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# Lighting Guide for the Isles of Scilly

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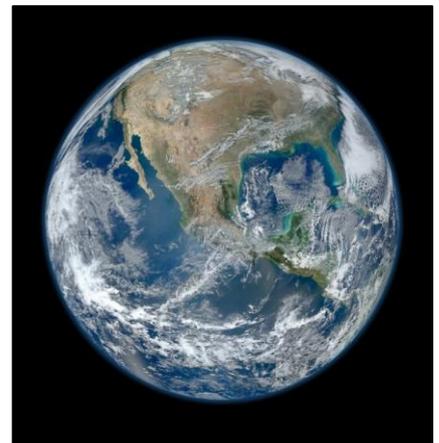
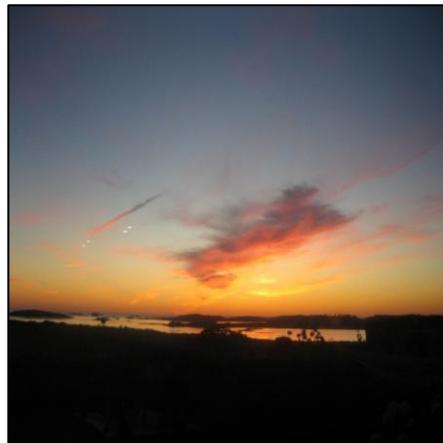


Council of the  
ISLES OF SCILLY

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If you require this information in another format or have any enquiries please contact:

Council of the Isles of Scilly, Town Hall, St. Mary's, Isles of Scilly, TR21 0LW

01720 424000

[enquiries@scilly.gov.uk](mailto:enquiries@scilly.gov.uk)

[www.scilly.gov.uk](http://www.scilly.gov.uk)

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#### Isles of Scilly Area of Outstanding Natural Beauty Unit

Figure 5, 6

#### Daniel Hargreaves

Figure 4

#### Graham Vaughan

2<sup>nd</sup> Picture Front Page. Inside Cover. Figure 7, 8

#### National Aeronautics and Space Administration

1<sup>st</sup> and 3<sup>rd</sup> Picture Front Page. Figure 1, 2, 3

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## Introduction

This document is a guide to good practice for the installation of external lighting on the Isles of Scilly. Whilst it is understood that the islands already enjoy dark skies, there is a need to protect and enhance this asset now and for future generations.

The introduction of artificial light has brought many benefits to society and indeed the requirement to reduce light pollution is not about removing those benefits. It is about managing artificial light in a sustainable manner. The Isles of Scilly are special because it is possible to see the Milky Way from the islands; a privilege shared by only 10% of the UK. Consequently there is a need to protect this attribute in an appropriate manner.

As this guide will explain, light pollution on the Isles of Scilly is beginning to have an impact on our ability to see the night sky – therefore we need to act now. Light pollution can have far reaching consequences; all of which can be avoided by suitable exterior lighting.

## The Dark Sky at Night

The dark night sky has enchanted people for millennia. Stars and planets have been an inspiration for art, science and religion and have led us to go into space and land on the moon. On a dark clear night, it is possible to see around 3,000 stars as well as the edge of our own galaxy, the Milky Way. With the naked eye, one can see as many as five planets, the International Space Station and even our nearest galaxy, Andromeda.

*“The faint light we now see from this neighbouring city of stars has been hurtling towards us through space at 186,300 miles per second. Even so, it has taken 2.2 million years to reach Earth”<sup>1</sup>*

Images produced by the Hubble Telescope show the grandeur of space and what lies beyond our solar system. However, even with a small camera and an amateur telescope it is possible to photograph the natural wonders of space.



Figure 1: 'Earth Rise' taken on the Apollo 8 Mission



Figure 2: The Cat's Eye Nebula taken by the Hubble Telescope

Darkness at night is something that defines the countryside. In the Isles of Scilly it is a significant feature of the Area of Outstanding Natural Beauty (AONB) designation. However, whilst the AONB has legal protection on the ground, the sky, including our view of the stars, is not included. Consequently, there is a real danger that the quality of the night sky could be compromised. There has been a substantial increase in light pollution across the UK, mainly derived from large towns and cities. The Isles of Scilly are not exempt from this national trend and have also experienced increases in light pollution.

