Reading Golf Club

Lighting Assessment

On behalf of **Fairfax (Reading) Ltd and Reading Golf Club Limited**

Project Ref: 45675/2502 | Rev: V1 | Date: November 2021

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1 Introduction

1.1 Overview

1.1.1 Stantec has been commissioned by Fairfax (Reading) Ltd and Reading Golf Club Ltd ('the Applicant') to prepare a Lighting Assessment for the development of Reading Golf Course for up to 223 residential homes ('the Proposed Development'). The Application Site sits within the jurisdiction of Reading Borough Council (RBC).

1.2 Aims and Objectives

1.2.1 The key aims and objectives of this lighting assessment are to:

- Identify national and local planning policy, guidance and standards as relevant to artificial lighting for the Proposed Development;
- Determine the existing lighting conditions within the Application Site and wider study area;
- Establish the minimum exterior artificial lighting required to construct and operate the Proposed Development safely and securely;
- Assess the potential effects of the minimum exterior artificial lighting required for the Proposed Development on light sensitive receptors; and
- Outline potential mitigation measures for the design of lighting so obtrusive light is minimised to within guideline levels.

1.3 Report Structure

1.3.1 The structure of the lighting assessment report is set-out below:

- **Section 2** – Describes the Application Site and the Proposed Development;
- **Section 3** – Sets out legislation, planning policy and guidance relevant to obtrusive light;
- **Section 4** – Details the methodology of the Lighting Assessment;
- **Section 5** – Outlines the existing baseline conditions of the Application Site including light sensitive receptors within and surrounding the Application Site;
- **Section 6** – Outlines the minimum lighting requirements for the Proposed Development;
- **Section 7** – Qualitatively identifies any potential effects on sensitive receptors (identified in Section 5) within the Application Site and wider study area;
- **Section 8** – Details measures to mitigate potential impacts (identified in Section 7) on light sensitive receptors (identified in Section 5); and
- **Section 9** – Identifies residual effects after mitigation and provides a set of conclusions.

2 The Application Site and Proposed Development

2.1 Application Site Location and Description

2.1.1 Reading Golf Club (RGC) traverses the constituency boundary of RBC and South Oxfordshire District Council (SODC). However, the Application Site falls entirely within the constituency boundary of RBC. The Application Site Location Plan is contained within **Appendix A**.

2.1.2 The Application Site is located within the northernmost suburb of Emmer Green, Reading. Emmer Green is located approximately 3.5 km north of the centre of Reading and has conurbation with Caversham to the south.

2.1.3 The Application Site is approximately 12.1 hectares (ha). The north western boundary abuts the existing section of the RGC within the constituency boundary of South Oxfordshire District. It is bounded to the east by the residential roads of Brooklyn Drive and Kidmore End Road. To the south lies the residential road of Lyefield Court and Emmer Green Primary School. To the south west lies the retirement complex Lyefield Court & the Conifers, which is set back from the boundary. To the west lies the residential roads Eric Avenue and Highdown Hill Road.

2.1.4 The Application Site has one primary point of access by way of a priority 'T' junction off Kidmore End Road. The Application Site also benefits from an emergency assess further north along Kidmore End Road by way of a cross over. There are no other means of public access onto the Application Site, vehicular or otherwise.

2.1.5 With the exception of the north western boundary, there is established tree planting along the boundaries of the Application Site, particularly along the western boundary with Eric Avenue and Highdown Hill Road. Mature vegetation is also present along parts of the southern boundary, particularly the south east corner.

2.1.6 The Application Site topography falls relatively uniformly from the south-east down towards the north-west. The highest elevation is approximately 86 m Above Ordnance Datum (AOD i.e. above sea level) in the south east, and the lowest elevation approximately 80 m AOD in the north west.

2.1.7 The Application Site envelopes 12.1 ha of land, of which approximately 3.83 ha are allocated by way of Policy CA1b in RBC's Local Plan. Policy CA1b makes provision for 90 to 130 residential homes, community provision including healthcare and replacement clubhouse.

2.2 The Proposed Development

2.2.1 The development proposals seek permission for an outline planning application, with all matters reserved except access, for the development of land at Reading Golf Club, involving demolition of the existing clubhouse and the erection of a new residential-led scheme, including provision of community infrastructure. A framework masterplan is provided in **Appendix B**. The description of development is as follows:

'Outline planning application, with matters reserved in respect of appearance, for demolition of the existing clubhouse and the erection of a residential scheme (C3 use to include affordable housing) at the former Reading Golf Club'

2.2.2 The Proposed Development will provide up to 223 dwellings of varying types, sizes and tenures. There will also be provision of open space with retention of existing landscape features wherever possible, including mature trees and hedgerows. New landscaping features are proposed, such as native tree planting along boundary fences. Footpath links will provide safe routes linking the residential areas with open space.

Access and Movement

2.2.3 Vehicle access will be located on the eastern boundary of the site from Kidmore End Road, in a similar location to where the existing car park access to the Golf Club is located. A secondary access will also be located on the eastern boundary of the site providing access to the nine houses within the crescent that faces onto Kidmore End Road. This access will also form an emergency access with a droppable bollard into the site.

2.2.4 A hierarchy of streets has been designed, with a main internal road running through the Proposed Development, linking a movement network that will be used by pedestrians, cyclists and vehicles. A footway/cycleway along the eastern edge of the primary street is proposed. There will also be footpath links that run along the boundary of the Application Site.

2.2.5 The framework masterplan has been designed to allow for the potential to provide a bus loop within the Application Site, subject to discussions with existing bus service providers. New bus stops would be provided.

3 Legislation, Policy and Guidance

3.1 Introduction

3.1.1 This section provides a review of the relevant national and local legislation, policy and guidance relevant to the assessment of obtrusive light in relation to the Proposed Development.

3.2 Legislation

Clean Neighbourhoods and Environment Act

3.2.1 The Clean Neighbourhoods and Environment Act 2005 (CNEA) amended Section 79 of the Environmental Protection Act 1990 by extending the statutory nuisance regime to include light nuisance, by stating the following:

"(fb)…artificial light emitted from premises so as to be prejudicial to health or a nuisance…"

"Subsection (1)(fb) does not apply to artificial light emitted from - (a) an airport; (b) harbour premises; (c) railway premises, not being relevant separate railway premises; (d) tramway premises; (e) a bus station and any associated facilities; (f) a public service vehicle operating centre; (g) a goods vehicle operating centre; (h) a lighthouse; (i) a prison."

3.2.2 Therefore, since 6th April 2006, artificial light can be considered to be a statutory nuisance unless it is from exempt premises. It should be noted that road lighting is not exempt from the CNEA, although they are unlikely to qualify as a statutory nuisance as they are not strictly located on a premises.

3.2.3 Guidance produced by the Department of Environment, Food and Rural Affairs (DEFRA) in April 2006, on Section 101 to 103 of the CNEA, extends the duty on local authorities to ensure their areas are checked periodically for existing sources of statutory nuisances.

3.2.4 If a light nuisance is considered by a local authority to exist, the local authority must serve a notice on the person responsible requiring the abatement of the nuisance, and/or restricting or prohibiting its recurrence.

3.2.5 Section 103 extends the defence of 'best practical means' to those statutory nuisances where light is emitted from industrial, trade or business premises and also from relevant outdoor sports facilities.

3.3 National Policy

National Planning Policy Framework

3.3.1 The National Planning Policy Framework (NPPF) was revised on 20th July 2021. This supersedes the existing policy within the previous NPPF (March 2012). The revised NPPF includes a number of references to the need to consider the effects of artificial lighting.

3.3.2 Paragraph 180 of the NPPF states:

"*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation." (Page 52)

National Planning Practice Guidance

3.3.3 The Government's Planning Practice Guidance (published in 2014 and updated in 2019) web-based resource presents specific guidance on light pollution (obtrusive light) presented in Paragraph: 001 – 006 that have been considered throughout the assessment, as set out in **Table 3.1** below.

Table 3.1: Review of Planning Practice Guidance

NPPG Guidance	How the guidance has been considered in this Lighting Assessment
Paragraph 1: What light pollution considerations does planning need to address?	There is potential for light from the Proposed Development to be obtrusive to people and wildlife or detract from the enjoyment of the night sky. Therefore, obtrusive light from the Proposed Development has been considered further within this report.
Paragraph 2: What factors can be considered when assessing whether a development proposal might have implications for light pollution?	This report considers where, when and how the light shines as the Proposed Development has the potential to adversely affect the use or enjoyment of nearby buildings or open spaces.
Paragraph 2: Will a new development, or a proposed change to an existing site, be likely to materially alter light levels in the environment around the site and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?	Effects on sensitive receptors and spaces outside of the Application Site will be assessed within this report in accordance with the PPG.
Paragraph 3: What factors are relevant when considering where light shines?	This report considers the potential for light intrusion effecting receptors outside the Application Site boundary which can lead to annoyance to people, compromise existing dark landscapes and affect natural systems.
Paragraph 4: What factors are relevant when considering when light shines?	This report considers the potential for lighting including when it may be required (**Section 6** sets out the anticipated Lighting Requirements).
Paragraph 5: What factors are relevant when considering how much the light shines?	This report considers the minimum requirements to construct and operate the Proposed Development safely and securely (**Section 6** Lighting Requirements). The Environmental Zone of the Application Site is established to ensure there is an appropriate level of lighting for the ambient lighting conditions. A framework of mitigation has been established to ensure that the light source and its spectral attributes would be considered further during the technical design process.
Paragraph 6: What factors are relevant when considering possible ecological impacts of lighting?	This report specifically considers the effects obtrusive lighting may have on ecological receptors (under ecological receptors in **Section 7**).

