



Light Management Plan – River Murray International Dark Sky Reserve



DRAFT FOR CONSULTATION
June 2025

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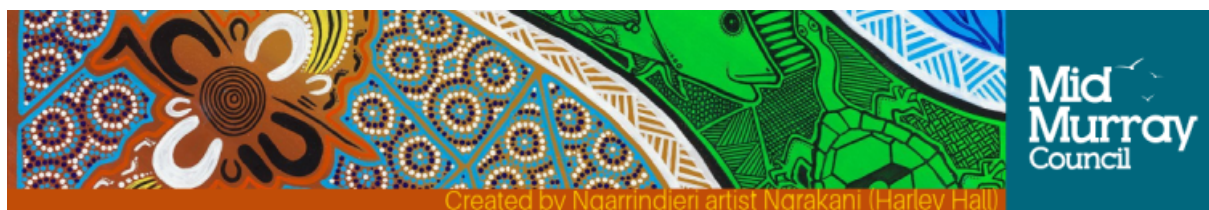
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Acknowledgement of Country

Mid Murray Council would like to acknowledge and pay respect to the Traditional Custodians of the land: the Ngadjuri, Ngaiawang, Ngangaruku, Ngarkat, Ngarrindjeri and Peramangk Peoples of the Mid Murray lands and waters.

It is upon their ancestral lands and waters that the Mid Murray Council operates, and Council pays respect to Elders, past and present, and their spiritual beliefs that are of continuing importance to those First Nations Peoples of today.

Council further acknowledges the contributions and important role that First Nations Peoples continue to play within the community



Introduction

This Light Management Plan has been developed to ensure that the River Murray International Dark Sky Reserve (the RMIDSR) satisfies the criteria set by DarkSky International and should be read in conjunction with the Dark Sky Policy adopted by the Mid Murray Council. The Plan is required to ensure that the already naturally dark sky in this region is not only protected, but also further enhanced, through various measures, including lighting education programs, a reduction in the number of lights and modifications to existing outdoor light fittings and globes.