Light pollution is the result of wasted exterior lighting illuminating the sky. It consists of 3 aspects:

- Sky glow – the pink/orange glow seen for miles around urban areas caused by a scattering of artificial light by airborne dust and water droplets;
- Glare – the uncomfortable brightness of a light source when viewed against a darker background;

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<sup>1</sup> Campaign to protect Rural England, *Night Blight! Report* (2003) <http://www.cpre.org.uk>

- Light trespass – light spilling beyond the boundary of the property on which a light is located.

Light pollution is unwanted and wasted light caused mainly by bad lighting practices. However, as explained by the International Dark-Sky Association (IDA), reducing light pollution can be a simple process.

*“In refreshing contrast to some of today’s complex and lingering environmental problems, many existing solutions to light pollution are simple, cost-effective and instantaneous. Recognising when outdoor lighting no longer serves its function and becomes a pollutant is the first step toward choosing appropriate solutions.”<sup>2</sup>*



Figure 3: Western Europe at Night taken from the International Space Station, January 22nd 2012

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<sup>2</sup> International Dark-Sky Association, *Light Pollution Guide – Practical Guide 1* (2010) <http://www.darksky.org>

## The Effects of Light Pollution

Whilst it is appreciated that the impacts of light pollution are not acute on the Isles of Scilly, the effects are significant and could potentially worsen.

### Human Health

The 24 hour day/night cycle, known as the circadian clock, regulates physiological processes including brain wave patterns, hormone production and cell regulation. The production of the hormone melatonin has a particular impact upon humans. Melatonin is a naturally occurring hormone released when humans are in darkness. It serves many functions in the body but primarily it regulates the daily cycle of our activities. Exposure to artificial light at night can interfere with melatonin production and, in turn, interfere with the circadian cycle. The ability to have a good night's sleep can help improve cognitive and motor skills, but can also help reduce weight gain, stress, depression and the onset of diabetes<sup>3</sup>.

A more immediate effect of light pollution is the impact it has on our eyes. Bright lights can cause damage to our eyes as too much light is being scattered across the retina affecting our ability to perceive colours and contrasts. Similarly, as we age, we undergo a natural process that reduces our ability to see. Artificial lighting can exacerbate this process so smart lighting decisions can help preserve our eyesight<sup>4</sup>.

### Wildlife

Like us, animals are attuned to the Earth's 24 hour cycle. Just as we are affected by jet lag, any deviation from the normal pattern can cause debilitating symptoms. Light pollution disrupts this pattern, impacting on behaviour that governs mating, migration, sleeping and eating.

Bright lights can cause nocturnal animals to experience a degradation of their natural habitat. Particularly important for the islands is the effect of excessive light levels on bats. Too much light can make foraging for food difficult. It can also mean a higher mortality rate due to impairment of vision and exposure to predators that usually would be unable to see them<sup>5</sup>. Lighting near roost sites can also disturb bats as it delays their emergence times. Due to the peak of nocturnal insects - a bat's main source of food - occurring at dusk, a delay in emergence can mean the time for feeding is missed<sup>6</sup>.



Figure 4: Brown Long Eared Bat

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<sup>3</sup> International Dark-Sky Association, *Light Pollution and Human Health Leaflet* (2009) <http://www.darksky.org>

<sup>4</sup> International Dark-Sky Association, *Light Pollution and Human Health Leaflet* (2009) <http://www.darksky.org>

<sup>5</sup> International Dark-Sky Association, *Light Pollution and Wildlife Leaflet* (2009) <http://www.darksky.org>

<sup>6</sup> Bat Conservation Trust, *Lighting and Bats* (2009) <http://www.bats.org.uk>



Figure 5: Storm Petrel – Migrates to the U.K. during the summer and can be seen on Scilly

Migrating and nesting birds are also affected by increased artificial light. When hunting, sleeping or travelling at night they can become confused when areas that are naturally dark are saturated with artificial light. Some birds can become fixated on a light source, flying to the point of exhaustion. Others can fly off course from their usual migration pattern, mistaking artificial light for natural light<sup>7</sup>. The Dawn Chorus can also be affected as birds will not start until the sunlight has overpowered the light pollution. Increased artificial light can therefore upset a bird's daily activities as they wake at the wrong time<sup>8</sup>.

Moths and other insects are attracted to artificial lights and may stay near one light all night. Such behaviour can make them easier prey for other nocturnal predators and therefore reduce their numbers. Similarly, by staying near one light they can expend too much energy, interfering with migrating and mating patterns and reducing their numbers further<sup>9</sup>.