3.4 Local Policy

Reading Borough Local Plan (2019)

3.4.1 The Reading Borough Local Plan was adopted in November 2019 and guides development in Reading up to 2036. The following policies are relevant to lighting associated with the Proposed Development:

CC8: Safeguarding Amenity

"Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of: … Artificial lighting…"

EN16: Pollution and Water Resources

"Development will only be permitted where it would not be damaging to the environment and sensitive receptors through land, noise or light pollution…

Proposals for development that are sensitive to the effects of noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution."

3.5 Guidance

Obtrusive Light

3.5.1 Guidance on obtrusive light is set out within the following guidance documents, further detail is provided in **Appendix C**:

- The Institution of Lighting Professionals (ILP) Professional Lighting Guide 04: Guidance on Undertaking Environmental Lighting Impact Assessments (2013); and
- ILP Guidance Notes for the Reduction of Obtrusive Light (2021).

Ecological

3.5.2 Guidance on obtrusive light in relation to bats as issued by the Bat Conservation Trust is listed below, further detail is provided in **Appendix C**:

- Bat Conservation Trust and ILP Guidance Note 08/18: Bats and Artificial Lighting in the UK (2018); and
- EUROBATS Advisory Committee. Publication Series No. 8: Guidelines for Consideration of Bats in Lighting (2018).

3.6 Lighting Standards

3.6.1 **BS EN 13201-1:2014 Road Lighting, Part 1 Guidelines on selection of lighting classes**: specifies the lighting classes set out in EN 13201-2 and gives guidelines on the selection of the most appropriate class for a given situation.

3.6.2 **BS EN 13201-2:2015 Road lighting - Performance requirements**: Defines performance requirements which are specified as lighting classes for road lighting aiming at the visual needs of road users, and it considers environmental aspects of road lighting.

3.6.3 **BS EN 5489-1:2020 Code of Practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas**: This document provides specific guidance on selecting lighting classes that will help design more energy efficient road lighting schemes. It gives the most up-to-date recommendations for general principles of road lighting including aesthetic, technical aspects, operation and maintenance.

3.6.4 **BS EN 12464-2:2014 Light and lighting - Lighting of work places Part 2: Outdoor work**: This document outlines requirements for lighting outdoor work places, focusing primarily on visual comfort and performance.

3.6.5 **CIBSE (2016) Lighting Guide LG6 – The Outdoor Environment**: presents lighting solutions to basic visual problems and individual characteristics of outdoor lighting applications.

4 Methodology

4.1 Introduction

4.1.1 This section provides an outline of the methods and procedures that were followed when undertaking the Lighting Assessment including how the baseline lighting conditions were determined and the assessment process that was undertaken.

4.1.2 The Lighting Assessment will:

- Identify potential existing obtrusive light within and around the Application Site;
- Establish the minimum demolition, construction and operational lighting required to safely and securely construct and operate the Application Site;
- Set out design recommendations to minimise obtrusive light both during construction and following completion; and
- Describe potential and residual effects from obtrusive light.

4.2 Baseline Conditions

Desk Based Information

4.2.1 A desk-based review of publicly available information was undertaken, in order to inform the existing lighting conditions, and to understand the context of the Proposed Development within its existing environmental setting. The following sources of publicly available information were reviewed as part of the desk-based review:

- Ordnance Survey mapping and aerial photography (2020);
- Google Street View (2012-2020); and
- Defra Multi-Agency Geographic Information for the Countryside (MAGIC) Map Application (2020).

4.2.2 Although the desk-based information enables a framework to be established for the assessment, the aerial photography and Google Street View are not up to date and therefore cannot be relied on as being definitive. A lighting survey was therefore completed and is detailed in **Section 4.3**.

4.2.3 The desk-based review was undertaken with consideration to the Ecological Impact Assessment (The Ecology Co-op, 2021).

4.3 Lighting Survey

4.3.1 The lighting survey was carried out having due regard to method outlined with the Institution of Lighting Professionals (ILP) PLG04 Guidance on Undertaking Environmental Lighting Impact Assessments. The lighting survey methodology has been agreed with RBC's Senior Environmental Health Officer (EHO)[1].

[1] Email correspondence between Graduate Environmental Planner (Stantec) and Senior EHO (RBC) on 2nd April 2020.

4.3.2 The lighting survey was undertaken on 23rd January 2020, between the hours of approximately 17:00 and 20:00. Weather conditions during the survey were dry with consistent heavy cloud cover across the Application Site. No stars were visible, and the moon phase at the time of the survey was a waning crescent moon, and not visible.

4.3.3 The lighting survey consisted of visiting the Application Site to record illuminance (lux) levels, take a series of photographs and record descriptions of the external lighting conditions to inform the assessment.

4.3.4 To gain a full representation of the existing lighting conditions on the Application Site, it was required that readings were taken at locations surrounding the Application Site to gain a full representation of existing lighting conditions. A plan of these locations is shown in **Appendix D.**

4.3.5 Readings were taken using a calibrated hand held EXTECH 45 LED Lux Meter. The lux meter which was used for the survey has an accuracy of ±3%. Lux readings were taken at 10 locations along the boundary of the Application Site. Readings were taken horizontally, as well as vertically in north, east, south and west directions, at approximately 1.5 m above ground. The lux reading results can be found in **Table 5.1**.

4.3.6 A series of photographs were taken of the night-time conditions of the Application Site. Photographs of night-time views were taken where potential obtrusive light was identified as these provide an adequate representation of the existing lighting conditions of the Application Site. The night-time photographs can be found in **Appendix E**.

4.3.7 Field notes were taken to provide a qualitative description of the existing sources of artificial light within the Application Site and the immediate surrounding area. Notes were taken regarding screening, vegetation and buildings/structures within or along the boundary of the Application Site. Consideration was given to existing residents, road users and ecological features (bats). Commentary was recorded regarding light spill, glare and sky glow.

4.3.8 Between the site visit being undertaken in January 2020 and submission of this application, baseline conditions are not considered to have materially changed on site and therefore the conclusions of this assessment remain valid.

Sensitive receptors

4.3.9 According to the guidelines set out in the ILP Guide 04 (ILP, 2013), receptors are specific elements affected by the development. In terms of lighting, this includes primarily visual effects on residents or individuals but also animals, plants or built heritage.

4.3.10 Sensitive receptors within and immediately surrounding the Application Site have been identified drawing in accordance with these guidelines and in consideration of the baseline technical document reviewed.

4.3.11 The ILP Guide 04 (ILP, 2013) recommends consideration of any of the following sensitive areas in or near the Application Site through the assessment:

- A World Heritage Site;
- Dark Sky Core or Buffer Zones;
- National Park Area;
- Outstanding Natural Beauty (AONB);
- Sites of Specific Scientific Interest (SSSI);

- Ramsar Sites;
- Conservation Areas; or
- Vulnerable Wildlife Habitats (e.g. insects, reptiles, bats).

4.4 ILP Environmental Zone

4.4.1 The ILP have established Environmental Zones for exterior lighting based on the existing external ambient lighting levels in the area (see **Table 4.1**). The ILP Environmental Zone classification for the Application Site has been determined based on professional judgement.

The ILP Environmental Zone classification determines the obtrusive light limitations for exterior lighting installations for that area. The specification of the limits for each ILP Environmental Zone are reproduced from the ILP guide (2021) in **Appendix F**.

Table 4.1: Environmental Zone Classifications, ILP 2021

Environmental Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

4.5 Assessment

Qualitative Assessment

4.5.1 The lighting impact assessment of the Proposed Development has due regard to the Institution of Lighting Professionals' (ILP's) Professional Lighting Guidance Notes for the Reduction of Obtrusive Light' and 'PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessments'.

4.5.2 This report presents a qualitative assessment of the effects of construction and operational lighting from the Proposed Development on sensitive receptors against the existing baseline lighting conditions. The assessment accounts for in-built mitigation designed into the layout of the Proposed Development such as soft landscaping.

4.5.3 The qualitative assessment considers the effects of obtrusive light from the Proposed Development on sensitive receptors. The sensitive receptors are set out in **Section 5.4**. The lighting requirements for the Proposed Development are outlined in **Section 6**. The potential effects of obtrusive light are identified in **Section 7**.

4.5.4 A lighting scheme and quantitative assessment of effect of lighting has not been prepared as details of the scheme are limited by the outline nature of the planning application and design principles being based on parameters.

Obtrusive Light

4.5.5 This qualitative assessment includes the consideration of potential adverse effects of the following three components of obtrusive light (as expressed in **Figure 4.1**):

- **Sky glow** – the brightening of the night sky above areas with large amounts of artificial light which may be reflected from illuminated surfaces or come from direct upward lighting installations;
- **Glare** – the brightness of a light source which is uncomfortable when viewed against a dark background. This is mostly experienced when light sources are not covered by a shield or directed by a suitable lens / reflector set up; and
- **Light intrusion** – when light affects areas beyond the boundary of the area which is to be lit. This is also known as 'spill' or 'trespass' and may cause nuisance or disturbance to sensitive receptors.

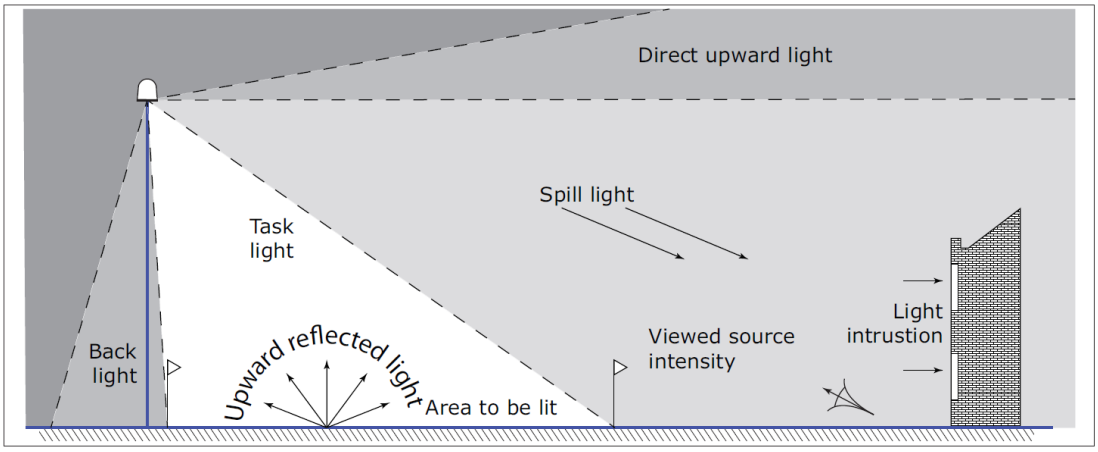


Figure 4.1: Diagrammatic Representation of Types of Obtrusive Light (ILP, 2021)

4.5.6 The ILP PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessment (2013) provides guidance on undertaking lighting assessment.