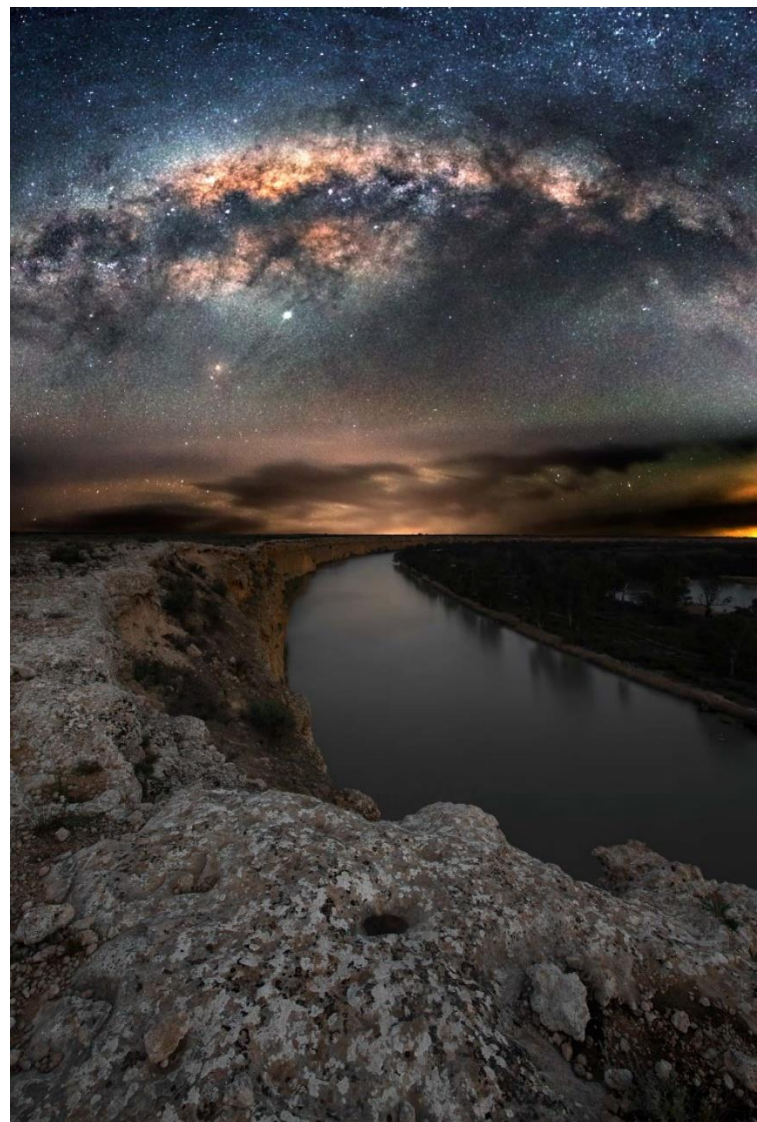
Aims

The aims of this Light Management Plan are:

- 1) To raise community awareness of the RMIDSR and seek their assistance in maintaining the Dark Sky.
- 2) To ensure that Council, other Government bodies and private landholders within the RMIDSR understand how they can assist in preserving, enhancing and promoting the Dark Sky Reserve concept.
- 3) To ensure all new public lighting meets International Dark Sky Standards.
- 4) To retrofit existing outdoor public lighting to meet DarkSky International standards.

This Light Management Plan conforms to all local, regional and national legislation. It provides additional policy not mentioned in the following legislation:

- 1) *Planning, Development and Infrastructure Act 2016*.
- 2) Planning and Design Code.
- 3) Australian Standards for public lighting AS 4282 (Control of the obtrusive effects of outdoor lighting), AS 1158 (Lighting for roads and public spaces) and AS 2560 (Sports lighting).



Where this document applies

This document applies to the geographical area to be known as the 'River Murray International Dark Sky Reserve'. As shown in Figure 1, this area spans between the eastern and western borders of the Mid Murray Council area and includes the southern portion of the Council area (excluding Mannum). The northern boundary of the reserve includes the township of Blanchetown.

