

LIGHTING IMPACT ASSESSMENT FOR OLD SARUM, SALISBURY, WILTSHIRE FOR PERSIMMON HOMES, WESSEX

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Executive Summary

The development is within an area that has been defined as an E2 environmental zone (low district brightness).

A baseline assessment of the impact from the football ground lighting has been undertaken with potential receptors being identified. This has been assessed with possible mitigation measures and initial changes to the proposed new developments layout to reduce impact and ensure the best outcomes possible for the new residents.

Viewing angles, glare, spill light and overall visual impact has been explored to provide comfort to the developer, and local authority, of the feasibility of the proposed development. This holistic approach will reduce the impact of light nuisance during times of floodlit training or match play.

A daytime site survey and assessment of the floodlighting has taken place and concluded that the sports pitch has been professionally lit with good overall measures in place to reduce spill, glare and impact on its surroundings. Rotation of certain plots on the layout, and the addition of boundary planting, should reduce any impacts on the proposed development to a negligible level.

The mitigation already provided by the well designed floodlighting scheme along with curfew times for floodlit play should enable a level of comfort for those developing and approving the site that light nuisance is sufficiently dealt with to move the development application forwards.

Introduction

It does Lighting Ltd have been commissioned to provide a lighting assessment for the proposed development at Old Sarum, Salisbury (The Site). This lighting assessment has been undertaken for our client, Persimmon Homes, and will detail design recommendations that will minimise adverse lighting effects upon the proposed new Site's residents, whilst enabling the sports facility to still utilise its floodlighting for training and events.

This assessment sets out the approaches that will be taken to ensure that the floodlighting installed at the sports ground will not greatly disturb or prevent residents from using their new homes in any suitable way they choose.

The lighting assessment of this Site has been completed by a competent person (level 4) as assessed under the Institution of Lighting Professionals (ILP) competency framework.

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The aim of the report is to assess:

- Current lighting installed around the proposed Site within the sports ground.
- Legislative, national and local parameters for lighting of the Site
- Potential for obtrusive light and light spill, and its possible affects upon human receptors, as identified within the Site.
- Limitations for usage of the sports lighting in regard to receptors.
- Appropriate measures for the Site to negate adverse impact upon human receptors
- Solutions for mitigation against any remaining, potential negative effects that arise from artificial lighting, in regard to human receptors.

The report has been based on information gained from the applicant, day time photography and visual assessment, light pollution maps and experience in sports floodlighting design, from which the impact of installed floodlighting can be quantified and assessed.

Factors that have been considered when assessing the lighting required and its potential impact include:

- Ambient illuminance and environmental zone classification.
- Allowable lighting levels from lit sports facilities in the vicinity of housing.
- Control of spill light and glare in relation to receptors and adjacent land.
- Lighting standards, legislation and parameters placed upon any potential new housing development and its residents
- Mitigation to reduce unavoidable impact of the floodlighting on the proposed new development.

Legislation and policy

The lighting assessment has been undertaken within the context of relevant planning policies, guidance documents and legislative instruments. These are summarised in 'Appendices and Reference' section of the document but are not exhaustive.

Method of assessment

A site visit and desk top survey was carried out to determine the overall geographical parameters of the site, its proximity to the existing floodlighting and the view of which from the site. This survey determined baseline information for the general impacts of the floodlighting, potential for spill light and glare within the vicinity of Site and allows us to consider the possible effects and required mitigation for the proposed new development to implement.

Property locations have been identified and assessed within the report. The potential for negative impacts has been investigated and where possible quantified.

Floodlighting impacts and mitigation has been produced, based on the standards and guidance which has been listed within References and Documents. Based on these requirements, proposals for an appropriate lighting installation have been determined, from which potential impacts and effects can be assessed. Following the evaluation of the proposed lighting installation, mitigation has then been considered and proposed.

The sports pitches floodlighting has been assessed to ensure that receptor locations are not negatively impacted upon and where possible to assess, that obtrusive light limitation levels have not been exceeded.

Baseline Assessment

Site location

The Site is situated within Old Sarum, Salisbury and is adjacent to the existing football ground which sits to the south west of the proposed Site. The area is fairly rural with just a few developments surrounding the proposed new site which are generally new builds from previous development.