4.5.7 The impacts of lighting effects during construction and operation are assessed against the criteria outlined in **Table 4.2** which is taken from the ILP PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessment (2013). The level of effect has been determined using this criteria based on professional judgement and giving consideration to both positive and negative lighting effects associated with the Proposed Development.

Table 4.2: Lighting Assessment Criteria (adapted from ILP PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessment (2013))

Nature	Level	Description
Positive	Major/ substantial beneficial effects	Significant improvement in night environment and/or reductions in glare, light intrusion and sky glow etc.
	Moderate beneficial effects	Noticeable improvement in night environment and/or reductions in glare, light intrusion and sky glow etc.
	Minor beneficial effects	Slight improvement in night environment and/or reductions in glare, light intrusion and sky glow
Neutral	None/ negligible	No significant effect or overall effects balancing out
Negative	Minor adverse effects	Slight increase in visibility of site, glare, light intrusion and sky glow etc.
	Moderate adverse effects	Noticeable increase in visibility of site, glare, light intrusion and sky glow etc.
	Major adverse effects	Significant problems with increase in visibility of site, glare, light intrusion and sky glow etc.

4.6 Limitation

4.6.1 In the absence of statutory guidance, the ILP 'Guidance Notes for the Reduction of Obtrusive Light' and 'PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessments' have been used as criteria against which to assess the effects of artificial lighting, in accordance with best practice.

4.6.2 The lighting survey was undertaken during the winter months when the growth of deciduous vegetation was not full. As such, there may be instances where sources of artificial lighting were visible during this lighting survey but are screened from view by fully grown vegetation during the summer and autumn months. Therefore, the lighting survey does not present an entirely representative sample of the Application Site, as the visibility of this artificial lighting may change throughout the year. This lighting survey presents a 'worst-case scenario' of the artificial lighting conditions on the Application Site. This limitation has been identified throughout the assessment where relevant.

5 Existing Lighting Conditions

5.1 Introduction

5.1.1 This section of the report establishes the existing external lighting conditions of the Application Site and the wider study area that form the 'baseline conditions'. This includes the Environmental Zone for the Application Site and light sensitive receptors within and surrounding the Application Site.

5.2 Existing Lighting

5.2.1 The existing lighting conditions of the Application Site were established through a baseline survey of illuminance (lux) readings (**Table 5.1**) and representative viewpoints (**Appendix E**). The location of the readings and viewpoints is contained within **Appendix D**.

5.2.2 The only source of existing artificial lighting within the Application Site is the RGC clubhouse and an adjacent dwelling, located in the south east corner of the Application Site. The RGC clubhouse has external 2 m high wall mounted metal halide lamps, facing at an approximate 45° angle, resulting in some glare effect[2]. Minor light spill was observed from within the RGC clubhouse onto the Application Site (See **Appendix E Location 2 (south east facing)**). No amenity lighting from the adjacent dwelling resulted in light spill onto the Application Site. The car park, immediately adjacent to the clubhouse, is lit by bollard lighting, causing minor glare (see **Appendix E Location 10** and **Location 11 (entrance)**).

5.2.3 The rest of the Application Site is comprised of the active golf course, and is therefore mostly dark. The golf course extends to the north west of the Application Site where there are no sources of artificial lighting (see **Appendix E Location 3 (north facing)**). Beyond the golf course in the north lies open green space and the village of Chalkhouse Green (~ 600 m north of the Application Site boundary), which is not visible from the Application Site due to the dense vegetation within the golf course.

5.2.4 To the north east of the Application Site, external amenity lighting is visible from residential properties along Brooklyn Drive. Very limited light intrusion onto the Application Site was observed from these properties as they were heavily screened by well-established, dense vegetation along the majority of the Application Site boundary.

5.2.5 Along the eastern boundary, external security/amenity lighting is visible from properties along Kidmore End Road, causing distant and minor glare (see **Appendix E Location 9**). There is Lighting Emitting Diode (LED) street lighting along Kidmore End Road, and passing car headlights are visible from the Application Site through the hedgerow. (See **Appendix E Location 11 (Kidmore End Road)**). It is worth noting that the lighting baseline survey was undertaken in January 2020 and as such the hedgerow may not have been fully grown.

5.2.6 To the south lies Emmer Green primary school. Security lighting is visible from within the school grounds, as well as internal lighting from the school hall, however this does not intrude onto the Application Site due to the distance from the Application Site (approximately 100 m from boundary) (see **Appendix E Location 8**). There did not appear to be any flood lighting within the school's sports pitches. Approximately 200 m beyond the primary school are residential properties along Grove Road. LED street lighting along Grove Road was visible from the Application Site, causing glare, however this does not intrude onto the Application Site.

[2] Light emitted from a light source with an angle between 0-85 degrees results in minimal sky glow effect but has some glare effect (ILP Guidance Notes for the Reduction of Obtrusive Light 2021 Table 1).

5.2.7 To the west lies residential properties along Eric Avenue and Highdown Hill Road. The amenity lighting of these properties was heavily screened along the boundary, although visible in some parts of the Application Site. However, no light intrusion onto the Application Site was observed.

5.2.8 Prominent sky glow was observed to the south of the Application Site (see **Appendix E Location 2 (south west facing)**) and noticeable sky glow was visible to the west.

5.2.9 Illuminance was measured along the boundary of the Application Site. The results of the illuminance survey are presented in **Table 5.1** below.

Table 5.1: Brightness of Surrounding Area

Location Number	Illuminance (lux)				
	Vertical	Horizontal			
		North	East	South	West
1	0.03	0.03	0.03	0.03	0.03
2	0.09	0.04	0.04	0.05	0.04
3	0.05	0.05	0.05	0.05	0.05
4	0.07	0.06	0.06	0.06	0.07
5	0.07	0.06	0.06	0.07	0.07
6	0.07	0.06	0.06	0.06	0.06
7	0.06	0.06	0.06	0.06	0.07
8	0.07	0.06	0.06	0.06	0.06
9	0.06	0.06	0.06	0.07	0.06
10	0.06	0.06	0.06	0.06	0.06

5.2.10 **Table 5.2** below presented examples of illuminance levels associated with different lighting conditions.

Table 5.2: Example illuminance levels (lux)

Lighting Condition	Illuminance (Lux)
British summer sunshine	50,000
Overcast sky	5,000
Well-lit office	500
Minimum for easy reading	300
Passageway or outside working area	50
Good main road lighting	5-20
Sunset	10
Typical side road lighting	5
Minimum security lighting	2
Twilight	1

Lighting Condition	Illuminance (Lux)
Clear full moon	0.25 to <1
Typical moonlight/cloudy sky	0.1
Typical starlight	0.001
Poor starlight	0.0001

Source: Reproduced from the Bat Conservation Trust and ILP Guidance Note 08/18: Bats and Artificial Lighting in the UK (2018).

5.3 ILP Environmental Zone

5.3.1 Given the existing sources of lighting present on Application Site and the extensive existing light sources within the surrounding area, the Application Site has been identified through the site walkover as within the following ILP Environmental Zone:

- ILP Environmental Zone E2: Rural

5.3.2 Whilst there may be old lighting present in the surrounding area which does not comply with the defined limits of this ILP Environmental Zone, the key to classification is considering the general after-dark nature of the area as a whole (ILP, 2021).

5.3.3 In accordance with this it is therefore considered that E2: Rural is the most appropriate classification for the area, as set out in the ILP Guidance Notes for Reduction of Obtrusive Light GN01:2021 (see **Appendix F**). This has been confirmed with RBC's Senior EHO[3].

5.3.4 The ILP provides limitations for obtrusive light for each Environmental Zone in terms of the upward lighting ratio; light intrusion and luminaire intensity.

5.4 Sensitive Receptors

5.4.1 The Application Site is not situated within a statutory or non-statutory designated area. In line with guidance outlined in **Section 4**, receptors have been identified within the surrounding area which could be potentially impacted by the Proposed Development.

Table 5.3: Existing Sensitive Receptors

Receptor	Description
Existing local residents	There are existing local residents located adjacent to the Application Site boundaries that have the potential to be impacted (intrusion, glare and sky glow) by the Proposed Development, these are residents at or along: ▪ Brooklyn Drive; ▪ Kidmore End Road; ▪ Lyefield Court; ▪ Gorselands; and ▪ Eric Avenue.
Motorist, cyclists & pedestrians	The roads adjacent to the Application Site are as follows: ▪ Brooklyn Drive; ▪ Kidmore End Road; ▪ Lyefield Court; ▪ Gorselands; and ▪ Eric Avenue.

[3] Email correspondence with Senior EHO (RBC) on 2nd April 2020.

