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Obtrusive Light Assessment Tom Wills Oval

Grand Parade
Sydney Olympic Park NSW

Prepared for:
Mapel media

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About Rubidium Light

Rubidium Light is a specialist lighting design consultancy that works with stakeholders across many areas of development from concept to final construction.

Rubidium Light has been operating since 2011 and brings together an in-depth knowledge of lighting and its application in technically difficult lighting solutions.

Rubidium Light prides itself on its ability to react quickly and in a cost-effective manner to provide outcomes both responsible and cost effective to its clients and the environment.

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1. INTRODUCTION

Rubidium Light has been engaged by Rees Electrical to undertake a Peer Review and Obtrusive Light Assessment on a proposed sports lighting installation design by Valio Lighting at Tom Wills Oval. The objective of this assessment is to quantify the possible adverse effects of light from the proposed sports lighting system in accordance with procedures as outlined in AS/NZS4282-2019 Control of the Obtrusive Effects of Outdoor Lighting and Australian Government Civil Aviation Safety Authority Part 139 Manual of Standards 2019.

2. DEFINITIONS

Luminous flux

The Measure of the quantity of light. For a lamp or luminaire, it normally refers to the total light emitted irrespective of the direction in which it is distributed. Unit: lumen (lm)

Luminous intensity

The concentration of luminous flux emitted in a specified direction. Unit: candela (cd)

Luminance

The physical quantity corresponding to the brightness of a surface (e.g., a lamp, luminaire, sky or reflecting material) in a specified direction. It is the luminous intensity of an area of the surface divided by that area. Unit: candela per square meter (cd/m²)

Illumination

A general expression for the quantity of light arriving at a surface. The physical measure of illumination is illuminance.

Illuminance

The luminous flux arriving at a surface divided by the area of the illuminated surface. Unit: lux (lx)

Reflectance

The ratio of the total luminous flux reflected from a surface to the total luminous flux which arrives at the surface. Usually expressed as a decimal in the range of 0 to 1 but may also be expressed as a percentage.

Glare

The discomfort or impairment of vision experienced when parts of the field of view (e.g., lamps, luminaires, sky) are excessively bright in relation to the general surroundings.

Luminaire

Equipment which houses the light source and directs the light in the desired directions. It includes items necessary for fixing, protecting, and operating the light source.

Threshold increment (TI)

The measure of disability glare expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Higher values of TI correspond to a greater disability glare.

Astronomical Twilight

Astronomical twilight is defined as when the geometric centre of the Sun is between 18° and 12° below the horizon.

3. SITE DESCRIPTION

The proposed sports lighting installation is located at Grand Parade, Sydney Olympic Park NSW. This property is commercial in nature and surrounded by a sporting precinct in all directions and several high-rise residential properties to the north of Sarah Durack Avenue.

The proposed lighting system includes 4 poles 44m in height each with a total of 88 luminaires.

The sporting surface is designed to be for the play of AFL and oval with overall dimensions of 173x131m approx.

4. OPERATION

The proposed lighting system is to be operated from dusk until 10pm each night.

5. RELEVANT GUIDELINES AND STANDARDS

The proposed lighting is reviewed against the requirements of the following standards to ensure compliance and reduce the adverse effects of lighting at night to adjacent residences, road users and aircraft (if in the vicinity of aerodromes) and the surround environment.

5.1. AS/NZS 4282:2023 Control of the obtrusive effects of outdoor lighting

5.2.1. Environmental Zones

This document outlines Environmental Zones to which the proposed lighting will be evaluated based on the location of the proposed installation relative to its surrounding environment.

Excerpt from Standard Table 3.1 Environmental Zone

Zones	Description	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

The proposed sports lighting installation is located in an A4 zone but has been evaluated under the requirements of **A3**.

5.2.2. Basis for differentiation of limits for Ev and I according to times of operation

This document also outlines two levels of illuminance and intensity control based on proposed time of use for a lighting system.

