Bradford on Avon

Draft Lighting Strategy

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1 INTRODUCTION

1.1 BACKGROUND

Human evolution has taken advantage of daylight to complete the vast majority of activities with the support of sunlight. Indeed, typically we seek rest and sleep during the hours of darkness and the essential health benefits of adapting to this diurnal rhythm is very well documented. Plants and animals have responded to the natural diurnal rhythm of light and dark throughout evolution. For millennia, however, humans have also sought to create the ability to introduce light during the hours of darkness, or inside dwellings and other structures, or to improve safety and security and to carry out tasks at night, where this provides a level of advantage. From flickering light created from open fires, torches, candles, oil and gas lamps, and the invention of the electric light bulb, to the orange hue of orange sodium streetlamps, and the advent of Light Emitting Diode (LED) lighting, humans have also evolved alongside the invention, development and proliferation of artificial lighting at night or ALAN.

ALAN has multiple positive benefits, but if inappropriately designed, positioned and used, can result in negative consequences for the natural world as well as for humans.

Concern about light pollution arising from ALAN has risen over the past few decades, as human populations and settlements and infrastructure increase (with the associated increase in need for ALAN). Gaston et al (2014) cite that globally there are more than 100 million streetlights (which will have increased over the last decade).

A fundamental change in widespread lighting technology is also underway, with the introduction of LED within buildings and to illuminate roads, paths and buildings. UK Government provides guidance[1] on the appropriate use of lighting (with respect to aspects such as planning and development), alongside a wide range of other organisations[2] such as the Institute of Lighting Engineers (ILE) and the The Chartered Institution of Building Services Engineers. Local Planning Authorities such as Wiltshire Council take this and other policy and best practice (including the negative effects of ALAN on people and the natural environment) into account when determining planning applications. In addition, Wiltshire Council (responsible for most street lighting) is investing in the conversion of its street lighting to LED lighting. The older types of lights are going out of production and the cost of energy is becoming prohibitive. The new lights are much more energy efficient and have a reduced carbon footprint.

Bradford on Avon Town Council (BOATC), in its role as community leader, Parish Council and statutory consultee on planning applications, role though the local Neighbourhood Plan, owner and operator of a range of buildings and amenity facilities within the town, and in response to its declaration of both climate and biodiversity emergencies, has expressed its concern about the potential effects of ALAN and the critical need to ensure it is both appropriate and does not result in significant negative effects.

The dominant source of ALAN in Bradford on Avon is associated with street (and path) lighting and residential lighting. Other lighting provision in the town is typically associated with businesses (e.g. shop fronts and security), other organisations such as schools, sports clubs and social venues, as well as local residents. BOATC has some external lighting on its land and buildings, and maintains green space in the town (which is typically dark). This ALAN provides a wide range of benefits to residents and visitors including in terms of safety, wayfinding, security, sports and amenity, arts and heritage and domestic use.

[1] https://www.gov.uk/guidance/light-pollution (accessed on 17/03/22)
[2] More information on these organisations and relevant technical references will be provided elsewhere in this document.

Bradford on Avon is also home to a rich biodiversity including a wide range of nocturnal wildlife that uses the green and blue spaces that lead to, from and across the town including the River Avon, Kennet and Avon Canal, woodlands, grasslands (including parks, verges and less formal open spaces), and gardens. Some of these areas are themselves protected in terms of legislation and policy, as well as legal and policy protection for a range of nocturnal species such as bats, owls and other birds, badger, hedgehog, fish, amphibians and invertebrates.

Figure 1.1 provides an overview of the Bradford on Avon Parish boundary and surrounds, highlighting the urban and rural/green space components.

Consequently, BOATC has commissioned this independent report to provide relevant information on ALAN, both generally, and specifically (in relation to both positive and potential negative effects on humans and the natural environment in Bradford on Avon). It will inform and help develop new and support existing policy, to act as a source of best practice reference (to BOATC and the community), highlight opportunities where improvements in ALAN could be made. It will support BOATC in promoting how it can influence the positive role of ALAN in the town, whilst safeguarding biodiversity and supporting its aims in restoring nature.

1.2 AIMS OF THIS REPORT

- To deliver a Lighting Strategy for Bradford on Avon, and to help guide action towards BOATC's Climate and Ecological Emergency (C&EE) and its C&EE Strategy.
- The Lighting Strategy will consider ecology, alongside other needs relating to lighting in the parish such as street lighting and other lighting for property security, personal safety, perception of personal safety, sustainable travel, heritage, sport, leisure and tourism.
- The Strategy will recommend actions BOATC can take itself, or influence others to improve lighting and its impact in the parish.
- It will provide guidelines to inform local planning applications and new developments.
- To inform updates into any Neighbourhood Plan revisions such as key green corridors.

1.3 HOW TO USE THIS REPORT

The remainder of this report is structured as follows:

- Section 2: Context
- Section 3: Methodology
- Section 4: Outputs - Literature Review
- Section 5: Outputs - Field Based Assessment
- Section 6: Best Practice and Design Opportunities
- Section 7: Analysis and Recommendations
- Section 7: Conclusions and Next Steps

This document also provides a number of Appendices containing wider supporting information.

Appendix A contains a bibliography of material referred to.
Appendix B contains desk study data relating to bats in Bradford on Avon
Appendix C contains a photographic gazetteer of lighting in Bradford on Avon
Appendix D contains the data collected from the field survey of ALAN in Bradford on Avon
Appendix E presents a draft BOATC Lighting Policy

Appendix F contains draft BOATC lighting and planning template responses
Appendix G contains larger scale versions of key plans included in the main body of the document.
Appendix H contains a copy of text to be used in a leaflet/website pages produced to inform residents and business owners.

Figure 1.1: Map of Bradford on Avon - the aerial image background shows the urban and green spaces, with lighting typically associated with urban streets

2 CONTEXT

2.1 OVERVIEW OF THE NEED FOR ARTIFICIAL LIGHTING: PEOPLE BASED

Natural lighting plays a key role in the everyday activities and tasks undertaken by humans, however, not everyone around the world experiences long sunlit days, natural light is not always sufficient or appropriate and humans undertake a vast range of activities at night. Artificial lighting at night is therefore essential in certain locations and for certain activities. Humans have transformed the outdoor night-time light environment in terms of natural cycles of light and darkness that have been consistent over geological periods of time. Typically, lighting is associated with public and private lighting sources associated with street lighting, architectural lighting, security lighting, domestic lighting, and vehicle lighting.

Rich and Longcore (2006) identify that a full moon on a cloudless night give an illuminance of the order of 0.1lux and on a moonless and overcast night this reduces to 0.0001 lux. This natural lighting at night is not sufficient to support the broad range of activities that occur or help minimise the potential for undesired events. Kyba *et al* (2011) highlight that direct lighting immediately under streetlamps is typically around 40 lux (higher for some sources) and remains about 1 lux several meters away. In addition, lighting can be reflected further away (e.g. under wet conditions) and sky glow (when artificial light is scattered in the lower atmosphere) is the equivalent (or even an order of magnitude higher) to high elevation summer moonlight in cloudy urban areas.

A balance needs to be struck between providing sufficient lighting, appropriately designed for a range of activities in the most suitable locations. A proliferation of poorly designed lighting has a range of undesirable effects which are explored further in Section 2.3.

Key drivers for the use of artificial lighting at night are outlined here.

- Safe navigation and access at night: The appropriate location of lighting assists humans to navigate and travel (by foot, bike or motorised vehicle) during the hours of darkness. Lighting allows for the recognition of key features and waymarks, the ability to read signs and directions, negotiate changes in direction, gradient and surface.
- Avoiding/minimising vehicle accidents/collisions is an important factor in providing artificial lighting at night. It will help avoid obstacles, hazards buildings and other vehicles/people and animals. This is particularly important in urban areas and where vehicles are travelling as speed.
- Lighting is often associated with measures to reduce or prevent crime. Lighting is therefore often located outside (and inside) buildings, car parks and other infrastructure, together with roads, pavements, and certain footpaths. Lighting can be used to permanently illuminate an area during the hours of darkness or timed/triggered by a range of sensors, most typically, passive infra-red (PIR).
- Lighting can also alleviate the fear of crime and encourage communities and individuals to undertake activities or walk/cycle at night instead of resorting to vehicle use.
- Artificial lighting is used to extend the opportunity to extend the time when activities can be undertaken during the day. This can include sitting outside for food and other social activities, playing sport, music concerts and theatre.
- Lighting is also used for aesthetic and architectural purposes. Well-designed lighting can transform the appearance of a building, trees and other features or simply highlight their presence. This can be a transformative act helping to enrich the setting and heritage of a place.

- Businesses and other organisations use lighting in a promotional manner which can include illuminating shop fronts/interiors, lighting billboards or other signage and directing people to their locations.
- Residential buildings are lit at night, both internally and often externally. Internal lighting can illuminate local external areas, and external lighting can illuminate both the building but is sometimes located away from a building to illuminate a driveway, entrance, or trees etc.

2.2 KEY LEGAL AND POLICY DRIVERS

There is legislation, policy and best practice that help inform and guide the appropriate use of lighting. This includes domestic legislation, national and local planning policy, alongside technical guidance on the design, specification, installation, and use of artificial lighting at night and best practice to minimise negative effects on people and the environment. This topic is explored further in Section 4.1.

2.3 POTENTIAL NEGATIVE EFFECTS FROM ARTIFICIAL LIGHTING

There are a number of negative effects associated with artificial lighting at night that cause concern for a large number of people. It is not unexpected that this is complex and different aspects cause different level of concern to different people, alongside effects to the environment/wildlife.

Health concerns

It has been reported that exposure to artificial light at night (ALAN) may cause negative health effects, such as weight gain, circadian phase disruption and sleep disorders. YongMin Cho et al (2015) reviewed the literature assessing the effects of human exposure to ALAN in order to list the health effects of various aspects of ALAN. Several electronic databases were searched for articles, published through August 2014, related to assessing the effects of exposure to ALAN on human health; these also included the details of experiments on such exposure. A total of 85 articles were included in the review. Several observational studies indicated that outdoor ALAN levels could be a risk factor for breast cancer and reported that indoor light intensity and individual lighting habits were relevant to this risk. Exposure to artificial bright light during the night time suppresses melatonin secretion, increases sleep onset latency (SOL) and increases alertness. Circadian misalignment caused by chronic ALAN exposure may have negative effects on the psychological, cardiovascular and/or metabolic functions. ALAN also causes circadian phase disruption, which increases with longer duration of exposure and with exposure later in the evening.

Light is made up of wavelengths of light, and each wavelength is a particular colour. The colour we see is a result of which wavelengths are reflected back to our eyes. It has also been reported that shorter wavelengths of light preferentially disturb melatonin secretion and cause circadian phase shifts, even if the light is not bright.

Nuisance

Artificial lighting at night can cause a nuisance that in some cases can be enforced against by local Councils. The Government sets out some helpful information on this.

Councils must look into complaints about artificial light from premises if the light could be classed as a 'statutory nuisance' (covered by the Environmental Protection Act 1990).

- For the artificial light to count as a statutory nuisance it must do one of the following:
- unreasonably and substantially interfere with the use or enjoyment of a home or other premises injure health or be likely to injure health

If they agree that a statutory nuisance is happening, has happened or will happen in the future, councils must serve an abatement notice. This requires whoever's responsible to stop or restrict the light. The notice will usually be served on the person responsible but can also be served on the owner or occupier of the premises. Natural light is not covered by statutory nuisance laws.

The following can cause an artificial light nuisance if they're not maintained or used properly:

- security lights (domestic and commercial)
- sports facilities (like floodlit football pitches)
- decorative lighting of buildings or landscapes
- laser shows and light art

Statutory nuisance laws don't apply to artificial light from:

- airports
- harbours
- railway premises
- tramway premises
- bus stations
- public transport operating centres
- goods vehicle operating centres
- lighthouses
- prisons
- defence premises like army bases
- premises occupied by visiting armed forces
- street lights – if there is a perceived/actual problem with street lighting it can be reported to Wiltshire Council.

If a business, trade, industrial or sports club premises is served with an abatement notice and they've used the best practicable means to stop or reduce the light nuisance, they may be able to use this as one of the following:

- grounds for appeal against the abatement notice
- a defence, if prosecuted for not complying with the abatement notice

When looking into complaints about potential light nuisances, councils can assess one or more of the following:

- whether it interferes with the use of a property
- whether it may affect health
- how it's likely to affect the average person (unusual sensitivities aren't included)
- how often it happens
- how long it lasts
- when it happens
- whether it's in the town or country

There are no set levels for light to be considered a statutory nuisance.

Change in character/urbanisation

Artificial lighting at night has implications for the setting and character of an area. It can introduce a more urban / industrialised feel to a previously darker and more rural or heritage led area, the lighting colour and intensity can change (e.g. from orange sodium lighting to white LED). People feel differently about such changes, some feeling positive and some feeling negative and concerned. The introduction of lighting can make people feel safer and more empowered to be outside at night, whilst other people feel passionate about retaining dark spaces. Modern lighting provides the opportunity to introduce a range of controls on artificial lighting to help address a range of concerns. Advantage should be taken over the use of appropriate lighting design and controls.

Impacts on wildlife

Evolution of life on our planet has been led by natural cycles of dark and light. A wide range of animals are nocturnal and rely on dark conditions for a range of physiological and behavioural functions. The introduction and growth of artificial lighting at night disrupts these, with a range of observed consequences for wildlife. This is addressed more fully in Section 4.2 of this document.

Energy/carbon and cost

The provision of artificial lighting requires electricity, and in many cases the generation of this will not be from a carbon neutral source such as solar, wind or hydropower. As such there is a carbon cost to the provision of artificial lighting at night. The proliferation of artificial lighting at night therefore increases energy consumption and carbon emissions. Another considerable concern is the cost of the energy consumed. More information on this topic is provided in Section 4.4 of this document.

2.4 GENERAL USERS OF ARTIFICAL LIGHTING IN BRADFORD ON AVON

Everyone living, working, visiting or travelling through Broadford on Avon will use/benefit from artificial lighting at night in some form. This includes:

- residents e.g. walking through the town, to home at night or to and from their mode of transport (if relevant); workers walking through the town, to and from work and to their mode of transport home;
- children and adults taking part in, supporting or supervising those undertaking a range of sports activities including football, bowls, swimming, tennis;
- parents taking and collecting children to and from school and nursery;
- children walking to and from school, or to visit friends or to clubs; adults walking to social activities/to and from friends and family; adults driving through or around the town;
- cyclists moving through and around the town;
- emergency services responding to incidents; residents and visitors appreciating the aesthetical/architectural lighting provided to highlight significant trees in the town centre and key buildings along the valley side;
- people enjoying eating and drinking outside alongside staff working at these establishments.