Receptor	Description
	However, all of these roads, with the exception of Kidmore End Road, have properties between the Application Site and the road which provide screening from any potential impacts of glare. Therefore, only road users on Kidmore End Road have been considered in this assessment. The road users of Kidmore End Road have the potential to be impacted (by glare) by the Proposed Development.
Heritage	Designated heritage features have the potential to be impacted (intrusion, glare and sky glow) by the Proposed Development. The nearest heritage assets to the Application Site are as follows: ▪ Old Grove House Grade II Listed (~128 m west) ▪ Barn to north east of Old Grove House Grade II* Listed (~154 m west) Given the distance, location of the Application Site and intervening built up area, it is not anticipated that the Proposed Development will have a material effect on lighting conditions experienced at these receptors and therefore they are not considered further within this assessment.
Ecology	Clayfield Copse Local Nature Reserve is approximately 390 m to the east of the Application Site, however due to the distance and the screening provided by residential properties between the reserve and the Application Site this is not considered to be a sensitive receptor in this assessment. The existing built structures on Application Site (existing golf clubhouse and adjacent dwelling) have negligible potential for roosting bats. Five trees on site were identified as low-high potential for roost features for bats. Bat activity has been observed within the site, including common species, with sustained foraging observed. It was concluded that the Application Site is of value to foraging/commuting bats at the local level. (Ecological Impact Assessment, The Ecology Co-op, 2021).

Table 5.4: Future Sensitive Receptors

Receptor	Description
Local Residents	New residents of the Proposed Development.
Motorist, Cyclists & Pedestrians	New internal roads within the Proposed Development.
Ecology and proposed habitats	Landscape proposals include retention of existing vegetation as well as provision of new vegetation (**Appendix B**).

6 Lighting Requirements

6.1 Introduction

6.1.1 This section outlines the minimum lighting requirements to safely and securely construct and operate the Proposed Development.

6.1.2 All external lighting will be designed in accordance with the lighting standards and guidance outlined in **Section 3.6 Lighting Standards**.

6.2 Construction Lighting

6.2.1 There will be no night-time working outside of the agreed standard working hours unless otherwise agreed with RBC for the Proposed Development. It is assumed that standard working hours for construction are:

- Monday to Friday: 8am to 6pm;
- Saturday: 8am to 1pm; and
- Sunday and bank holidays: no working.

6.2.2 Work during darkness is therefore more likely during the winter months when the days are short (sunrise ~08:00 and sunset ~16:00) and lighting is required.

6.2.3 The general lighting requirement is predictable for fixed elements of the construction works such as site offices, compounds, welfare facilities, parking areas, fuel storage areas and plant storage areas.

6.2.4 Task specific lighting to maintain safety around excavation areas, concrete pour sites and other specific activities will vary according to weather conditions, programme and the particular tasks being undertaken.

6.2.5 Lighting may also be present from construction vehicles and plant which often deploy flashing lights and strobes when operating which can cause additional adverse effects to nearby receptors.

6.3 Operational Lighting

6.3.1 Operational lighting is required throughout the Proposed Development to provide the minimum level of lighting to complete activities safely, move through the Application Site, reduce the potential for crime and meet highway safety standards.

6.3.2 This section provides an overview of the likely lighting requirement that will emerge in relation to the Application Site, although this will be confirmed during the detailed design stage.

6.3.3 **Sections 3.4 - 3.5** outline the relevant guidance and standards which has been used to inform lighting requirements for the Proposed Development and will be used to inform the subsequent lighting design.

Residential Built Development

6.3.4 Any residential development provided may be equipped with amenity lighting (e.g. bollards) and external security lighting to illuminate communal areas, footpaths, signage, storage areas and parking areas.

6.3.5 The external lighting design for roads, footpaths and public amenity areas within residential built development areas will be in accordance with BS 5489-1:2013, which provides standards for roads and public amenity areas.

6.3.6 Lighting designed to the standards set by BS 5489-1:2013 is also recommended in ILP guidance to act as a measure to reduce crime within developments.

Landscaping and Public Open Space

6.3.7 Landscaping and public open space will be provided as part of the proposal including retained green spaces from the previous golf course.

6.3.8 Some lighting may be required across these spaces in order to maintain safety and prevent crime. As a general principle, lighting in these areas should be kept low key and will only be installed where necessary in order to reduce the fear of crime and to maintain safety. Lighting within these areas will be designed in accordance with BS 5489-1:2013 which provides standards for the lighting of roads and public amenity areas.

Access, Roads and Junctions

6.3.9 The access to the Application Site will be off Kidmore End Road at the eastern corner of the Application Site, with an additional access for pedestrians and cyclists only (except in emergencies) north of the main access.

6.3.10 A new set of internal roads will be created to enable safe access to the existing highway and effective operation of the Proposed Development. This will also include pedestrian and cycle routes throughout the Application Site, as well as cycling parking provision. These routes will also require street lighting to meet the minimum requirements for safety and security.

6.3.11 Plans including the locations of the proposed lighting columns have not yet been developed but the street lighting design will be designed in accordance with the BS5489-1:2013 requirements.

6.4 Central Management Systems

6.4.1 External lighting within the Proposed Development could also be connected to a street lighting Central Management System (CMS) and remotely controlled during the night. RBC has a Mayflower CMS to control and manage street lighting within the borough. Through CMS, individual street lights can be switched on/off at specific times. ‘Part-night lighting’ refers to lights switched off between midnight and 5am, which could be implemented within the Proposed Development.

6.4.2 A dimming regime can also be used, for example reducing the light output from 75% of full power to 50% at midnight. The lighting would then be increased back to 75% output power at 5am. In doing so, certain areas can remain lit to reduce crime and provide a sense of security, whereas lighting in other areas can be dimmed down to reduce obtrusive light.

6.4.3 Maintenance is also more efficient under a CMS system, as faults are automatically registered with information on location and repairs. This will insure lighting within the Proposed Development is maintained to a satisfactory level to continue safety and comfort.

6.4.4 Lighting along the access and internal roads could also connect to RBC’s CMS to be centrally switched off or dimmed between midnight and 5am. Consideration must be given to the minimum safety standards to operate the roads safely. This option can be explored further during the detailed design stage.

6.4.5 The implementation of RBC's CMS for the Proposed Development should be considered at the detailed design stage.

7 Potential Effects

7.1 Introduction

7.1.1 This section identifies any potential effects from the exterior lighting design on the current and future sensitive receptors within and surrounding the Application Site in absence of mitigation measures.

7.1.2 Lighting during the construction phase of the Proposed development may have different effects on sensitive receptors than lighting required for the operation of the Proposed Development and therefore have been considered separately in this section.

7.1.3 For the purposes of this assessment the effects of obtrusive light have been assessed against the baseline conditions, as set out in **Section 5**.

7.2 Environmental Zone

7.2.1 As set out in **Section 5**, the desk-based review and lighting survey have indicated that the Application Site is best characterised as ILP Environmental Zone E2: Rural, which has been confirmed by RBC's Senior EHO.

7.2.2 At the time of writing, a detailed lighting scheme is not available, however given the scale and nature of the Proposed Development and it's lighting requirements, many new sources of artificial light will be introduced to an area of low district brightness. The lighting requirements for the Proposed Development are outlined in **Section 6**.

7.2.3 There is potential to change the night-time ambiance of the Application Site. If the Proposed Development is unable to observe the limitations for obtrusive light set for ILP Environmental Zone E2: Rural (outlined in **Appendix F**), this would change the classification of the Application Site to Environmental Zone E3: Suburban. The impacts of this may include greater sky glow, glare and light intrusion.

7.2.4 This can be mitigated against through a sensitive detailed lighting design. The detailed lighting design for the Proposed Development can help to minimise light intrusion and achieve the limits for E2. This is further discussed in **Section 8**.

7.3 Construction

7.3.1 Generally, construction lighting tends to lead to more obtrusive lighting than operational lighting because of its temporary nature, and the type of lighting equipment used. For ease of deployment and use, construction lighting tends to be mobile, and focus on providing the widest coverage of light from the fewest possible units; in order to minimise time spent maintaining and installing the equipment. This, along with the fact that it is often poorly directed or installed, can result in temporary effects of glare, light intrusion and sky glow if good practice measures are not employed.

7.3.2 Due to the nature of the development, some dwellings may be occupied whilst others are being constructed. Therefore, potential effects of temporary construction lighting may therefore affect both existing sensitive receptors outside the Proposed Development (as set out in **Table 5.3**) and future sensitive receptors within the Proposed Development (as set out in **Table 5.4**).

7.3.3 Lighting associated with construction vehicles can similarly result in adverse effects for similar reasons. In addition, vehicles often deploy flashing lights and strobes when operating which can cause additional adverse effects because of the proximity of the Application Site to occupied dwellings to the north east, east, south and west of the Application Site. It may also have an impact on future residential receptors that occupy dwellings whilst construction is still taking place on site.

7.3.4 It is therefore anticipated that lighting during the construction will result in a temporary **Moderate Adverse** effect (without mitigation) during the construction phase.

7.3.5 It is anticipated that any potential effects from obtrusive light associated with construction phase lighting can be mitigated through employment of best practice measures. Management measures to control and thereby mitigate the effects of artificial lighting which can be adopted during construction are described in **Chapter 8**.

7.4 Operation

7.4.1 Potential effects of obtrusive light from the operational development may affect both existing sensitive receptors outside the Proposed Development (as set out in **Table 5.3**) and future sensitive receptors within the Proposed Development (as set out in **Table 5.4**). These are set out below.

7.4.2 The development proposals include the demolition of the existing RGC clubhouse and car park. Therefore, the obtrusive light caused by these structures as described in **Section 5.2** (e.g. minor glare from the bollard lighting) will not exist during the operation of the development. Therefore, the obtrusive light from these structures is not considered further in this assessment.

Existing Residents (near to the Application Site)

7.4.3 Residential receptors on Brooklyn Drive, Kidmore End Road, Lyefield Court, Gorselands and Eric Avenue have the potential to be affected by light intrusion from proposed street lighting and external security and amenity lighting (in the absence of mitigation). There is also potential for there to be adverse effects from glare from security and amenity lighting where this is not properly installed or maintained.