There is a potential conflict between the lighting requirements necessary to facilitate an activity and the maintenance of amenity and environmental integrity. Two sets of limits for Ev and I are given, based on the times that the lighting is to operate, as follows:

- (a) *Limits for non-curfew period The higher of the two sets of limits shall apply for operation of the lighting outside the curfew.
The non-curfew limits have as their objective the facilitation of the intended activity while giving recipients of spill light some relief from it being obtrusive.*
- (b) *Limits for curfew period The lower of the two sets of limits shall apply for operation of the lighting during the curfew period during which maintenance of the amenity and environmental integrity of the area become the dominant considerations.*

Excerpt from Standard Section 3.2.4

The proposed sports lighting installation will only be operated during non-curfew periods. The lighting system will be evaluated under the requirements of **Non-Curfew**.

5.2.3. Basis for differentiation of limits for luminous intensity (I) according to precedent

This document also outlines two levels of intensity control and provides some dispensation for reuse of existing elements where a lighting system is being upgraded.

Level 1 (L1) and Level 2 (L2) limits for intensity (I) shall be in accordance with Table 3.3.

Generally, L1 limits shall be used unless there are certain circumstances that justify L2 limits, specifically—

- (a) *where there is no existing lighting system, and new luminaires are used on new support structures, e.g. poles, buildings, grandstands, L1 limits shall apply;*
- (b) *where there is no existing lighting system, and new luminaires are used on existing support structures, L1 limits shall apply;*
- (c) *where there is an existing lighting system that is being removed/replaced, and where new luminaires are used on new support structures L1 limits shall apply*
- (d) *where there is an existing lighting system that is being retained, either wholly, or in part, any new luminaires on new support structures shall meet L1 limits; and*
- (e) *where there is an existing lighting system that is being retained, either wholly, or in part, or is being removed/replaced, any new luminaires on existing support structures should meet L1 limits. Where the existing support structures are not sufficiently high, or in ideal locations, such that the necessary LTP's for the primary purpose of the lighting system cannot be reasonably achieved, then L2 limits may be used for new luminaires. The application of L2 limits should be strictly limited to only those luminaires where L1 cannot be reasonably achieved, and not generally applied to the whole system. Where L2 limits are used it should be demonstrated that the obtrusive effect of the new scheme is not greater than the previous lighting system.*

Excerpt from Standard Section 3.2.5

The proposed sports lighting installation is new, and the site does not currently include a lighting system will be evaluated under the requirements of **L1**.

5.2.4. Maximum Values of Light Technical Parameters

Excerpt from Standard Table 3.2 Maximum Values of Light Technical Parameters as it applies to lighting installations.

Zones	Maximum Vertical illuminance (Ev) lux		Threshold increment (TI)		Upward Light Ratio
	Non-curfew	Curfew	Maximum TI %	Default adaptation level (Lad) cd/m ²	Maximum ULRs or ULRI
A0	0a	0.0	N/A	N/A	0.00
A1	2	0.1	20	0.1	0.00
A2	5	1	20%	0.2b	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

NOTES:

a For A0, Ev shall be as close to zero as practicable without impacting safety considerations.

b For an internally illuminated sign in a A2 zone, Lad ≤ 0.25 cd/m²

Excerpt from Standard Table 3.2

5.2.5. Maximum luminous intensities per luminaire

Excerpt from Standard Table 3.3 Maximum luminous intensities per luminaire at the vertical surface.

Zone	Luminous intensity (I), cd		
	Non-curfew Level 1 (L1)	Non-curfew Level 2 (L2)	Curfew
A0	See Note	See Note	0
A1	2500	5000	500
A2	7500	12500	1000
A3	12500	25000	2500
A4	25000	50000	2500
TV	100000	165000	0

5.3. Australian Government Civil Aviation Safety Authority Part 139 (Aerodromes) Manual of Standards 2019

This guide outlines the requirements of upward spill light within 6000m of an aerodrome. This requirement ensures no light sources interfere with the take-off and landing operations of aircraft.

