.7 Parameters for Outdoor Carparks

This table is assigned to nighttime vehicle and pedestrian movements in outdoor car parks. It includes lighting for parking spaces, aisles, circulation roadways, designated parking spaces intended for people with disabilities and designated areas for pedestrians to cross circulation roadways and access roadways.

LIGHT TECHNICAL PARAMETERS

With reference to the table extracts from AS/NZS 1158 2020 above, the external lighting for the Hunter Indoor Sports Centre has been designed to comply with the following design categories and light technical parameters:

<u>Roads PR2:</u>	<u>Pathways PP3:</u>	<u>Carparks PC2:</u>
Average Illuminance: 3.5 lux	Average Illuminance: 7 lux	Average Illuminance: 7 lux
Minimum Illuminance: 0.2 lux	Minimum Illuminance: 1 lux	Minimum Illuminance: 1.5 lux
Uniformity (UE2): <8	Minimum Vertical Illuminance: 0.3 lux	Minimum Vertical Illuminance: 1 lux
	Uniformity (UE2): <5	Uniformity (UE2): <8
		Disabled Park PCD Minimum Illuminance: >14 lux

4 LIGHTING CALCULATIONS

4.1 PHOTOMETRIC CALCULATIONS

Luminaire photometric and technical data was procured either directly from manufacturers or via the manufacturers website and is understood to be the latest and most up to date version of the luminaire photometry and equipment technical information.

For the purpose of this report, we have used a moderate maintenance factor. The maintenance factor applied to the luminaires is 0.75.

LIGHTING SOFTWARE

Lighting modelling software used to complete the calculations was AGI32 version 20.11.