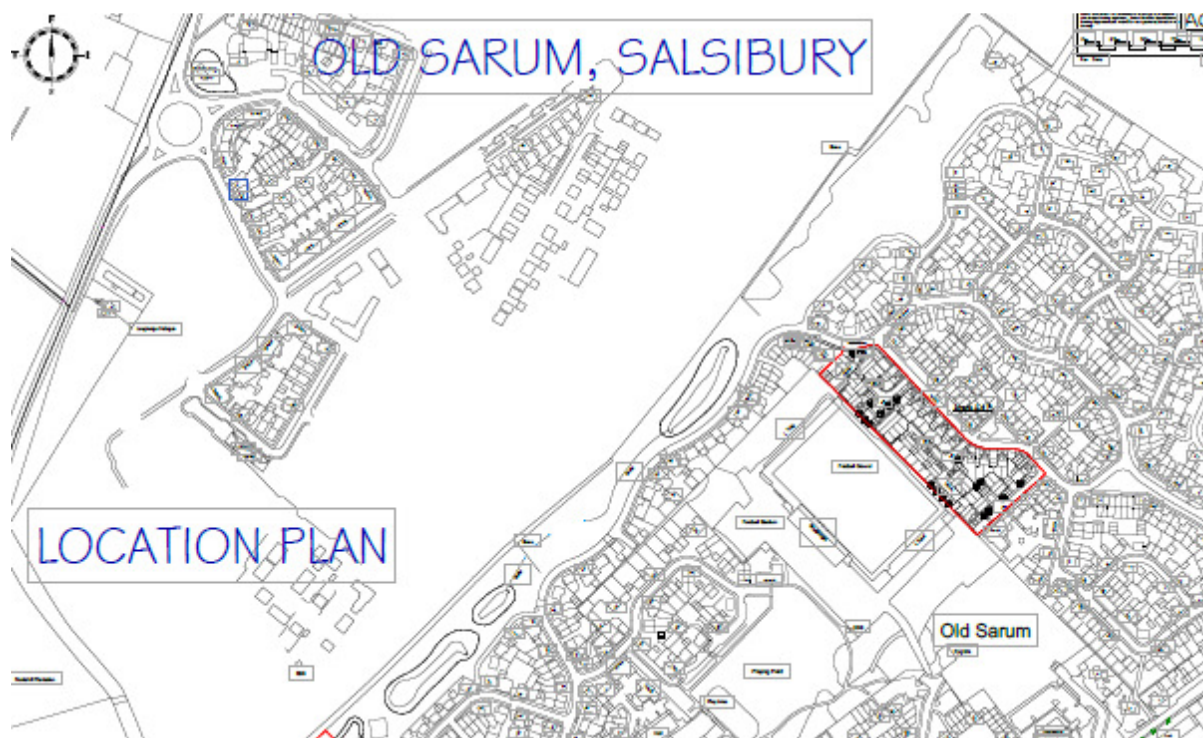


Figure 1 - Image showing the location of the Site and surrounding geography and infrastructure.

The Site itself is mostly open grassland within the boundaries of the existing developed area and will fill a sizable gap which exists next to the football ground on its north east edge.

Proposed Development



Figure 2 – Illustrative masterplan of the proposed development.

The site is irregular in shape, comprising a total area of approximately 2.51 acres. There is a desire to locate a mix of private and affordable properties within the Site, as shown in the draft proposed layout within Figure 2. The design team have reorganised the location of some properties to minimise the likelihood of glare from the sports pitch floodlighting and reduce any direct view of the lights, this aims to provide a level of increased visual comfort.

Existing development lighting, and floodlighting.

Surrounding the Site.

Existing street lighting is already in existence surrounding the proposed new site along with the floodlighting from the sports pitch. The houses adjacent to the proposed new site are likely to be experiencing the same implications from the sports ground that the proposed site will, as viewing angles already experienced by residents would be similar to those of the proposed new housing. This means that any potential issues have been mitigated sufficiently for

development in the past and should not pose any significant risk to the new development and its receptors.



Figure 3 - Image of existing view from the road bordering the proposed site demonstrating the view already experienced by current properties within the existing development.

Some of the sports lighting tower locations orientate the lighting units away from the proposed development whilst others are turned in the direction of the existing and proposed housing.

