Macquarie Point Multipurpose Stadium

PoSS Lighting Assessment and Electrical & Hydraulic Infrastructure

Introba

Macquarie Point Stadium

Issue	**Description**	**Date** (DD.MM.YY)	**Prepared By**	**Signed Off**
0	Draft Issue	13/06/24	BJM / GS	
1	Issue for PoSS	26/06/24	BJM / GS	BJM
2	Issue for PoSS	12/07/24	BJM / GS	BJM
3	Issue for PoSS	24/07/24	BJM / GS	BJM
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5	Issue for PoSS	04/09/24	BJM / GS	BJM

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Disclaimer

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1 Introduction

The Project of State Significance (PoSS) application requires a number of specialist inputs and this report particularly addresses Lighting; and Electrical and Hydraulic infrastructure relating to Macquarie Point Multipurpose Stadium (the Stadium).

The items addressed within this report relate to the following.

8.3	**Light**
8.3.1	The reports are to describe the existing light conditions of the project site and the vicinity. The reports are to describe all sources and integration of proposed lighting and its use during different activities, including during events and outside of events. The reports are to evaluate the potential for adverse effects arising from lighting, including the cumulative impact, taking into account surrounding sources of lighting. The reports are to consider the nature of adjacent use and development potentially adversely impacted from lighting on the site, and whether there are any potential effects on fauna or on traffic safety. If necessary, the reports are to outline control measures to prevent light spill.
8.3.2	The reports are to review and detail appropriate light spill assessment methodology, standards and acceptable limits. Where relevant, the choice of a particular methodology over alternative methodologies is to be explained. Assessment of impacts and effects are to include information on the significance, duration and timing of the impact. Assumptions and judgements are to be stated clearly and the nature and magnitude of uncertainties are to be clearly defined.

9.3	**Utility services (Related to Electrical and Hydraulic)**
	The reports are to discuss, assess and demonstrate that: • the activity can occur within the capacity of existing utility services (electricity, gas, water, stormwater, sewerage); • where relevant, the required augmentation of utility services is viable and supported by asset managers; and • where the development directly impacts on existing utility services, assets are able to be relocated or modified in an acceptable manner.

2 Lighting

To demonstrate that the new external lighting, which is part of the Macquarie Point Multipurpose Stadium - Project of State Significance (POSS) has considered lighting spill to the neighbouring properties, an assessment against AS/NZS 4282: 2023: Outdoor Lighting Obtrusive Effects, will be primarily utilised. The Australian Standard (AS) 4282:2023 sets out requirements for the control of the obtrusive effects of outdoor lighting. It includes limits for the relevant light technical parameters to control these effects.

Note - The scope of this report relates to light that will be emitted from the Stadium, and not potential light sources associated with future buildings in the Macquarie Point Precinct.

2.1 Existing Lighting Conditions

An audit of the existing lighting was undertaken on the night of the 29/05/2024, commencing at 6:30pm when the area was dark and artificially illuminated.

As part of the audit the following was observed, along with a number of horizontal illumination (lux) readings – refer to Appendix A and the image below.

Note:

Horizontal illuminance: is the amount of light falling on a horizontal surface, measured in lux. In the case of the lighting audit, the light meter was held close to the ground.

Lux: is a metric unit of measurement for Illumination

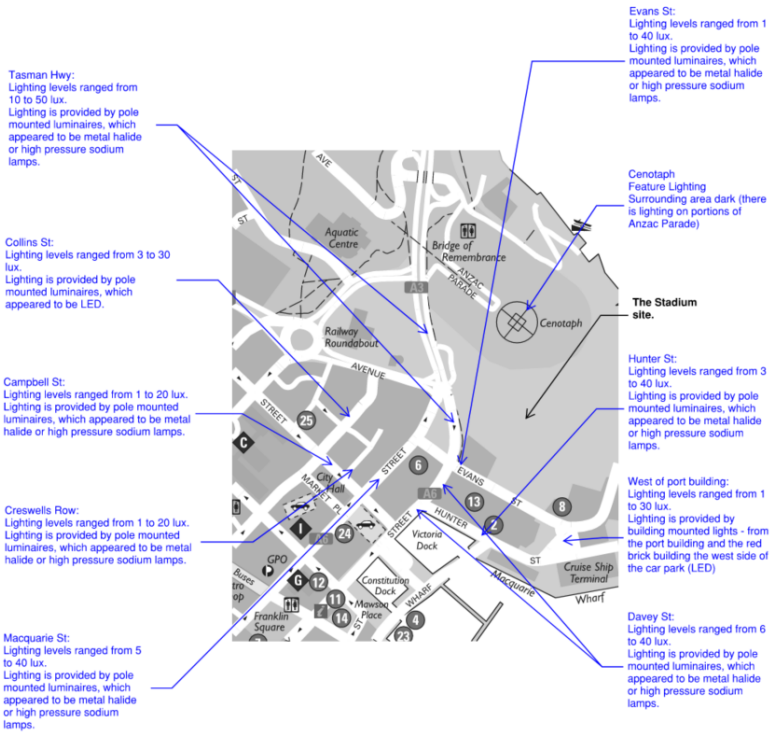
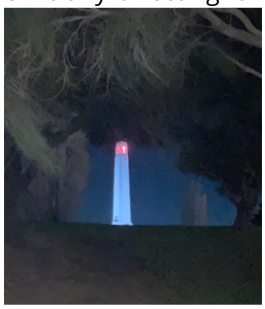


Image Above – night lighting audit findings 29/05/2024.

The existing lighting in the area of the Stadium is typical for city/town centres, with regularly spaced pole lighting mounted on the edge of the roadways, which ranged in mounting height from 6m to 12m.

The majority of the lighting observed was either metal halide (and possibly high pressure sodium); with only a minimal number of LED luminaires in the areas. The pole mounted lighting illuminated the roadways and footpaths, with some light spill observed onto properties.