7.4.4 It is therefore anticipated that there may be a **Moderate Adverse** effect on these residential receptors without mitigation.

Existing Residents (distant)

7.4.5 More distant residential receptors within Emmer Green beyond the residential receptors listed above are likely to be screened by intervening properties and so are unlikely to be affected by light intrusion or glare. However, they may notice a change in the night-time scene towards the existing golf club site where there are currently limited light sources.

7.4.6 Given the nature of the Proposed Development, it is anticipated that there would be a perceivable change in the level of sky glow experienced by residential receptors.

7.4.7 It is therefore anticipated that there will be a **Minor Adverse** effect on these residential receptors without mitigation.

Future Residents

7.4.8 The lighting baseline survey showed that there is minimal light spill from the surrounding area on to the Application Site. However, there were instances of minor glare from distant LED street lighting from surrounding roads, including Kidmore End Road, Eric Avenue, Gorselands

and Grove Road. Without proper mitigation, there is potential for future residents to be impacted by existing obtrusive light from the surrounding area.

7.4.9 The location of new lighting within the Proposed Development (e.g. street lighting) has the potential to negatively impact new residents where it is installed adjacent to, or directed into, bedroom windows. During the detailed design stage, consideration will be given to the siting of lighting to reduce potential for disturbance to residents.

7.4.10 It is therefore anticipated that there may be a **Moderate Adverse** effect on future residential receptors without mitigation.

Motorists, Cyclists & Pedestrians (Existing and Future)

7.4.11 Effects of obtrusive light to road users are primarily related to glare. Disability glare reduces the contrast between objects and their background such that their visibility is decreased. Glare can also impact pedestrians and cyclists although this is not as critical as for motorists, because speed of movement is much lower, giving a greater reaction time[4].

7.4.12 Street lighting within the Proposed Development will be designed to adoptable standards and therefore it is not anticipated that this will have an adverse effect to drivers on Brooklyn Drive, Kidmore End Road, Lyefield Court, Gorselands and Eric Avenue or future road users within the Proposed Development.

7.4.13 Where lighting is required at the new access point on Kidmore End Road at the south east of the Application Site, cyclists and pedestrians using Kidmore End Road are likely to notice an increase in light levels experienced as currently the entrance to the existing RGC clubhouse is within the vicinity, and this is lit by 1 m high bollard lighting within the RGC car park.

7.4.14 It is therefore anticipated that there will be a **Minor Adverse** effect on existing road users of Kidmore End Road.

Ecology (Existing and Future)

7.4.15 An Ecology Chapter has been submitted in support of this application, which outlines the ecological assessment in full (prepared by The Ecology Co-op, 2021).

7.4.16 Demolition of the buildings will have no foreseeable impacts on bats given the unsuitability of the structures to function as roosts.

7.4.17 Several mature trees along the Application Site boundary were identified as having bat roost potential. These trees will be retained under the development proposals and therefore have no direct foreseeable impact on bat roosts in trees.

7.4.18 Further to the retained vegetation, there will be additional planting, which will provide new areas of habitat. This includes proposed bolster hedge planting along the north and west boundaries which will help limit obtrusive lighting impacts on surrounding sensitive receptors.

[4] BS EN 5489-1:2013 Code of Practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas.

7.4.19 However, there is potential for future light sensitive ecological receptors, which will be supported by the new habitat, to be disturbed by intrusive lighting associated with the Proposed Development where they are in close proximity to built up areas or roads with street lighting.

7.4.20 Light intrusion from external lighting onto the retained trees identified as having bat roost potential can cause disturbance and impact bat behaviour, as bats will typically avoid well-lit areas. In the absence of mitigation, there is therefore potential for there to be a **Minor Adverse** effect to bats.

7.4.21 A wildlife sensitive lighting design will be required to reduce potential adverse effects from street lighting; and security and amenity lighting from buildings and structures. Further information on the proposed mitigation measures are outlined in **Section 8.3.**

8 Mitigation Measures

8.1 Introduction

8.1.1 This section sets out measures to mitigate potential impacts (identified in **Section 7**) on sensitive receptors (identified in **Section 5**).

8.2 Environmental Zone

8.2.1 The central principle of mitigation for operational lighting of the Proposed Development is that the detailed lighting designs are kept within the limitations set for obtrusive light (see **Appendix F**) for the appropriate ILP Environmental Zone, where technically possible.

8.2.2 As noted in **Section 7.2**, this is possible to achieve through good lighting design. Good lighting design principles, such as designing in accordance with the standards outlined in **Section 3.6**, using a luminaire tilt of 0 degrees to reduce levels of upward light spill, and a dimming regime in line with RBC's requirements can help to ensure that the Proposed Development can avoid exceeding the limitations for obtrusive lighting. It is therefore anticipated that this is achievable.

8.3 Construction

8.3.1 Potential effects resulting from artificial lighting during construction can be mitigated through a range of design and control measures, including the use of shields and hoods on luminaires, appropriate timing of working hours and operation of security lighting, as well as consideration of the orientation of luminaires, and the avoidance of 'over-lighting'.

8.3.2 General principles to mitigate the adverse effects of lighting associated with construction of the Proposed Development are listed below:

- Construction lighting should be directed so it does not create light intrusion outside of the immediate working area;
- Sufficient lighting units used to avoid the need for tall, wide beam lighting units to illuminate large areas;
- Vehicle lights should be properly directed and lenses must be intact to prevent un-necessary glare and breakout of obtrusive light (this is also an MOT requirement);
- Lighting should be reduced when not required for safety purposes. Security lighting should be kept at the minimum level needed for visual and security protection;
- If appropriate, to reduce the need for fixed visible lighting outside working hours, the use of infrared flood lighting and CCTV systems should be considered for security;
- All lighting related to the works will be designed and fitted to minimise light intrusion onto surrounding woodland habitats;
- The use of visual screening, such as hoardings between more sensitive visual receptors and construction light sources in proximity to the Application Site; and
- Dark corridors should be maintained during the evening, overnight or early morning (i.e. outside approximately one hour before dusk and one hour after dawn) by avoiding light intrusion on this area.

- Consideration will also need to be given to the effect construction lighting will have on new residents on the site, preventing obtrusive light affecting the trees beyond the site boundary and the potential effects construction lighting will have on bats.

8.4 Operation

General Design Principles

8.4.1 Potential effects on sensitive receptors during operation of the completed scheme can be avoided through appropriate lighting design. Measures to mitigate potential effects such as sky glow, glare or light intrusion include the type of luminaire, as well as the design and positioning of lights (e.g. power, orientation, and height of the luminaire), the use of shields and dimming or part night lighting. The following principles should be considered during the detailed lighting design:

- Lighting should be directed away (or controlled) from the sensitive receptors identified in **Section 5.3** to prevent obtrusive light adversely affecting them;
- Minimising light break-out above the horizontal using 'full cut-off' lighting systems. This is achieved through placing lighting units correctly and also by fitting them at a height such that they can be directed downwards rather than horizontally;
- Lighting should be designed to avoid reflectance from buildings and plant – so external lighting should be mounted onto buildings or on lighting stands and directed to the area where it is needed rather than facing building facades. Surfaces should be dark in colour and uniformed, i.e. no bright concrete with preferences towards tarmac and dark paving;
- Reducing external lighting levels outside working hours (post-curfew) to levels suitable for maintaining safety and security; and
- Use of automated devices to switch lights (particularly security lighting) on and off according to activity/ambient light levels.

Ecology Design Objectives

8.4.2 Ecological design objectives to minimise the adverse effects of lighting on bats using the trees identified for potential roost features across the Application Site are listed below and will be taken into consideration during preparation of the detailed lighting design. These have been determined in accordance with BCT guidance and reflected in the Ecological Impact Assessment. The impacts on ecological receptors (bats) are detailed within the Ecological Impact Assessment.

- Avoiding lighting on key habitats and features altogether, where possible. The lighting design should be bat sensitive and allow 'dark zones' to be maintained on the identified trees along the north-western, western and southern Application Site boundaries.
- Apply mitigation to reduce lighting to agreed limits in sensitive locations. Any increase in baseline lighting levels within the 'dark zone' should be less than 0.5 lux. Where lighting is required in proximity to these habitats (e.g. for safety and security reasons), reducing light intrusion onto these areas can be facilitated by fitting lamps with hoods, cowls, louvers or shields. Consideration should be given to the use of lower level lighting columns and/or luminaries which have a lesser impact on bats, including those which have a: low or no Ultra Violet (UV) element; warm white spectrum to reduce blue light content; and/or feature peak wavelengths higher than 550 nm[5] .

[5] See Bat Conservation Trust and ILP – Bats and Artificial Lighting in the UK (2018) for further details

- The use of a Central Monitoring System (CMS) to control lighting could be used (where available) to help reduce disturbance of bat commuting and foraging corridors by enabling lighting to be dimmed or switched off in these areas during bat commuting or emergence times. This implementation of a CMS should be considered at the detailed design stage.

- Compliance with illuminance limits and buffers should be demonstrated. A lighting plan which provides modelled horizontal lux contours of external lighting within the Application Site should be used to inform the detailed lighting design to enable suitable lighting levels to be provided in areas where sensitive receptors are located. Lux contours for 0.2, 0.5, 1, 5 and 10 lux should be shown (and above this if applicable) in accordance with Bat Conservation Trust and ILP guidance (2018)[5]. Details of the ecological mitigation should be included in an Ecological Management Plan, secured by a suitable worded planning condition.

8.4.3 A lighting plan providing contours of illuminance from proposed external lighting within the Application Site will be prepared and used to inform the preliminary lighting design to enable target illuminance levels to be achieved for sensitive receptors. The preliminary lighting design will be submitted to RBC for approval at the detailed design stage.