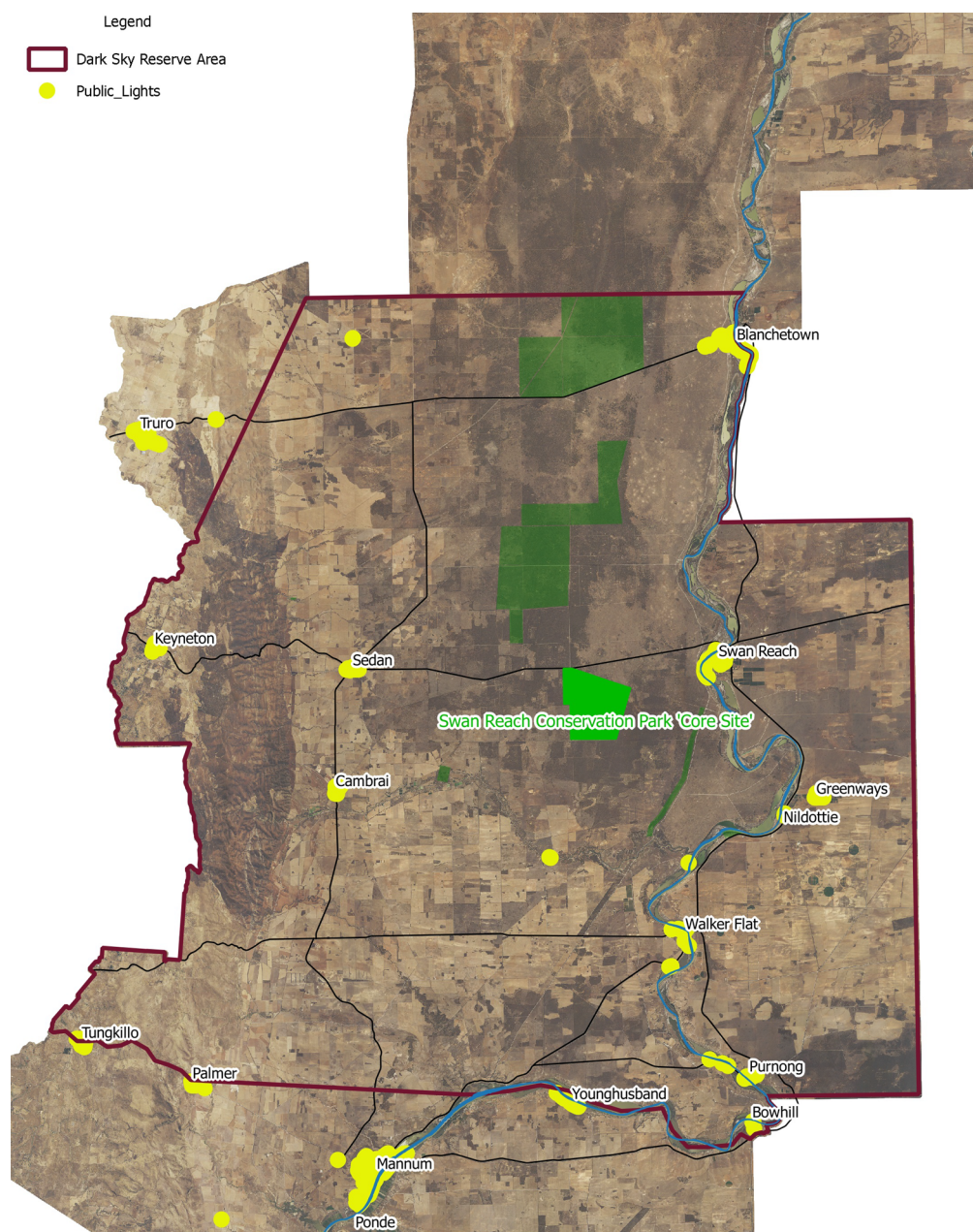


Figure 1 River Murray International Dark Sky Reserve

Why a Dark Sky?

Light pollution has a detrimental effect on the ability to view the night sky and poses a threat to the native fauna and flora. Excess lighting impacts on nocturnal animals and unnecessarily wastes energy.

A dark sky showcases the natural night sky and allows it to be enjoyed by residents, visitors and future generations. It enables community benefit through economic growth from sustainable and eco-friendly tourism. It ensures protection for a natural asset in a dark sky location which is increasingly difficult to protect around the world.

The RMDSR aims to preserve, protect and enhance the night sky of the Mid Murray region.

What is good lighting?

Outdoor lighting used in public, commercial, or industrial settings is generally intended to ensure a secure and functional environment. Additionally, it can serve purposes such as enhancing human comfort or supporting business activities. On the other hand, preserving dark areas, managing artificial light during certain seasons, or reducing skyglow may be essential for safeguarding wildlife, supporting astronomical observations, or promoting dark sky tourism.

Good lighting directs light where it is needed, does not cause glare and is only needed for its intended use. Good lighting does not shine above a horizontal plane and is appropriately contained so that it does not cause nuisance to neighbours.