Areas of Particular Interest:

Location	Description
Evans St	Evans St currently has pole mounted lighting for the street lighting and for path lighting. The uses of the street vary from Residential (e.g. on the Evans and Davey St end), to commercial and industrial at the east end. AS4282 focuses on the residences, mainly where bedrooms are present. The assessment described in the next section will review lighting from the future Stadium and assess it does not unduly negatively affect these spaces.
Port Authority Area	Although AS4282 does not focus on business premises it is appreciated that Port Authority functions cannot be negatively impacted. The port property adjacent to the water, has large light towers currently installed, with large flood lights. While we have not measured the lux levels being emitted, it is estimated that the levels would be between 20 to 50lux. We understand there is also concern for navigation, the control tower and the views of the port from the water, when the Stadium is in operation. This will be reviewed further in the next section; however, we would expect with the aiming of the sports lighting downwards and the large sections of solid façade, the navigation should not be negatively impacted.
Cenotaph	The Cenotaph has decorative lighting to illuminate the structure, with the surrounding area essentially dark, to allow the Cenotaph to be the primary focus. With reference to the next section of the report, the Stadium will not emit any direct lighting that will negatively impact the decorative lighting.  

For non event days the new lighting will be assessed against category A4 of AS4282, which is for ambient lighting conditions of 'High District Brightness'. Broadcast event level lighting will be assessed against the 'TV' category. Observations and assessment will also be made relating to other aspects of spill lighting.

Below are AS4282 extracts for reference.

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 km^2). There may be smaller environmentally sensitive areas.		

Image Above – AS4282 Table 3.1

2.2 Proposed Lighting Schemes

2.2.1 Facade and Decorative Lighting

The intention is to illuminate key feature of the Stadium, to provide interest and to enhance the aesthetic at night. The development of the decorative lighting is yet to be undertaken; however, the project is committed to complying with AS4282 and the scheme adopted will demonstrate compliance.

Refer to Appendix B, for further information.

2.2.2 Sports Lighting

As the venue will be fully roofed, the sports lighting scheme is internal and not technically subject to AS4282, however, given the transparent roof sections and sections of more transparent facade, some reflected light may spill from the venue, as such this lighting will also be assessed against AS4282. The sports lighting scheme and arrangements are still in development and the sections below are based on the current concept design. As the sports lighting design progresses, it will continue to be assessed against AS4282. The concept level design does provide guidance on the magnitude of the spill lighting, which is calculated to be minimal, as further described in the sections below.

2.3 Proposed Lighting Operation

2.3.1 Lighting Control

The sports lighting and facade lighting will be controlled using a centralised lighting control system, which will have the ability to control and dim each light fitting individually or in small banks of lights. The lighting control system will allow for flexible control and to allow the lighting control to automatically operate as needed.

2.3.2 Event Operation

2.3.2.1 Sporting Events

Lighting Type	Operation
Sports Lighting	If a broadcast event is in operation at night/dusk, lighting will operate at full output for the duration of the event, along with a period of time prior and after the event. Sports lighting may also be operated during day time events, if deemed necessary by management or officials. Typically, the sports lighting is also used as part of the event lighting e.g. if a goal is kicked, lights will flash (at dimmed level). Lighting would be used for nighttime events as well as for day time events (when cloudy or for shadow reduction purposes). Typically lighting will be turned off by the AS4282 curfew time (11pm).
Facade Lighting	Façade lighting will operate prior and during events. Facade lighting may dynamically change, e.g. scroll through colours.

Note – the above is based on typical Stadium operation and the new operator may choose to operate the lighting different to description noted above.

2.3.2.2 Concerts

Lighting Type	Operation
Sports Lighting	For a music / stage performance, the sports lighting is not expected to operate. The lighting may be used pre and post event, at a highly dimmed level (operating at 10-20%) to help with setup and egress.
Facade Lighting	Facade lighting will operate up to curfew time (11pm); with post curfew operation to be confirmed and agreed with local Council. Facade lighting may dynamically change, e.g. scroll through colours.

2.3.2.3 Other

Lighting Type	Operation
Sports Lighting	For other events that are not to be broadcasted, we would expect the sports lighting to only operate at a highly dimmed level e.g. for a trade conference, the lighting could be utilised for general lighting to achieve safe moment lux levels. This would be achieved by operating the lights at 20% output or less. The lighting may be used for sports training (non-broadcast); this too would have the lighting operating at a dimmed level.
Facade Lighting	Façade lighting will operate up to curfew time (11pm); with post curfew operation to be confirmed and agreed with council. Facade lighting may dynamically change, e.g. scroll through colours. After this time it will be dimmed (lower output) or switched off.

2.3.2.4 Non-Event Times Operation

Lighting Type	Operation
Sports Lighting	The lighting may be used for maintenance and setup, at a highly dimmed level (operating at 10-20%) to help with setup and egress.
Facade Lighting	Façade lighting will operate up to curfew time (11pm); with post curfew operation to be confirmed and agreed with council. Facade lighting may dynamically change, e.g. scroll through colours.

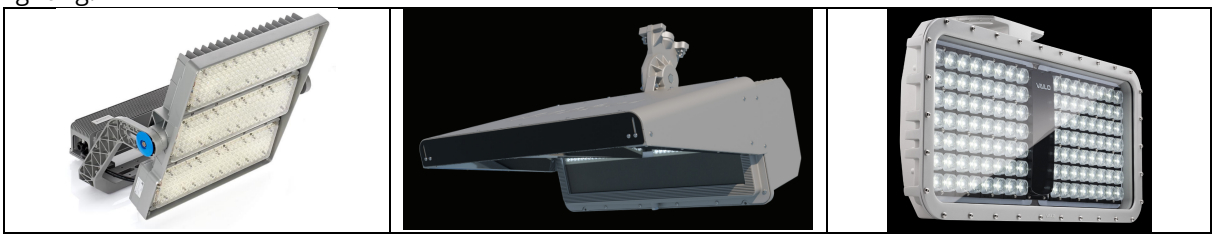
2.4 Proposed Light Fittings (Luminaires)

The light fittings will be selected to meet the required lighting levels, but also to minimise the effect on the neighbouring properties. This has included the careful selection of lighting optics that focus the output on the required areas, and through considered aiming.

As the project is only in the early phases, the below are examples of the types of light fittings that may be considered, and final selection will not negatively impact the basis of this report. The light fittings being considered either have integrated shields, or can incorporate shielding, as a means of further ensuring lighting control is maximised.