Figure 6: Moths on Scilly

<sup>7</sup> International Dark-Sky Association, *Light Pollution and Wildlife Leaflet* (2009) <http://www.darksky.org>

<sup>8</sup> Royal Society for the Protection of Birds, *Nocturnal Song* (2011) <http://www.rspb.org.uk>

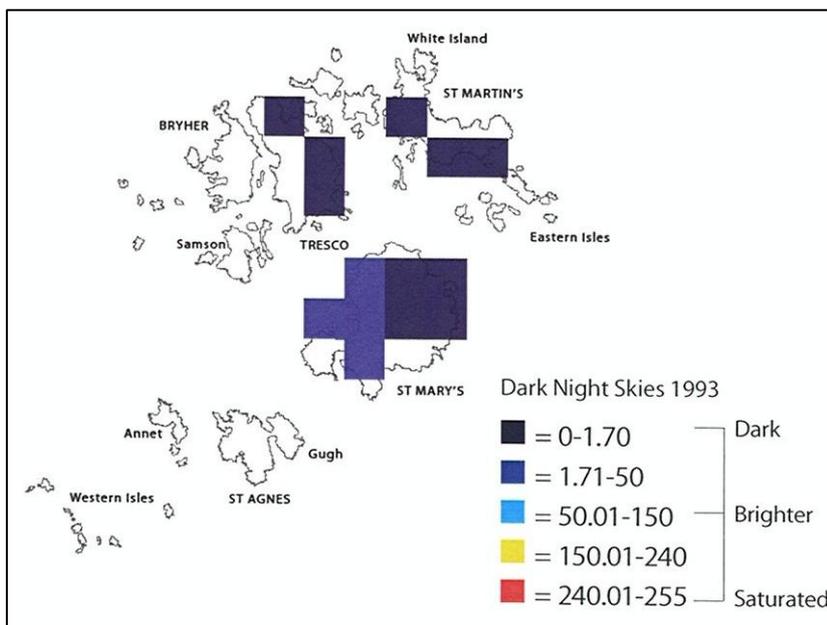
<sup>9</sup> Butterfly Conservation Trust, *Light Pollution and Moths* (2011) <http://www.butterfly-conservation.org>

## Lighting on the Isles of Scilly

On the Isles of Scilly light pollution is minimal and may seem unimportant. However, since the introduction of mains electricity in 1931, there has been a gradual encroachment on the dark night sky. A study conducted by the Campaign to Protect Rural England compares data collected in 1993 and 2000. The aim was to produce an approximate measure of light pollution for the UK.

This study has resulted in a country-wide map being created. Shown below are the maps created for the Isles of Scilly Area of Outstanding Natural Beauty Management Plan 2010 – 2014<sup>10</sup>. On the maps, a pixel represents a square kilometre. Colours illustrate satellite measurement of artificial light ranging from no light detected (0) to full saturation (255).