The list of users and variety of uses is extensive.

2.5 SUMMARY OF PROVISION OF ARTIFICAL LIGHTING IN BRADFORD ON AVON

The majority of the primary and secondary roads (including residential streets) in Bradford on Avon are furnished with street lighting. Most are on individual poles, but some are mounted on buildings. These provide illumination of the roads and pavements. In additional there is also lighting provided to illustrate certain, or part of key paths through the town.

Certain areas of green space have aesthetic/architectural lighting (e.g. Westbury Gardens), alongside architectural lighting of some buildings such as Holy Trinity Church, St Margaret's Hall and the Saxon Chapel of St Laurence, St. Mary Tory. Lighting is provided at Bradford on Avon Train Station, the central car park and the Sainsbury's car park, together with St Margaret's car park.

Many shops/businesses retain illumination of shop fronts/display or signage at night. This is provided for promotional purposes or as part of security measures, and occasionally to help support access.

Bradford on Avon Football Club has large floodlights that are periodically used.

Dwellings in Bradford on Avon have internal lighting which spills out beyond the buildings when curtains/blinds are not used. Artificial lighting is used to highlight features of dwellings (aesthetics), or entrances, pathways and as security measures (typically timed and triggered by passive infra-red detectors).

Notwithstanding this, there remains a sizeable part of the urban component of Bradford on Avon that is currently unlit. This includes private gardens, certain roads, paths and car parks, certain businesses/other buildings, parks, the canal towpath and river, the majority of the railway corridor, and other sizeable greenspaces including the former golf club and farmland.

2.6 OVERVIEW OF LIGHTING, NOCTURNAL WILDLIFE AND NATURE RECOVERY

Wildlife can affect nocturnal wildlife in a number of different ways. Two key areas of effect are related to disorientation and attraction/repulsion. The addition of artificial lighting to an environment can affect foraging and reproductive behaviour, predator-prey interactions, habitat use, community structure and physiology. An example of this is where bats have shown a change in foraging behaviour, flight routes and evening emergence times in response to artificial lighting. There is a considerable body of academic evidence relating to this (e.g. Stone et al, 2009; Longcore and Rich, 2004, Corre et al 2002; Biere, 2002; Perry and Fisher, 2005 and Bat Conservation Trust, 2018).

It is likely that effects of artificial lighting at night are species specific and associated with the role that ambient lighting plays on physiology and behaviour and the type of artificial lighting used in a specific location.

With such a range of fundamental effects on wildlife, it is critical that appropriate measures are introduced to consider the need for lighting, the best design and location for lighting and the ability to control lighting in a way that is compatible with nocturnal wildlife.

With an ever-growing population and increase in urban living, it is critical to understand the implications of artificial lighting at night on people and the environment to ensure nature conservation and recovery can go hand in hand with the necessary provision of artificial lighting that humans require. This is reflected in the Government's objective for halting the biodiversity crisis and driving forward nature recovery as set out in Stone et al, 2009; Longcore and Rich, 2004, Corre et al 2002; Biere, 2002; Perry and Fisher, 2005 and Bat Conservation Trust, 2018, the Environment Act 2021, other legislation and associated mechanisms.

3 METHODOLOGY

3.1 DATA GATHERING

A broad range of information has been used to inform this document and these are set out below.

3.1.1 Literature Review

Information was derived from the following sources of information:

- Summary of national and local legal and planning policy on ALAN
- Summary of ecological impact of ALAN, including bats as well as other species and habitats
- Summary of other factors relating to ALAN, including property, security, personal safety, the perception of personal safety, sustainable transport, heritage, sport, leisure and tourism
- Summary of carbon impact on ALAN, including energy saving and considering Wiltshire Council's LED street lighting programme
- Summary of best practice on ALAN from elsewhere in the Bath and Bradford on Avon Bat SAC and on design principals including from the ILE and from BCT.

Bats are frequently used as a bioindicator or a 'canary in a coal mine' due to their position near the top of the food chain and their sensitivity to a number of environmental factors. There have been more studies on the effects of lighting on bats than other nocturnal animals and there have been a high number of bat activity surveys and monitoring surveys conducted in and around Bradford on Avon due to the presence of the Bath and Bradford on Avon Bats Special Area of Conservation (SAC) and constituent Sites of Special Scientific Interest (SSSI) and the legal requirement to maintain the conservation status of the SAC. As a result, understanding critical areas for bats within the town is considered essential but also will act as a surrogate for a wide range of other nocturnal animals.

A desk study has been conducted to investigate the location of known bat roosts and flight paths within BoA. A summary of the results is provided in Appendix B. The following sources of information have informed the plan:

- Professor Fiona Matthews, University of Sussex, who has conducted many years of research into bats in and around Bradford on Avon;
- Wiltshire and Swindon Biological Records Centre (WSBRC) data search for key species (Bechstein's, greater horseshoe and lesser horseshoe bats) conducted in 2020;
- A review of bat survey reports produced in support of planning applications within Bradford on Avon; and
- Preliminary Ecological Appraisal Reports produced for key areas in Bradford on Avon by Ecosulis Ltd in 2020.

3.1.2 Wiltshire Council Lighting Locations and Specifications

Wiltshire Council / Atkins provided information on the location, distribution and type of street lighting. These were mapped in ArcGIS Pro to produce a street lighting location plan. An Excel spreadsheet was made available that included the technical details of each light including road name, unit number, unique ID, road information, information on conservation area and AONB, whether LED or heritage luminares already installed, number of LEDs, luminaire output, estimated minimum dim lumen output. Using this information (which is kept up to date by Wiltshire Council and Atkins), Bradford on Avon Town Council would be able to identify specific streetlighting that is considered to be unsuitable or in need of improvement.

More recent development e.g. that around the eastern margins of the town either side of the B3107 is not included on the data provided at the time of writing. These areas were included in the field survey.

3.1.3 BoATC External Lighting Locations and Specifications

Bradford on Avon Town Council has provided information the lighting current installed and operated at premises and locations it owns/controls.

Table 1: BoATC External Lighting Locations and Specifications

• Location of Lighting	• Appendix G Figure Ref J00730-012A & B	• Lighting Recommendations
• Barton Farm	• BAR01	• Replace light with warm LED lights. • Use motion sensor with a 1 minute duration. • Reduce height of light. • Avoid blue-white short wavelength light.
• Cemetery	• CEM01	• Remove light if possible or: • Use a motion sensor. • Replace light with warm LED lights. • Avoid blue-white short wavelength light.
• Culver Close	• CUL01-04	• Replace lights with warm LED lights. • Continue using motion sensors which are well aimed and on short 1 minute duration. • Avoid blue-white short wavelength light. • Use hoods, cowls and make uni-directional keep in a downwards direction.
• Kingston House	• KIN01	• Replace light with warm LED light with a hood/cowl and make uni-directional. • Avoid blue-white short wavelength light. • Use a motion sensor with a 1 minute duration.
• Poulton	• POU01	• Replace light with warm LED light with a hood/cowl and make uni-directional. • Avoid blue-white short wavelength light. • Use a motion sensor with a 1 minute duration.
• Scout Hut	• SCO01	• Remove lights 01 and 03 • Reduce height of light 01

		• Replace light with warm LED light with a hood/cowl and make uni-directional. • Avoid blue-white short wavelength light. • Use a motion sensor with a 1 minute duration. • Relace lights 04 to 06 with warm LED light with a hood/cowl and make uni-directional.
• St Margaret's Hall (SMH)	• SMH01	• Remove uplighters on lights 01-04. • Relace lights 05 and 06 with warm LED light with a hood/cowl and make uni-directional. • Lower height of light 06. • Remove light 07. • Remove lights 08 to 10 or replace with warm LED lights • Avoid blue-white short wavelength light.
• St. Margaret's Toilets (SMT)	• SMT01	• Replace lights 01 to 03 or replace with warm LED lights • Avoid blue-white short wavelength light. • Replace lights with down pointing lights.
• Tourist Information Centre (TIC)	• TIC01	• Replace lights 01 to 06 with warm LED lights. • Use motion sensors which are well aimed and on short 1 minute duration. • Avoid blue-white short wavelength light. • Use hoods, cowls and make uni-directional keep in a downwards direction.
• Victory Field	• VIC01	• Replace lights 2 and 3 with one warm LED light • Replace lights 4 and 5 with one warm LED light • Use motion sensors which are well aimed and on short 1 minute duration. • Avoid blue-white short wavelength light. • Use hoods, cowls and make uni-directional keep in a downwards direction.
• Westbury Garden	• WES01 & WES05	• Replace lights 01 to 04 with warm LED lights with hoods, cowls and make uni-directional. • Use motion sensors which are well aimed and on short 1 minute duration. • Replace lights 05, 07 and 08 with warm LED lights, consider changing to downward pointing lights. • Consider using infrared lighting on the tree or warm low level LED lighting.

• Youth Centre (YC)	• YC01	• Replace lights 01 and 02 with one warm LED light with hoods, cowls and make uni-directional. • Use motion sensors which are well aimed and on short 1 minute duration. • Avoid blue-white short wavelength light. • Lower height of light. • Remove light 9 • Remove light 14 • Remove light 23 • Replace all remaining lights with warm LED light with hoods, cowls and make uni-directional.

3.1.4 General Street ALAN Baseline Mapping

A field survey around Bradford on Avon was completed by Johns Associates to observe/measure lighting presence/absence and relative lux levels in general terms across the town, including areas associated with street lighting and other sources. Illustrative photographs were taken.

3.1.5 Significant Private ALAN Baseline Survey

A field survey around Bradford on Avon was completed by Johns Associates to observe/measure lighting presence/absence and relative lux levels at significant private sources of ALAN. Illustrative photographs were taken.

A field survey around Bradford on Avon was completed by Johns Associates to observe/measure lighting presence/absence and relative lux levels Field survey/mapping and to evaluate the results of the University of Sussex modelling.

3.1.6 Review of Ecological Desk Study Data

Information provided on nocturnal wildlife was provided from Bradford on Avon Town Council, supported by information it holds from the Wiltshire and Swindon Biological Records Centre.

3.1.7 Production of BoATC Key Habitat/Ecological Designations Map

A range of Opensource mapping data was used in combination with other information within ESRI ArcGIS pro to examine the spatial relationship between sources of artificial lighting at night and human and ecological receptors. These included, parish boundary, Ordnance Survey basemap, Priority Habitats, statutorily designated sites of nature conversation importance, and Natural England Green Infrastructure and Living England data.

Information on known key bat roosts and critical flightlines/foraging areas was kindly provided by Dr Fiona Matthews of the University of Sussex.

3.2 CONSULTATION

The principal organisations consulted during the production of this document were Bradford on Avon Town Council, Wiltshire Council / Atkins, Professor Fiona Matthews

3.3 GIS AND INTERPRETATION

Spatial data from the various sources in combination with the field mapping were combined in ESRI ArcGIS to produce a series of plans that supported the interpretation of the information and informed this Lighting Strategy.

3.4 LIMITATIONS, CONSTRAINTS AND ASSUMPTIONS

This Lighting Strategy is derived from a range of published information (cited in the bibliography at the rear of this document), feedback from certain organisations consulted during its production, and field observations. The spatial scope of the surveys was limited to publicly accessible spaces unless otherwise stated. The surveys focused on lit areas, rather than measuring lighting levels within unlit areas. Buffer zones for street lighting are based on a number of local observation and applied generally. It is assumed that unlit areas beyond the buffers are dark and less than 1 lux. It was not possible to observe/trigger/confirm all areas of private lighting. Photographs were taken with an iPhone 12 Pro, that uses LIDAR and other sensors to capture night time images. As such, the photographs presented are illustrative, rather than representative.

Notwithstanding these points, it is considered that the Lighting Strategy provides a reasonable reflection of the current lighting conditions in Bradford on Avon, summary of the cited text and robust guidance for Bradford on Avon Town Council, and the town community.

4 OUTPUTS: LITERATURE REVIEW

4.1 SUMMARY OF NATIONAL AND LOCAL PLANNING POLICY AND RELEVANT LEGISLATION ON ALAN

4.1.1 National Planning Policy Framework

The need to address the impact of light pollution on the countryside is recognised in the National Planning Policy Framework (NPPF).

NPPF Clause 185c 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."

Clause 179 of the NPPF requires planning policy to plan for biodiversity at a strategic landscape-scale across local authority boundaries. Planning policy should identify and map components of the local ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity, wildlife corridors and stepping stones that connect them and areas identified by local partnerships for habitat restoration or creation. The NPPF requires planning policy and decisions to minimise impacts on and provide net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures.

Clause 179, 180 and 181 underline the overriding importance of European sites and removes the presumption in favour of sustainable development (Paragraph 182) where development requiring appropriate assessment under the Birds or Habitats Directives is being considered, planned or determined.

4.1.2 Wiltshire Local Plan Core Strategy

Policy 50 of the Wiltshire Core Strategy: Biodiversity and Geodiversity states: "It is vital that all stages of sustainable development are informed by relevant ecological information, from site selection and design to planning decisions and long- term management. All effects should be considered, including positive and negative, direct and indirect, cumulative, and on and offsite impacts over the lifetime of the development (including construction, operational and restoration phases), also giving consideration to disturbance effects such as noise, lighting, recreational pressures, trampling, traffic, domestic pets, vandalism etc.

As a result of Core Policy 50, development potentially affecting the Bath and Bradford on Avon SAC, must provide avoidance and mitigation measures to ensure no adverse impact on integrity of the SAC. Core Policy 50 also requires development to be undertaken in accordance with the Wiltshire Council Bat SAC Guidance (Wiltshire Council, September, 2015). The Wiltshire Bat SAC guidance explains how development activities can affect Wiltshire's bat SACs (including from lighting) and what must be done to avoid or mitigate any impacts. It aims to flag up the types and locations of development that present risks to the SACs so that the needs of bats can be taken into consideration as early as possible in order to avoid unnecessary delays to development projects.