Sports Lighting

The below are examples of the sports light fittings (luminaires) that may be used for the venue's sports lighting.



The fittings will be aimed facing downwards, and the fitting selected will have good optical control, which results in the light focusing on the intended aimed direction, with little lighting directly spilling from the fittings. Based on this, any light leaving from the venue, will be as a result of reflectance e.g. light reflecting off the field of play or other internal surfaces.

Façade Lighting

Characteristics and selection of façade and decorative lighting to be progressed in the future and will be selected mindful of AS4282.

2.5 AS4282 and Obtrusive Lighting Compliance

The lighting schemes will be designed to meet AS4282 Obtrusive lighting requirements.
This standard sets limits for spill lighting that can be imposed on the neighbouring properties. By complying with AS4282 and the required calculations, the lighting is achieving best practices and demonstrates the level of spill lighting is reasonable and should not have a negative impact on neighbouring properties.

The lighting calculation described above, has informed an understanding of the potential impact on the existing site conditions and the surrounding uses. Each of these conditions is described below, with consideration given for the potential for adverse effects from lighting associated with the Multipurpose Stadium and other surrounding sources.

2.5.1 Façade and Decorative Lighting

AS4282 Compliance will be confirmed as the scheme is developed.

2.5.2 Sports Lighting - Lighting Calculation for Spill Lighting

Sports lighting is mounted below the roof, to achieve the nominated sports lighting broadcast requirements. Final performance requirements are yet to be agreed, but as a minimum the sports lighting will meet the requirements of the AFL Guide for broadcast lighting; this nominally requires 1500lux in a vertical direction facing the main cameras, over the playing field area.

Based on the above, we have completed concept level lighting design calculations using the industry standard software AGI32. Within AGI we have included an open roof, to assess if any spill lighting will occur. The modelled open roof allows for 100% light transmission as a conservative assessment, in reality the transparent roof material would absorb and reflect a component of the light. The AGI32 model also includes the transparent/open sections of the façade, to include any spill lighting contributed from these areas.

A vertical calculation plane has been included in the AGI model along the residential building interfaces in accordance with AS4282. This calculation plane has been included to a height of 20m. Should future buildings be constructed to a heigh over 20m, this assessment is still valid, as the lighting levels were seen to be diminishing above this height. The light spill is within the limits of AS4282 and is <25lux. The vertical calculation plane was included along Evans St (east-west) and along the western boundary (north-south). Residential buildings are not expected on the north or east side of the Stadium.

AS4282 Lighting assessment has been completed, as per table 3.1, with the area considered A4 and TV. A4 would apply for non-broadcast event days, as an area of 'High District Brightness'; and will be used for the AS4282 assessment. Table 3.2 notes the limits applicable to each zone. For event days which would be broadcast 'TV' category can be used for assessment.

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
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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 km^2). There may be smaller environmentally sensitive areas.		

Applicable to non-broadcast lighting → A4

Applicable to broadcast lighting → TV

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/m²	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

Applicable to non-broadcast lighting

Applicable to broadcast lighting

Table 3.3 — Maximum luminous intensities per luminaire

Zone	Luminous intensity (I), cd		
	Non-curfew Level 1 (L1)	Non-curfew Level 2 (L2)	Curfew
A0	See Note	See Note	0
A1	2 500	5 000	500
A2	7 500	12 500	1 000
A3	12 500	25 000	2 500
A4	25 000	50 000	2 500
TV	100 000	165 000	0

NOTE For A0, I shall be as close to zero as practicable without impacting safety considerations.

Images Above – extracts of AS4282-2023

With regards to the AS4282 extracts above, the term 'Non-curfew' relates to the time periods where lighting is agreed to be able to operate at full output, which is typically set by council and the term 'Curfew' refers to periods of time when lighting is not permitted to operate by council (or the lighting can only operate at a reduced output). We have only assessed the Non-curfew period and the Stadium management would need to adhere to any operational limitations imposed by Council or other governing bodies.

As per AS4282 table 3.2, 3.3, we need to limit non-curfew (typically before 11pm) light spill to be <25lux vertical at the residential boundaries; <25,000cd and max Upward Light Ratio of 3%; for A4 zone.

Using the software package AGI32, we have completed a full AS4282 assessment which is a feature of the software, the below is an extract showing full compliance. For conservatism, we have calculated the full broadcast (concept) lighting, against the A4 environmental zone e.g. we confirmed non-event lighting limits, with the broadcast lighting at full output. But in reality on non event days when A4 zone applies, the light levels would be dimmed with lower output – refer to the operation section. This approach is conservative as we are reviewing full lighting output against the more stringent non-broadcast spill lighting criteria (for lux).

Note – AGI32 confirms compliance with AS4282 - 2019; which is more onerous than the newer version of AS4282 – 2023 (which doesn't set a limit to broadcast level lighting for example).

Obtrusive Light - Compliance Report

AS/NZS 4282:2019, A4 - High District Brightness, Non-Curfew L1
Filename: Mac Point Sports Lighting Concept [5D] - AS4282 V1
25/06/2024 2:06:47 PM

Illuminance

Maximum Allowable Value: 25 Lux

Calculations Tested (5):

Calculation Label	Test Results	Max. Illum.	
ObtrusiveLight_3_Ill_Seg1		**PASS**	0.1
ObtrusiveLight_3_Ill_Seg2		**PASS**	0.0
ObtrusiveLight_3_Ill_Seg3		**PASS**	3.9
ObtrusiveLight_3_Ill_Seg4		**PASS**	4.5
ObtrusiveLight_3_Ill_Seg5		**PASS**	1.7

Upward Waste Light Ratio (UWLR)

Maximum Allowable Value: 3.0 %

Calculated UWLR: 0.7 %
Test Results: **PASS**

Image Above – snip from AGI32 calculation of AS4282 assessment

As noted from the AS4282 calculation summary above, the sports lighting will comply with lux, and upward waste light ratio.

Luminous intensity will be addressed through shielding being added to the luminaire and by virtue of the stadium building elements, which will reduce visibility to directly see the light fittings from the residential buildings and from other directions.