9 Residual Effects and Conclusion

9.1 Introduction

9.1.1 This section identifies the residual obtrusive light effects from the Proposed Development and any recommendations that should be considered through the detailed design process.

9.2 Residual Effects

9.2.1 With the implementation of the proposed mitigation measures during preparation of the preliminary lighting design, it is anticipated that potential obtrusive lighting effects will be reduced so they are within guideline levels. The residual effects anticipated to sensitive receptors are outlined in **Table 9.1** below

Table 9.1: Residual Effects

Receptor	Sensitivity (i.e. intrusion, glare or sky glow)	Effect (without mitigation)	Mitigation	Residual Effect
Construction				
Local Residents (existing)	Glare, intrusion	**Moderate Adverse** effect.	Mitigation measures outlined in **Section 8.3**.	**Negligible – Minor Adverse** effect. However, effects will be temporary and primarily occur during winter months when lighting is required in the evenings due to shorter days.
Motorists, Cyclists and Pedestrians (existing)	Glare	**Moderate Adverse** effect.	Mitigation measures outlined in **Section 8.3**.	**Negligible – Minor Adverse** effect. However, effects will be temporary and primarily occur during winter months when lighting is required in the evenings due to shorter days.
Ecology (existing)	Glare, intrusion	**Moderate Adverse** effect	Mitigation measures outlined in **Section 8.3**.	**Negligible – Minor Adverse** effect. However, effects will be temporary and primarily occur during winter months when lighting is required in the evenings due to shorter days.

Operation				
Local Residents (existing)	Glare, intrusion, sky glow	**Minor – Moderate Adverse** effect.	Mitigation measures outlined in **Section 8.4**.	**Negligible** effects for intrusion and glare. **Minor Adverse** effects for sky glow.
Residents (future)	Glare, intrusion	**Moderate Adverse** effect.	Mitigation measures outlined in **Section 8.4**.	**Negligible** effects.
Motorists, Cyclists and Pedestrians (existing and future)	Glare	**Minor Adverse** effect.	Mitigation measures outlined in **Section 8.4**.	**Negligible** effects.
Ecology (existing and future)	Glare, intrusion	**Minor Adverse** effect.	Mitigation measures outlined in **Section 8.4**.	**Negligible** effects.

9.3 Conclusion

9.3.1 The site is largely dark and contains no artificial light sources as it is primarily comprised of agricultural land. The site has therefore been characterised as low level district brightness ILP Environmental Zone E2 (rural). The Proposed Development will introduce new sources of artificial lighting to this area associated with residential land uses and street lighting for safe access.

9.3.2 A number of sensitive receptors were identified within the surrounding area which may potentially be impacted by obtrusive light associated with the Proposed Development. Of the receptors identified those which are most likely to be negatively impacted by introduced sources of obtrusive light were residents located in close proximity to the site boundary on Brooklyn Drive, Kidmore End Road, Lyefield Court, Gorselands and Eric Avenue, as well as road users on Kidmore End Road.

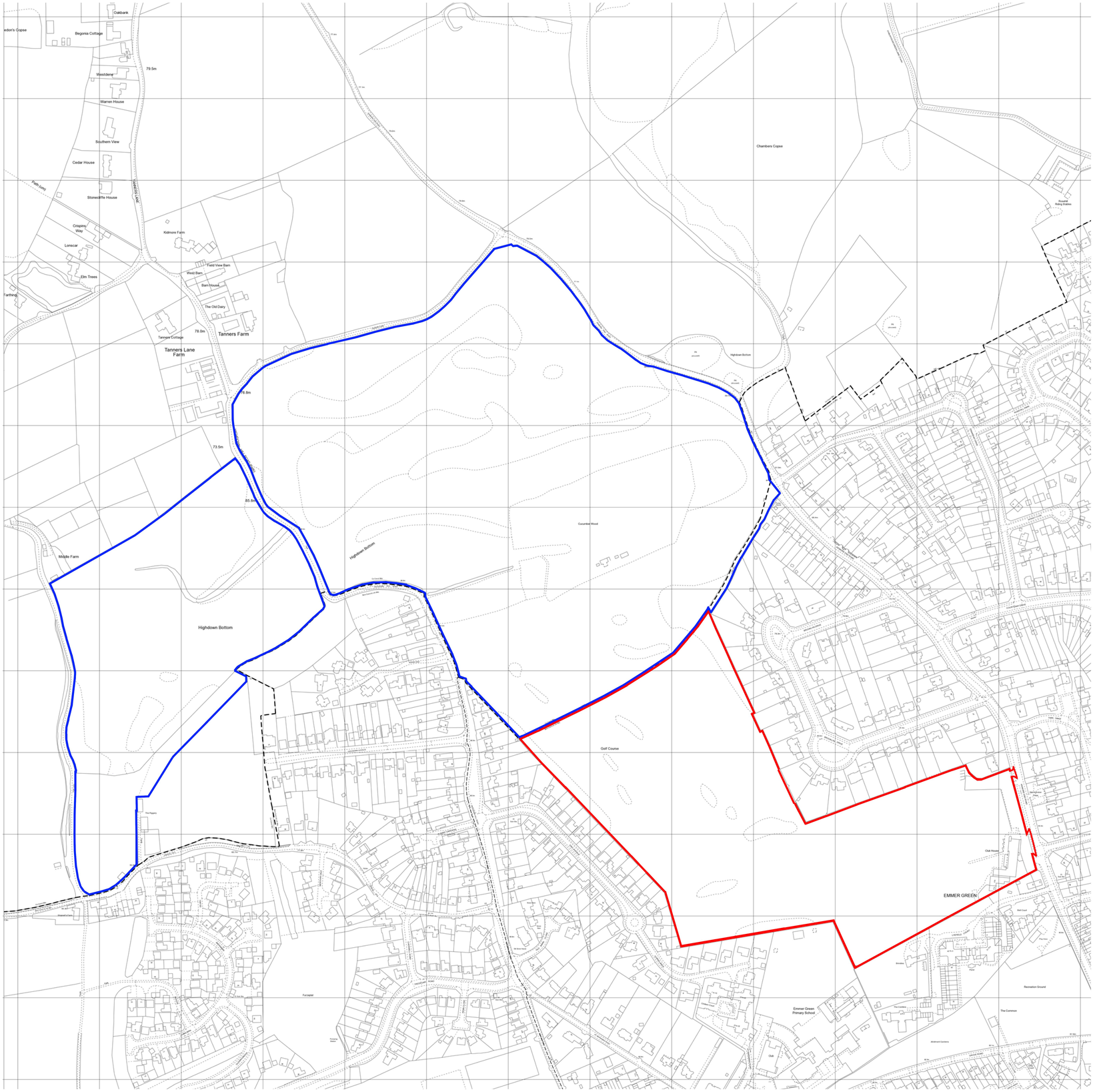
9.3.3 In addition, bats using the trees identified as potential for roosting around the site boundary, as well as using habitat within the site for foraging have the potential to be negatively affected where there is light intrusion onto this habitat.

9.3.4 Mitigation measures and general design considerations have been identified in **Section 8** which will help reduce effects associated with glare, light intrusion and sky glow to identified receptors during construction and operation to reduce potential impacts to an acceptable level. This includes targeting the lighting limitations of for ILP Environmental Zone E2 (Rural) during the detailed lighting design.

9.3.5 A preliminary lighting design will be submitted for the approval of RBC at the detailed design stage which will be informed by an illuminance contour plan of external lighting for the Proposed Development to demonstrate that obtrusive light limitations for sensitive receptors can be achieved.

9.3.6 The preliminary lighting designs will aim to provide suitable lighting for the proposed land uses to allow them to function safely and effectively, in accordance with the relevant guidance and standards and recommendations presented with this lighting assessment

Appendix A Application Site Location Plan



Metres

0 20 40 60 80 100

1:2500

Supplied by: Latitude Mapping Ltd 08 May 2018
© Crown copyright and database rights 2018 OS 100038864
Reference: OI1226899
Centre coordinates: 471350 177152

N

Fairfax

Fairfax (Reading) Ltd and Reading Golf Club Ltd

project:

Land at:

READING GOLF CLUB
KIDMORE END ROAD,
EMMER GREEN, READING

title:

LOCATION PLAN

date: May '20 **scale:** 1:2500 @ A1

drawing number:	Rev.
2036/PL.01	B

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Appendix B Framework Masterplan

Fairfax

Fairfax (Reading) Ltd and Reading Golf Club Ltd

Scale: 1 : 1000 Drn By: PjH Date: Oct '21

Drg No: 2127/PL.04 Rev.L

Project: Land at former:
READING GOLF CLUB
KIDMORE END ROAD,
EMMER GREEN, READING

Drawing Title:
SITE LAYOUT

Copyright: Paul J Hewett R.I.B.A. Chartered Architect

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Appendix C Guidance

Obtrusive Light
▪ The Institution of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light (2011); and ○ This guidance provides advice on lighting including the recommendation to local planning authorities to specify Environmental Zones for exterior lighting based on the existing external ambient lighting levels in the area. These documents also provide design guidance including maximum obtrusive (lighting pollution) lighting level limits for each environmental zone – focusing on reflected light and glare in particular. ▪ ILP Professional Lighting Guide 04: Guidance on Undertaking Environmental Lighting Impact Assessments (2013). ○ This guidance outlines good practice in lighting design and provides practical guidance on the production and assessment of lighting impacts within new developments. The guide covers guidance on undertaking lighting surveys, taking photographs and measurements at night and what to cover in a Lighting Assessment Report.