Provision of a coherent and linked landscape for bats is also in accordance with Core Policy 52, which requires development to make provision for the retention and enhancement of the local green infrastructure network. This includes the requirement to identify and provide opportunities to enhance and improve linkages between the natural and historic landscapes of Wiltshire.

Policy 51: Landscape states: "Development should protect, conserve and where possible enhance landscape character and must not have a harmful impact upon landscape character, while any negative impacts must be mitigated as far as possible through sensitive design and landscape measures. Proposals should be informed by and sympathetic to…. vii. Tranquillity and the need to protect against intrusion from light pollution, noise, and motion."

Policy 57: Ensuring high quality design and place shaping states: A high standard of design is required in all new developments, including extensions, alterations, and changes of use of existing buildings. Development is expected to create a strong sense of place through drawing on the local context and being complementary to the locality. Applications for new development must be accompanied by appropriate information to demonstrate how the proposal will make a positive contribution to the character of Wiltshire through: …….. x. the sensitive design of advertisements and signage, which are appropriate and sympathetic to their local setting by means of scale, design, lighting and materials

Policy 59: The Stonehenge, Avebury and Associates World Heritage Site and its setting states:….. The setting of the World Heritage Site is not precisely defined and will vary depending on the nature and visibility of the proposal. A future setting study will provide further information and a preferred methodology for the assessment of proposed development for its potential impact on the WHS and its attributes of OUV. Light pollution and skyglow which could adversely affect the site must be adequately addressed through the careful management of development.

4.1.3 BoA Neighborhood Plan 2013 - 2026

The BoA Neighborhood Plan outlines two policies that are relevant to lighting and nocturnal wildlife. Policy GS2 states that: "Proposals for development will be expected to conserve and enhance areas, habitats and features and species of biodiversity importance within the Plan area and should deliver a net enhancement to the biodiversity of the site. All new development should work with the grain of the landscape and townscape, and secure the protection and enhancement of public and private green spaces and landscape features."

The NPPF requires development to achieve a net gain for biodiversity. Bradford contains a variety of nationally and locally important wildlife sites and species, including:

- the Cotswolds AONB;
- Gripwood Quarry SSSI;
- Wiltshire County Wildlife Sites ('Belcombe Court Wood', 'Lowland Calcareous Grassland North of Belcombe Road Surrounding Electricity Sub Station'; 'River Avon'; and the 'Kennet and Avon Canal'); and
- a range NERC Priority Habitats including 12 traditional orchards.

The town's open farmland, with pasture and hedges, is used by bats such as greater and lesser horseshoes and Bechstein's bat for foraging and commuting and the town lies within a Consultation Zone for bats in relation to the nearby Bath and Bradford on Avon Special Area of Conservation (SAC). All developments must take account of Wiltshire Council's HRA Guidance on the Bath and Bradford on Avon Bats Special Area of Conservation to ensure no loss of site integrity."

POLICY GS3 states that: "All applications within the Neighbourhood Plan area that affect known or potential bat habitat should be accompanied by a bat survey. Where found necessary appropriate mitigation will need to be provided, having regard to the Wiltshire Council Habitats Regulations Guidance Document. This Policy applies to all development, change of use, transport and access proposals.

The Neighbourhood Plan area lies within the Consultation Zone associated with the European designated Bath and Bradford on Avon Special Area of Conservation and provides supporting habitat for a wide range of bats including those protected under Annex II of the Habitats Regulations. Habitat includes buildings both historic and modern, as well as natural features such as trees, cliffs and caves for roosting and breeding, and water bodies, water courses, woodland, trees, hedges and open fields for foraging and commuting. Mitigation may include the retention, protection, restoration and management of open areas and other habitat and the design or modification of buildings to accommodate bats. Given that bats are affected by light pollution, the design of lighting schemes will also be important. All developments must take account of Wiltshire Council's HRA Guidance on the Bath and Bradford on Avon Bats Special Area of Conservation to ensure no loss of site integrity."

4.1.4 BS 5489 – Road Lighting

A local authority does not have a duty to provide street lighting; however once provided, the local authority does have a duty to maintain the system in a safe condition. The standards for street lighting are laid down in British Standard: BS.5489 and European Standard BS EN 13201.

BS5489 is a multipart document containing:

Part 1 Code of practice for road lighting. General principles

Part 2 Code of practice for road lighting. Lighting for traffic routes (Group A)

Part 3 Code of practice for road lighting. Lighting for subsidiary roads (Group B)

Part 4 Code of practice on road lighting. Lighting for single-level road junctions, including roundabouts (Group C)

Part 5 Code of practice for road lighting. Lighting for grade-separated junctions

Part 6 Code of practice on road lighting. Lighting for bridges and elevated roads (Group D)

Part 7 Code of practice on road lighting. Lighting for underpasses and bridged roads (Group E)

Part 8 Code of practice on road lighting. Lighting for roads with special requirements (Group F)

Part 9 Code of practice on road lighting. Lighting for town and city centres and areas of civic importance (Group G)

Part 10 Road lighting. Code of practice for lighting for motorways

4.1.5 Clean Neighbourhoods and Environment Act (2005)

Intrusive lighting was made a statutory nuisance under the Clean Neighbourhoods and Environment Act (2005). This act gives power to individuals to complain about poor lighting which has an adverse impact on their property. Complaints should be directed via the Environmental Health Department of Wiltshire Council.

4.1.6 Wildlife Legislation

Many species of animal and plant receive some degree of legal protection. For the purposes of this report, legal protection refers to: species included on Annex II of the Habitats Directive 1992 (Council of European Communities, 22/07/1992), Schedules 2 and 5 of the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 and Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 (as amended), excluding species that are only protected in relation to their sale (see Section 9[5] and 13[2]) reflecting the fact that the proposed development does not include any proposals relating to the sale of species.

Legal offences associated with species listed on Schedule 2 of the Conservation of Habitats and Species Regulations and Schedule 5 of the Wildlife and Countryside Act in England and Wales (e.g. bats, otter, great crested newt, dormouse) include *inter alia*:

- Deliberate capture, injury or killing of animals or taking or destroying their eggs;
- Deliberately disturb animals in a way that would significantly affect their local distribution or abundance, or affect their ability to survive, breed or rear young;
- Intentional or reckless disturbance of an animal in its place of shelter or protection;
- Damaging or destroying a resting place or breeding site;
- Intentionally or recklessly obstructing access to a place of shelter or protection; and
- Possess, control, transport, sell, exchange or offer for sale/exchange any live or dead animal or any part of an animal.

All species of wild bird are protected under the Wildlife and Countryside Act (WCA 1981, as amended) from killing or injury. In addition, it is an offence to take or damage/destroy their eggs and to damage or destroy a nest whilst it is in use. Species listed on Schedule 1 of the WCA (such as barn owl) receive additional protection in that it is illegal to also *disturb* birds or their young whilst occupying, or near to, an active nest.

Badgers are protected under the Protection of Badgers Act 1992 (UK Government, 1992) which makes it an offence to wilfully kill, injure or take (or attempt to kill, injure or take) a badger; or to disturb badgers whilst occupying their setts (this could include illuminating sett entrances).

The Bath and Bradford-on-Avon Bats SAC (hereafter 'the SAC') is a European Site designated under the Habitats Directive 92/43/EEC (European Council, 1992), which is transposed into UK law under the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (the Habitats Regulations) (UK Government, 2019). The citation for the SAC designation represents a formal description of the reasons why the site has been designated for its conservation importance. SACs are afforded stringent legal protection under Regulation 63 of the Habitats Regulations. In summary, the legal protection of the SAC prevents permission from being granted for development which will adversely affect the integrity of a SAC unless the conditions of three prohibitive tests (the 'derogation tests') are met. When deciding whether the integrity of a SAC would be adversely affected by development, the legislation requires the application of the precautionary principle, i.e. where there is 'reasonable scientific doubt' as to whether an adverse effect on the integrity of the site would occur, development should not be permitted (unless the three derogation tests are met).

Regulation 63 of the Habitats Regulations requires the decision-taker (the 'Competent Authority') to undertake a strict step-wise assessment process for any plans or projects to ascertain potential impacts on European Sites and whether the 'integrity' of the European Site will be adversely affected. This assessment process is known as 'Habitats Regulations Assessment' (HRA). It is important to note that HRA must be applied to 'plans' as well as 'projects'. This means that strategic local plan documents must be subject to HRA as well as individual

developments which are subject to planning applications. In practice, HRA at the strategic 'plan' level enables more meaningful consideration of potential 'in-combination' impacts; and means that strategic mitigation can be applied effectively to deal with such cumulative effects.

A series of Conservation Objectives for the SAC have been published for the Bath and Bradford on Avon Bats SAC, which provide a statutory framework for decision making in respect of development proposals and therefore help inform HRAs undertaken at the plan and project (planning application) level. In addition, the objectives are to be used to inform the design and delivery of mitigation measures deemed necessary to conserve or restore the SAC and/or to prevent the deterioration or significant disturbance of its qualifying features as required by the provisions of Article 6(1) and 6(2) of the Habitats Directive. The Site Improvement Plan prepared for the SAC by Natural England identifies an action for planning authorities to produce and promote guidance to inform strategic planning and enable developers to take full account of the SAC in their schemes. The Trowbridge Bat Mitigation Strategy contributes to the delivery of this priority requirement.

The Natural Environment and Rural Communities Act (2006) includes a provision whereby competent authorities must take into account biodiversity and in particular, protected species and sites when forming policy and making decisions e.g. on planning applications or its own activities.

4.2 SUMMARY OF ECOLOGICAL EFFECTS OF ALAN, INCLUDING BATS AS WELL AS OTHER SPECIES AND HABITATS

4.2.1 Impacts of Artificial Light on Invertebrates

Artificial light has the potential to significantly disrupt ecosystems and it is widely observed that some invertebrates, such as moths, are attracted to artificial lights at night (Bruce-White, 2011). In addition, the polarisation of light shiny surfaces attracts aquatic insects, particularly egg laying females away from water and reflected light has the potential to attract pollinators and impact on their populations, predators and pollination rates. Lighting is also believed to affect glow worms, which have been recorded in a number of currently unlit locations around Bradford on Avon.

Light reflected off coloured artificial surfaces also has the potential to impact on invertebrate populations. Some colours are very attractive to pollinating insects as they are strongly associated with flower colours. Many invertebrates are known to be repelled by light, subsequently, as artificial light increases in distribution and intensity, there are fewer suitable places for the sensitive species to survive and reproduce (the displacement of invertebrates around lighting is sometimes referred to as the 'doughnut effect'.)

Dormancy

Changes in activity levels can be caused by an increase in artificial light. A high level of illumination can cause night flying insects to cease flying and settle preventing insects from feeding and breeding and reducing the level of prey for other species such as bats. Many diurnal (day active) invertebrates such as butterflies have larvae that feed at night to avoid predation. It is thought that changes in artificial light levels impacts the behaviour of night feeding larvae by inhibiting their feeding patterns and making them more susceptible to predation.

Many flowers are pollinated at night, mainly by moths and light pollution has many spectral peaks that would affect the apparent colour and contrast of flowers at dusk and night. Moths require visual and olfactory floral stimuli in order to locate and feed on flowers (Raguso, 2005) and unlike humans and bats, moths have colour vision at low light intensity. There is a possibility, that flowers that are adapted to nocturnal pollination can be affected by emitted light pollution, although no studies have been published to date investigating the impact.

4.2.2 Impacts of Artificial Light on Bats

Artificial light is known to have severe impacts on bats, acting through a range of different mechanisms (Stone E., 2013). Light falling on a bat roost exit point, regardless of species, will at least delay bats from emerging, which shortens the amount of time available to them for foraging. As the main peak of nocturnal insect abundance occurs at, and soon after dusk, a delay in emergence means this vital time for feeding is missed. At worst, the bats may feel compelled to abandon the roost. Bats are faithful to their roosts over many years and disturbance of this sort can have a significant effect on the future of the colony. Effects can be particularly pronounced during the winter when bats periodically emerge from hibernation (a state of torpor) and feed during milder periods. The influence of lighting on foraging habitats and feeding at this time of year can be particularly profound.

In addition to causing disturbance to bats at the roost, artificial light can also affect the feeding behaviour of bats and their use of commuting routes. There are two aspects to this: one is the attraction that short-wavelength light (UV and blue light) has to a range of insects; the other is the presence of lit conditions.

Many night-flying species of insect are attracted to lamps that emit short wavelength component (Bruce-White, 2011). Studies have shown that, although noctules, serotines, pipistrelle and Leisler's bats, take advantage of the concentration of insects around white street lights as a source of prey, this behaviour is not true for all bat species. The slower flying, broad-winged species, such as long-eared bats, barbastelle, greater and lesser horseshoe bats and the Myotis species (which include Brandt's, whiskered, Daubenton's, Natterer's and Bechstein's bats) generally avoid external lights (Bat Conservation Trust, 2009).

This means that light that spills onto bat commuting routes or foraging areas can cause avoidance behaviour by some light-sensitive species (including the rarer SAC species greater horseshoe, lesser horseshoe and Bechstein's) and isolate or fragment habitat in the landscape (Stone E., 2013). This will mean that bats may be forced to abandon foraging areas or commuting routes for sub-optimal habitat (which may ultimately result in abandonment of roosts if that alternative habitat is insufficient to sustain the colony). Lighting can be particularly harmful if it illuminates important foraging habitats such as river corridors, woodland edges and hedgerows used by bats. Studies have shown that continuous lighting along roads creates barriers which some bat species cannot cross (Fure A., 2012).

It is also known that insects are attracted to lit areas from further afield. This could result in adjacent habitats supporting reduced numbers of insects, causing a further impact on the ability of light-avoiding bats to feed.

The introduction of new lighting is therefore a significant issue for greater horseshoe, lesser horseshoe and Bechstein's bats, the designated features of interest for the Bath and BoA Bat SAC.

4.2.3 Impacts of Artificial Light on Birds

The effect of artificial light on birds in an urban setting is less significant. The majority of urban bird species are diurnal and are largely unaffected by ALAN. The indirect effect of light that degrades invertebrate foraging resource is one possible effect but this has not been the subject of extensive research at this point.

Clearly nocturnal species such as owls will prefer to forage in unlit areas as there will be more prey available. Migrating birds can be drawn to light sources and there can be increased mortality risk in collision with buildings at night (e.g. lighthouses) – but this is not considered to be an issue in BoA due to the area not being a night time migration hot spot.