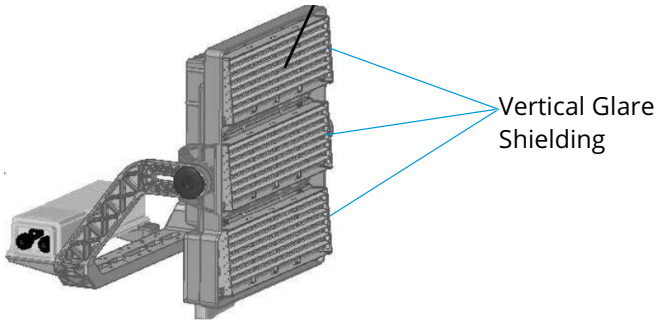


Image Above – Example glare shields attached to a light fitting

While not a requirement of AS4282 (which does not list horizontal limits), we have also included a horizontal calculation grid around the stadium which provides a further indication of the level of spill lighting for demonstration purposes (and to ease visualising any impact), the output of this is in the larger image below.

The below is an extract from the AGI32 lighting calculation. Included is the sports lighting directed at the field of play to achieve broadcast level lighting. The surrounding points are horizontal lux measurement points, based on this calculation. Refer to the table below for the colour coding of the points. Vertical calculation planes for AS4282 assessment are also included, as described above (along the boundaries).

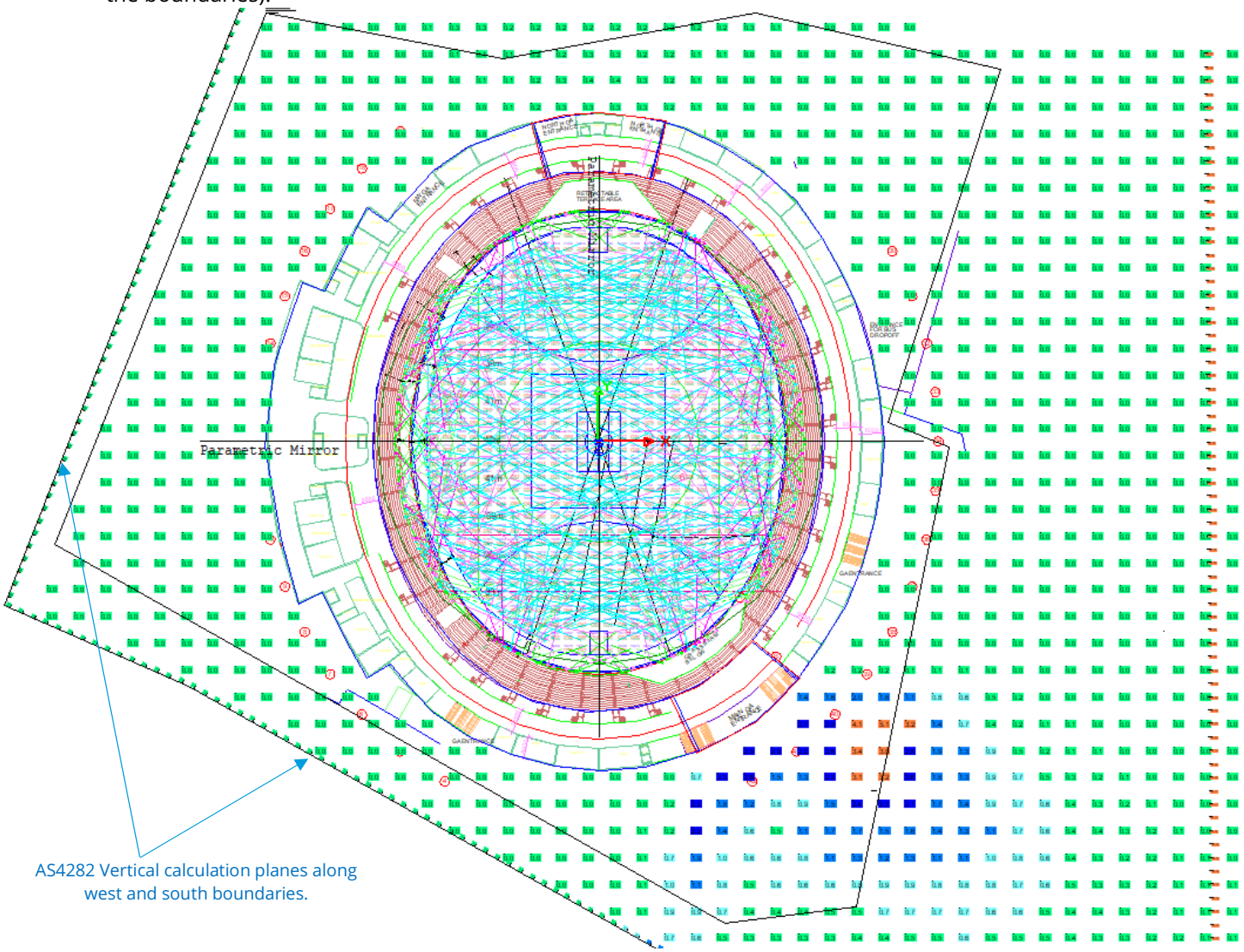


Image Above – snip from AGI32 lighting calculation (the numbers are lux values at ground level)

The colour coding of the spill lighting is as follows (these values are horizontal lux, at ground level):

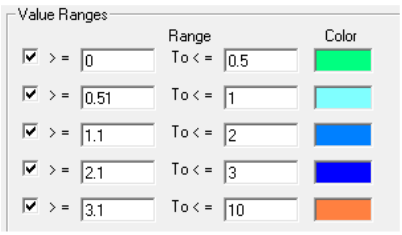


Image Above – snip from AGI32 lighting calculation, for colour coding of lux point values in next image

The image below is a pseudo colour render of the calculations completed, to show the horizontal lux values represented as the colours noted in the index on the side of the image.
Note – the playing surface will exceed 10lux, the red colour includes all values >10lux (the playing surface is likely in the range of 1500lux or more)