In proximity

Existing artificial floodlighting in proximity to the Site consists of what appears to be Thorn High Intensity Discharge (HID) floodlights which have cowls and are aimed at no more than 10 degree uplift from the horizontal. They are mounted on high tower commercial floodlighting columns and positioned within the sports ground to aim their peak beams at the pitch area. The scheme looks to be well designed and maintained, with no luminaires pointing upwards or away from the pitch.

There is no reason to believe sky glow, glare or high levels of spill light are experienced by the surrounding areas from this floodlighting installation however due to Covid-19 sports were not being played and therefore night time levels could not be taken whilst on site.



Figure 4 - Image of current floodlighting facing towards proposed new site.



Figure 5 – Close up image demonstrating the angle of floodlights and their cowls which reduce visibility of the lamps, therefore reducing the potential for glare.

Current light pollution levels

In the wider context, the Site is situated within a Rural/Suburban transition Sky area (as defined within the Bortle Scale; see appendix 1), with the proposed Site already being affected by the current levels of sky glow and glare within the vicinity. These impacts have been considered as part of the assessment and will be addressed during the Sites development.

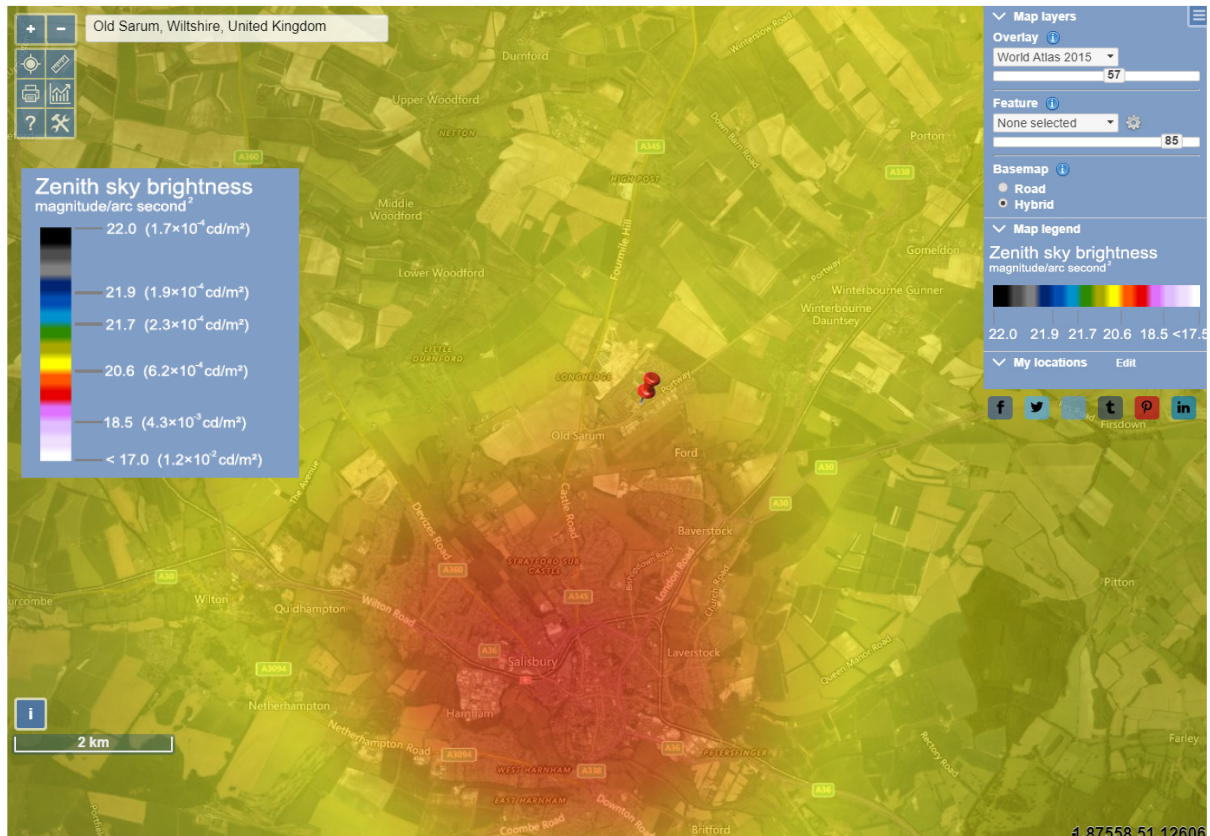


Figure 6 - Image showing the zenith brightness and Bortle Scale classification for the Site. Image courtesy of www.lightpollutionmap.info.