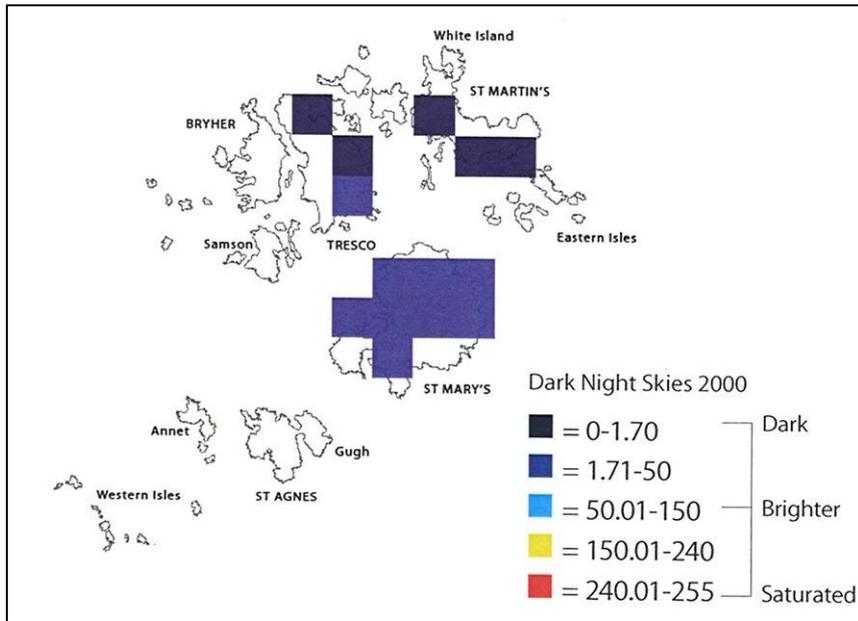
### 1993 Map



The map shows that on the islands of St. Agnes and Bryher, no artificial light was detected. This is not to say that there is no light pollution on these islands, only that the satellite did not detect any at that moment in time. A small amount of light leading to relatively dark night skies was detected on St. Martin's, Tresco and St. Mary's. The western half of St. Mary's reveals a larger amount of artificial light at night.

<sup>10</sup> Isles of Scilly Area of Outstanding Natural Beauty, *Management Plan 2010 – 2014* (2010) <http://www.ios-aonb.info>

## 2000 Map



7 years later St. Agnes and Bryher still show no artificial light at night. Again, whilst this does indicate very minimal amounts of light pollution, it does not mean that it does not occur. The bulk of St. Mary's has moved into the second colour band as well as the south-eastern part of Treasco. Whilst dark night skies are still very likely to occur on the Isles of Scilly, the data shows that even over a small period of time, light pollution has increased.

### National Designations

The Isles of Scilly are unique in that the whole archipelago is designated an Area of Outstanding Natural Beauty as well as a Conservation Area. The entire coastline of Scilly is also designated a Heritage Coast illustrating the prestigious but indeed fragile nature of the Isles of Scilly. As stated, the sky is not protected by any statutory designation, although the presence of dark night skies makes a valuable contribution to the island's peacefulness and tranquillity.

## Reducing Light Pollution

Lighting in itself is not a problem; it only becomes a problem where it is excessive, poorly designed or badly installed. Many people are likely to be contributing to light pollution without realising it, simply because they do not know about the consequences of poor exterior lighting. There is a common misconception that lighting an area as brightly as possible will increase safety and visibility. Inappropriate lighting can produce glare and increases the contrast between light and dark making it difficult to see beyond the lit area. It can also create deep shadows offering concealment.

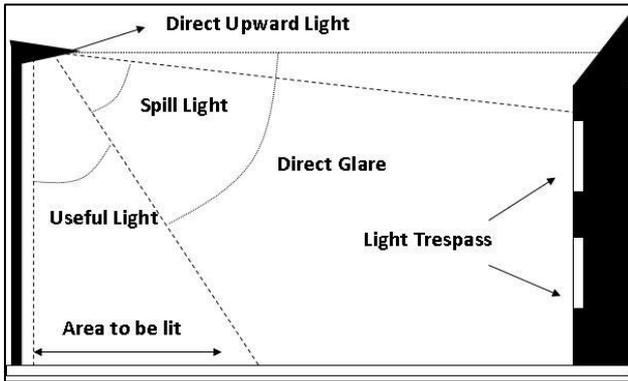


Figure 7: Light pollution and wasted light

Light pollution is not the only result of poor exterior lighting. The energy required, and of course the energy wasted, in lighting areas beyond the intended purpose means money and electricity are being thrown away by householders, businesses and organisations alike. Any light that falls outside the intended area (including up into the sky) is wasted light because it is not being used for the task it was installed for. However, it is still costing money and using fossil fuels. Figure 7 shows how light can easily be wasted. A light that is not properly installed can create spill light which is a direct cause of light trespass. Light trespass can be a significant nuisance if it occurs on a neighbouring property.

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There is an obvious need to reduce light pollution, save money and protect the environment, which can be achieved by following a set of simple guidelines as shown in figure 8. When installing exterior lighting, it is important to only light the target area. Minimising light spillage and trespass can be achieved by angling lights so that the main beam angle is kept below 70° from the horizontal. Fixtures installed at higher levels allow for lower main beam angles. The use of full cut-off lights or louvers is also acceptable in excluding light from where it is not needed. Reducing the length of time a light is on can be achieved by installing a motion detector or a timer. If possible, these need to be independent from the light fixture itself so the detector can be aimed separately to the light. Light pollution can also be reduced by selecting appropriate bulbs. Using high wattage bulbs can overlight an area and increase glare, reducing the ability to see beyond the lit area. Using a lower wattage bulb will save energy and reduce light pollution<sup>11</sup>. The bottom line however, is simply to shine lights down, not up.