CALCULATION RESULTS

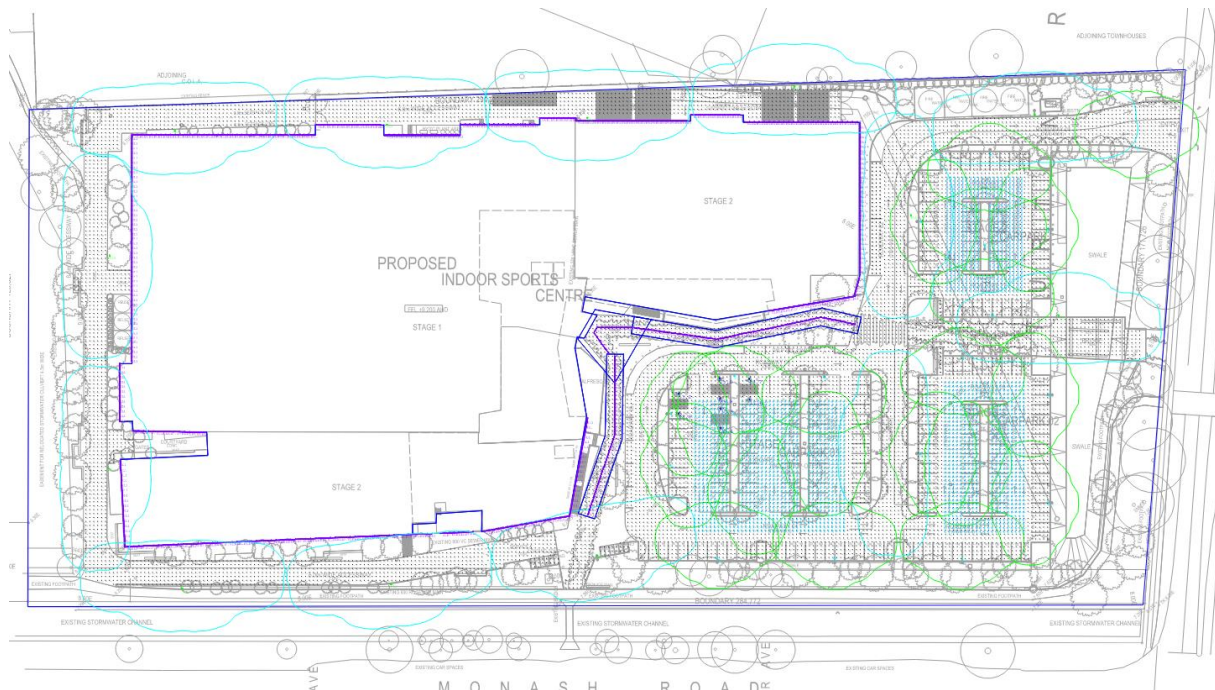


Figure 10: Lighting Calculation Compliant with AS/NZS 1158




Luminaire Schedule						
Symbol	Qty	Label	Tag	LLF	Luminaire Lumens	Luminaire Watts
	21	ITALO 1 5P5 S05 7030 100-2M	PL1	0.750	5310	37.4
	13	ITALO 1 5P5 STU-M 7030 100-2M	PL2	0.750	5440	37.4
	492	Ligera 50 80DIF1200 1124mm	SL1	0.750	1349	12.35

Figure 11: Lighting Luminaire Schedule

Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Max/Avg
6m Wide Accessway PP3	Illuminance	Lux	21.03	263.2	0.5	12.52
Access Roadway PC2	Illuminance	Lux	10.83	72.1	1.4	6.66
Bridge PE2	Illuminance	Lux	8.00	39.2	0.3	4.90
Bus Parking	Illuminance	Lux	16.65	27.0	7.4	1.62
Circulation Roadway PC2	Illuminance	Lux	9.11	42.3	1.8	4.64
Drop Off Zone 1	Illuminance	Lux	22.02	46.0	4.3	2.09
Drop Off Zone 2	Illuminance	Lux	15.55	38.1	8.3	2.45
Forecourt PP3	Illuminance	Lux	140.46	374.6	0.7	2.67
Motorbike Parking 1	Illuminance	Lux	8.28	11.5	5.3	1.39
Motorbike Parking 2	Illuminance	Lux	22.11	40.7	9.1	1.84
Pathway 1 PP3	Illuminance	Lux	2.17	2.5	1.7	1.15
Pathway 2 PP3	Illuminance	Lux	12.04	15.4	6.4	1.28
PCD 1	Illuminance	Lux	N.A.	17.2	17.2	N.A.
PCD 2	Illuminance	Lux	N.A.	29.8	29.8	N.A.
PCD 3	Illuminance	Lux	N.A.	25.0	25.0	N.A.
PCD 4	Illuminance	Lux	N.A.	29.8	29.8	N.A.
PCD 5	Illuminance	Lux	N.A.	30.9	30.9	N.A.
PCD 6	Illuminance	Lux	N.A.	20.4	20.4	N.A.
PCD 7	Illuminance	Lux	N.A.	19.7	19.7	N.A.
PCD 8	Illuminance	Lux	N.A.	17.6	17.6	N.A.
Promenade PP3	Illuminance	Lux	6.38	15.4	1.6	2.41
Service & Loading Zone	Illuminance	Lux	20.92	57.1	4.9	2.73
Stage 1 Carpark 1 PC2	Illuminance	Lux	12.19	34.5	2.5	2.83
Stage 1 Carpark 2 PC2	Illuminance	Lux	10.91	27.9	2.5	2.56
Stage 2 Carpark 1 V1	Illuminance	Lux	N.A.	30.5	3.4	N.A.
Stage 2 Carpark 1 V2	Illuminance	Lux	N.A.	25.4	1.7	N.A.
Stage 2 Carpark 2 V1	Illuminance	Lux	N.A.	26.8	2.9	N.A.
Stage 2 Carpark 2 V2	Illuminance	Lux	N.A.	24.5	2.2	N.A.
Stage 2 Carpark PC2	Illuminance	Lux	12.47	40.5	3.3	3.25
Stage 2 Carpark V1	Illuminance	Lux	N.A.	27.7	2.8	N.A.
Stage 2 Carpark V2	Illuminance	Lux	N.A.	25.6	3.8	N.A.