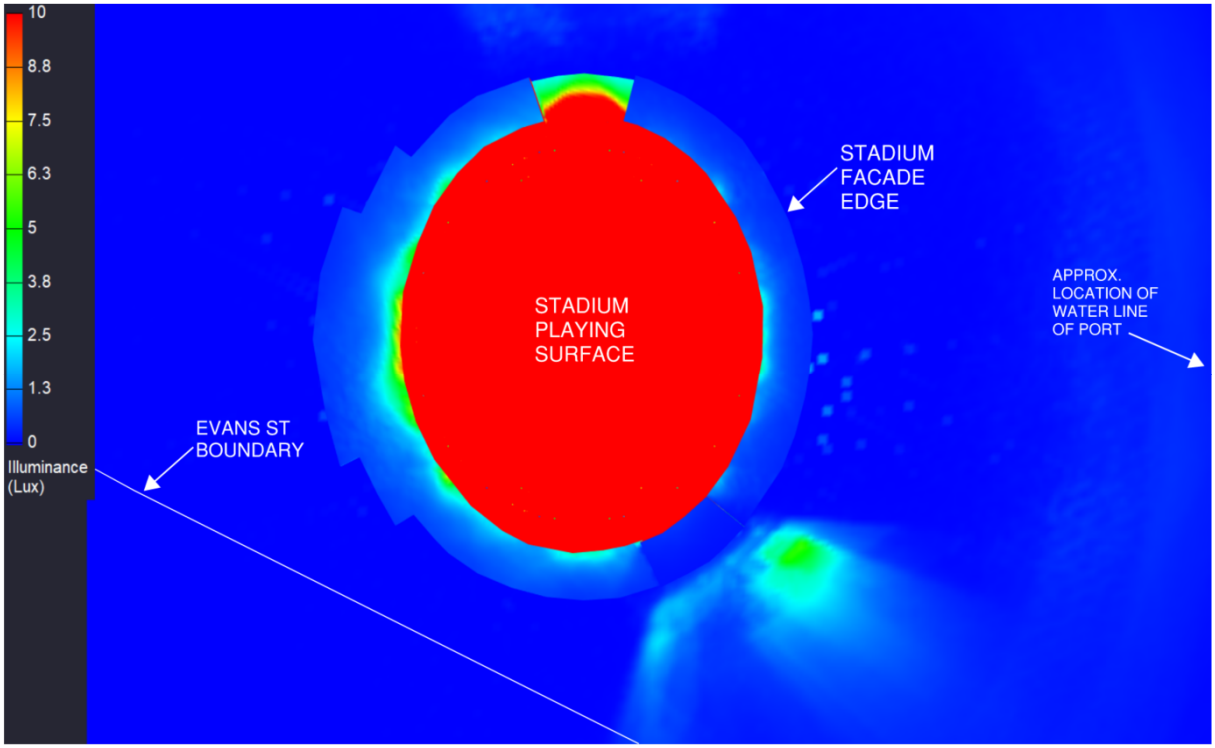


Image Above – snip from AGI32 showing colour coding for lux levels

As can be seen from the images above, the majority of the surrounding area has blue shaded values, which means the lighting spill is <1 lux horizontal. On the southwest where the façade is somewhat open/transparent, the light spill is locally up to 5lux and less than 10lux.

Note – this is based on an approximation of the concept design façade, included in the light modelling software.

2.5.2.1 Port Operations

As can be seen from the calculation results above the light spill on the port area is minimal, with horizontal contribution < 1lux.

We have also completed a vertical calculation grid on the port area (at approximately the water edge), running north to south, which shows the vertical spill is also minimal. The vertical lighting lux levels range from 0lux up to around 10lux. While not a requirement of the AS4282 assessment, this is below the 25lux listed maximum spill lighting limit.

When the Stadium is viewed from the water (e.g. on a boat), the Stadium sports lighting will be visible and is expected to be a glow emanating predominantly upwards, as a result of the reflected lighting from the field of play, through the transparent roof. The upward glow will be minimal and will comply with upward light limits. Facade and decorative lighting will be relatively low output and while this will be

visible from afar, these light fittings will not contribute any spill lighting onto the port area, located east of the Stadium.

From a navigational perspective, boating traffic should also be unaffected, as again the lighting will be visible from afar, however, the light fittings will not contribute to lighting levels e.g. much like you can see city lights from many kilometres away, they do not affect actual lighting levels, the lighting is perceived by the eye as a light source in the dark sky, but the measurable light contribution would be negligible. It would also be expected that the Stadium will become a navigational point of reference, as per other buildings and features along the shore line.

From the perspective of control tower staff looking north, we would not expect their viewing to be negatively impacted, as the lights are all downwards facing. From the elevated viewing area of the control tower, staff viewing the port water ways will not be within the focal aiming point of any of the lighting, with upward lighting only as a result of reflected light from the playing surface.

2.5.2.2 Impact on Vehicle Traffic

The Stadium lighting has also been reviewed against any impacts on traffic (people operating vehicles). It is understood that lighting glare can impact road safety.

Traffic will be outside of the focal aiming point of the Stadium lighting, as such people in vehicles should not be impacted by any direct lighting contribution and should not be subject to glare, as the facade and stadium roof will act as a barrier.

The facade on the west and southwest is largely non-transparent (to the field of play), which will aid in blocking the fittings from the direct view of vehicles and as per the AS4282 confirmation, the vertical light emanating beyond the site boundary is less than or comparable to the street lighting contribution (and <25lux).

2.5.2.3 Fauna and Flora

It is noted that there is little vegetation on the project site, the majority of the vegetation is located in the Royal Hobart Regatta Grounds to the north of the project site, and as such, it is not expected that any existing fauna will be affected by the spill light. According to the report by North Barker[1] (who reviewed the Fauna and Flora, as Ecosystem consultants), it is understood that there is no critical habitat for protected or threatened species in the vicinity of the project area.

Further, as can be seen from the sections above, the spill lighting, in particular to the north (towards the park) of the stadium is minimal.

2.5.2.4 Evans St and Western Area

The entire length of Evans St that faces the stadium has been included in the spill lighting assessment and has been proven to be compliant with AS4282; as such the Stadium should have minimal impact on residents or potential future residents should any of the other building be converted to residential in the future. The same would be the case for the area west of the stadium, which has also been included in the AS4282 assessment.