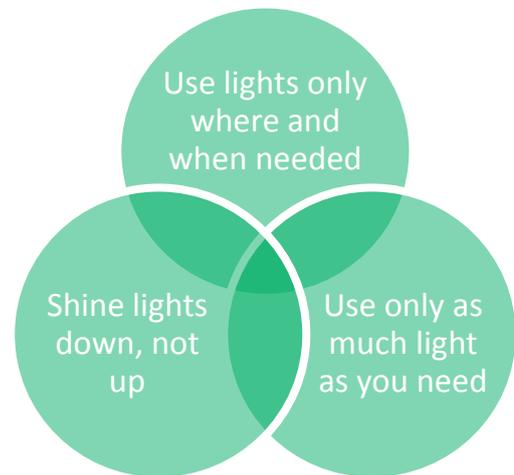


Figure 8: Appropriate Lighting Techniques

<sup>11</sup> Guidance Notes for the reduction of obtrusive lights (2005) <http://www.britastro.org>

## Appropriate Lighting Equipment

The type of light needed will depend on the purpose for which it is intended. In installing any lighting scheme, the lights must be appropriate to context.

### Street Lighting

Low pressure sodium lights, which produce an orange glow, have in the past, been commonly used in lighting areas. Increasingly however, full cut-off, high pressure sodium lights are being installed. These produce a white/pink light and help to reduce light pollution but still appropriately light the area<sup>12</sup>.

### Domestic Lighting

Due to the price and ease of installation, the majority of domestic security lighting will likely be tungsten halogen floodlights. These tend to use 300/500 watt lamps which might light an area well but will also produce glare and dark shadows beyond the intended area. Therefore, lamps below 150 watts are much more suitable for their intended purpose. These still light an area adequately but remove unnecessary glare. A compact fluorescent light is also a suitable alternative to high wattage lights and can be useful in locations where low levels of illumination are required<sup>13</sup>.

### Sensor Switches

Whilst lighting that comes on only when necessary is the most preferred option, it is recognised that lighting may need to be on for a long time. In these circumstances, compact fluorescent lights are an excellent choice. For other exterior lighting, the use of passive infra-red (PIR) sensors is recommended. If correctly installed and aligned, a PIR sensor will only switch on a light when movement is detected, thus removing the need for all night lighting. If such lighting is used, it should be tested to ensure that the correct type of movement trigger has been selected<sup>14</sup>.

### Light Source

Choosing a light source can be a confusing process with many options available. In principle, there are four factors to take into consideration when purchasing lighting equipment:

- Colour appearance – What colour the lighting appears to be. Important in creating an overall effect.
- Colour rendering – The ability of the light to render colour accurately. Although less important in exterior lighting, poor colour rendering can have a deadening effect on an area.
- Lamp life – The average life of a lamp in a large installation. This is important for maintenance costs.

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<sup>12</sup> Supplementary Planning Guidance Controlling Light Pollution and reducing lighting energy consumption, West Lothian Council(2009) <http://www.westlothian.gov.uk>

<sup>13</sup> Supplementary Planning Guidance Controlling Light Pollution and reducing lighting energy consumption, West Lothian Council(2009) <http://www.westlothian.gov.uk>

<sup>14</sup> Lighting, Supplementary Planning Guidance No, 4 Croydon Council (1998) <http://www.croydon.gov.uk>

- Efficacy – The output of the lamp in relation to its energy usage, measured in lumens per watt. This has often been the main consideration in choosing a light source due to costs.

The following table sets out these four factors in relation to typical types of lamp available<sup>15</sup>:

Lamp Type	Efficacy	Lamp life	Colour appearance	Colour rendering	Lamp appearance and purpose
Low pressure sodium	High	Long	Monochromatic yellow	Bad	Long, narrow clear lamp commonly used for street lighting due to low maintenance costs
High pressure sodium	Medium/High	Long	Orange/White	Average	Compact lamp, clear or phosphor coated. More expensive than low pressure sodium but a better alternative in street lighting
Metal halide	Medium	Medium	Cool and warm white	Good	Compact lamp, clear or phosphor coated, used for high quality where colour rendering is important. Useful for accentuating features or architecture
Mercury	Medium	Good	Cool and warm white	Average	Compact phosphor coated lamp used commonly for street lighting in mainland Europe. Can be useful for exterior lighting on non domestic buildings
Fluorescent	Medium	Medium/Low	Full range of colours	Excellent	Long, tubular lamp useful for special effects in exterior lighting. Not suitable for general exterior lighting needs
Tungsten Halogen	Low	Low	White	Excellent	Small, tubular, low voltage lamp used for accent lighting due to small lamp size and colour. Lower wattage versions best for domestic exterior lighting
Tungsten	Low	Medium	Warm white	Excellent	Small lamp used for domestic interior lighting