When determining the sky glow¹ and glare² associated with the proposed planning application, the base line has been determined by the use of the Bortle scale (Appendix 1).

¹ Upward light reflected in the atmosphere above areas with poor optically controlled luminaires

² Bright light sources viewed from a distance which are distracting.

Radiance and zenith brightness - Radiance is a measure of the light being emitted, reflected or transmitted from a surface that can be viewed by the naked eye. Radiance, when combined with luminance, can be thought of as the 'brightness' of an area or surface. Zenith brightness is the measurement of the brightness of the night sky and the apparentness of the stars to the observer. Low zenith brightness indicates that the stars are not readily visible to an observer, which will be due to light pollution reflecting and refracting off particles within the atmosphere above the observer position. Greater brightness (radiance) of an area will result in higher sky glow/light pollution and therefore decrease the zenith brightness.

The light pollution simulation for the Site (Figure 6) demonstrates that on the Bortle scale the Site is a 4, which is classified as Rural/Suburban transition Sky. The Bortle scale runs from 1 to 9.

Classification of 4 on the Bortle Scale gives a NELM (naked eye limiting magnitude) of 6.1 – 6.5. Visibility of the night sky when viewed from these areas is as follows:

- the zodiacal light is still visible, but does not extend halfway to the zenith at dusk or dawn
- light pollution domes visible in several directions
- clouds are illuminated in the directions of the light sources, dark overhead
- surroundings are clearly visible, even at a distance
- the Milky Way well above the horizon is still impressive, but lacks detail
- M33 is a difficult averted vision object, only visible when high in the sky
- limiting magnitude with 12.5" reflector is 15.5

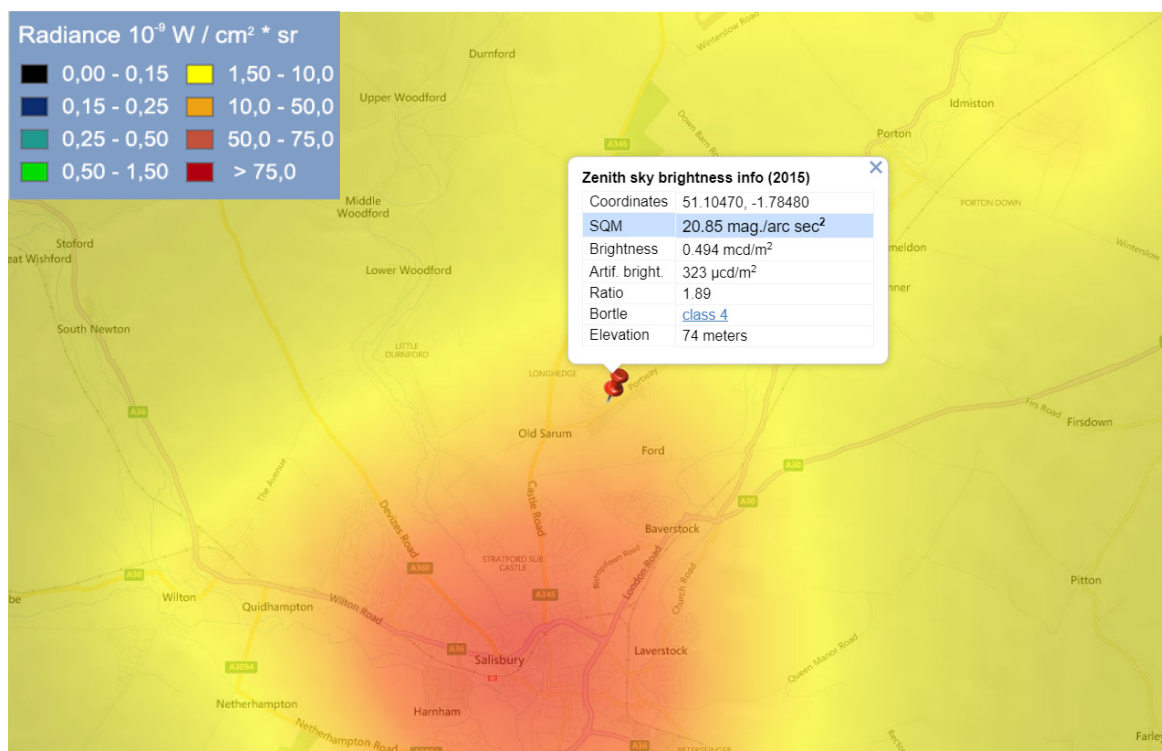


Figure 7 - Image demonstrating the radiance for the Site. Image courtesy of www.lightpollutionmap.info

The image above (Figure 7) demonstrates the intensity of artificial lighting levels within the area.