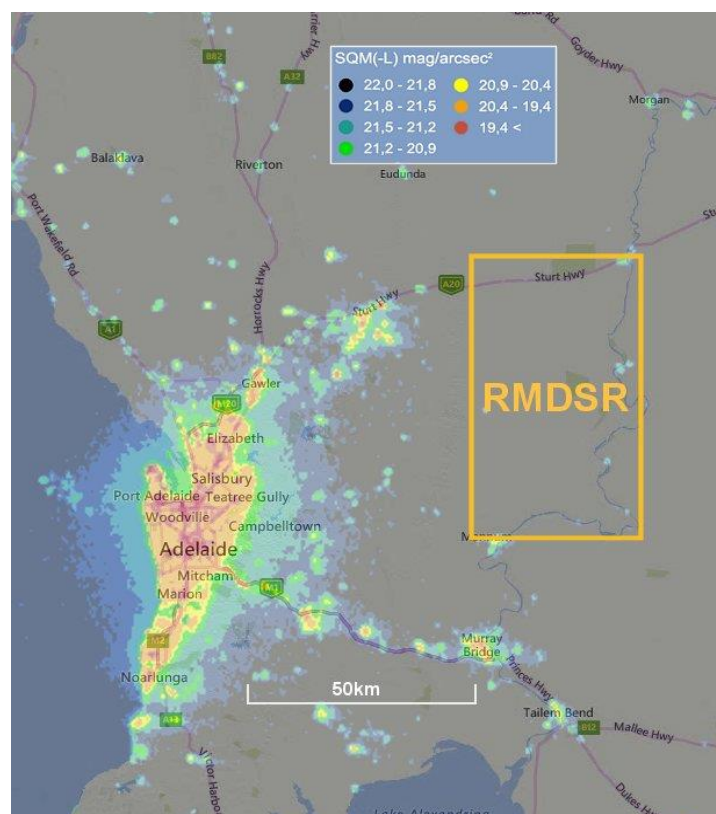


Best practice lighting design

Natural darkness has conservation value in the same way as clean water, air and soil and should be protected through good-quality lighting design.

The following simple management principles can be used to reduce light pollution:

- 1) Start with natural darkness and only add light for specific purposes.
- 2) Use smart technology, adaptive light controls to manage light timing, intensity and colour.
- 3) Light only the object or area intended – keep lights close to the ground, directed, and shielded to avoid light spill.
- 4) Use the lowest intensity lighting appropriate for the task.
- 5) Use non-reflective, dark-coloured surfaces.
- 6) Use lights with reduced or filtered blue, violet and ultraviolet wavelengths.



Existing lighting in the Dark Sky Reserve

There is a wide variety of existing outdoor lighting within the RMIDSR. A positive aspect of the location of this Reserve is that it is in an area which is not subject to large development pressures, and therefore it is unlikely any new substantial arrays of lighting will be developed in this area in the coming years.

Conservation Parks

There are five conservation parks within the Dark Sky Reserve area; Swan Reach Conservation Park, Marne Valley Conservation Park, Ridley Conservation Park, Brookfield Conservation Park and Ngaut Ngaut Conservation Park. The Swan Reach Conservation Park is the core site of the reserve. Development is restricted in these sites for conservation purposes. There is no current outdoor lighting in the conservation parks.

Ferries

There are three ferries which operate within the Reserve area 24 hours a day. Ferries operate at Walker Flat, Purnong and Swan Reach. Due to safety requirements, the lighting on these ferries is required to be bright. With the aim of the lights being retrofitted to meet the DarkSky International Standards for outdoor lighting within ten (10) years of Dark Sky Accreditation.

Shack Areas and Townships

Street lights are located within some shack areas and townships in the Dark Sky Reserve. All street lighting in these areas will be retrofitted to meet the DarkSky International Standards for outdoor lighting within ten (10) years of Dark Sky Accreditation. Current LED rollout by SAPN to 3000K covering the Council area will be completed by July 2025.

Commercial Properties

As the area contains some commercial operations, some level of commercial lighting will be required to be maintained, however Mid Murray Council and the Mid Murray Landcare SA Inc. will work with owners of commercial premises to ensure outdoor lighting and illuminated advertising signage meet the International Dark Sky Standards. As a principle, digital signage is preferred option to meet light pollution guidelines and prevent unnecessary light spill.

Rural Areas

The Mid Murray Council has many rural farming properties. These areas are generally free of streetlights and outdoor lighting.



Management of Lights

Given the vast expanse of the proposed RMIDSR, and the complex land tenure arrangements (many hundreds of privately owned parcels of land), it is proposed that this matter be approached from a community education perspective, with all private landowners being encouraged to upgrade existing external lights to be compliant with the DarkSky International Standards.

Demonstration Site - Cambrai

To raise awareness of the reserve and educate the Mid Murray community about good lighting, the Main Street of Cambrai has been identified as a demonstration site which will display different types of lighting which are deemed to be compliant. With a population of under 300, Cambrai is home to Council offices, a general store, a hotel and local services including a school and swimming pool. Cambrai is a central destination in the Reserve.

Cambrai offers the opportunity to showcase smart technology options for the control of artificial light at night through smart dimming technology and pedestrian and traffic throughput measurement.

Statutory Requirements

The Mid Murray Council has a statutory role regarding new development in accordance with the *Planning, Development and Infrastructure Act 2016*, the Building Code of Australia and the Planning and Design Code. The Mid Murray Council will liaise with the State Planning Commission to integrate lighting policy in the Planning and Design Code.