ALAN has the potential to benefit some species of birds, particularly those that predate on bats, as the increase in light allows diurnal bird species (such as peregrine falcon *Falco peregrinus*) that have been observed hunting bats

around historic buildings that are lit at night. Clearly this is a source of conflict and would not occur naturally without the influence of artificial light.

4.2.4 Impacts of Artificial Light on Other Mammals

Lighting can impact on commuting routes of animals such as otter and badger and the addition of lighting inappropriated located to illuminate a badger set may result in disturbance, which is an offence under the Protection of Badgers Act (1992).

The effects of ALAN on small mammals found in Bradford on Avon such as hedgehog and rodents is also poorly defined. Artificial light has been shown to increase predation risk and, similar to bats, create areas that mammals will no longer feel safe enough to forage in as a result of light.

The effect of PIR lighting (i.e. the sudden bright lighting of an animal) has the compounding impact of affecting mammalian night vision and will render the vision of nocturnal mammals significantly less effective for an extended period of time, affecting its capacity to forage and avoid predation.

4.3 SUMMARY OF OTHER FACTORS RELATING TO ALAN, INCLUDING PROPERTY, SECURITY, PERSONAL SAFETY, THE PERCEPTION OF PERSONAL SAFETY, SUSTAINABLE TRANSPORT, HERITAGE, SPORT, LEISURE AND TOURISM

Gaston et al provide a helpful overview on the use of artificial lighting at night for the purposes of protecting property, general security, personal safety and the perception of person al safety. The use of lighting to achieve this is not clear cut. He states that "*criminal behaviour has traditionally been heavily linked to the cover of darkness. Poor visibility increases a sense of threat for humans and unlit areas were historically to be avoided (Jakle 2001). The introduction of artificial night time lighting not only increased human economic activity from the latter part of the nineteenth century but it was also believed to make the night time urban environment safer for much of society; "gaslight is found to be the best nocturnal police" (Emerson 1860). This perceived link between street lighting and public safety persists to the present. It is suggested that improvements in street lighting, and potentially other sources, help to reduce crime either by increasing surveillance and thus providing deterrence or because they lead locally to increasing community pride and informal social control which in turn reduce crime (Welsh and Farrington 2008).*

Evidence that there is a causal relationship between the introduction of night time lighting and a decrease in crime is, however, far from clear. Some studies conclude that recorded crime decreases where lighting is introduced or improved (*Painter 1989*; *Painter and Farrington 1997*; *Pease 1999*). Others conclude that there is no clear correlation and that it may be the public's fear of crime that diminishes with lighting rather than actual crime itself (*Atkins et al. 1991*); from a policy perspective the perception of safety may be as important as any practical effects."

The introduction of appropriate lighting along key routes at night may encourage an increase in sustainable transport use such as walking, cycling (including electric bikes) and in some location the use of electric scooters. A balance needs to be struck, however, between the benefits obtained from sustainable (active travel) modes of transport (e.g. health, reduced carbon emissions, lower cost) and the continued need to ensure that the negative effects of artificial lighting at night are recognised and addressed through suitable design and mitigation. Best practice design criteria must be employed, together with an assessment of effects on ecology, landscape character, amenity, and nuisance (e.g. for nearby residents). Sources of further information can be found later in Section 4 of this document.

Heritage features and the townscape of Bradford on Avon can be highlighted and promoted through the appropriate use of architectural/aesthetic lighting. This can be seen in a number of locations around the town e.g.

the coloured illuminated of trees in Westbury Garden, lighting the Town Bridge, lighting Holy Trinity Church, the Saxon Chapel of St Laurence and St. Mary Tory. Such use of lighting, if carried out appropriately) can improve a sense of place, identify interest and connectivity throughout the town.

The use of artificial lighting at night can also help to increase amenity and use of public facilities, access to night-time businesses such as restaurants and pubs, and help drive economic growth and tourism. The ability to eat and drink outside and use more of the public realm for this has grown since the start of the Covid-19 pandemic and looks set to continue through proposed legislation in the 2022 Queen's Speech. Bradford on Avon is very lucky to have a wide range of high quality restaurants, pubs and other faculties, that, in combination with its architecture, greenspaces, river and canalside setting, provide an enriched night time environment for residents, visitors and employees alike.

Sport also requires the correct provision of artificial lighting at night to enable safe and effective participation and in many cases spectating. Sport England (2012) has produced a Design Guidance Note[3] covering Artificial Sports Lighting. Lighting technology has been considerably improved since this time and additional design guidance and the involvement of specialist lighting designers and engineers must also be sought.

Lighting requirements will vary for each sport and these need to be understood to ensure safety and the ability for the sport to be undertaken. Many sports involve quick player actions and reactions and involve relatively small objects travelling at high speed and in three dimensions.

It remains imperative, however, that the environmental considerations of artificial lighting for sports is fully taken into consideration from the outset, including when considering the feasibility of locating new sports facilities (e.g. on open green space) as well as improving existing lighting

4.4 SUMMARY OF CARBON IMPACT ON ALAN, INCLUDING ENERGY SAVING AND CONSIDERING WILTSHIRE COUNCIL'S LED STREET LIGHTING PROGRAMME

Research has been conducted on the reduction in UK carbon emissions through the use of white light (LED) for street lighting by University College London. Information from its website[4] highlights the following observations and outcomes.

CO2 emissions

In the UK in 2005, there were 8.12 million lighting points on the country's streets using approximately 3.14 TWh of electricity, meaning CO2 emissions of 1.32 megatons. 6.31 million of these lighting points were streetlights. With the rise in environmental concerns, pressure grew on local authorities to reduce the level of public lighting in order to save energy. But street lighting is considered important for crime prevention and public safety.

Reducing energy use

One of the key indicators of adequate street lighting is for two people to be able to recognise each other at a distance of four metres.

[3] https://sportengland-production-files.s3.eu-west-2.amazonaws.com/s3fs-public/artificial-sports-lighting-design-guide-2012-051112.pdf?VersionId=idf6IPDBxvEehgIfTpKhcJMTu0wKmOrx

[4] https://www.ucl.ac.uk/bartlett/research/impact-bartlett/impact-our-research/reduction-uk-carbon-emissions-through-use-white-light (accessed on 05/05/22)

By setting up a dummy street and using a wide range of lighting and experimental subjects, Peter Raynham (UCL Institute for Environmental Design & Engineering) showed that white lights with lower illuminance had the same benefits as brighter sodium lights.

Switching to white streetlights made it possible to maintain the benefits of street lighting but reduce energy use by a third.

The British Standard for Street Lighting

In 2003, the British Standard for Street Lighting was reissued with revised guidance based on this research. In particular, it permitted dimmer white lights to be used on subsidiary roads. As a result, there was been a growing move towards white lighting.

Switching to white lighting

All residential street lighting renovations since 2006 financed through Public Finance Initiatives have moved to white lighting. The number of white lighting units grew from 450,000 in 2008 to 1.45 million in 2012.

The reduction in energy usage has been significant. In 2012, the change to white lighting saved 112 GWh of electricity in the UK, and saved local councils over £10 million in electricity costs. This represents a total saving of 45 megatons of CO2 emissions in 2012, or nearly a tenth of the UK's emissions savings that year.

The company Amey has been involved in a number of projects to reduce emissions and costs from street lighting that are compliance with British standards for road lighting. A useful case study on its website[5] identified the following.

"Savings vary, but typically up to 75% of the energy used by high intensity discharge lamps, can be saved by switching to LED streetlighting supported by a central management system (CMS). The system allows lighting levels to be varied as the use of an area changes throughout the hours of darkness, whilst accurately recording the changes in energy use for each streetlight which is on an unmetered supply. The CMS also negates the need for someone to drive around at night looking for outages as it automatically reports any issues. LED street lighting offers a sustainable and environmentally friendly option for motorways, car parks, residential areas, public transport stations and more. In addition, directing only the amount of light that is needed in a concentrated output, has seen a reduction in light pollution particular prevent in urban locations."

The State of the Nation Streetlighting Survey 2020 (Streetlighting Advisory Services, 2020, on behalf of UK Roads Liaison Group) found that the massive financial savings and emission reductions that are still to be made. An ongoing investment of £755 million could generate £6.8bn of electricity cost savings and 5 million tonnes of emission savings over the next 25 years if the UK street lighting estate were fully converted to energy efficient LED.

It is therefore not surprising that Wiltshire Council has embarked on an extensive streetlighting programme. Its website[6] highlights the following.

Wiltshire Council is making a £12 million investment to convert its street lighting to LED lighting. The older types of lights are going out of production and the cost of energy is becoming prohibitive. The new lights are much more energy efficient and have a reduced carbon footprint.

[5] https://www.amey.co.uk/social-value/our-social-value-stories/reducing-emissions-through-innovative-street-lighting/ (accessed on 21/04/22)
[6] https://www.wiltshire.gov.uk/article/1250/LED-lighting-project (accessed on 21/04/22)

There are almost 45,000 street lights on Wiltshire Council's highway network. Energy costs have risen sharply in recent years, and are likely to continue to rise in the longer term. The annual cost for street lighting energy is currently over £1,900,000, and with current budget restrictions these costs are becoming increasingly unaffordable.

Light Emitting Diode (LED) lighting is energy efficient and has reduced in price considerably in recent years. At present, only 3% of the Council's street lighting is LED lighting, with the majority being the older low pressure sodium (SOX) or high pressure sodium (SON) units. The SOX units are becoming obsolete and going out of production, and are becoming increasingly difficult to obtain.

LED lights use considerably less energy than the older SOX and SON units. A major advantage is that LED lights provide the opportunity to dim the lighting during off-peak periods to further reduce energy consumption. LED lighting dimmed between 8pm and 6am, with additional dimming after 11pm, would typically reduce energy consumption by 69% compared to the current SOX units.

It is proposed to convert most of the Council's street lighting to LED units over the next two years. The cost of the project is estimated to be £12,295,000 and it is expected to have a pay back in 11.88 years, but this could be substantially sooner depending on future energy costs.

The light from the LED units looks different as it is not orange in colour as some of the older lighting is. The new lights will provide similar lighting levels with less light spill and be considerably cheaper to operate and maintain. Instead of being turned off for part of the night many of the lights will be dimmed during off peak periods to further reduce energy consumption.

It is understood that lighting in Bradford on Avon will be (or has been) updated to LED lighting with the following specifications: 2700K CCT LED, utilising Urbis Schreder Axia 3 lanterns. Any existing equipment already changed prior to LED replacement project may be 4000K or 3000K CCT LEDs. The funding to convert these to 2700K is currently unavailable. Only higher CCT LED equipment within the Cotswold Area of Outstanding Natural Beauty (AONB) have currently been included in conversion as part of this project.

Figure 4.1 illustrates the location of street lights in Bradford on Avon, kindly provided by Wiltshire Council/Atkins.

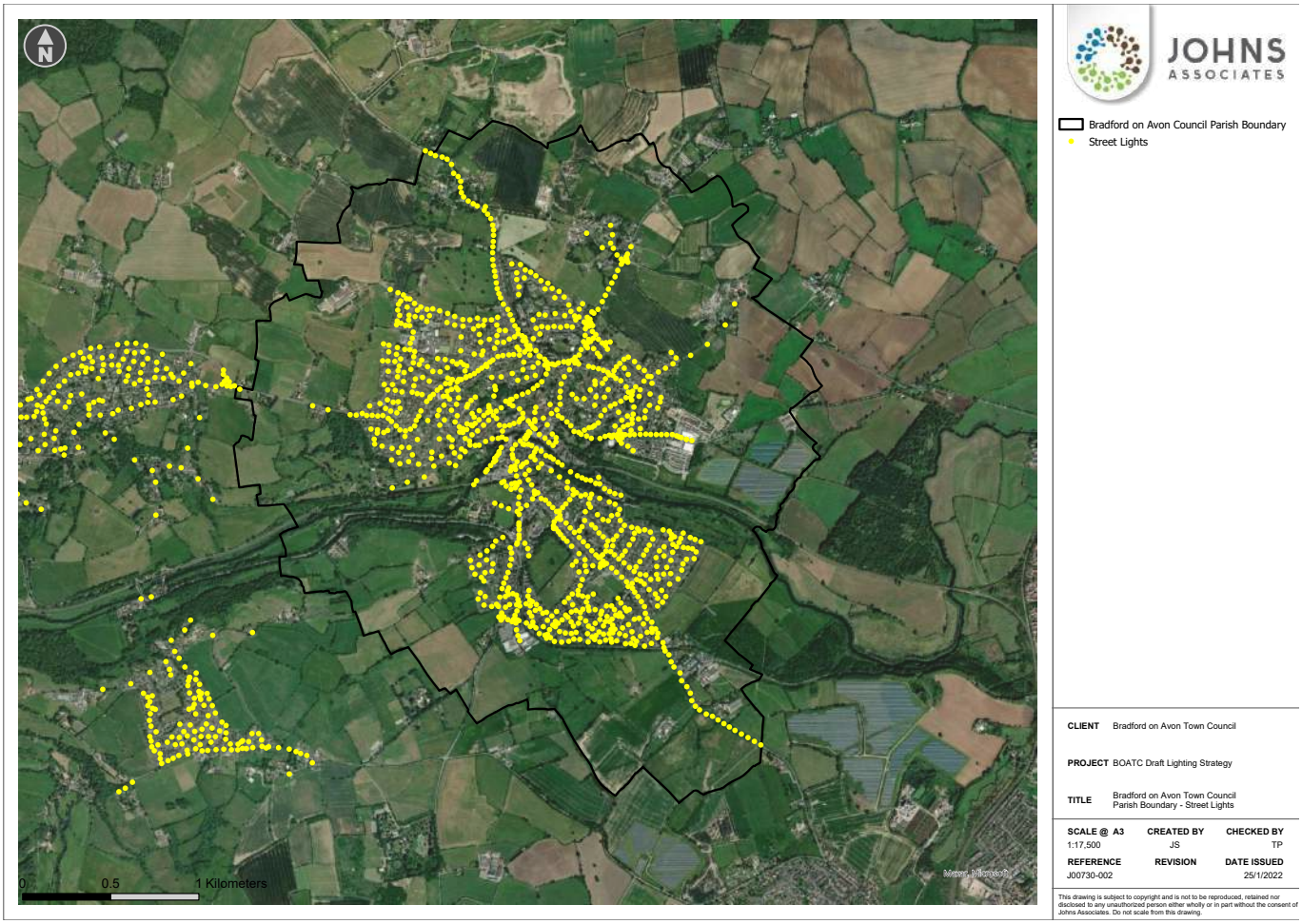

Figure 4.1 Location of Street Lighting in Bradford on Avon (nb additional lighting is present but not shown within new mixed use development on the eastern side of the town).