When viewed from further away on the western side of the stadium, as with the view from the east side (discussed above) the lighting will be visible from afar, however, the light fittings will not contribute to

[1] North Barker Ecosystem Services, 22nd July 2024, 'Macquarie Point Precinct Plan – Natural Values Assessment' Report, prepared for The Macquarie Point Development Corporation.

lighting levels e.g. much like you can see city lights from many kilometres away, they do not affect actual lighting levels, the lighting is perceived by the eye as a light source in the dark sky, but the measurable light contribution would be negligible.

2.5.2.5 Cenotaph

The decorative lighting of the Cenotaph relies on the surrounding area having a relatively low lighting level, so that the lighting can contrast with the darker surroundings, when directed at the monument.

As can be seen from the calculations, the spill lighting directed north is expected to be very minimal (<1lux horizontal in the vicinity of the stadium, which will reduce with distance) and should not impact the existing decorative lighting scheme.

2.6 Conclusion

The lighting will be controlled through the use of good light fitting optics, aiming and by shielding, to minimise light spill.

Based on the calculated light spill beyond the property boundary there should not be adverse effects arising from the Stadium lighting, including the cumulative impact when taking into account surrounding sources of lighting. The lighting review considered the neighbouring properties, flora and fauna, port uses and nearby traffic.

Light spill analysis has included an assessment in accordance with AS4282. The primary concern of AS4282 is during non-broadcast events (which will be the most common situation), which is when lux spill levels are assessed on the neighbouring properties. AS4282 recognises that when a broadcast event is in operation this necessitates the need for a high lighting level and a spill lighting assessment is not required; none the less we have shown through calculation that during all modes of operation the spill lighting should be minimal and compliant with AS4282.

3 Electrical and Hydraulic Infrastructure

3.1 Electrical

To date we understand JMG (as the site infrastructure Engineers) have reviewed the existing services for the redevelopment. The below references and summarises the relevant aspects of the infrastructure report prepared by JMG[2].

Based on the current layouts, the calculated electrical demand for the Stadium is in the order of 5.5MVA, this includes 25% spare. However, as the venue is considering seating capacity growth, we would suggest infrastructure is sized to for at least 6MVA to allow flexibility. For reliability, the current proposal is for two substations, each with a day one capacity of 3MVA (with physical size to cater for 2 x 2MVA transformers). As such two HV feeders (minimum) would be required, which also allows for redundancy.

The new site High Voltage arrangements, will be part of the wider Macquarie Point Precinct, including the District Infrastructure System (DIS). With reference to the JMG report; Mac Point will have a maximum demand in the order of 10.7MVA.

The JMG report advised the below, with regards to existing and proposed TasNetworks infrastructure in the vicinity of the development:

- Site has two existing feeders:
    - Feeder 14061 – From East Hobart Zone Substation (tbc) via the Domain Shipyards/Regatta Grounds foreshore to the TasWater sewerage treatment plant (STP).
    - Feeder 14062 – From East Hobart Zone Substation to Evans Street substation.
- The proposed future arrangement is still in development and being considered by TasNetworks. Based on previous findings the below was put forward as options:
    - The reinforcement of exiting 11 kV feeders to provide a shared N-1 arrangement from three distribution feeders.
    - A dedicated N-1 supply arrangement from two new distribution feeders from East Hobart Zone substation.
    - The current indication from TasNetworks is to provide a supply from Davey St Sw (new) and a supply from Evens Street #2 (new).

From the two points of electrical supply, the stadium would be linked into the wider project HV infrastructure, with two substations being planned within the stadium footprint.

By having at least two feeders supplying the site, this should provide an adequate level of redundancy, should a single feeder fail.

[2] JMG, July 2024, 'Services Report, Macquarie Point Infrastructure Strategy', prepared for The Macquarie Point Development Corporation.

3.2 Hydraulic

To date JMG have reviewed the existing Water and Sewerage services for the redevelopment. The below references and summarises the relevant aspects of the infrastructure report prepared by JMG[3].

3.2.1 Water Supply System

It is anticipated that dual 150mm metered mains pressure supply connections will be provided to the Stadium that will be supported via potable water supply tanks and pressure pumps that will ensure adequacy of water supply for the Stadium.

Fire Services supply systems for the Stadium will be supplied from the dual mains pressure water supply connections that in turn will supply water to dedicated fire water storage tanks and associated pump systems of suitable capacity to meet local fire code and fire brigade requirements.

Irrigation supplies for the watering of the Stadium playing surface are anticipated to also be supplied from the dual mains pressure water supplies connection as dedicated metered water supplies. It anticipated that irrigation supplies will be operated outside normal operation hours.

Estimated peak water supply demands and fire service supply flows, anticipated for a 24,500 to 26,000 occupancy capacity, along with staff and athletes, would be as follows. Where appropriate infrastructure will be sized to allow for the future capacity increase:

- Potable water demand - 35 l/sec (based upon assessment of Stadium to BCA and AS 3500)
- Fire services water demand - 66 l/sec (subject to Fire Service Engineers confirmation)
- Irrigation water demand - 10 l/sec (subject to Irrigation Engineers confirmation)

3.2.2 Sewer Drainage

The site naturally drains to the southeast, which provides the opportunity for the connection of the Stadium in this orientation. Based on the initial infrastructure assessment, it is anticipated that a new pump station facility would have an overflow to the environment set at a level of 2.0m AHD and it is recommended that any private sewerage connection be connect at a minimum of 2.5m AHD to avoid the potential of backflow into the private sewerage drainage network. It is anticipated that at least one 300mm Authority sewerage drainage outfall point will be set in place extending form the new sewage reticulation main set at a level of 2.5m AHD.

It is anticipated that gravity drainage for the Stadium will be greater in length than 200m, therefore, a series of private sewer pump stations have been considered to be installed at various locations around the Stadium that will collect sewer drainage discharges that may not readily connect to the site outfall via gravity type piping. The pump systems would comprise a minimum of dual computer-controlled pumps and macerators on the pump inlets, that in-turn will pump the collected sewerage to the gravity outfall point(s).

