**FENESTRATION + LIGHTING DESIGN + LIGHT POLLUTION** 

# **DESIGN + ACCESS STATEMENT APPENDIX - B**

# TO SUPPORT THE APPLICATION FOR A PROPOSED NEW DWELLING **HIGHCLERE HOUSE**

### SYMONDS YAT, ROSS-ON-WYE, HR9 6BN

Prepared by

## **CORE.** LIVING

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contact: team@core.living

#### FENESTRATION + LIGHTING DESIGN + LIGHT POLLUTION ETC

#### INTRODUCTION

Obviously it will always be the preferred option to use natural daylight whenever possible, for almost all functions within the home. Daylight is healthy, free and non-polluting. The building fenestration has been carefully designed to take advantage of this environmentally sound resource. It is not just a case of choosing a size of window for the maximum natural daylight and placing it in a wall or roof. Many other factors must be very carefully considered and balanced to ensure that the design proposals do not create unwanted side effects, such as internal overheating, lack of privacy, or spoiling the local amenity for others with solar reflection, night-time light spill or other light pollution.

Over glazing might cause problems with sunlight reflection during the day and possible light pollution from internal artificial lighting spill during the night. These are issues we have taken very seriously within our design proposals. Rather than speculate about the possible impacts, the key is to understand the issues in detail and then highlight the methods employed to mitigate and eliminate the problems.

#### MEASURING LIGHTING - LUMENS, CANDELA AND LUX

Lux and lumens are properties of light that are useful to assess the appropriateness of lighting installations.

The aim of a lighting design is to ensure that the output (lumens), Intensity (candela) and illuminated brightness of surfaces (lux) are appropriate for the area and also protect and enhances the night sky and reduces light spill pollution.

**Lumens** – The total light radiated by a lamp. Generally 500 lumens is sufficient for most domestic needs

Candela (cd) - The intensity of light in a given direction

**Lux** (lumen per m<sup>2</sup>) – The illumination on a surface. A higher value lux means the illumination is greater and will appear brighter.

#### DESCRIPTION OF POSSIBLE ISSUES

There are three generally accepted types of pollution associated with obtrusive light:

#### Sky glow

This is the brightening of the night sky which can be seen emanating in the horizon from cities or other brightly illuminated areas and is the main source of pollution in our countryside. It is caused by the illumination of air molecules and particles and is created both by reflected surfaces and badly directed light. Light that travels near the horizontal is the most damaging as it travels furthest and lowest through the atmosphere. In simple terms this can be avoided by ensuring lights are pointing down, and not above the horizontal plane.

#### Glare

This is the uncomfortable brightness of a light source when viewed against a contrasting darker background. Due to the rural and less populated character of the landscape, lights in rural areas will be relatively higher in glare than in urban areas. This is particularly noticeable when looking from raised viewpoints into the darker landscape below. This can be avoided by having light sources positioned so that they are not directly visible to outside viewers

#### **Light Intrusion**

This is the "trespass" of light spilling beyond the property or area being lit. Although this pollution generally relates to windows and intrusion into private property, light intrusion also applies to habitats and areas of high ecological value. This can be avoided by ensuring the lighting design pays attention to the task in-hand, namely lighting the interior, with tight angled lamps as well as careful positioning of light fittings and the use of angled cowls or louvred fittings to direct light to where it is needed and not wasted.

In addition we should also consider solar glare or sunlight reflection. It is possible that, at certain times of the year at a particular time of the day, direct sunlight could be reflected directly back from a glazing unit to an external viewer, causing a brief but bright refection. Due to the location of the proposed house, the shading and angle of the glazing & near-by foliage etc solar glare will only be visible from with the properties own garden, & not from the wider surroundings. However direct sunlight hitting glazing can have further environmental impacts. To alleviate this it is possible to use solar control glazing and to set the windows back under overhanging eaves or other structure to form a sunshade device. These eliminate the possibility of solar glare from the windows of the proposed property as a problem.

Each of the types of light pollution listed above can be greatly reduced or eliminated with various design interventions. The methods utilised within the design of the proposed new house are detailed later in this appendix.

Dark skies are a special quality that benefit both people and wildlife. They are generally defined as skies relatively free of light pollution where you can see a clear starry sky and importantly, our own galaxy the Milky Way, stretching as a ribbon of faint stars across the sky.

Although the area around Symonds Yat is not designated as a Dark Sky Reserve, it is clearly a place of great natural beauty with areas of generally low light pollution. And although the proposed house occupies a site relatively close to other dwellings our design proposals have taken on board best practice with regard to design and lighting consideration for preserving and enhancing the local Dark Skies.