5 BEST PRACTICE ON ALAN IN BRADFORD ON AVON AND GENERAL DESIGN PRINCIPALS

5.1 LIGHTING SURVEYS TO INFORM ECOLOGICAL IMPACT ASSESSMENTS

This section uses best practice guidance relating to bats as a surrogate for other light sensitive/nocturnal animals. Some of the technical information in this section has been reproduced with the kind permission of Bath and North East Somerset Council from their Waterways Design Guidance Protecting Bats in Waterside Development (Bath and North East Somerset Council, 2018).

In addition to the guidance set out in this section, it is expected that the approach to lighting for new development, including a lighting survey, is undertaken in accordance with the guidance in (Bat Conservation Trust and Institution of Lighting Professionals, 2018) and (Gazaryan, S., and Meyer-Cords, T. (Eds) (2018).

The introduction of new lighting can result in adverse impacts to populations of Bechstein's, greater horseshoe and lesser horseshoe bat in BoA. It is therefore critical to maintain functional dark foraging habitats and commuting corridors for these species. See Appendix 1 for the location of known commuting corridors and bat roost locations. In order to achieve this alongside new development, it will be essential that the bats and lighting issue is acknowledged and integrated into the design process from the outset, and in an iterative way. It should not be left to later design stages or be retrofitted into development proposals. In order to demonstrate that the development has been designed to accommodate light-sensitive bats, it will be necessary to provide the baseline lighting survey and modelling information set out below.

Where baseline lighting surveys are confirmed to be required in consultation with Wiltshire Council, they must be undertaken by a suitably experienced and competent lighting professional (member of the Chartered Institution of Building Services Engineers (CIBSE), Society of Light and Lighting (SLL), Institution of Lighting Professionals (ILP) or similar). The lighting professional should determine the appropriate number and location for sample readings to be taken, considering the habitats of value to bats on site and the potential need for the samples to be repeated post-development as closely as possible.

Baseline measurements should be taken systematically across development sites or features in question. That is, they will need to be repeated at intervals to sample across the site or feature, either in a grid or linear transect as appropriate. At each sample location, a reading should be taken at ground level on the horizontal plane (to give illuminance hitting the ground). Vertical readings should also be taken at each sample location at 1.5m (to replicate the height at which horseshoe bats will typically fly); and at 4m (to replicate the height at which Bechstein's bats will typically fly). The orientation for vertical readings should be perpendicular to the surface/edge of the habitat feature in question (such as a wall or hedgerow) in order to produce a 'worst case' reading. Further measurements at other orientations may prove beneficial in capturing influence of all luminaires in proximity to the feature or principal directions of flight used by bats. This should be discussed in pre-application discussions with Wiltshire Council.

An appropriately high-quality light meter must be used which is V-Lambda and Cosine Corrected and the type of light meter used for the survey must be specified in a baseline survey report (e.g. Minolta T10). Measurements should always be taken in the absence of moonlight, either on nights of a new moon or heavy cloud to avoid artificially raising the baseline. Baseline surveys must be undertaken with all existing luminaires switched on and undimmed, and where possible, with all internal lighting switched on and with blinds or screens over windows removed. Where possible, measurements should be taken during the spring and summer when vegetation is mostly in leaf, in order to accurately represent the baseline during the principal active season for bats and again to avoid artificially raising the baseline.

A horizontal illuminance contour plan (isolux plot) should be prepared by the lighting professional, plotted at ground level. Vertical illuminance contour plots for 1.5m above ground level and at 4m above ground level, or similar graphic representations of illuminance levels showing light spill on vertical planes, will also need to be submitted with the planning application. Each contour plan should be accompanied by a table showing their minimum and maximum lux values.

5.2 PLANNING RECOMMENDATIONS

Where the effects of lighting may have a significant negative effect upon the SAC species of bats, a Habitat Regulations Assessment (HRA) will be required to be conducted by Wiltshire Council, the competent authority to assess whether there will be a significant effect upon the integrity of the conservation status of the Bath and BoA Bat's SAC. The ecological and lighting consultants reports will outline any mitigation measures required for lighting and will inform an AA to be conducted by Wiltshire Council. BoATC should be mindful of any plans for new lighting within the town where key bat roosts or commuting routes could be affected and give careful consideration to the need for lighting, location and positioning and type of lighting.

The Bath Pattern Book Lighting Strategy provides examples of lighting which may be applicable to lighting in BoA. The river waterline should remain unlit and new/updated lighting located on paths adjacent to the river should comprise unidirectional bollard lighting pointing away from the riparian habitat and onto the path only. Lighting should be designed to avoid direct and reflected lighting to the river, around known bat roosts and along flight paths (Appendix A).

As an overarching principle, dark corridors must be maintained around resting places, foraging areas and commuting corridors with no net increase in light levels as a result of the development in areas used by sensitive wildlife. It should be noted that enhancements would also be welcome i.e. development schemes that actively reduce lux levels associated with habitat features. Dark corridors could also be extended with local resident co-operation and agreement.

Planning applications for developments with a significant increase in lighting should include pre and post development lux contour plans, which should be based on topographic survey and prepared by a lighting engineer. Derivation of post-development lux contours must include the illuminance arising from all light sources, including highways lighting, flood lighting, security lighting, other external lighting and internal lighting (i.e. light spill from windows). The latter is particularly important where buildings are designed as glass-fronted or are located in close proximity to habitat features.

Post-development lux contours need to be considered and presented at the height at which local species occur i.e. not just at ground level. As such, consideration needs to be given to calculating vertical illuminance in lux for given habitat features, as well as horizontal lux contours at different heights.

Lux levels for important wildlife habitat features to be retained or created would ideally be zero. As a minimum requirement, lux levels at the height at which the target species are active must be < 1 lux measured at the outer perimeter of the habitat feature. The Trowbridge Bat Mitigation Strategy, February 2020 recommends a minimum distance of 15 m from the development to the outside edge of any part of the bat core habitat to be provided as a buffer zone.

Existing lighting which is within a redline boundary included within a planning application that is not low spill, unidirectional and too bright will be updated to mitigate the effects to nocturnal wildlife as informed through development lux contour plans and a lighting specialist where required/appropriate to the scale of the development.

Dark corridors for hedgehogs should be created to help safely connect isolated populations and avoid dangerous areas by leading them around roads through dark corridors.

It is likely to be necessary to buffer habitat features considerably from light sources in order to secure suitable light levels, taking into account the potential for private owners to fit their own external/security lighting in the future.

Installing the right type of lamp and luminaire can minimise the impact and simple measures such as use of timers, closing curtains and switching off lights can reduce domestic light pollution, alongside also saving energy use and heat loss.

Placement of new windows, home extensions and skylights may be considered and designed to create the least lighting impact. Curtains and blinds and light-reducing tinting/film may be considered as could placing internal lighting away from windows and at heights to reduce reflection and direct light spill to vegetation.

For larger or more sensitive developments, a competent lighting designer could be employed who will apply the principles of providing the right light, in the right place, at the right time and controlled by the right system.

There are a range of guidance documents available that set out excellent design principles that could be considered for lighting; and these may be used to assist with design of lighting schemes that are sensitive to wildlife. The following links provide more guidance:

- International Dark-Sky Association Five Principals for Responsible Outdoor Lighting
- Bat Conservation Trust Artificial Lighting and Wildlife
- Bat Conservation Trust and the Institution of Lighting Professionals Bats and Artificial Lighting in the UK
- The Royal Commission on Environmental Pollution Artificial Light in the Environment

As a starting point, it is important to consider whether lighting is necessary at all before going on to consider design. Consider no lighting solutions where possible such as white lining, good signage and LED cats eyes.

Minimise the spread of light to at, or near horizontal and ensure that only the task area is lit. Flat cut-off lanterns or accessories may be used to shield or direct light to where it is required. Consider a range of design solutions to target light to where it is needed ie not the habitat features, including height of lighting, low intensity luminaires with shielding designed to prevent light spill, deployment of fencing and tree/ shrub planting to screen light sources.

There is frequently a conflict between highways lighting requirements and requirements for dark corridors e.g. there is typically only a limited design that will be acceptable to the Highways Authority before they will adopt a new road. These conflicts must be identified at the earliest opportunity; and developers will be expected to find innovative solutions to these conflicts, including consideration of sections of non-adopted private highway if necessary.

Policy GS2 in the Bradford on Avon Neighborhood Plan 2013 to 2026 refers to the protection of Bats and the Bath and BoA Bats SAC and states 'Given that bats are affected by light pollution, the design of lighting schemes will also be important'. It is recommended that the next Neighborhood Plan document has a specific policy for the reduction of lighting throughout the town, providing the necessary light for security etc, but which is proportionate and appropriate to the end use, minimising excess light spill. This should also relate to the local protection and extension of green and dark corridors, and link to national policy and initiatives for the same provision.

5.3 LIGHTING DESIGN SOLUTIONS

The following measures could be considered for incorporation within lighting schemes to reduce and minimise the impact from development. Lighting design must be undertaken by a suitably competent lighting professional. The recommendations have been informed from the digital library provide by the Institute of Lighting Professionals (ILP) and the Bat Conservation Trust including 08/18 Bats and artificial lighting in the UK.

Mitigating Light Spill from Exterior Lighting Provision

Consider whether exterior lighting is absolutely required and avoid lighting where unnecessary. The likely uses of the external spaces/routes of a development must be fully understood to determine whether they should be lit after dark, and if so how, to what level and during which hours of use after dark. All of these may be articulated as part of a proposal.

Where lighting is unavoidable, seek to reduce light intensity and numbers of luminaires, and ensure the use of the most directional and focused luminaires available. Careful specification of optics and light shielding/shaping accessories fitted to luminaires as specified by a lighting professional can further reduce light spill. Aim to ensure that the Upward Light Ratio (ULR) of the installation is limited to 0% in order to stop poorly aimed luminaires and reduce glare. Mounting heights could be minimised to reduce the distance light can spill.

Light sources with low blue and low UV content to be employed. In preference modern LEDs should be selected as these emit significantly less or no UV light so are less disruptive to both insects and bats Warm colour temperature LED light sources to be employed preferably at 2700 Kelvin (as these have been shown to cause less impact on bats) (Stone E. L., 2015; Stone E. L., 2009; Stone E. L.).

The transition to LED street lighting in BoA will be beneficial to nocturnal fauna. It may be possible to install cowls on particular lights in sensitive locations e.g. along the main flight paths and in proximity to important bat roosts in particular those associated with the SAC.

Installation by developers of specified security lighting will minimise the likelihood of new occupants installing their own devices. Such essential specified security lighting should exclusively use PIR motion-sensitive luminaires located and designed to avoid light spill into bat habitat and buffer zones. Security lighting must be specified to minimise above horizontal outputs and should comprise LED warm light sources (at 2700 Kelvin).

Consider the use of Control Management Systems (CMS) to apply dimming regimes during the night to reduce levels of illuminance during periods of high bat activity (typically soon after dusk and the hours pre-dawn) or to ensure lighting only comes on when it is needed e.g. when activated by the movement of pedestrians. Pre-programmed dimming could be included on all highway lighting with the dim level appropriate to the location and highway safety requirement. Even colour shifting can be considered. This should not be at the expense of public safety and could include the use of presence detectors to enable light levels to intensify or light colours to shift when required. E.g. Low levels of amber-red light could be employed along protected corridors, with warm white light with increased colour rendering activated to support pedestrian safety and security.

Where light spill cannot be avoided, consider using barriers to light: light intensity can be reduced in some locations by creating a light barrier to restrict the amount of light spill reaching sensitive areas. Barriers can be in the form of walls, bunds or fences. Tree planting on bunds alongside roads can also help mitigate light spillage. Vegetation can be used to enhance these features, but shouldn't be relied upon in achieving desired light levels.

Mitigating Light Spill from Interior Lighting Provision

Building set back and orientation can dramatically reduce the reach of light spill and the encroachment on sensitive bat habitat features so should be carefully considered with the input of a lighting professional.

The careful planning of internal building layout and proposed use may be an option for achieving the above standards near bat habitats where: there are space restrictions on small developments; existing buildings are being retrofitted; or in very limited circumstances for larger developments. These are likely to be a formal requirement of any planning permission. The following factors should therefore be taken into consideration at the design stage. As many of these factors are difficult to enforce for the lifetime of the development, their suitability would be assessed against the particular significance of the bat feature concerned.

- The design and depth of window reveals and reduced transparency of glazing to substantially reduce light transmission.
- The use of balconies and louvered windows to reduce light transmission onto sensitive bat habitat features.
- Tight optical control must be applied to any luminaire within 1.5m of glazing. This includes the use of, for example, 'darklight' type downlights with deep recessed light sources and focused beams. Diffuse fluorescent type luminaires should be avoided alongside glazing.
- Light fittings can be set back away from windows and also recessed into ceilings rather than using pendant luminaires to further control light transmission.
- Light spill from ground floor spaces should not extend beyond 1.5m of the glazing line.
- In the case of office lighting, lighting to areas behind glazing should be controlled on a separate lighting circuit to enable them to be switched off or dimmed separately when a different area of the office floor is in use.
- All internal lighting must be switched off when the room is unoccupied – this is only relevant to commercial buildings and should be achieved through the use of lighting control systems and/or appropriate building management.
- The use of automated dimming circuits and automated blinds on windows to attenuate light spill is unacceptable due to concerns regarding their long-term maintenance.

Minimising Light Spill from Domestic Properties

Raising awareness will help reduce light pollution from residential properties. Domestic lighting is mostly outside of planning control and it too can have an impact on biodiversity.

Most security, gateway or garden lighting is purchased and installed by members of the public who are not fully aware of the environmental impacts of artificial lighting. Information on lighting types, installation and maintenance is provided above in Section 4.5.2 can be given by local councils and manufacturers and retailers should be informed of the impacts.