The Department of Climate Change, Energy, the Environment and Water – National Light Pollution Guidelines for Wildlife (May 2023) also include provisions for managing light pollution. For example:

Lighting Design: These could be expanded to mandate the integration of smart technology, requiring developers to demonstrate the use of adaptive lighting controls and compatibility with ongoing monitoring systems.

Lighting Objectives: Guidelines could incorporate AI-driven predictive models to simulate light spread during the planning phase, helping to proactively reduce ecological impacts, astronomy or dark sky tourism.

Lighting Standards and Guidelines in the River Murray International Dark Sky Reserve

Installation of all outdoor public lighting on Council owned land and public street lighting shall be 'Dark Sky friendly'. Outdoor lighting needs to meet the following criteria to be considered 'Dark Sky friendly'.

- Lights with greater than 500 lumens must be fully shielded to prevent any light being emitted at or above the horizontal plane.
- Be fitted with smart technology control systems, motion sensors or timers where possible to enable switching or dimming.
- Have a coordinated colour temperature (CCT) less than 3000K.
- Be switched off when not needed.
- Not emit light on white or other reflective surfaces.

The following principles are adopted for all outdoor lighting within the Reserve:

Principle 1: Start with darkness and only use light when needed

Before installing or replacing a light, determine a clear purpose for that light. Start from the perspective of darkness and install outdoor public lighting, only when deemed necessary. This lighting should only be activated when needed.

Before installing or replacing a light, consider the purpose of the light by deciding:

- When the light is used?
- How the use of light will affect the surrounding area?
- Where the light should be directed?

Motion sensors and timers should be installed, where practical, to ensure that outdoor lighting is only used when needed. If there are no motion sensors and timers installed, lights should be switched off when not in use.

The use of smart technology for the control and dimming of lighting should be considered where possible and included to enhance the function of motion sensors and timers.

Principle 2: Use energy efficient globes

Lighting should be energy efficient to reduce carbon footprint. Lighting should have a maximum correlated colour temperature (CCT) limit of 3000K to be considered 'dark sky friendly'. It is recommended that the CCT value does not exceed 2700K. 'Warm' lighting has a lower CCT value, causes fewer disturbances to wildlife and reduces sky glow.

Principle 3: Avoid light spill

All outdoor lighting should be directed downwards so that spill light is avoided. Spill light is light that falls outside the area that is intended to be lit. Spill light from internal and external lighting of a development can cause glare, light trespass and wastes energy.

Light which is directed above the horizontal plane creates artificial sky glow and does not serve a useful purpose to the community. Light should be directed downwards and in any case less than a horizontal plane, preferably up to 30 degrees below the horizontal.

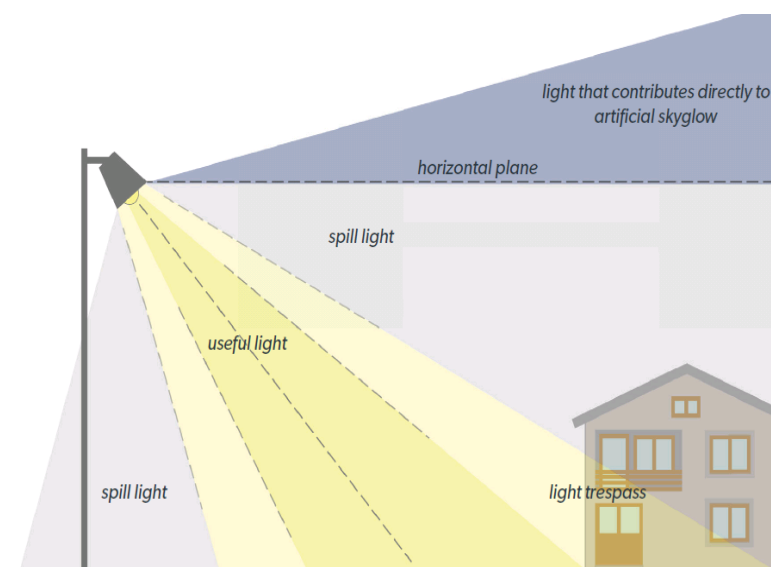


Figure 2 Light spill

Lighting used for night operations and industry should be directed downwards, be a warm light and be shielded.