Ecological
Guidance on obtrusive light in relation to bats as issued by the Bat Conservation Trust (BCT) and Eurobats is listed below: ▪ Bat Conservation Trust and ILP – Bats and Artificial Lighting in the UK (2018); and ○ Bats and Artificial Lighting in the UK (August 2018) provides guidance on general principles of lighting to mitigate adverse effects on areas where bats are known to be present and / or commuting to feeding areas. The document sets out advice for bat workers and lighting professionals to ensure that both parties work together to achieve the most effective solution in delivering an appropriate artificial lighting solution whilst reducing the adverse effects on bats. ▪ EUROBATS Advisory Committee. Publication Series No. 8: Guidelines for Consideration of Bats in Lighting (2018). ○ In October 2018, new Eurobats guidance on bats and artificial lighting was published. This was drafted by a panel of experts including BCT and uses the currently available research and knowledge to look at solutions to avoid, mitigate and compensate the negative impacts of artificial light. It is broad international guidance that complements the nationally drafted BCT / ILP guidance.

Appendix D Illuminance (lux) Reading Locations

Stantec

Client

Fairfax (Reading) Ltd and Reading Golf Club Ltd

Reading Golf Course

Lighting Survey

0 50 100 m

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Figure 01	Rev A

Document Path: Z:\Projects\45675\02_mxd\45675_LightingAssessment.mxd

Appendix E Representative Photographs

Location 1

Description: view from the eastern corner of the Application Site, looking south to south west.

Qualitative Description of Existing Lighting

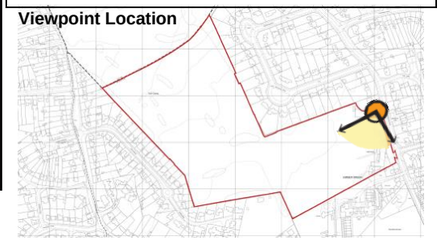
Principle Light Sources: RGC clubhouse amenity lighting and external metal halide (MH) lighting, Lyefield retirement complex amenity lighting, and distant residential amenity lighting from Eric Avenue.

Light Spill, Glare and Sky glow: minor light spill from RGC amenity lighting and glare from external MH lighting. Prominent sky glow south of Site.

Screening: mature vegetation and well-established hedgerow screens most of Kidmore End Road.

Primary Receptors: resident of adjacent dwelling, residents of Lyefield retirement complex, and foraging bats.

Viewpoint Location



Location 2 (south east facing)

Description: view from opposite Brooklyn Drive, looking south east towards RGC clubhouse

Qualitative Description of Existing Lighting

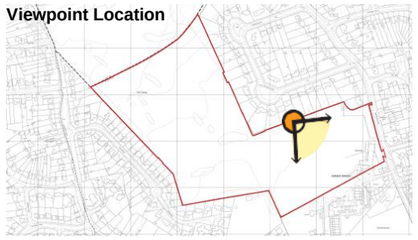
Principle Light Sources: RGC clubhouse amenity lighting and external wall mounted MH lighting. Car park bollard parking also visible to left of RGC clubhouse. Distant residential lighting from properties behind the clubhouse on Kidmore End road.

Light Spill, Glare and Sky glow: glare from RGC external MH light and car park bollard lighting. Minor light spill from RGC amenity lighting.

Screening: no screening from RGC clubhouse. Screening from residential properties on Brooklyn Drive along boundary.

Primary Receptors: resident of adjacent dwelling and foraging bats.

Viewpoint Location



Location 2 (south west facing)

Description: view from opposite Brooklyn Drive, looking south west. This is a continuation of the photograph above in Location 2 (south east facing).

Qualitative Description of Existing Lighting

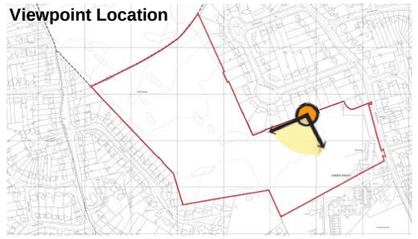
Principle Light Sources: distant residential amenity/security lighting along Gorselands and Eric Avenue.

Light Spill, Glare and Sky glow: prominent sky glow to the south of the Application Site.

Screening: good screening from mature vegetation within and along the site boundary.

Primary Receptors: Foraging bats.

Viewpoint Location



Location 3 (north facing)

Description: view from corner opposite Brooklyn Drive beneath veteran oak, looking north towards the golf course.

Qualitative Description of Existing Lighting

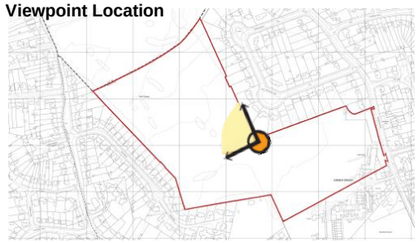
Principle Light Sources: none visible from this location.

Light Spill, Glare and Sky glow: none visible from this location.

Screening: mature vegetation within Application site, as well as within the golf course outside the boundary area.

Primary Receptors: potential roosting and foraging bats.

Viewpoint Location



Location 3 (south facing)

Description: view from corner opposite Brooklyn Drive beneath veteran oak, looking south towards Emmer Green primary school.

Qualitative Description of Existing Lighting

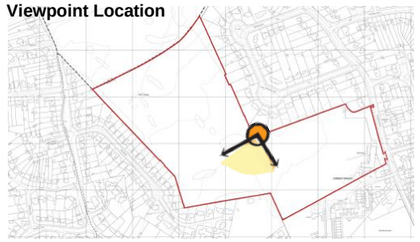
Principle Light Sources: distant Emmer Green primary school amenity lighting, residential amenity/security lighting from properties along Gorselands and Eric Avenue, distant LED street lighting along Grove Road beyond primary school and along Eric Avenue.

Light Spill, Glare and Sky glow: Glare from LED street lighting on Grove Road and Eric Avenue. Prominent sky glow to south.

Screening: mature vegetation within Application site and along south west corner boundary.

Primary Receptors: potential roosting and foraging bats.

Viewpoint Location



Location 4

Description: view from north east corner, looking west to north west

Qualitative Description of Existing Lighting

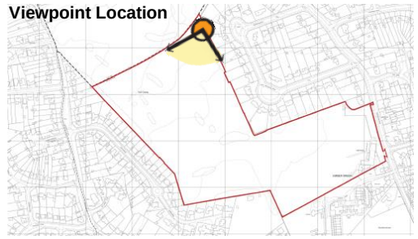
Principle Light Sources: distant residential amenity/security lighting along Gorselands, Eric Avenue and Highdown Hill Road. Distant LED street lighting along Eric Avenue.

Light Spill, Glare and Sky glow: Glare from LED street lighting along Eric Avenue. Sky glow to south and south west of site.

Screening: dense vegetation in north east corner. Heavy screening from residential properties in south due to vegetation on site and along boundary. Partial screening of residential properties along Eric Avenue and Highdown Hill Road.

Primary Receptors: Foraging bats.

Viewpoint Location



Location 5 (east facing)
Description: view from the northern boundary, looking east to properties along Brooklyn Drive.

Qualitative Description of Existing Lighting

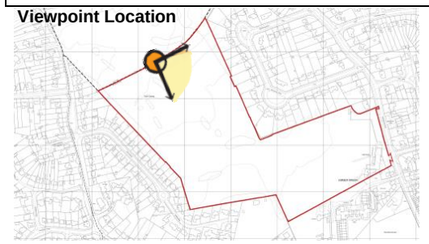
Principle Light Sources: residential amenity/security lighting from dwellings on Brooklyn Drive.

Light Spill, Glare and Sky glow: minor glare from residential lighting.

Screening: partial screening from vegetation along eastern boundary.

Primary Receptors: Foraging bats.

Viewpoint Location



Location 5 (south west facing)
Description: view from the northern boundary, looking south west towards Eric Avenue.

Qualitative Description of Existing Lighting

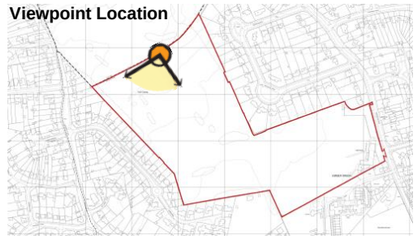
Principle Light Sources: distant amenity/security lighting from residential properties along Eric Avenue and Gorselands.

Light Spill, Glare and Sky glow: minor glare from some residential amenity/security lighting. Minor sky glow visible in south.

Screening: mature vegetation along northern part of Eric Avenue, sparser further south. Some vegetation within the site provides partial screening of properties on Gorselands.

Primary Receptors: Potential roosting and foraging bats.

Viewpoint Location



Location 6
Description: view from north west corner of Application Site, looking along the western boundary.

Qualitative Description of Existing Lighting

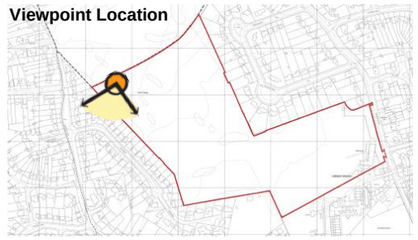
Principle Light Sources: amenity/security lighting from residential properties along Eric Avenue and Highdown Hill road.

Light Spill, Glare and Sky glow: none visible

Screening: good screening from mature vegetation along western boundary, however, it is patchy in places

Primary Receptors: Potential roosting and foraging bats.

Viewpoint Location



Location 7
Description: view from the western boundary, looking towards properties on Eric Avenue and Gorselands in the south west corner.

Qualitative Description of Existing Lighting

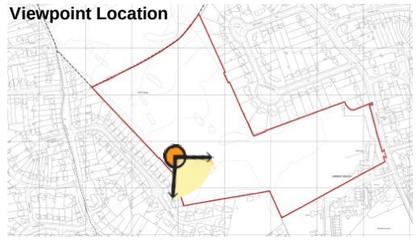
Principle Light Sources: amenity/security lighting from residential properties on Eric Avenue and Gorselands. LED street lighting also visible from these roads.

Light Spill, Glare and Sky glow: Minor glare from LED street lighting along Eric Avenue and Gorselands.

Screening: mature vegetation along western boundary provides partial screening. Very minor sky glow observed.