By focusing on evidence-based measures to support bats, the outcomes will typically be suitable to support a wide range of other light sensitive and nocturnal animals that are associated with domestic properties and gardens. This includes reducing or turning off garden lighting when not needed, changing security lighting to a dimmer setting, using triggers such as passive infra red, fitting hoods or cowls and angle to limit light pollution. switching using

infra red security cameras for security rather than lighting. The free publication 'Stars of the Night[7]' produced by the Bat Conservation Trust, Wildlife Trusts and Royal Horticultural Society provides a helpful resource for homeowners, that will also be of use to local conservation groups, schools and other organisations. The CPRE Star Count is a national effort to reduce and measure light pollution, improving our countryside and environment and is a useful source of further information.

The International Dark Skies Associates provides a helpful summary principals for responsible outdoor lighting on its website www.darksky.org

[7] https://www.wildaboutgardens.org.uk/sites/default/files/2018-08/wild%20about%20gardens_stars%20of%20the%20nights_help%20bats.pdf (accessed 20/04/22)

Five Principles for Responsible Outdoor Lighting

Too often, outdoor electric lighting installations at night are over lit, left on when not needed, and are harmful to the environment. As a result, light pollution is a growing global issue that can negatively affect our environment and impact our quality of life. IDA and the Illuminating Engineering Society have published the joint Five Principles for Responsible Outdoor Lighting. By joining forces, our shared goal is to prevent and reduce light pollution through the proper application of quality outdoor electric lighting.

By applying these principles, properly designed electric lighting at night can be beautiful, healthy, and functional. Projects that incorporate these principles will save energy and money, reduce light pollution, and minimize wildlife disruption.

Five Principles for Responsible Outdoor Lighting

If light is deemed useful and necessary, follow these guidelines to prevent, or when that's not possible, minimize light pollution:

USEFUL – All light should have a clear purpose.

Before installing or replacing a light, determine if light is needed. Consider how the use of light will impact the area, including wildlife and the environment. Consider using reflective paints or self-luminous markers for signs, curbs, and steps to reduce the need for permanently installed outdoor lighting.

TARGETED – Light should be directed only to where needed.

Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.

LOW LIGHT LEVELS – Light should be no brighter than necessary.

Use the lowest light level required. Be mindful of surface conditions as some surfaces may reflect more light into the night sky than intended.

CONTROLLED – Light should be used only when it is useful.

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.

COLOR – Use warmer color lights where possible.

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed. Light where you need it, when you need it, in the amount needed, and no more.

Reproduced from www.darkskies.org

6 OUTPUTS: FIELD BASED ASSESSMENT

6.1 ILLUSTRATIVE PHOTOGRAPHS

A gazetteer of illustrative photographs showing the variety of lighting associated with Bradford on Avon can be found in Appendix B.

6.2 ANALYSIS OF DARK / LIGHT MAPPING AND HABITATS

The field surveys of lighting around Bradford on Avon found that the majority of roads in the town are lit by street lighting. A significant proportion of the lighting is now LED based, although alternative types remain installed. The non-LED lighting had the greatest levels of lighting (e.g. up to 100 lux compared to typically LED lux levels of circa 10 lux).

Based on observation during this survey, it is considered that streetlighting has a general buffer of between 5 to 7.5 metres behind the lighting fixture, meaning that adjacent spaces (e.g. gardens and houses) can also be illuminated.

Lighting is provided along a number of footpaths, small areas of open space (e.g. Westbury Gardens), key car parks, and at key facilities such as the train station. A certain amount of shop/business lighting is provided, but many are unlit at night.

Architectural/aesthetic lighting is used successfully in a limited number of key locations to enhance the night time character of the historic town.

Residential lighting varies in terms of the presence of external sources such as security lighting, gateway lights, garden lights. All residential properties will spill light from windows unless curtains or blinds etc are used.

The brightest areas of lighting were associated with Cottles Avenue, the Sainsbury's Car Park, parts of Treenwood Industrial Estate, outside Timbrells Yard (footpath) and areas associated with Kingston Mills.

There was a variety of lighting extent and colour (temperature) associated with LED streetlighting. Some are white light, whilst others are a warmer colour. Some LEDs are placed and equipped so that the lighting spill is well contained, creating a pool and with limited long distance 'glare', whilst others are less contained and are visible to pedestrians from quite a distance away, sometimes requiring shading of the eyes as they are approached. It was also noted a high level of reflection from wet surfaces from LEDs after rainfall. Notwithstanding this, LED lighting does present a generally more contained extent of lighting across the town (which can be seen in some of the plates in Appendix B).

The survey has also confirmed that Bradford on Avon contains a good number of unlit and dark areas (typically green space) both within and adjacent to the urban parts of the town. These include residential gardens, parks, allotments, amenity greenspace, certain road verges, the majority of the River Avon corridor, the majority of the Kennet and Avon Canal corridor, the former golf course, and agricultural land.

Figure 5.1 (also included in Appendix B) illustrates the position of street lighting (and SSSI) and a 7.5m lit buffer associated with Bradford on Avon. It can be seen that street lighting is not present throughout the Parish, and although residential lighting and some lighting from agricultural operations/buildings will be present, there are substantial areas that are unlit and are dark.

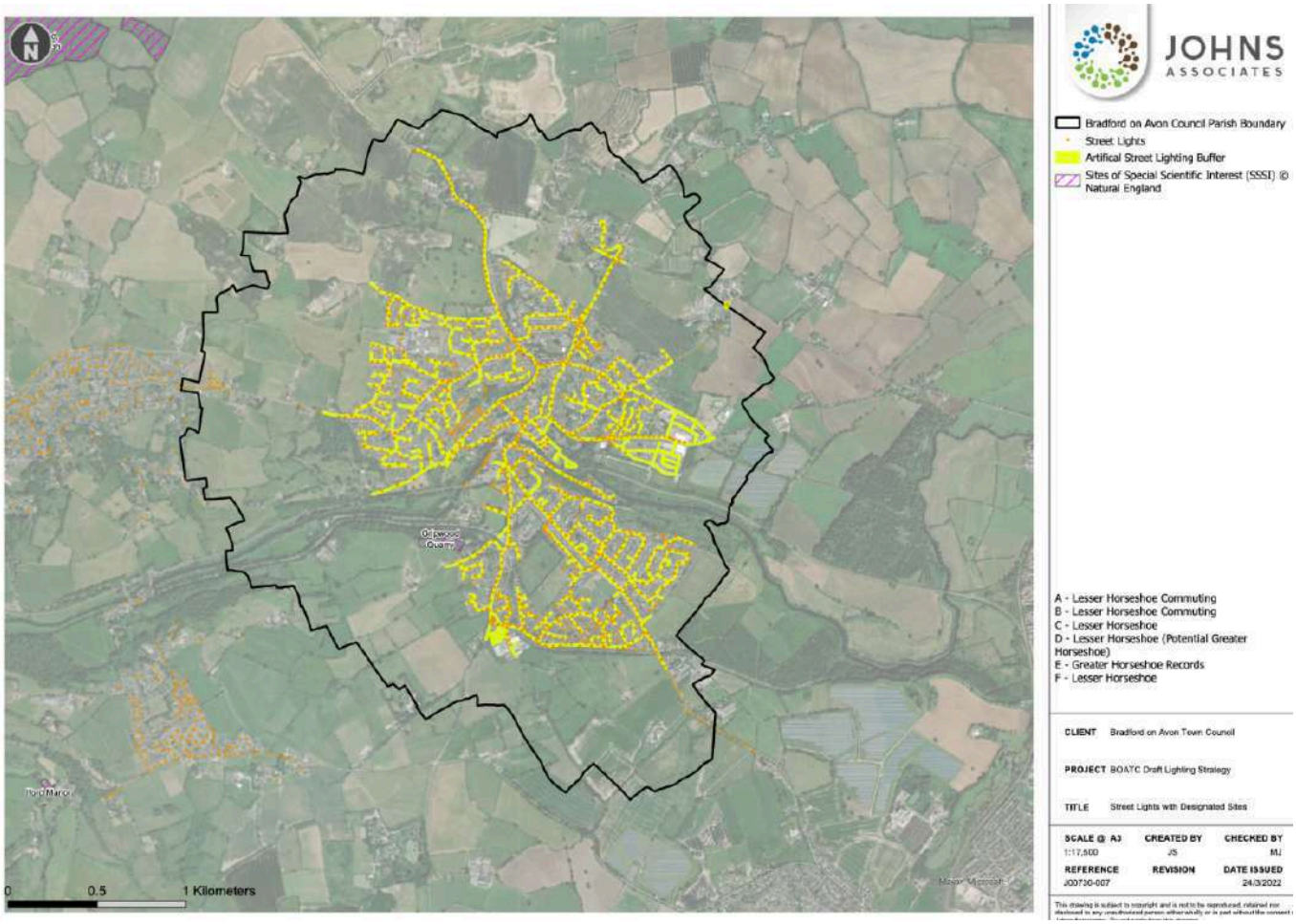

Figure 5.1 Street Lighting and SSSI Associated with Bradford on Avon

Figures 5.2, 5.3 and 5.4 show the position of street lighting and a 7.5m lit buffer in associated with Priority Habitats, known key bat roosts and commuting/foraging areas, and Green Blue Infrastucture.

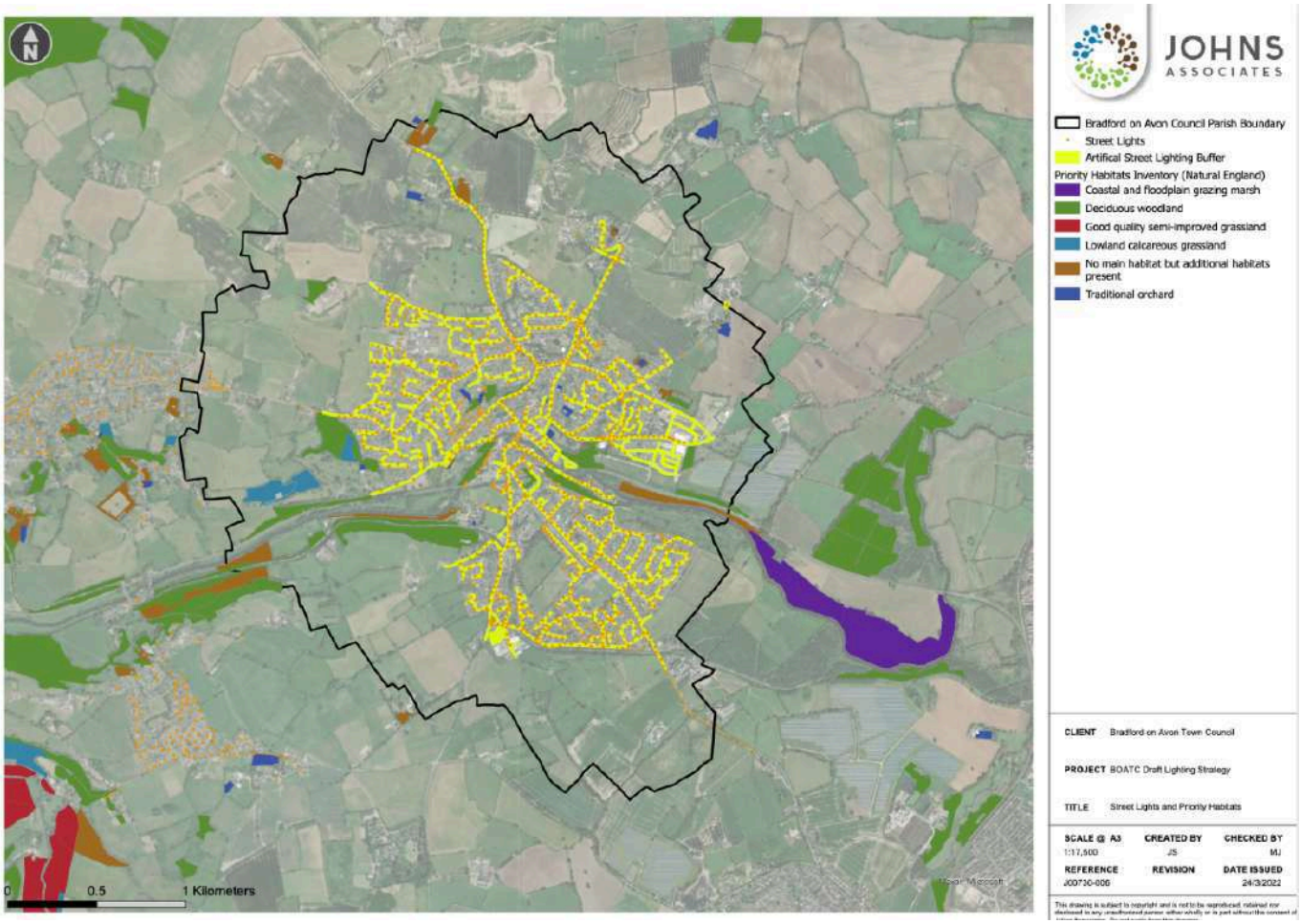

Figure 5.2 Street Lighting and Priority Habitat Associated with Bradford on Avon

Figure 5.2 highlights that the majority of the street lighting is located away from the mapped Priority Habitats, although it is close to some areas of deciduous woodland within the urban centre.