Figure 12: Lighting Calculation Summary

4.2 OBTRUSIVE LIGHTING/ LIGHT SPILL CALCULATIONS

For the purposes of these obtrusive lighting/light spill calculations being representative of the worst-case scenario, we have amended the maintenance factor of luminaires to 1.

Luminaire photometric and technical data was procured either directly from manufacturers or via the manufacturers website and is understood to be the latest and most up to date version of the luminaire photometry and equipment technical information.

LIGHTING SOFTWARE

Lighting modelling software used to complete the calculations was AGI32 version 20.11.

CALCULATON RESULTS

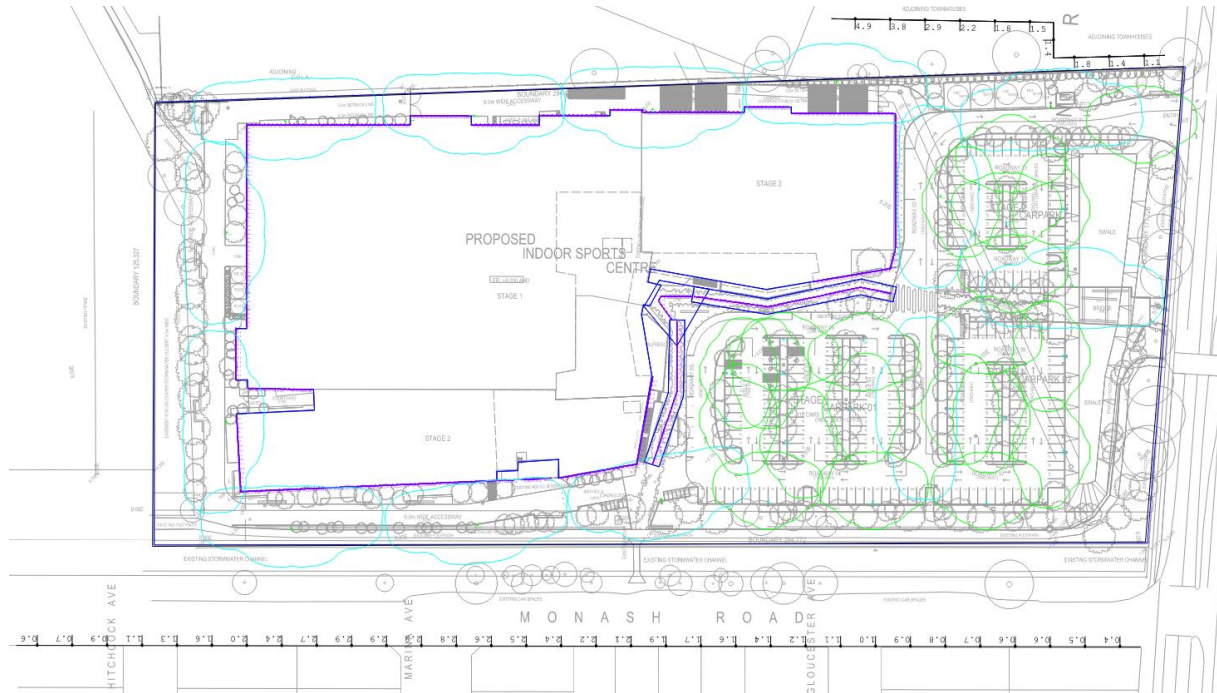


Figure 13: Lighting Calculation Compliant with AS/NZS 4282

Calculation Summary					
Label	CalcType	Units	Avg	Max	Min
ObtrusiveLight_Monash Road_Cd_Seg1	Obtrusive - Cd	N.A.	3.59	9	0
ObtrusiveLight_Monash Road_Ill_Seg1	Obtrusive - Ill	Lux	1.59	2.9	0.4
ObtrusiveLight_Townhouses_Cd_Seg1	Obtrusive - Cd	N.A.	23.17	42	5
ObtrusiveLight_Townhouses_Cd_Seg2	Obtrusive - Cd	N.A.	37.00	37	37
ObtrusiveLight_Townhouses_Cd_Seg3	Obtrusive - Cd	N.A.	32.00	34	30
ObtrusiveLight_Townhouses_Ill_Seg1	Obtrusive - Ill	Lux	2.85	4.9	1.5
ObtrusiveLight_Townhouses_Ill_Seg2	Obtrusive - Ill	Lux	1.40	1.4	1.4
ObtrusiveLight_Townhouses_Ill_Seg3	Obtrusive - Ill	Lux	1.43	1.8	1.1