Light spill can be avoided by:

- Installing light fittings with an opaque cover and flat glass, mounted horizontally on both axes;

★ Night use				Day use ☀		
Kelvin colour temperature	2700K	3000K	3500K	4100K	5000K	6500K
Associated effects and moods	• ambient • intimate • personal	• calm • warm	• friendly • inviting	• precise • clean • efficient	• daylight • vibrant	• daylight • alert
Appropriate applications	• living / family rooms • commercial / hospitality		• kitchen / bath • Light commercial	• garage • commercial	• commercial • industrial • institutional	
✓ Most preferred				Least preferred ✗		

Table 1: Colour temperatures and appropriate uses
Note: LEDs can produce any colour temperature, but warm colours are preferred.

Figure 3 Colour Temperature

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- Mounting the light under part of a building, verandah or roof so light is blocked from shining above the horizontal plane;
- Designing buildings to internalise light and prevent it from escaping into the night sky;
- Using a blind or shutter to prevent light escaping from skylights and solar tubes.

Principle 4: Shield lights

Shielded lights do not allow any light above the horizontal plane. Non-shielded light bulbs expose light to shine in all directions and should be avoided. Fittings which shield light so that it is directed downwards is preferred. Figures 4, 5 and 6 show appropriate shielding of light.

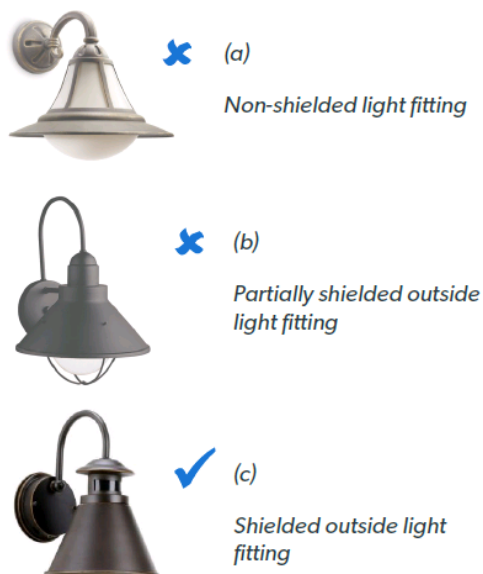


Figure 4 Shielding of light

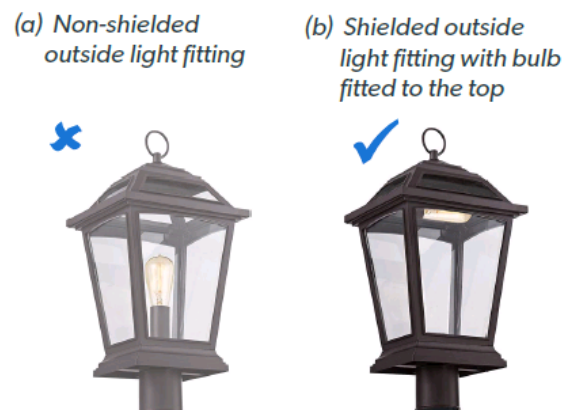


Figure 6 Exposed bulb that allows light to shine in all directions and a fitting designed to minimise light spill by only allowing downward projection of light



Figure 5 Floodlights fitted with different shielding design

Table 1: Intensity of lighting for various activities

Activity type	Lumens emitted
Dwelling	1800-7200
Single porch light	900
Tennis court (domestic)	100 000
Farm building	1800-7200
Single security light	900-4000
Swimming pool	1200
Public open space/small car park	1200
Small sports oval (single field)	1 000 000
Road lighting	Refer to AS/NZS 1158
Rural Industries	<1 000 000
Stockyards (commercial)	<1 000 000
Mining and extractive industries	>5 000 000
Advertising signage (externally lit)	1800-7200
Small motel or commercial building	12 000
Recreational, decorative, promotional and special events lighting	No greater than necessary.