In addition, any gravity drainage system that may connect directly with the new Authority sewerage drainage outfall will be provided with overflow relief system to ensure sewerage does not back charge internally in the Stadium.

Estimated peak sewerage supply demands, anticipated for a 24,500 to 26,000 occupancy capacity, along with staff and athletes, would be as follows. Where appropriate infrastructure will be sized to allow for the future capacity increase:

- Sewerage demand - 35 l/sec (based upon assessment of Stadium to BCA and AS 3500 and considers 100% of the incoming potable demand may be discharging to the sewerage system outfall)

[3] JMG, July 2024, 'Services Report, Macquarie Point Infrastructure Strategy', prepared for The Macquarie Point Development Corporation.

4 Explanatory Information

4.1 Explanatory Information - for General Building Services Reports

4.1.1 Exclusive Use

This report has been prepared by Introba Consulting, at the request of the Client exclusively for the benefit and reliance of the Client.

This report is an engineering report prepared in accordance with the Client's directions, having due regard to the assumptions that Introba Consulting may be reasonably expected to make in accordance with sound engineering practice and exercising the obligations and the level of skill, care and attention required of it under the terms of the engagement.

The following section contains important information about this report. This report, in whole or in part, may only be reproduced, or distributed with the prior written permission of Introba Consulting or the Client, and this permission must accompany every copy of this report.

Introba Consulting's engagement by the Client is on the basis that Introba Consulting's liability, whether under the law of contract, tort, statue, equity or otherwise, is limited as set out in the terms of the engagement.

4.1.2 Third Party Reliance

This report is prepared exclusively in accordance with instructions given by or on behalf of our Client. Introba Consulting therefore excludes any responsibility for the use of, or reliance on, the report by any third party and the use of, or reliance on, the report by any third party is at the risk of that party. Any third party wishing to act upon any material contained in this report should first contact Introba Consulting for detailed advice which will take into account that party's particular requirements.

It is not possible to make a proper assessment of this report without a clear understanding of the terms of engagement under which the report has been prepared, including the scope and directions given to, and the assumptions made by, Introba Consulting in the preparation of this report.

4.1.3 Scope

The particular scope of Introba Consulting's brief in this matter, including the scope of investigation requested by the Client, means that the report necessarily concentrates on readily apparent major items.

This report is provided strictly on the basis that the information that has been provided can be relied on is accurate, complete and adequate. However, we accept no liability for the accuracy or otherwise of this information, except where Introba Consulting expressly indicates in the report that it has verified the information to its satisfaction.

Nothing in this report shall be read or applied so as to purport to exclude, restrict or modify, or have the effect of excluding, restricting or modifying the application of all or any of the provisions of the Trade Practices Act 1974 or any other legislation which by law cannot be excluded, restricted or modified.

4.1.4 Compliance with Current Building Codes, Regulations and Standards

Building Codes, Regulations and Standards (Regulations), particularly with respect to fire safety systems, may have changed since the original construction. Buildings constructed in accordance with the Regulations in force at the time, may not now comply with current Regulations.

The report may identify areas of non-compliance with current Regulations but it does not purport to provide a comprehensive analysis of compliance with current Regulations. Accordingly Introba Consulting recommends that the Client should seek specialist regulatory/building code advice to confirm any non-conformances.

4.1.5 Accuracy

If the reader should become aware of any inaccuracy in or change to any of the facts, findings or assumptions made in this report, the reader is requested to inform Introba Consulting so that we may assess its significance and review the report's comments and recommendations.

Appendix A – Existing Lighting Audit

EXISTING LIGHTING CONDITIONS AUDIT

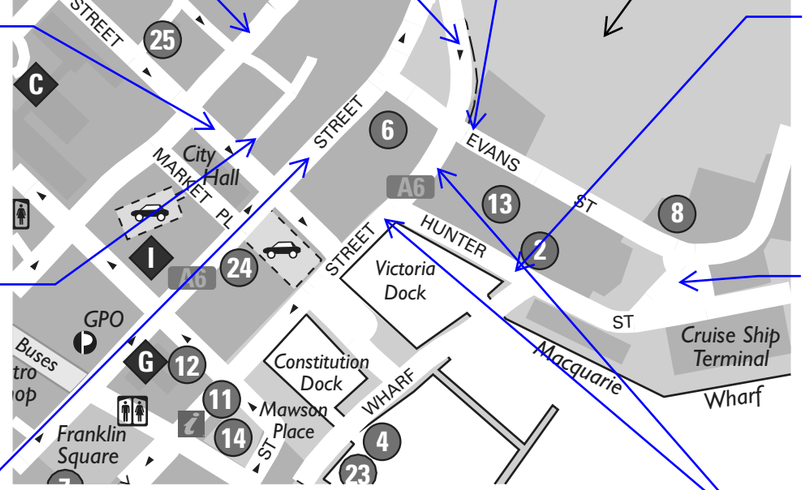
Tasman Hwy:
Lighting levels ranged from 10 to 50 lux.
Lighting is provided by pole mounted luminaires, which appeared to be metal halide or high pressure sodium lamps.

Collins St:
Lighting levels ranged from 3 to 30 lux.
Lighting is provided by pole mounted luminaires, which appeared to be LED.

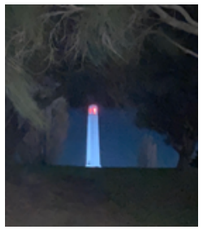
Campbell St:
Lighting levels ranged from 1 to 20 lux.
Lighting is provided by pole mounted luminaires, which appeared to be metal halide or high pressure sodium lamps.

Creswells Row:
Lighting levels ranged from 1 to 20 lux.
Lighting is provided by pole mounted luminaires, which appeared to be metal halide or high pressure sodium lamps.

Macquarie St:
Lighting levels ranged from 5 to 40 lux.
Lighting is provided by pole mounted luminaires, which appeared to be metal halide or high pressure sodium lamps.



Evans St:
Lighting levels ranged from 1 to 40 lux.
Lighting is provided by pole mounted luminaires, which appeared to be metal halide or high pressure sodium lamps.