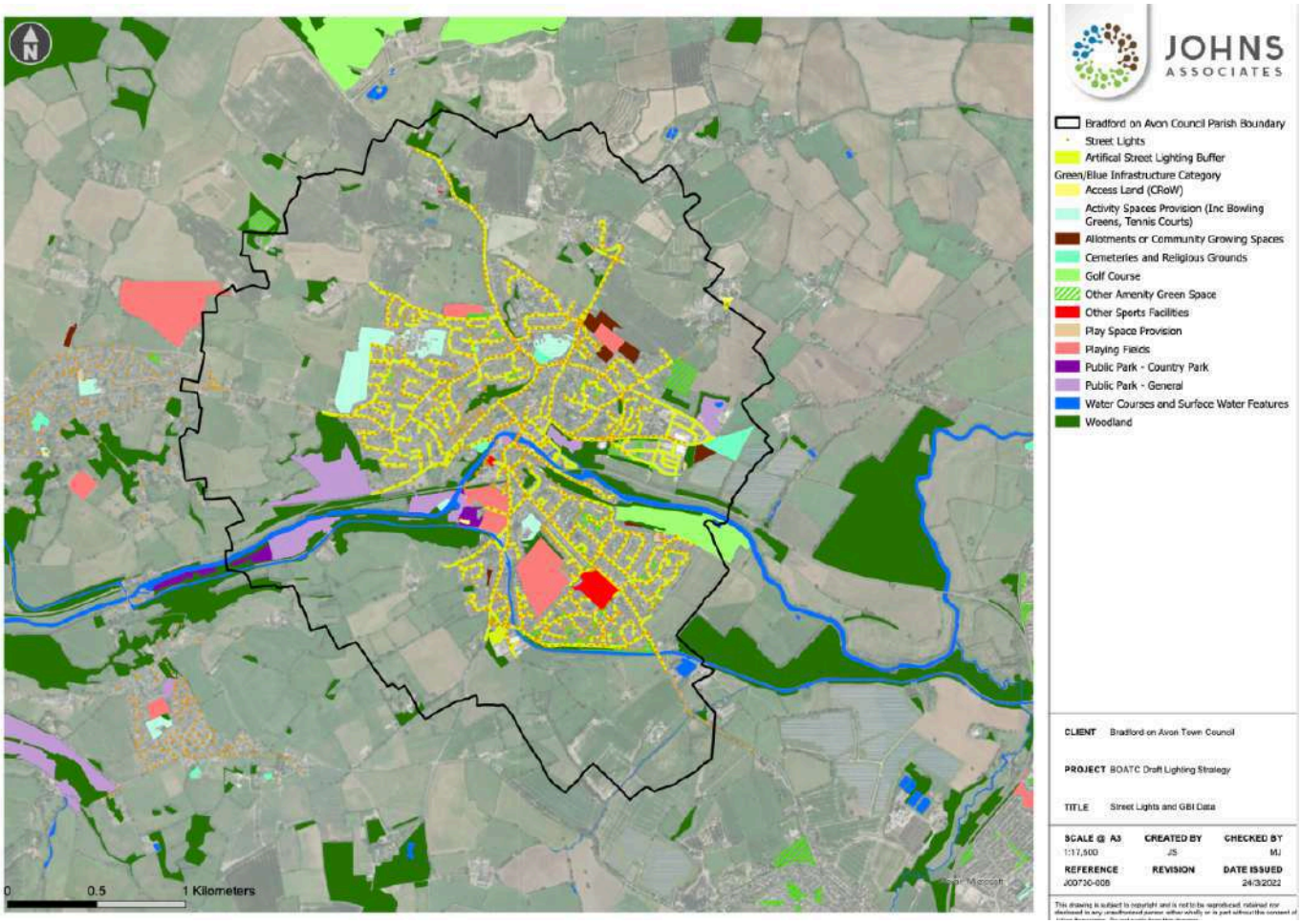

Figure 5.3 Street Lighting and GBI Associated with Bradford on Avon

Figure 5.3 highlights that the majority of the mapped GBI associated with Bradford on Avon is located away from most of the street lighting, although areas of playing fields, woodland and activity spaces are close to/adjacent to nearby streets and their lighting. These areas of GBI are, however, typically unlit themselves.

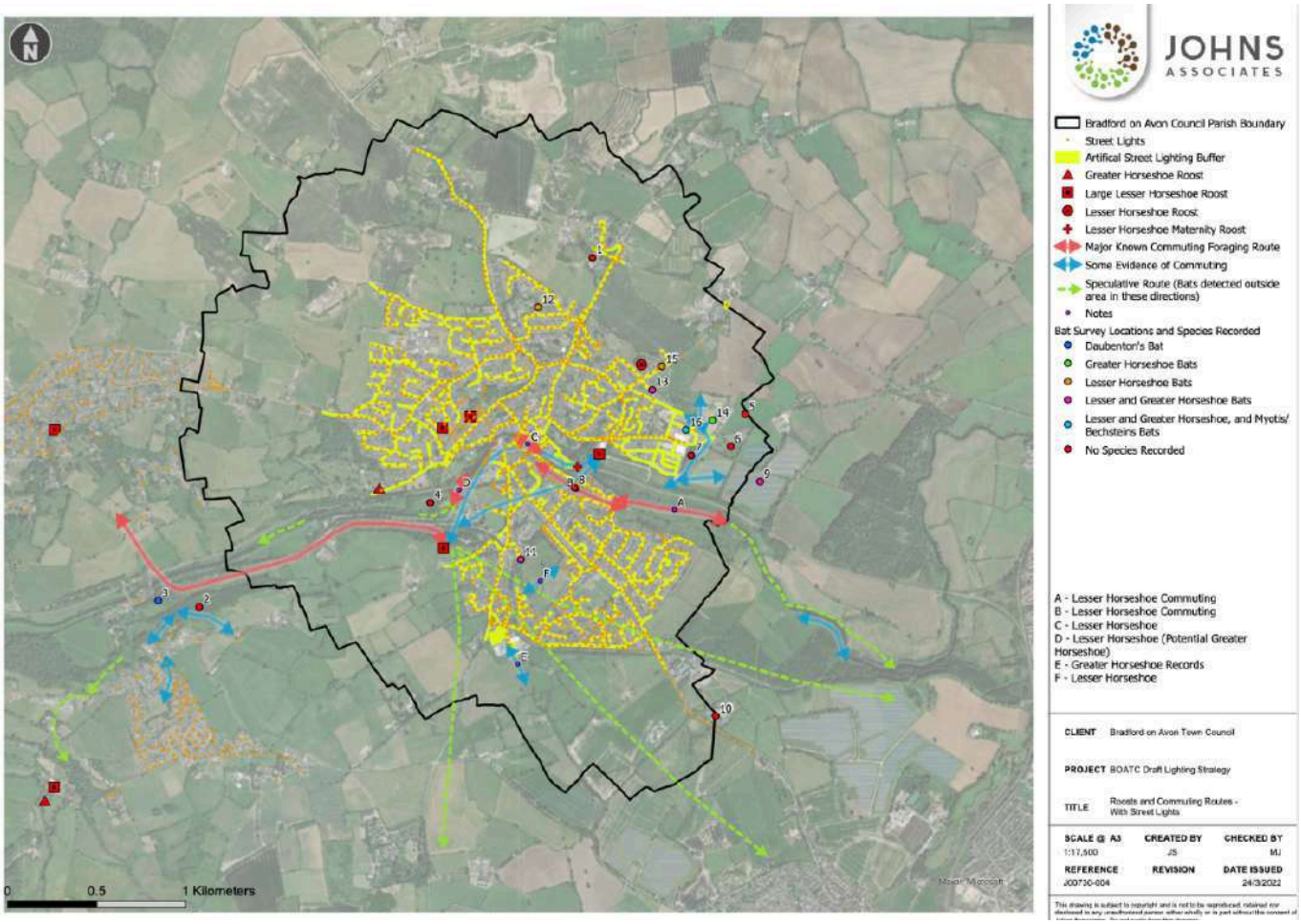

Figure 5.4 Street Lighting and Key Bat Roosts and Commuting Routes Associated with Bradford on Avon

Figure 5.4 illustrates how key bat roosts and a number of the commuting routes are in close proximity to street lighting. Other sources of lighting will also be present in these areas. It is critical that lighting is managed and moderated to maintain the functionality of these roost and corridors. Elsewhere, dark corridors provide critical commuting routes, not just associated with Bradford on Avon but also in linking more distant roosts and foraging grounds as well as the core sustainable grounds associated with the SAC. These include the River Avon, Kennet and Avon Canal, and linkages across agricultural land and along woodlands. It is imperative that these existing areas of functional habitat remain protected and dark.

6.3 OTHER FACTORS RELEVANT TO ALAN

The lighting field survey identified that Bradford on Avon has a wide range of different types of lighting present. This included the presence of street lighting, property and security lighting, lighting to support personal safety, sustainable transport (pavements, some paths and roads), promote its heritage, architecture and aesthetics, sport, leisure and tourism. More information can be found in the photographic gazetteer in Appendix B.

6.4 PRIORITIES FOR RETAINING DARK HABITAT

Figure 5.5 highlights areas of highest lighting (associated with streetlighting), moderate lighting associated with businesses located away from street lighting and residential properties, together with areas of darkness.

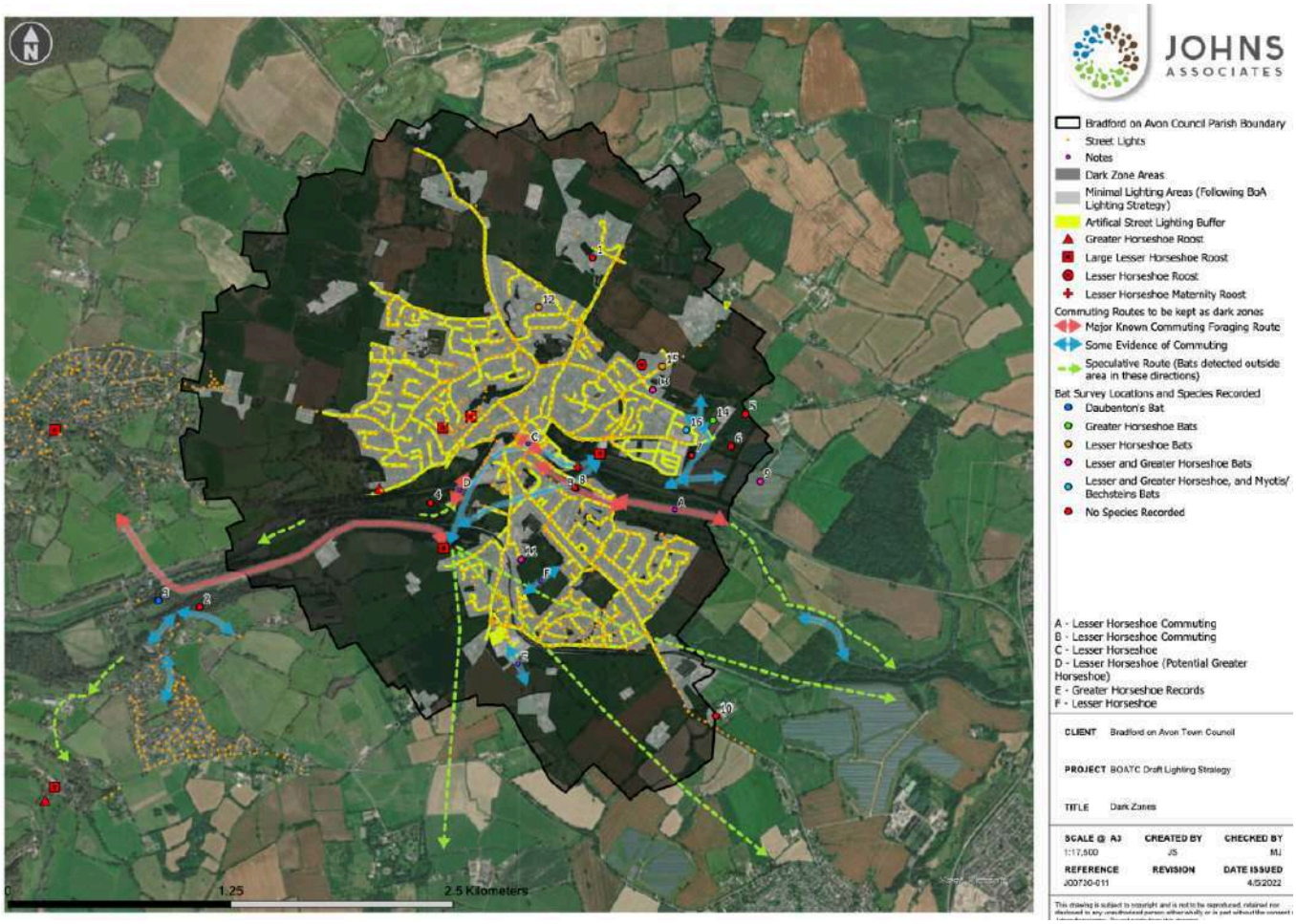

Figure 5.5 Areas of Darkness, Intermediate and Higher Lighting in Bradford on Avon

The areas of darkness shown in this plan form the spatial basis for implementing a policy to protect and retain existing areas of dark skies.

Policy to restrain the erosion of dark areas or increase the areas of minimal darkness/lighting should be implemented using this strategy, requiring best practice to be followed and the need for the lighting justified. It is these areas where the biggest level of benefit can be achieved as the main sources of lighting are from domestic properties or localised point sources (e.g. business security lighting), so larger areas of low lighting are already present and provide valuable wildlife corridors and functional habitat, whilst pedestrian/vehicular access along key human travel corridors also typically provided.

Policy to improve lighting in the most lit areas (shown as the street lighting buffer) should also be implemented. This will require engagement and financial support from external parties (e.g. Wiltshire Council, private building or land/business owners), although it is likely to be targeted where LED lighting needs to be extended and LED provision optimised in terms of human and environmental sensitivities. Voluntary agreements could also be made with owners of commercial premises to reduce or improve external lighting, or consider a lighting curfew.

6.5 OPPORTUNITIES TO RESTORE DARK HABITAT

There are several partially or fully lit areas within Bradford on Avon that could be enhanced for nocturnal biodiversity and an improved appreciation of the night sky. In principal, these are the areas highlighted in grey in Figure 5.5 (Minimal Lighting Areas).

Residents can be encouraged, through publicity and the provision of a suitable educational leaflet/website information, to implement their own measures voluntarily to reduce lighting. This includes the use of curtains and blinds when internal lighting is used at night. This not only minimises light spill to gardens but also helps reduce heat loss and associated energy consumption. Householders should also be encouraged to review their use of external lighting and follow good practice advice to remove it where not essential and minimise its use otherwise.

Neighbourhood groups can work together to restore dark corridors through garden areas, providing essential links to wider unlit areas and key functional habitat. If this was applied throughout Bradford on Avon a number of additional new / restored dark corridors would become established providing much needed alternative habitat for a range of nocturnal animals. It would also provide an enhanced opportunity for residents to appreciate the night sky.

Commercial businesses can be encouraged to reduce lighting levels through the adoption of alternative technology (e.g. PIR cameras linked to security alarms) to avoid the need for security lighting. Where essential, these should be on a timer and activated by a motion sensor. Lighting specifications should be based on the lasts standards and always seek to illuminate to a minimum required level and in essential locations only.

A voluntary code of practice could be established with local businesses and residents to maximise the opportunity to restore and protect dark habitat.