The South Downs National Park Authority (SDNPA) was designated as an International Dark Sky (IDA) Reserve in May 2016. The SDNPA has produced a Technical Advice Note which sets out their approach to lighting design and the protection and enhancement of Dark Skies. Its aim is to provide developers and planners with the necessary information to submit and assess fenestration and lighting schemes which are appropriate to the landscape. The SDNPA Technical Advice Note has formed the basis for the lighting and elevation and window layout design for this project to ensure the protection and enhancement of the Dark Skies. The recommendations and measures set out within the guidance also serve to mitigate for any possible adverse visual impact for the design, particularly light spill from the west elevation, that might have been visible from distant & close views at night.

#### LIGHTING DESIGN STATEMENT - PRINCIPLES OF THE DESIGN

A key part of the energy use, comfort & wellbeing considerations is the use of natural day light within the property for as much of the lighting needs as is possible. Natural light from the sun is full spectrum & dynamic. Full spectrum means that the light contains all the colours of the rainbow. Dynamic means that the light intensity & colour temperature changes with the time of day. The sun emits radiation over the full range of wavelengths. Sunlight is crucial for our health & wellbeing. It affects our day-night rhythm, it keeps our vitamin D levels in balance, which helps us to absorb the calcium from our food. Additionally daylight inhibits the production of melatonin, which ensures that we get tired when it gets dark. Cortisol does the opposite & makes us alert & focused. If we do not get enough daylight, both substances are present in the body at the wrong time; common consequences of this imbalance are: headaches, sleep disorders & depression.

To ensure the new house has the highest levels of energy performance (see Section 5 -Sustainability), with minimal energy in-use, it is a critical part of the building's design to ensure solar heat-gain is kept to a minimum. This is to avoid internal over-heating and therefore the need to provide mechanical cooling. This must be done whilst still maintaining internal natural light levels to ensure a comfortable and healthy visual environment. There is a carefully balance to be achieved.

We are also acutely aware that the landscape and views are to be enjoyed by everyone, visitors and residents, as well as wildlife, and it would be wrong to propose a design that had a detrimental impact on the local environment and how others enjoy it. The new design aims to enhance the location. To this end we have been particularly mindful of the possibility of solar reflection and glare during the day from certain view points as well as possible light spill, or light pollution after sundown. Attention has been paid throughout the design to these issue, and it is particularly, but not uniquely, relevant when considering the proposed upper level of the north elevation.

A number of key design decisions have been taken to ensure that the proposals do not cause reflective glare during the day or light pollution during the night. It should be remembered that wasted light is wasted energy, wasted energy is wasted money.

The headline design decision taken to minimise or eliminate solar glare and light pollution are listed below and are further detailed later in this section:

- Using an appropriate amount of glazed area.
- Provide overhangs etc to shield sunlight from directly hitting windows at key locations
- Install moveable internal shading blinds to key glazed areas
- Use solar controlling glass to prevent solar reflection and solar gain
- Correct design and specification of the lighting installation, including smart controls

#### APPROPRIATE AMOUNT & LOCATION OF GLAZING

The proposed house has the primary glazing facing in a northerly direction, to make the most of the natural light, the views & minimise solar heat gain. No windows are proposed on the west elevation & only the front door & side light are proposed on the east elevation to the lower ground floor. There is minimal glazing facing to the south onto the rear garden area. Rooflights are a particular source of light spill pollution, therefore no rooflights are proposed for the new house, eliminating this issue.

#### PROVIDE OVERHANGS FOR SOLAR SHADING

The proposed main elevation has eaves overhang of over 1000mm to shield sunlight from directly hitting the upper level glazing.

#### **INTERNAL BLINDS**

Blinds and / or curtains will be fitted to all windows to allow for total control of light entering or leaving the property as well as privacy.

#### CORRECTLY SPECIFIED GLAZING

Solar control glass is to be used in all glazing to the property to prevent solar reflection and solar gain. It is proposed that Pilkington Glass Suncool<sup>tm</sup> One (or similar) is used in all glazing. This glass is specifically designed to cut down light transmittance, primarily to reduced solar gain, but this also works to cut out light spill from within the property to outside. Suncool<sup>tm</sup> One will cut down light transmittance (in and out) by approximately 60% compared to regular, clear float glass, greatly reducing light spill from the property as well as reducing internal overheating from solar gain.

#### **CORRECT DESIGN + SPECIFICATION OF LIGHTING INSTALLATION**

The management of our dark skies relies upon good lighting design that is appropriate for the setting, & does not pollute or pose a significant negative impact to the special quality of a starry sky. The lighting design has followed the best practice principles listed below, as recommended in the SDNPA Dark Skies Technical Advice Note, to ensure good lighting that reduces light pollution and its impact on dark skies:

- Lighting will not adversely degrade the sky quality beyond the immediate area to be lit.
- All lights to be angled down no unnecessary light above or near the horizontal.
- Light will be directed only where it is needed not in a direction that causes a nuisance to neighbours or wildlife.
- Lighting will be switched off when not needed.
- Light will be to the appropriate illuminance there will be no needless over lighting.
- Lamps will be installed in dark sky friendly fixtures that prevent unnecessary upward light.
- Lights will be installed at the lowest possible height to achieve lighting levels
- No bright white & cooler temperature lamps will be used.