Principle 5: Avoid over lighting

Lighting should be installed to be appropriate for the activity taking place. The amount of light produced (lumen) is the most important consideration to ensure an area is not over lit.

The intensity of outdoor lighting should be appropriate for its intended use. Unshielded lights should be limited to 500 lumens.

Principle 6: Use asymmetric beams for floodlighting

Floodlights are required for sporting facilities and commercial stock yards. Where floodlights are proposed, the light fittings with asymmetric beams should be used. The fittings should direct light down toward the surface being lit to prevent light spill, as shown in Figure 7.

Flat glass fittings should be installed with the glass horizontal to make efficient use of the brightest part of the beam and to eliminate light spill.

Principle 7: Direct light away from reflective surfaces.

During the design phase, it is advisable to choose surfaces with low reflectivity near outdoor lighting that align with the intended function of the area. Illuminance, which

measures the amount of light reflected off a surface, depends on the material's reflective characteristics. For instance, natural grass surfaces typically produce low illuminance, whereas lighter-coloured surfaces such as uncoloured concrete, artificial grass with sand infill, or pale walls, can reflect more light.

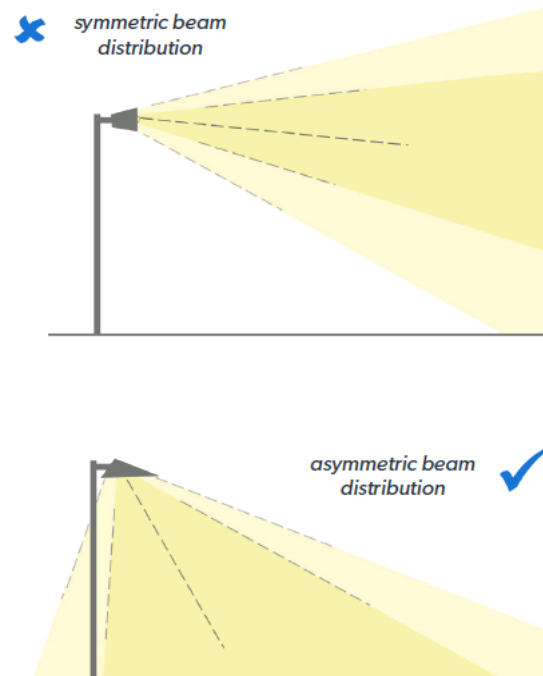


Figure 7 Appropriate light fixtures for floodlighting

Restricted Lighting

Lighting on advertisement signage is prohibited, except where it can be demonstrated that it meets the principles of 'Dark Sky Friendly Lighting'.

Digital signage is the recommended approach to advertising. Digital signage is subject to tighter controls through the Australian Standards AS/NZS 4282:2023 Control of obtrusive effects of outdoor lighting.

Digital signage must:

- Result in **50% less light spill** to dwellings when displaying dynamic content.
- Have a maximum upward light rate of **45%**.
- Be tested in a photometric lab to accurately determine light spill to environment.
- Be dimmable to ensure compliance and demonstrate the enabling of this dimming capability at required times of the night.

The use of searchlights is prohibited within the Swan Reach Conservation Park, except when used by emergency personnel.

Monitoring

The Mid Murray Council will deploy a Dark Sky Monitoring Grid comprising:

- Sky quality meters (SQMs) at regular intervals (positioned as required) to measure ambient light levels and track compliance with DarkSky International's artificial brightness thresholds (>0.5 mcd/m²).
- Alternative to installed SQMs deploy drone or mobile light meter technology to assess ambient light levels on a periodic basis.
- GIS-enabled dashboards to visualise real-time data, identifying hotspots of non-compliant lighting for targeted enforcement.

Private landowners within the Reserve must grant access to Council-operated sensors installed or mobile measurements taken on

their properties, ensuring uninterrupted data collection. Exemptions apply only to classified agricultural or industrial zones.

Community Engagement

Launch a Dark Sky Citizens Science Program leveraging smart devices.

Residents may install Council-provided light pollution apps (e.g. Loss of the Night) to report non-compliant fixtures via geotagged photos.

Data from community reports will integrate with the Council's monitoring grid, prioritising areas for educational outreach.