The above information indicates that sky glow in the general area will be noticeable but not excessive, which is normal for most rural/suburban transition sky locations. This in turn demonstrates that the residents and ecological receptors that will inhabit the Site are already subjected to some level of light pollution.

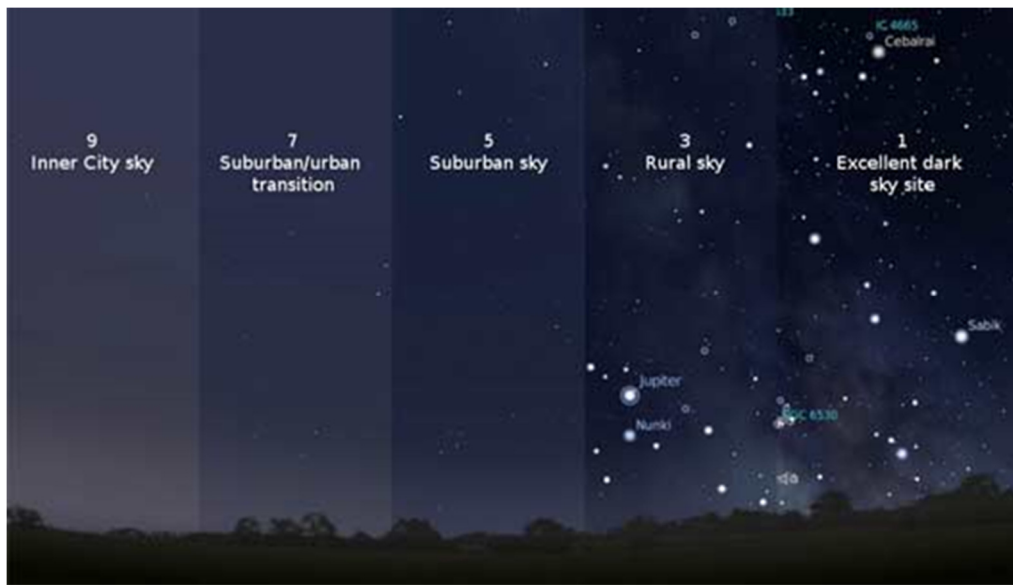


Figure 8 - Image showing the various classifications within the Bortle Scale.

Bortle Scale – The Bortle Scale is a numerical way of quantifying the zenith brightness at a given point. The Bortle Scale has nine levels within which to categorise areas and lists each level with both a number and title. The Bortle Scale ranges from; 1 (excellent dark sky site) to 9 (inner city sky). A full list of the Bortle Scale categories can be found within the appendix of this document.

Environmental zone classification

The Environmental zone for the area has also been assessed against the parameters below.

There are five different zones which are listed in the ILP (Institution of Lighting Professionals) Guidance notes and are as follows:

Table 1 – Environmental Zones			
Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Figure 9 - Image showing the table of environmental zones, as listed within ILP guidance notes.

As demonstrated earlier within this report; the Site will be on the edge of Old Sarum and is surrounded by mainly open grassland and fields as well as the existing housing development which means its classed as a rural/suburban location.

The proposed development is for residential housing only. These facilities are not likely to increase night time activities within the Site, and as such it is considered that the likely night time activity for the Site will be low.

Due to the relatively low housing density planned on the Site overall, it should be considered that the potential population density for the Site will be low.

As shown within figure 9, the general district brightness for the Site should be considered as being Low.

The Site is considered to be an E2 Environmental Zone after considering its rural location (yet reasonable proximity to infrastructure and housing within the town of Old Sarum), likely night-time activity (low) and current district brightness (low).