#### LIGHTING PERFORMANCE SPECIFICATION

The previously listed principles will used for the protection of the local Dark Skies these will be achieved by the following performance specification when finalising the detailed lighting design:

#### IDA - 500 Lumen Level

The lowest possible lumen output will be used to generate required lux levels - it is proposed that no lamp above 500 lumens will be specified.

### Colour temperature (Correlated Colour Temperature - CCT)

The colour temperature of a light source is often referred to as the CCT of the source. Cool white and blue rich lighting is the most harmful to wildlife (and to humans). The proposed lighting scheme will be designed with a colour temperature, CCT of between 2700K and 3200K.

#### Spectrum - Broadness and UV component

No lights with a broad spectrum will be used in the proposed lighting design. This is to eliminate the spill of harmful wavelengths, particularly in the Ultra-Violet spectrum which affects wildlife.

#### Upward Light or Sky Glow

The upward spill of light will be avoided – it is the worst contributor to sky glow. Upward and near horizontal paths of light can travel a greater distance through dirty air which increases the scattering of light by atmospheric particles such aerosols, water vapour and air pollution. It is this scattering of light that creates the sky glow blooming, or halo-effect, which tends to be more prominent over cities were the density of scattering particles (air pollution) is higher. This light is often called 'wasted' light as it generally unnecessarily lights nothing but air, pollutes the sky and costs money and carbon to do so. The light installation will be designed to have an upward light ratio (ULR) of zero which eliminates upward and side spill. There are many luminaires on the market that produce a 0% ULR. Lights will be used in the proposed design as they are a major contribution to Sky Glow light pollution.

#### Luminaire Intensity or Glare

To prevent Luminaire Intensity or glare direct visibility of the lamps within the property from the outside will be eliminated by careful placement and design of fittings. Light will be directed to where it is needed, with the source not visible from surrounding areas. The effect of glare, as viewed by an external observer, is controlled by limiting the viewed intensity. Cut off fixtures, cowls and baffles will be used to block any unwanted views of the lights from the landscape. The design will not over light particularly in the direction of sensitive and dark areas.

#### LIGHTING PERFORMANCE SPECIFICATION (continued)

#### Luminaire Intensity or Glare

Glare is measured as 'Source Intensity' in Candela's – the strength of light. Cut-off Luminaires can have a variety of glass features that alter the path of light and are classified according to the amount of light that shines above the horizontal. The design will utilise luminaires that are cut-off with no more than 2.5% of the light they omit above the horizontal.

#### Light Intrusion / Spill

To eliminate light spill the lighting design will ensure lights fittings are installed correctly to reduce the spill of light beyond that of the immediate task area. Lights will be located to direct light within the property. Any areas that do not require illumination, or areas that should not be lit will not be artificially illuminated; this will include hedgerows, other habitats and neighbours' property. Spill is measured in Lux – illuminance of a surface (vertical).

#### Lighting Control

Internal lights will be switched off when not needed. It is proposed that a central computer lighting control system will be installed to ensure energy efficiency and that lights are not accidentally left on. Systems such as the RAKO Whole House Control, have demonstrated a up to a 20% reduction in energy use for lighting, due to smart control features.

#### **External Lighting**

Low Height Installation for external safety. Footpaths will be lit with lower powered, low level bollards or wall lights, no external overhead lighting will be used. Garden lighting will be kept to a minimum and all garden lights will be mounted at low level, to only light areas required for health and safety reason, such as steps and areas of uneven path, or safe routes from vehicles.

#### Domestic floodlighting

Domestic floodlights are some of the most disruptive and annoying lights, and will not be used within the proposed lighting design.

#### **Proximity and Timed Circuits**

Proximity PIR (Passive Infra-Red) sensors will be fitted to external lighting. This will minimise the amount of time the light is on for and greatly reduce the impact of pollution. Timed circuits will be used to prevent lights from being needlessly on after a certain time. Timed circuits will be set to no more than 5 minutes. No automatic Dusk till Dawn (low light) sensors will be fitted to lights for the proposed design.

#### LIGHTING DESIGN CONCLUSION

With the measures listed above we can ensure that the proposed new house will not have a detrimental effect or cause harm to the location or to the amenity of others, including the local wildlife. The appointed, and suitably qualified ecologist, has provided guidance and input into the proposed lighting design and specification as well as their own ecology report to accompany the Full Planning Application. The ecologist's recommendations will be followed fully when designing the lighting layout in detail.

### CORE. LIVING