Cenotaph
Feature Lighting
Surrounding area dark (there is lighting on portions of Anzac Parade)

The Stadium site.

Hunter St:
Lighting levels ranged from 3 to 40 lux.
Lighting is provided by pole mounted luminaires, which appeared to be metal halide or high pressure sodium lamps.

West of port building:
Lighting levels ranged from 1 to 30 lux.
Lighting is provided by building mounted lights - from the port building and the red brick building the west side of the car park (LED)

Davey St:
Lighting levels ranged from 6 to 40 lux.
Lighting is provided by pole mounted luminaires, which appeared to be metal halide or high pressure sodium lamps.

Introba

0010488-SKE30524
ELECTRICAL SERVICES
EXISTING LIGHTING AUDIT
Design: BJM
Date: 11/7/24
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Appendix B – SBP Decorative Lighting

1 General design guidance

In large-scale stadium lighting projects, the management of luminous intensities and light spill is critical. Light spill occurs when artificial light spreads beyond its intended area, causing unwanted illumination of nearby spaces. This not only wastes energy but also disrupts local wildlife, the human neighborhood and adds to light pollution, dimming our view of the night sky.

To adress this issue, all analyses and simulation checks should consider all surrounding light sources (direct and reflected) and the environment, as well as the stadium's functional floodlights and different usage scenarios. In our case, these sources, in addition to the architectural lighting of the building envelope, include:

· Floodlight reflections on the lawn, illuminating through the ETFE roof.

· Grow light reflections through the ETFE roof.

· Light passing through the glass sections of the west building.

· Perimeter lighting and area lighting around the stadium.

· Illuminated naming installations facing the street.

The INTERNATIONAL DARK-SKY ASSOCIATION (ISA) emphasizes the importance of reducing light pollution to protect ecosystems and preserve the natural night sky. IDA's structure and operations are designed to effectively address light pollution through a combination of advocacy, education, community engagement, and technical expertise. Precise lighting design, shielded fixtures, and smart lighting controls are essential to reducing light pollution. Following these steps will ensure that stadium lighting is both effective and environmentally responsible.

2 Project Facade Lighting Requirements and Considerations

Applicable Standards and Environnemental Zone:

We are committed to achieving the requirements outlined in AS4282, which provides guidelines for the control of obtrusive effects of outdoor lighting.

The project is assumed to fall under Environmental Zone A4, which applies to areas with high district brightness, such as town and commercial areas, industrial, and port areas. This zone allows for the highest lighting intensity.

Event-Specific Lighting Dynamics:

During events, lighting intensities will be carefully managed to limit their impact. However, it is important to recognize the significant visual effects of mega event lighting on the stadium surroundings.

Event lighting may include vivid color changes and video content displayed on the facade, contributing to the overall lighting intensity.

Inside the stadium bowl, the reflection of floodlights on the lawn and the resulting illumination through the ETFE roof covering will enhance the brightness and contribute to the external lighting ambiance.

Further Lighting scenarios

The lighting of the stadium and the precinct will vary depending on the different use scenarios and events, and will be designed to enhance the visual appeal and identity of the stadium. Beside the above mentioned mega event that is limited in terms of time and quantity, this can be classified as follows:

- A side event that takes place in the multifunctional areas of the stadium and requires a limited, medium lighting intensity.

- Daily lighting of the stadium as an object, with a low intensity and a limited duration to be agreed.

- Usual lighting of the stadium surroundings, in accordance with the usual lighting scenarios of the city of Hobart.

3 Lighting Design Recommendations

Focused and Programmable Lighting:

Implement strategies such as focused lighting design, the use of dimmable and programmable lighting systems, and the incorporation of shielding where feasible. This will help mitigate excessive lighting and reduce environmental impact.

Multi-layer Lighting Approach:

Adopt a multi-layer lighting strategy that includes ambient, human scale, and festive layers. Ensure balanced lighting levels to create a safe, pleasant environment without excessive luminance. Use subtle color and intensity changes to animate the building and tell a visual story. On non-event days, dim the ambient lighting to the lowest level, focusing only on selected areas.

Well-engineered Installation:

Design lighting solutions that integrate seamlessly into the structure, prioritizing the lighting effect over the visibility of the light source. Shield direct-view luminaires to minimize skyward light emissions. Repetitive and jet slightly varied lighting compositions can create a magical nocturnal atmosphere while maintaining easy maintenance.

Intelligent Lighting Control System:

Utilize a dimmable, color-changing dynamic LED system, integrated with time clock scheduling and daylight sensing to adjust light levels based on events and time of day. Ensure the lighting control system is fully integrated with the building and exterior systems, providing feedback to the broader building management system for optimal performance and energy efficiency.

Coordination for Event-specific Lighting:

Coordinate intensively with stakeholders to define lighting scenarios for mega-events, balancing environmental demands with the visual impact. Explore the combination of indirect and direct view luminaires, as well as temporary installations versus integrated façade solutions, to create spectacular event lighting with minimal environmental impact.

4 Quantification of luminous intensities and light spill

To quantify the impact of lighting on visitors, the neighborhood, and skyward light spill, we conduct lighting calculations in accordance with AS4282 at selected sensitive locations.

It is important to note that these calculations alone do not constitute an assessment or approval. These calculations provide benchmarks, other comparable venues, such as stadia or lighting venues in Tasmania should and can be referred to get a full picture and understanding of the feature lighting.

The detailed feature lighting design phase will commence later, once comprehensive lighting design visuals have been developed, further information can be provided to the Commission upon request.

AS4282 lighting calculations will be completed to confirm compliance, during the detailed design phase of the project.

Appendix Data sheets

All folders include data sheets for luminaires from various manufacturers, organized by application type. Energy efficiency and environmental impact have been meticulously considered. These data sheets provide singular examples of different luminaire variations. Numerous additional options are offered by manufacturers for each luminaire, including different light outputs, illuminances, beam angles, shades, connection types, pixel densities, control options, and many more.

The specific application, driven by design intent, boundary conditions, and project-specific and sustainability requirements, will determine the choice of luminaire variations and specifications in the next project steps.

The data sheets in the shared folders can be explored for inspiration and to understand the various options available and how they can meet our unique project needs.