<sup>15</sup> Lighting, Supplementary Planning Guidance No, 4 Croydon Council (1998) <http://www.croydon.gov.uk>

## Lighting and the Planning System

Much of the policy about exterior lighting has been written in relation to the Government's publication "Lighting in the Countryside". Amongst other points it states that:

*"The principle means of tackling lighting issues are: by increasing public awareness of the possible problems that badly designed and installed lighting can lead to; better advice on ways of minimising impacts; and the more effective use of existing planning powers"<sup>16</sup>*

This publication helps guide the preparation of development plan policies and, in turn, assist in the determination of planning applications. Since 2005, under The Clean Neighbourhoods and Environment Act, lighting is considered a statutory nuisance. Under the planning system however, artificial light itself does not constitute development. Instead, the actual lighting fixture constitutes development. This means that anyone wishing to install exterior lighting would only require permission if the light fixture alters the material appearance of the building. In some applications external lighting is part of a development proposal; therefore lighting can be seen as a material planning consideration. In these cases lighting should be considered as part of the whole building design and should be sympathetic to existing architecture. Provided there are reasonable grounds for doing so, the Local Planning Authority can control applications for lighting schemes in future developments.

### Non-Domestic Buildings

The installation of a lighting scheme of a nature and scale that would represent a material change of a structure or an engineering operation requires planning permission. In determining applications the Local Planning Authority seeks to minimise light pollution and to regulate lighting schemes through planning conditions. Conditions can cover matters such as hours of illumination, light levels and the need for horizontal cut off.

### Domestic Buildings

Installing external lighting on domestic buildings is considered permitted development and therefore planning permission is not required. However, this does not dispense with the need to approach the subject of external lighting with sensitivity and consideration, especially in the potential impact on neighbouring properties.

### Listed Buildings

Consent to attach anything to, or to install anything within the curtilage of, a listed building will need listed building consent. Whilst the appropriate choice of lighting can benefit the historic environment, it is important that this does not create light pollution.

### Advertisements

Advertisements are controlled by a separate piece of legislation. Whilst it gives deemed consent to certain types of advertisement, the illumination of adverts is not encouraged on Scilly as it is not considered to be appropriate to the character of the islands.

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<sup>16</sup> Lighting in the Countryside: Towards Good Practice, Department for Community and Local Government (1997)  
<http://www.communities.gov.uk>

## Summary

Light pollution is a growing issue and is in danger of compromising our ability to see the dark night sky. On the Isles of Scilly, it is easy to look up and be in awe of the grandeur of space. However, as this guide has shown, there has already been an encroachment on the dark night sky. Any further light pollution should therefore be kept to a strict minimum.

Fortunately, this can be achieved relatively easily. Following the principles outlined in this guide will help reduce light pollution and will allow residents and visitors on Scilly to continue to enjoy the dark skies.

A lighting audit, included as an appendix to this guide, will allow you to assess your lighting requirements. A glossary is also appended to explain some terms used in this guide.

External lighting is useful for all. However, inappropriate or poorly installed external lighting can be a nuisance and may cause light pollution. This guide advocates lighting that is appropriate in its context, correctly installed and sensitive to neighbouring properties.

The Isles of Scilly are unique. Whilst the sky is not protected by any legislation, dark night skies significantly enhance the islands' national designations (AONB, Conservation Area and Heritage Coast) and add to the natural beauty of the landscape. Protecting the dark night sky by following the advice set out in this guide will reduce light pollution and therefore preserve this asset now and for future generations.