Table 2 – Obtrusive Light Limitations for Exterior Lighting Installations – General Observers						
Environmental Zone	Sky Glow ULR [Max %]⁽¹⁾	Light Intrusion (into Windows) E_v [lux]⁽²⁾		Luminaire Intensity I [candelas]⁽³⁾		Building Luminance Pre-curfew⁽⁴⁾
		Pre-curfew	Post-curfew	Pre-curfew	Post-curfew	Average, L [cd/m²]
E0	0	0	0	0	0	0
E1	0	2	0 (1*)	2,500	0	0
E2	2.5	5	1	7,500	500	5
E3	5.0	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

ULR = **Upward Light Ratio of the Installation** is the maximum permitted percentage of luminaire flux that goes directly into the sky.

E_v = **Vertical Illuminance in Lux** - measured flat on the glazing at the centre of the window.

I = **Light Intensity in Candelas (cd)**

L = **Luminance in Candelas per Square Metre (cd/m²)**

Curfew = **the time after which stricter requirements (for the control of obtrusive light) will apply**; often a condition of use of lighting applied by the local planning authority. If not otherwise stated - 23.00hrs is suggested.

***** = **Permitted only from** Public road lighting installations

Figure 10 - Image of the ILP's table of Obtrusive Light Limitations for Exterior Lighting Installations.

The table above details the allowable levels of obtrusive light for exterior lighting applications and is determined by the Environmental zone.

Evaluation

Limitations

Any existing lighting within an area has the potential to have a negative impact on receptors, whether they be human or ecological. Poorly designed lighting schemes can produce levels of light considered inappropriate for an area and may also produce obtrusive light and glare.

The well-designed flood lighting scheme will likely have a minimal impact on its locality, whilst providing a much needed social centre for the community.

Light levels of over 1 lux, on the vertical plane against bedroom windows should not be experienced after curfew by the new Site. Therefore, switch off times after 11pm should be adhered to and enforced where necessary to ensure receptors experience enough darkness to sleep.

Legislation, British Standards and best practice guidance

Best practice guidance and standards set out limitations on exterior lighting limitations. These standards and guidance notes should be adhered to, to ensure that safe and appropriate lighting is provided.

As the existing pitch lighting will have required planning permission it is fair to assume a comprehensive design and evaluation process took place to ensure the impact was minimal on its surroundings. This further supports our assessment that the proposed new development will not experience debilitating levels of obtrusive light from this facility as long as play is contained to suitable times within the winter months and switched off at curfew.

Environmental zone

The classification of an environmental zone gives limitations for a lighting installation in regard to obtrusive light. The Site has been classified as an E2 zone.

This means that pre and post curfew levels are set and should be adhered to. Should there be an issue with levels then other measures such as trees or fencing should be implemented to shield direct view of any sports lighting that may be orientated towards the new development. However, with the shielding and orientation of the flood lights at the time of the site visit it is not anticipated that significant further measures will be required.

Obtrusive light

Limitations for light intrusion, sky glow, luminaire intensity and building luminance are set out within Table 2 of ILP guidance. All lighting installations should comply with the limitations prescribed for the assessed environmental zone within which they are situated. Compliance with the obtrusive light limitations should ensure minimal impacts upon receptors and the environment at large.

The Site has been classified as E2, as demonstrated earlier within this report.

Obtrusive light limitations for an area classified as E2 include:

- A maximum upward light ratio from any lighting installation of 2.5%
- A maximum light intrusion level of 5 lux pre-curfew and 1 lux post-curfew
- A maximum luminaire intensity of 7,500 candelas pre-curfew and 500 candelas post-curfew
- A maximum building luminance of 5 lux pre-curfew only.

As the lighting was already approved by the planning department for compliance we have assumed the above criteria has been met for the other development already in place and will be consistent for the new Sites requirements.

Observations

Summary of the sports pitch lighting in relation to the proposed new development.

- All sports lighting design must conform to British Standards and other best practice guidance.
- All lighting must conform to the obtrusive light limitations for an E2 environmental zone
- The sports lighting has been approved by planning and is therefore presumed to comply with the above.
- All luminaires have been installed with less than 10 degree uplift.
- Cowls/shields are fitted and will contain direct view of the lamps
- Switching times are likely to be set to go off before the 11pm curfew
- Lighting will only be used for training and play during the winter months as and when required.
- Glare and spill light have been managed in a way suitable for such a facility and will therefore only impact the proposed new sites residents in a negligible way.
- Any sports pitch lighting will provided some spill light during its times of operation so all impacts cannot be completely mitigated however its felt that sufficient measures have been taken to reduce them to as low as possible whilst still enabling compliant design and usage for the sports club and its activities.