Figure 14: Obtrusive Light Calculation Summary

Obtrusive Light - Compliance Report

AS/NZS 4282:2019, A4 - High District Brightness, Curfew
Filename: External Lighting Obtrusive Calc Rev2
22/05/2025 2:56:39 PM

Illuminance

Maximum Allowable Value: 5 Lux

Calculations Tested (4):

<u>Calculation Label</u>	<u>Test Results</u>	<u>Max. Illum.</u>
ObtrusiveLight_Townhouses_III_Seg1	PASS	4.9
ObtrusiveLight_Townhouses_III_Seg2	PASS	1.4
ObtrusiveLight_Townhouses_III_Seg3	PASS	1.8
ObtrusiveLight_Monash Road_III_Seg1	PASS	2.9

Luminous Intensity (Cd) At Vertical Planes

Maximum Allowable Value: 2500 Cd

Calculations Tested (4):

<u>Calculation Label</u>	<u>Test Results</u>
ObtrusiveLight_Townhouses_Cd_Seg1	PASS
ObtrusiveLight_Townhouses_Cd_Seg2	PASS
ObtrusiveLight_Townhouses_Cd_Seg3	PASS
ObtrusiveLight_Monash Road_Cd_Seg1	PASS

Upward Waste Light Ratio (UWLR)

Maximum Allowable Value: 3.0 %

Calculated UWLR: 0.0 %
Test Results: **PASS**

Figure 15: Obtrusive Lighting Compliance Report

4.3 SUMMARY OF CALCULATION RESULTS

The above calculation results show the intended external lighting design is compliant with both the minimum recommendations of AS/NZS 1158 and the maximum restrictions of AS/NZS 4282. This means the current documented design for the external lighting to the Hunter Indoor Sports Centre has no obtrusive lighting impacts to the adjoining residential areas, light pollution or light spill into the night sky or site surrounds, and no obtrusive impacts to the safety of the road network.

To further mitigate the obtrusive effects of the external lighting scheme, especially during the nighttime environment when the Hunter Indoor Sports Centre is not getting the same level of use, we propose utilising smart lighting control strategies as expanded below.

5 LIGHTING CONTROL STRATEGIES

An effective tool in further limiting obtrusive lighting is the use of appropriate lighting controls. Lighting control technologies are rapidly advancing, and LED light sources allow greater flexibility in terms of dimming and switching. Smart technologies and sensors can be incorporated in a lighting installation to provide a higher degree of control. A selection of lighting control strategies that should be considered include:

- Step dimming, whereby external lighting runs at full brightness in peak times and dims to a lower level late at night when usage is decreased.
- Curfew switch-off of certain types of lighting (e.g. at 10pm – The HISC operates 2 days a week from 7am – 10pm). This can be appropriate for ‘decorative’ lighting, which is not required for safety or orientation, and can be turned off late at night when it is less likely to add value.
- Motion detector control – luminaires incorporate motion sensor, lighting ramps up to maximum when movement is detected, reverts to minimum level when no movement is detected.

5.1 PROPOSED LIGHTING CONTROL STRATEGY

We recommend the external lighting at the Hunter Indoor Sports Centre to operate as follows:

- Dusk – 10pm: All lighting to be 100% on.
- 10pm – Dawn: All lighting to dim down to 30%, intelligent lighting control to dim up lighting back to 100% only when presence is detected. Only 3x luminaires to dim up in the location of detected presence. Dimming up sequence of 3x luminaires to follow movement (as person walks down path etc.) and dim back to 30% when movement is no longer detected.

For further details on lighting control functionality refer to external lighting layout plan 23376-E01 C.