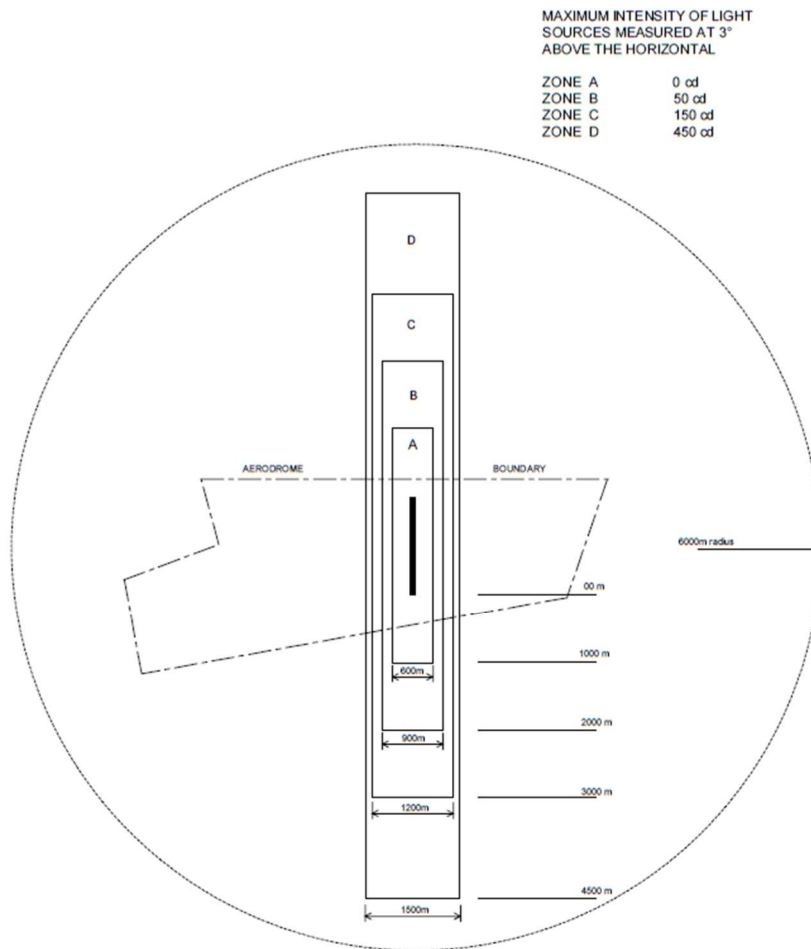


Figure 9.21-1: Maximum lighting intensities

As the proposed lighting location is not within a 6000m radius of an aerodrome this requirement **does not** apply.

5.2. Combined Relevant Maximum Values of Light Technical Parameters

Below is a summary of the combined Maximum Value of Light Technical Parameter at which the proposed lighting system will be evaluated for its surrounding environmental conditions and time of day.

Zones	Maximum Vertical illuminance (Ev) lux	Threshold increment (TI)		Upward Light Ratio
	Non-curfew	Maximum TI %	Default adaptation level (Lad) cd/m ²	Maximum ULRs or ULRI
A3	10	20%	1	0.02

Zone	Luminous intensity (I), cd
	Non-curfew Level 1 (L1)
A3	12500

6. EVALUATION OF LIGHTING SYSTEM OBTRUSIVE LIGHT PERFORMANCE

Section 6 evaluates the requirements of the lighting system against established light technical parameters.

6.1. Maximum Vertical illuminance

An AGI32 V21.5.0.1 file has been provided by Valio Lighting with the location of residential properties relative to the proposed lighting system as per the relevant standard Figure 3.1.

Location	Maximum Vertical illuminance (EV) lux
Boomerang Tower	7
Opal Tower	1
Sarah Durack Residential Tower (Figtree Drive)	1

COMPLIANT A3 Non-curfew

6.2. Upward Light Ratio

Analysis of the lighting model and IES formatted photometric file provided shows an asymmetrical distribution emission to mitigate upward light ratio. 0.7% of all light emitted is above the vertical plane.

COMPLIANT A3

6.3. Threshold Increment

Threshold Increment has been evaluated using computer modelling with AGI32 version 21.5.0.1 software. All relevant travel directions towards to the site have been evaluated and analysed as per the method outlined in AS/NZS4282-2019 at an adaptation level of 1 applied. **COMPLIANT A3**

6.4. Maximum luminous intensities per luminaire

An AGI32 V21.5.0.1 file has been provided by Valio Lighting with the location of residential properties relative to the proposed lighting system as per the relevant standard Figure 3.1.

Luminaire intensity has been evaluated on a vertical plane in these locations and found to be below the required limit (12500 cd). **COMPLIANT A3 Non-curfew L1**

7. CERTIFICATION

The proposed sports lighting system has been evaluated and found to be compliant with all requirements of obtrusive lighting standards.

The report is to read in conjunction with Vailo Drawing Tom Wills Oval Stage 1 500 lux Revision 27C.



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