Residual effects

Post construction mitigation

All efforts have been made to achieve an appropriate approach towards the layout of the new houses on the Site to achieve the least impact from the existing sports pitch lighting. Obtrusive light limitations should be checked once the development has been completed and additional trees or fencing provided should the, pre and post curfew, levels be exceeded. These measures can also be supported by the sports clubs cooperation with expected usage and switch off times to ensure the community are protected from excessive light levels within their homes.

Further mitigation, if required, should include:

- Post construction compliance checking of actual lighting levels.
- Further trimming of the sports lighting switch off times, if required once the site is developed.
- The use of closed fencing or vegetation as a physical barrier.
- A sensible, inclusive approach to the management of the sports pitch's facilities and its lighting.
- As and when replacement of the lighting is considered this process should include the impact on the local residents as LED lighting often brings increased glare and spill light as its not so easily contained for the floodlighting of sports pitches.

Conclusion

In providing an assessment of the required lighting consideration has been given to:

- The need to develop the area
- Current sports lighting and light pollution in the locality
- Identification of areas and features that are sensitive for receptors.
- Requirements and limitations for in regard to receptors
- Potential mitigation to further reduce potential impacts on the new receptor population, caused through artificial sports lighting.

The report has highlighted the need to develop the Site to whilst being mindful of its proximity to the existing sports club and its floodlighting. It has concluded that the already installed lighting appears to be within best practice guidance and will cause a negligible impact to the new residents of the proposed development if well managed and sympathetically used.

The report has assessed the current ambient light and district brightness of the area and has concluded that the overall ambient light levels, sky glow and light pollution are average for a rural/suburban location and that any new residents will already experience this without the floodlighting contribution.

The report has assessed the limitations and restrictions that should be applied to the sports lighting adjacent to the Site.

The assessment has concluded that the proposed development will experience a negligible effect upon receptors, whilst allowing development of this new Site.

The report has also explored mitigation against the potential residual effects that the sports lighting may have on proposed development.

It is the conclusion of this report that a well-designed housing development layout has been proposed for the Site which considers the sports lighting and its viewing angles for the potential new residents. It is therefore the opinion of *it does Lighting Ltd* that the development should be sufficiently well designed to protect new residents from as much light spill, glare and light pollution, as possible, whilst still enabling use of the pitch and its facilities.

Abbreviations and Definitions

- **Luminance** The intensity of light in a given direction from a surface. The surface may be a light source (such as a lamp), or a reflector (such as a road surface). The unit is candelas per metre squared (cd/m^2).
- **Illuminance** The luminous flux density at the surface being lit. Usually measured with a light meter. The unit of measure is lux, one lumen per square metre.
- **Maintained illuminance** The minimum light level over an area.
- **Average illuminance (Avg.)** Illuminance averaged over a specified surface.
- **TCW** Total Circuit Wattage.
- **Maintenance factor.** The factor used to adjust the luminaire output to represent the reduction in light levels over time.
- **DNO** Distribution Network Operator.
- **LED** Lighting Emitting Diodes.
- **Colour temperature (K)** It is the value given to the colour of the light in degrees' kelvin. It can range from 1500K to 7000K, 1500k being warm/red to 7000K being cool/blue.
- **Luminaire** Combination of a light source, a housing, and electronics, with the purpose of providing light.
- **S/P ratio** The scotopic/photopic (S/P) ratio is a way of adjusting for the relative strengths of these two responses with in the eye and translating them to lighting. S/P is calculated using the scotopic and photopic lumens for the light source. Cooler/higher colour temperatures tend to have higher S/P ratio compared to lower/warm sources.

Reference Documents

Regulations and References.