Primary Receptors: Potential roosting and foraging bats.

Viewpoint Location



Location 8

Description: view from the southern boundary, looking towards Emmer Green Primary School in the south.

Qualitative Description of Existing Lighting

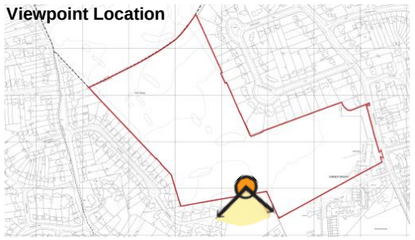
Principle Light Sources: amenity lighting from Emmer Green primary school. Distant LED street lighting visible from Grove Road beyond the primary school.

Light Spill, Glare and Sky glow: Glare from Emmer Green primary school amenity/security lighting. Glare from LED street lighting on Grove Road.

Screening: mature vegetation in south west corner, sparser along southern boundary.

Primary Receptors: Potential roosting and foraging bats.

Viewpoint Location



Location 9

Description: view from the southern boundary, looking towards RGC clubhouse and residential dwelling.

Qualitative Description of Existing Lighting

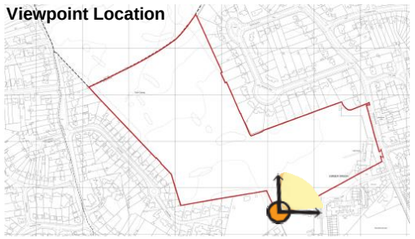
Principle Light Sources: Amenity/security lighting from RGC clubhouse and adjacent dwelling. Bollard lighting from adjacent RGC car park. Distant amenity/security lighting visible from residential properties Kidmore End Road. LED street lighting also visible from Kidmore End Road.

Light Spill, Glare and Sky glow: Distant glare from street lighting along Kidmore End Road. Glare from bollards in RGC car park.

Screening: sparse vegetation along southern boundary provides some screening from Lyefield complex. Hedgerow provides some screening from Kidmore End road.

Primary Receptors: residents of Kidmore End Road, resident of adjacent dwelling, road users of Kidmore End Road and foraging bats.

Viewpoint Location



Location 10

Description: view from the south east corner adjacent to the RGC clubhouse, looking towards RGC clubhouse and residential dwelling.

Qualitative Description of Existing Lighting

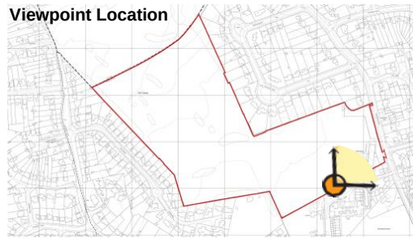
Principle Light Sources: amenity/security lighting from RGC clubhouse and adjacent dwelling. Bollard lighting from RGC adjacent car park. Distant amenity/security lighting visible from residential properties Kidmore End Road.

Light Spill, Glare and Sky glow: Glare from bollards in RGC clubhouse parking lot. Minor light spill from amenity lighting from RGC clubhouse.

Screening: no vegetation screening RGC clubhouse and adjacent dwelling.

Primary Receptors: resident of adjacent dwelling, foraging bats.

Viewpoint Location



Location 11 (entrance)

Description: view from the RGC car park, looking towards bollard lighting.

Qualitative Description of Existing Lighting

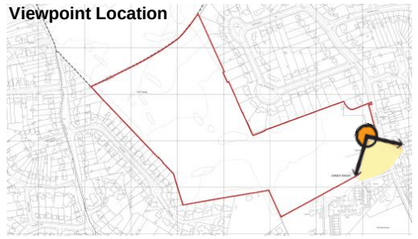
Principle Light Sources: bollard lighting in car park, amenity/security lighting from RGC clubhouse.

Light Spill, Glare and Sky glow: Minor glare from bollards. Light spill from amenity lighting from RGC clubhouse.

Screening: mature hedgerow (not in photograph) screens bollards from Kidmore End Road and properties.

Primary Receptors: residents along Kidmore End Road, road users on Kidmore End Road.

Viewpoint Location



Location 11 (Kidmore End Road)
Description: view from the RGC car park, looking towards residential properties on Kidmore End Road.

Qualitative Description of Existing Lighting

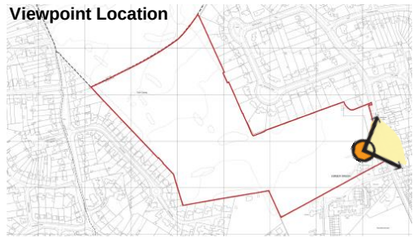
Principle Light Sources: amenity/security lighting from properties along Kidmore End Road, LED street lighting along Kidmore End Road Car headlights also visible through hedgerow.

Light Spill, Glare and Sky glow: Minor glare from LED streetlights and passing cars.

Screening: mature hedgerow partially screens Application Site.

Primary Receptors: Residents and road users of Kidmore End Road.

Viewpoint Location



Appendix F ILP Lighting Specification

Table D.1: Obtrusive Light Limitations for Exterior Lighting Installations – General Observers (ILP GN01, 2021)

Environmental Zone	Sky Glow Maximum values of upward light ratio (ULR) [URL/%] (1)	Maximum values of vertical illuminance on properties Illuminance in the vertical plane (Ev) [Lux]		Maximum permitted values of average surface Luminance(cd/m^2) (2)	
		Pre Curfew	Post Curfew	Building façade luminance	Sign luminance
E0	0	n/a	n/a	<0.1	<0.1
E1	0	2	<0.1*	<0.1	50
E2	2.5	5	1	5	400
E3	5.0	10	2	10	800
E4	15	25	5	25	1,000**

Definitions

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

Ev = **Vertical Illuminance in Lux** and is measured flat on the glazing at the centre of the window

L = **Luminance in Candelas per Square Metre Cd/m^2**

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.

(1) This does not take into account the effect of light reflected upwards from ground that also contributes to sky glow. This is the traditional method to limit sky glow and is suitable to compare different single luminaires.

(2) The values apply to both pre- and post-curfew, except that in zones 0 and 1 the values shall be zero post curfew. The values for signs do not apply to signs for traffic control purposes

* If the installation is for public (road) lighting then this may be up to 1 lx.

***This figure has been amended to correct the decimal noted in the guidance document

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP GN01:2021

Table D.2: Obtrusive Light Limitations for Exterior Lighting Installations (Upward Flux Ration) – General Observer

Environmental Zone	Type of Installation		
	Road	Amenity	Sport
E0	n/a	n/a	n/a
E1	2	n/a	n/a
E2	5	6	2
E3	8	12	6
E4	12	35	15

This table allows the effect of both direct and reflected upward components of a whole installation to be taken into account. The factor being the upward flux ratio (UFR) and CIE 150 suggests that table 7 is used for all installations consisting of four or more luminaires.

Clauses 6.4.2 and 6.4.3 of CIE 150:2017 describe the calculation methods for both ULP and UFR. Light emitted just above the horizontal in a zone between 90º and 110º is extra critical for sky glow in large open areas around observatories

An additional measure in these areas limits the luminous intensities (I_{90} – I_{110}) as follows:

- between 90° and 100° < 0.5 cd/1000lm;
- between 100° and 110° 0 cd.

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2021

Table D.3: Obtrusive Light Limitation for Exterior Lighting Installations – Limits for the Luminous Intensity of Bright Luminaires - General Observer

Light technical parameter	**Application Conditions**	**Luminaire group (projected area Ap in m2)**					
		0< Ap ≤ 0.002	0.002 <Ap ≤ 0.01	0.01 <Ap ≤ 0.03	0.03 <Ap ≤ 0.13	0.13 <Ap ≤ 0.50	Ap ≥0.5
Maximum luminous intensity emitted by luminaire (I in cd)	E0						
	Pre-Curfew	0	0	0	0	0	0
	Post Curfew	0	0	0	0	0	0
	E1						
	Pre-Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
	Post Curfew	0	0	0	0	0	0
	E2						
	Pre-Curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10.0 *d*	7,500
	Post Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500
	E3						
	Pre-Curfew	0.86 *d*	1.9 *d*	3.8 *d*	7.5 *d*	15 *d*	10,000*
	Post Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	1,000
	E4						
	Pre-Curfew	1.4 *d*	3.1 *d*	6.3 *d*	13 *d*	26 *d*	25,000
	Post Curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
Aid to gauging Ap		2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding Ap representative area (m^2)		0.0008	0.004	0.016	0.063	0.251	>0.5

Notes:

1. d is the distance between the observer and the glare source in metres;
2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cutoff in the designated directions;
3. Ap is the apparent surface of the light source seen from the observer position
4. For further information refer to Annex C of CIE 150
5. Upper limits for each zone shall be taken as those with column Ap>0.5

*This figure has been amended to correct the decimal noted in the guidance document

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2021

Table D.4: Obtrusive Light Limitation for Exterior Lighting Installations – Road Users

Road Classification (1)	Threshold Increment (TI)	Veiling Luminance (L_v) (2)
No road lighting	15% based on adaptation luminance of 0.1cd/m^2	0.037 cd/m^2
M6/M5	15% based on adaptation luminance of 1.0cd/m^2	0.23 cd/m^2
M4/M3	15% based on adaptation luminance of 2.0cd/m	0.40 cd/m^2
M2/M1	15% based on adaptation luminance of .05cd/m^2	0.84 cd/m^2

TI = The measure of disability glare (the reduction in visibility caused by intense light sources in the field of view) expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare

Lv = The luminance that would need to be superimposed on a scene in object space to reduce the scene's contrast by an amount equal to the added retinal illuminance from scattered light on the scene's retinal image. It is most commonly used to describe the contrast-reducing effect of a glare source in the field of view.

(1) Road classifications as given in CIE 115:2010
(2) The veiling luminance values specified in this table are based upon on a permissible TI value of 15%

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2021