Develop **Augmented Reality (AR) Astro Tourism Tools**, such as:

- Constellation-guiding mobile apps with red-light night vision modes to enhance stargazing without disrupting dark adaptation.
- Interactive kiosks at reserve entry points displaying real-time sky quality metrics and optimal viewing locations.

Smart Technology

Implement smart technology solution to assist with the measurement, control and compliance with Dark Sky principles and DarkSky International requirements for certification.

Implement Machine Learning-Driven Lighting Curfews:

- Analyse historical traffic, weather, and tourism data to dynamically adjust lighting schedules in commercial zones.
- For example, reduce streetlight intensity by 70% during low-activity periods (00:00-04:00) while maintaining safety in high-pedestrian areas.

Implement smart technology assessment criteria to development approvals where new outdoor lighting is included in a development application.

Compliance

To ensure compliance with the Light Management Plan and the overarching guidelines of DarkSky International, the following is required to occur:

- A commitment from Mid Murray Council and South Australian Power Networks when renewing/replacing public outdoor lighting in the RMIDSR that meet the principles of 'Dark Sky friendly lighting'.
- All outdoor public lighting which is non-compliant and needs replacing must be fitted with compliant fixtures. If a light can be made complying by replacing the light bulb, this must be done when the lamp dies.

By 2026, 90% of outdoor lighting within the RMIDSR will be compliant with this Light Management Plan.

By 2031, 100% of outdoor lighting within the RMIDSR will be compliant with this Light Management Plan.

Reporting

An annual report will be submitted to DarkSky International, detailing the progress made to achieve their goals and provide monitoring of dark sky measurements within the Reserve. This annual report will be undertaken by the Mid Murray Landcare SA Inc. with assistance as required from Mid Murray Council.



Glossary

Augmented Reality – Augmented Reality (AR) is a technology that overlays digital information such as images, 3D models, text, audio, or other sensory enhancements onto the real-world environment in real time, typically through devices like smartphones, tablets, AR glasses, or head-mounted displays. Unlike virtual reality, which immerses users in a completely simulated environment, AR enhances and modifies the user's perception of their actual surroundings by blending virtual elements with the physical world.

CCT – Correlated Colour Temperature – is a specification used in lighting to describe the colour appearance of the light emitted by a source, relating it to the colour of light produced by an ideal blackbody radiator at a specific temperature, measured in degrees Kelvin (K). Lower CCT values (e.g. 2700K-3000K) produce a warm, yellowish or reddish light, similar to incandescent bulbs or sunrise/sunset. Higher CCT values (e.g. 5000K-6500K) emit a cool, bluish-white light, resembling daylight at noon or some fluorescent and LED lights.

Digital Signage – Digital signage is an electronic display system that uses digital screens (such as LCD, LED, OLED, or projectors) to show multimedia content like images, videos, graphics, and text for communication, advertising, or information purposes.

Lumens – A lumen (symbol: lm) is the International System of Units (SI) measurement for luminous flux, which quantifies the total amount of visible light emitted by a source as perceived by the human eye. In practical terms, lumens measure how bright a light source appears: the higher the lumen value, the brighter the light.

Lux – Lux (symbol: lx) is the International System of Units (SI) measurement for illuminance, which quantifies the amount of light that falls on a given surface area. Specifically, one lux is defined as the

illumination produced when one lumen (the total amount of visible light emitted by a source) is evenly distributed over one square metre.

Shielding – Light shielding in lighting refers to the use of physical barriers, such as casings, covers, caps or shields, to control and direct the distribution of light emitted by a fixture. The primary goals of light shielding are to:

- Reduce glare, which can cause discomfort or temporary blindness.
- Minimise light spill or trespass onto neighbouring properties.
- Prevent skyglow, which obscures the night sky.
- Guide light to desired areas, improving efficiency and visibility.

Sky Quality Meters – A Sky Quality Meter (SQM) – is a scientific instrument designed to measure the luminance (brightness) of the night sky, specifically as the zenith (the point directly overhead). It quantifies the night sky brightness using the unit “magnitudes per square arcsecond,” a logarithmic scale commonly used by astronomers to assess skyglow and light pollution.