- Well-lit Highways – Code of Practice for Highway Lighting Management – UK Lighting Board 2004;
- Well Maintained Roads – Code of Practice for Highway Maintenance Management – Roads Liaison Group 2005;
- Health and Safety at Work Act, 1974;
- BS 7671, Requirements for Electrical Installations;
- BS 4533: 1992, Luminaires - Section 102.3, Specification for Luminaries' for road and street lighting;
- BS EN 13201, Parts 2, 3 and 4, Road lighting;
- BS 5489: 2013, Code of practice for the design of road lighting;
- BS EN 60529: 1992, Specification for Clarification of Degrees of Protection provided by Enclosures;
- Disabled Persons Act 1981;
- The Disability Discrimination Act October 1995;
- Institution of Lighting Professionals: Competency Requirements for Lighting Design Staff 2007;
- Institution of Lighting Professionals: 'Guidance Notes for the Reduction of Light Pollution' available at <http://www.ilp.org.uk/>
- Institution of Lighting Professionals 'Guidance on Undertaking Environmental Lighting Impact Assessments' (PLG-04)
- Department of the Environment and Countryside Commission document 'Lighting in the Countryside – Towards good practice'
- ILP and CIBSE document 'Lighting the Environment – A guide to good urban lighting'
- SDNPA – Dark Skies Technical Advice Note 2018

Appendices

Appendix One

Bortle scale information

The **Bortle scale** is a nine-level numeric scale that measures the night sky's brightness of a particular location. It quantifies the astronomical observability of celestial objects and the interference caused by light pollution.

The table below summarises Bortle's descriptions of the classes.

Class	Title	NELM	Description
1	Excellent dark-sky Site	7.6–8.0	the zodiacal light is visible and colourful the gegenschein is visible the zodiacal band is visible airglow is readily visible the Scorpius and Sagittarius regions of the Milky Way cast obvious shadows many Messier and globular clusters are naked-eye objects M33 is a direct vision naked-eye object limiting magnitude with 12.5" reflector is 17.5 (with effort)
2	Typical truly dark Site	7.1–7.5	the zodiacal light is distinctly yellowish and bright enough to cast shadows at dusk and dawn airglow may be weakly visible near horizon clouds are only visible as dark holes against the sky surroundings are barely visible silhouetted against the sky the summer Milky Way is highly structured many Messier objects and globular clusters are naked-eye objects M33 is easily seen with naked eye limiting magnitude with 12.5" reflector is 16.5
3	Rural sky	6.6–7.0	the zodiacal light is striking in spring and autumn, and colour is still visible

			some light pollution evident at the horizon clouds are illuminated near the horizon, dark overhead nearer surroundings are vaguely visible the summer Milky Way still appears complex M15, M4, M5, and M22 are naked-eye objects M33 is easily visible with averted vision limiting magnitude with 12.5" reflector is 16
4	Rural/suburban transition	6.1–6.5	the zodiacal light is still visible, but does not extend halfway to the zenith at dusk or dawn light pollution domes visible in several directions clouds are illuminated in the directions of the light sources, dark overhead surroundings are clearly visible, even at a distance the Milky Way well above the horizon is still impressive, but lacks detail M33 is a difficult averted vision object, only visible when high in the sky limiting magnitude with 12.5" reflector is 15.5
5	Suburban sky	5.6–6.0	only hints of zodiacal light are seen on the best nights in autumn and spring light pollution is visible in most, if not all, directions clouds are noticeably brighter than the sky the Milky Way is very weak or invisible near the horizon, and looks washed out overhead limiting magnitude with 12.5" reflector is 15
6	Bright suburban sky	5.1–5.5	the zodiacal light is invisible light pollution makes the sky within 35° of the horizon glows greyish white clouds anywhere in the sky appear fairly bright surroundings are easily visible

			the Milky Way is only visible near the zenith M33 is not visible, M31 is modestly apparent limiting magnitude with 12.5" reflector is 14.5
7	Suburban/urban transition	4.6–5.0	light pollution makes the entire sky light grey strong light sources are evident in all directions clouds are brightly lit the Milky Way is invisible M31 and M44 may be glimpsed, but with no detail through a telescope, the brightest Messier objects are pale ghosts of their true selves limiting magnitude with 12.5" reflector is 14
8	City sky	4.1–4.5	the sky is light grey or orange - one can easily read stars forming familiar constellation patterns may be weak or invisible M31 and M44 are barely glimpsed by an experienced observer on good nights even with a telescope, only bright Messier objects can be detected limiting magnitude with 12.5" reflector is 13
9	Inner-city sky	4.0	The sky is brilliantly lit many stars forming constellations are invisible and many fainter constellations are invisible aside from the Pleiades, no Messier object is visible to the naked eye the only objects to observe are the Moon, the planets, and a few of the brightest star clusters