## Further Guidance

For further guidance on light pollution and dark night skies please visit the following websites:

- **Campaign to Protect Rural England** – [www.cpre.org.uk](http://www.cpre.org.uk)
- **International Dark-Sky Association** – [www.darksky.org](http://www.darksky.org)
- **British Astronomical Association** – [www.britastro.org](http://www.britastro.org)
- **Institute of Lighting Professionals** – [www.theilp.org.uk](http://www.theilp.org.uk)
- **Isles of Scilly Area of Outstanding Natural Beauty Partnership** – [www.ios-aonb.info](http://www.ios-aonb.info)

## Appendix 1: Lighting Audit

Use these questions to conduct an audit of your exterior lighting.<sup>17</sup>

	What?	Yes	No	Why?	How?	Notes
1	Do you have exterior lighting?			Exterior lighting can cause sky glow, glare and light trespass creating light pollution	Look carefully at your exterior lighting needs – can you reduce the number of lights around your property?	
2	Do you have exterior security lighting?			Poor security lighting can create dark shadows and make it difficult to see past the lit area	Can you reduce the wattage of the bulbs you are using?	
3	Does it light further than you intended?			Any light falling outside the area you need to light is wasted light and could also be a nuisance to neighbours	Check this by comparing the area the lights are <i>intended</i> to illuminate against the area they <i>actually</i> light. Adjust the angle of lights or fit shades appropriately	
4	Are the lights activated by a motion detector?			A motion detector means lighting is only on when it is needed	Installing a motion detector will help reduce light pollution	
5	If activated by a motion detector can the lights be activated from outside the boundary of your premises?			Lighting should only be activated by movement <i>within</i> the boundary of your premises	Check where lights can be activated from and adjust motion detectors if necessary. Ideally, purchase lights which can be used with motion detectors that can be aimed separately to the lights themselves	

<sup>17</sup> Reducing Light Pollution from Premises, South Devon Area of Outstanding Natural Beauty Unit (2011) <http://www.southdevonaonb.org.uk>

6	Do any of your lights create glare?			Glare can make it difficult and uncomfortable to see	Shade the light and change to a lower watt bulb
7	Do you leave any exterior lights on overnight?			It may not be necessary to have all of your exterior lighting on all night or operating at the same level	Fit a timer or sensor so that lights are switched on only when needed
8	Do you have car park lighting?			Lighting is only needed when customers and staff need to use the car park	Fit a timer or sensor so that lights are switched off outside business hours
9	Are you using the most efficient type of bulb for the job?			Different types of bulbs can be more appropriate for the lighting task	Look at what you are trying to achieve – would a bulb with better colour rendering or length of life be more suitable

## Appendix 2: Glossary

**Asymmetrical beam** – Floodlights giving a fan-shaped lighting pattern: available in wide, medium and narrow beams.

**Beam angle** – The angle formed by the centre of the beam of light from a lamp relative to the vertical. When light is emitted from a lamp it forms a cone from the light source. The shape of this cone will depend on the reflector design in the lamp.

**Colour rendering** – Effect of a light source on the colour appearance of objects in comparison with their colour appearance under normal day lighting.

**Fixture** – The assembly that holds the lamp in a lighting system. It includes the elements designed to give light output control, such as a reflector (mirror) or refractor (lens), the ballast, housing, and the attachment parts.

**Floodlighting** – A lighting technique using wide-angle floodlights positioned so that the entire subject is covered in even illumination. This technique is often associated with large amounts of glare, bright lighting, a flat dull effect and a contribution to light pollution.

**Front glazing** – The front face of the lighting unit through which the light passes.

**Full-cut-off fixture** – A fixture that allows no emission of light above a horizontal plane through the fixture.

**Glare** – The discomfort or impairment of vision which is experienced when part of the visual field is excessively bright in relation to the general surroundings. Direct glare normally occurs when the viewer can see the light source. Glare can cause discomfort or inability to see detail.

**Light trespass** – Any light which illuminates beyond the intended area, particularly into residential areas or properties, which is perceived to be a nuisance.

**Luminaire** – The complete lighting unit, including the lamp, the fixture, and other parts.

**Mounting height** – The height of the fixture or lamp above the ground

**Obtrusive Light** – Any light which illuminates beyond the intended area can be considered a form of light pollution. The extent to which it is perceived as being a nuisance will depend on the background light from other sources and the light intensity.

**Sky glow** – A phenomenon where light, usually from a major light source such as an urban area or industrial/recreational floodlight installation is seen, often from many miles distance as a glow in the sky. Some of the light is reflected from the illuminated surfaces although most is emitted directly skyward from poorly designed lighting systems.

**Spotlight** - A fixture designed to light only a small, well-defined area.