BOATC will continue to liaise with Wiltshire Council, the Cotswold AONB Board and other statutory consultees in supporting initiatives to reduce lighting levels and remove unnecessary lighting. In particular, road lighting specifications and the placement of existing / additional road lighting serves an opportunity to restore dark habitat as this represents the most extensive form of night time illumination within the Parish.

7 RECOMMENDATIONS

7.1 BOATC SERVICE DELIVERY, INCLUDING ALAN ON BOATCS ESTATES

In delivering its services, BOATC will seek to implement best practice in terms of artificial lighting at night, as set out in this document and in compliance with relevant planning policy and legislation. It is recognised, that as part of these duties, BOATC also seeks to enhance the lives and livelihood of the town and as such employs lighting for a range of purposes including recreation and amenity, seasonal events, art and aesthetics and safety and security.

Lighting installations on some of the BOATC buildings and facilities can be improved through the systematic review and replacement of external lighting with LED fixtures and fittings. This includes the lighting at the Youth Centre.

Future activities and any developments led by BOATC will fully acknowledge and evaluate the role of lighting and seek professional guidance on locations for lighting, potential effects (on people and biodiversity) and mitigation so that the installed design and specifications avoid or minimise significant effects.

7.2 INFLUENCING OTHERS TO IMPROVE LIGHTING AND ITS IMPACT IN THE PARISH

As a community leader and role model, BOATC is well placed to inspire and influence others (residents and businesses) to improve lighting and reduce its impact across the Parish. There are key opportunities to reduce lighting levels within areas located away from street lighting, e.g. gardens, driveways, around houses and business premises and lighting associated with educational establishments and amenity facilities.

Influence can be in the form of raising awareness of legal obligations associated with lighting such as nuisance, or effects on legally protected species and habitats such as bat roosts and the potential for disruption/severance of flyways/foraging habitat associates with bats and bat roosts (e.g. inappropriate lighting along the river corridor).

Consultation on any revisions to the Neighbourhood Plan can feature lighting as a key topic and provides an excellent opportunity to gain community engagement, participation and ownership of lighting effects and opportunities to reduce inappropriate lighting across the town.

BOATC can be a source of advice, and by referring to this document (see Appendix A – Bibliography), can direct residents and businesses to best practice handbooks, specialist lighting organisations and specifications.

Finally, BOATC can raise awareness and create publicity about artificial lighting at night through its website and/or a leaflet (please see Appendix H) and through public meetings.

7.3 RECOMMENDATIONS FOR BOATC'S NEIGHBOURHOOD PLAN

The neighbourhood plan sets out current policy in relation to lighting, but through consultation, any revision to the Neighbourhood Plan can take the opportunity to revise, extend and promote additional measures in terms of artificial lighting at night. It should seek to establish policy to:

- highlight/designate and protect key existing dark zones around the town in the interests of nature conservation and/or avoiding harm to the Cotswold AONB and its setting (e.g. protecting the key dark corridors associated with the River Avon, the Kennet and Avon Canal, the former golf course, parks, woodlands, allotments and agricultural land).

- minimise additional lighting in Bradford on Avon (especially in the darker areas) to only when there is a clear need associated with safety, security and amenity;

- adopt current best practice standards for any additional lighting, taking into account legal and wider policy requirements;

- create new dark corridors through the town through voluntary agreements between neighbours and commercial organisations.

7.4 RECOMMENDATIONS FOR WILTSHIRE COUNCIL'S GBI STRATEGY, LOCAL NATURE RECOVERY AND STREET LIGHTING

BOATC endorses and welcomes the Wiltshire Council Green Blue Infrastructure Strategy and is keen to continue to be actively involved in its development, alongside the forthcoming Wiltshire Local Nature Recovery Strategy and reviews of streetlighting.

Through the GBI Strategy and the Local Nature Recovery Strategy, BOATC would like to see commitments to protecting current and securing additional key corridors for biodiversity and people. IN doing so, these need to be maintained as dark corridors unless active travel safety requires some lighting. In this situation, BOATC would seek to be consulted to ensure its own objectives are met in terms of artificial lighting at night and that streetlighting (the largest contributor to ALAN in the Parish) is optimised and not extended.

BOATC welcomes the transition to LED lighting by Wiltshire Council and recognises the opportunities this provides in terms of directional lighting, digital controls and energy/carbon/financial savings. Notwithstanding this, it is clear that there are better specifications that should be implemented in many parts of the Parish, minimising light levels/spill and avoiding bright white/blue lighting, alongside reducing potential nuisance. BOATC encourages Wiltshire Council to review lighting provision in Bradford on Avon and seek opportunities to implement the better standards to current lighting as part of a rolling program of improvement in ALAN and avoid lower performance specifications for any new lighting.

7.5 RECOMMENDATIONS FOR UPDATES TO WILTSHIRE COUNCIL'S LOCAL PLAN

BOATC has identified opportunities to deliver an enhanced ALAN through potential review and revision to policy in the Local Plan. This could include:

- Provision of local insight and advice to police crime advisors so that appropriate minimum but safe lighting levels can be achieved;

- Setting minimum lighting levels and adoption of best practice specifications for domestic and commercial planning applications (including unadopted roads);

- Seeking to minimise lighting levels for applications for new /modified advertising;

- Seeking to ensure appropriately sensitive specifications are adopted for Listed Building Consents.

8 CONCLUSIONS AND NEXT STEPS

Bradford on Avon Town Council (BOATC), in its role as community leader, Parish Council and statutory consultee on planning applications, role though the local Neighbourhood Plan, owner and operator of a range of buildings and amenity facilities within the town, and in response to its declaration of both climate and biodiversity emergencies, has expressed its concern about the potential effects of ALAN and the critical need to ensure it is both appropriate and does not result in significant negative effects on people, biodiversity and the landscape.

The dominant source of ALAN in Bradford on Avon is associated with street (and path) lighting and residential lighting. Other lighting provision in the town is typically associated with businesses (e.g. shop fronts and security), other organisations such as schools, sports clubs and social venues, as well as local residents. BOATC has some external lighting on its land and buildings, and maintains green space in the town (which is typically dark). This ALAN provides a wide range of benefits to residents and visitors including in terms of safety, wayfinding, security, sports and amenity, arts and heritage and domestic use.

Bradford on Avon is also home to a rich biodiversity including a wide range of nocturnal wildlife that uses the green and blue spaces that lead to, from and across the town including the River Avon, Kennet and Avon Canal, woodlands, grasslands (including parks, verges and less formal open spaces), and gardens. Some of these areas are themselves protected in terms of legislation and policy, as well as legal and policy protection for a range of nocturnal species such as bats, owls and other birds, badger, hedgehog, fish, amphibians and invertebrates.

From a review of a range of information and time spent measuring and observing artificial lighting at night in Bradford on Avon, it can be concluded that the dominant influence and spatial extent is from street lighting, with certain commercial and sports/amenity lighting also having a more notable localised influence, with residential lighting making up the majority of the rest of key lighting influences. From observation, it appears that the majority of brightly lit locations are associated with roads, certain paths, commercial areas and certain sports/recreation. The switch to LED has resulted in cost, energy and carbon emission savings, and it is welcomed that the program of LED street lighting continues to be delivered by Wiltshire Council.

It is considered reasonable to conclude that there are opportunities to improve on the levels/placement of some street lighting through consultation with key organisations such as Wiltshire Council as well as limit the spread of street lighting. There are considerable dark areas that need to be protected, some of which fall within the Cotswold AONB and its setting, and/or are associated with legally protected habitats used by species such as bats. There are also considerable areas that are partially lit e.g. influenced by residential lighting and it is here where the easiest reduction in artificial lighting could be achieved through the provision of advice/guidance and promoting sensible use of lighting at home. This could include reviewing the type and positioning of lighting/lighting furniture to reduce spill and glare, extent/timings of use, fitting and using curtains and blinds to windows to reduce light spill, reduce energy, cost and carbon.

Section 6 of this document sets out best practice in terms of artificial lighting at night in Bradford on Avon and can be used, in conjunction with the references provided and lighting professionals (where needed), to inform the design and delivery of lighting improvements or new lighting.

Section 7 of this report provides a range of recommendations for BOATC to consider in its service delivery, to influence others to improve lighting and its impact, for future revisions to the Bradford on Avon Neighbourhood Plan, for Wiltshire Councils, Local Plan review, its GBI Strategy and Local Nature Recovery Strategy.

BOATC will take forward proposed lighting policy in its decision making and provide lighting and planning responses to relevant planning applications (see Appendix E and F). It recoignises the value of good lighting in the

right place and will seek to promote best practice by circulating and highlighting information on artificial lighting at night in Bradford on Avon through a specially designed leaflet and on its website (see Appendix H.)

APPENDIX A: BIBLIOGRAPHY AND FURTHER READING

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APPENDIX B: BAT DESK STUDY DATA

Site	Map Location	Report	Client	Date	Findings
Arnolds Wood	1	Preliminary Ecological Appraisal for Arnold's Wood J006652 (Ecosulus)	Bradford on Avon Town Council	September 2020	No records of bats within the site. The site has good potential for roosting bats with several mature trees. The woodland on site provides good habitats for bats however it has limited connectivity.
Becky Addy Wood	2	Preliminary Ecological Appraisal for Becky Addy Wood, Bradford-on-Avon J006652 (ecosulis)	Bradford on Avon Town Council	September 2020	The site provides high quality roosting and foraging habitats. It is unlikely to be subject to light spill and is well connected to additional woodland habitats.
Barton Farm County Park – Far End	3	Preliminary Ecological Appraisal for Barton Farm Country Park, Far End, Bradford on Avon	Bradford on Avon Town Council	September 2020	Daubenton's bat has been recorded within the site. The site provides high quality foraging habitats for bats and is subject to low light levels. The site has good connectivity to woodland edge habitats and the River Avon. Some of the trees on site may have potential for roosting bats.
Barton Farm County Park – North Meadow	4	Preliminary Ecological Appraisal for Barton Farm Country Park, North Meadow, Bradford on Avon	Bradford on Avon Town Council	September 2020	The meadow and surrounding woodland provide high quality foraging habitat for bats. The site may be subject to low levels of light spill however this will be minimal and not constant. Some of the trees could provide roosting opportunities for bats.
Brooklands	5	Preliminary Ecological Appraisal for Brooklands, Bradford on Avon (Ecosulus)	Bradford on Avon Town Council	September 2020	The site does not currently support features for roosting bats. However, the long tussocky grassland and hedgerows could provide potential foraging habitat for bat species. The western boundary of the site backs onto a commercial area, which may be subject to light spill. The site is open grassland habitat therefore lacks dark corridors
Cemetery	6	Preliminary Ecological Appraisal for Bradford-on-Avon Cemetery	Bradford on Avon Town Council	September 2020	There have been a number of bat records within the local area, but none have been recorded on site The site has suitable habitat for bats within the broadleaved parkland/scattered trees on site, some of these trees are mature and could have bat roosting features. In addition, the site is connected to the nearby railway line via a line of trees which serves as a dark corridor for bats. It is also within close proximity to the River Avon green corridor, which bats may use to access the wider environment.

Site	Map Location	Report	Client	Date	Findings
					There are three old buildings within the site, which all hold opportunities for roosting bats, including as potential hibernation sites.
Kingston Wood	7	Preliminary Ecological Appraisal for Kingston Wood, Bradford on Avon	Bradford on Avon Town Council	September 2020	The site has some potential for roosting bats, enhanced by bat boxes installed on several trees within the site. The site is not impacted by high levels of light spill. Therefore, it may be suitable to light sensitive species. The site is slightly north of the railway line and the River Avon corridor, which provides valuable commuting corridors for bats.
Greenland Wood/The Strips	8	Preliminary Ecological Appraisal for Greenland Wood/The Strips, Bradford on Avon (Ecosulis)	Bradford on Avon Town Council	September 2020	The site has many mature trees which would provide suitable habitat for roosting bats. In addition, the site is adjacent to the River Avon which serves as a valuable commuting corridor for bats in the wider area. Old bat boxes are present on some trees indicating that there is potential for bats to be roosting. The site may be subject to light spill from the nearby residential areas which may reduce the numbers of light-sensitive bats using the site.
Kingston Farm	9	Kingston Farm, Bradford on Avon, Wiltshire: Bat Survey Report (Environmental Gain Ltd)	BOA Properties Ltd	March 2013	Bat surveys were conducted between 2010 and 2012. Lesser and greater horseshoe bats were recorded using Combe Mine under the western field. 11 bat species were recorded using the site for foraging and commuting including greater and lesser horseshoe and Bechstein's.
Kingston Farm	9	Kingston Farm, Bradford onAvon, Wiltshire, Ecological Management Plan (engain)	C G Fry and Son Ltd	July 2015	Combe mine lies partially under the western end of the site which supports a hibernating and transitional population of horseshoe bats.
Kingston Farm	9	Kingston Farm Bradford on Avon Wiltshire, Ecological Management Plan (environmental gain)	BOA Properties Ltd	May 2011	PEA in 2011 found no roosting potential. Desk study found bats including greater horseshoe utilise the boundary hedgerows for commuting.
Widbrook House	10	Widbrook House, Bradford on Avon, Wiltshire Results of Bat Surveys (SLR Consulting)	Ashley Design Associates	October 2008	One dusk and one dawn was conducted in October 2008 and found buildings used by brown long-eared bat as a day roost.

Site	Map Location	Report	Client	Date	Findings
Widbrook House	10	Daytime bat survey 2012 outbuildings at Widbrook Farm, Widbrook, Bradford on Avon (CTM Wildlife)	Ashely Design Associates	July 2012	Internal inspection of buildings in July 2012 concluded buildings are no longer being used by bats.
St Katherines Quarry	11	St Katherine's Quarry Bradford on Avon Wiltshire Ecological Appraisal (AD Ecology)	Colburn Holmes	February 2012	Cave system was walked in 2012 to assess for overwintering bats. The majority of the cave is unsuitable for supporting significant bat roosts however historic monitoring has found the cave to support small numbers of roosting bats including greater and lesser horseshoe.
Berryfield House	12	Berryfield House, Bradford on Avon Phase 1 Habitat and Faunal Survey (Aspect Ecology)	Castlemead Care	August 2011	Phase 1 in 2011 found Veteran oak on site which has moderate bat potential. Woodland and hedgerow could provide commuting route for bats.
Berryfield House	12	Berryfield House, Bradford on Avon Ecological Assessment (Aspect Ecology)	Castlemead Care	August 2011	No records of bats on site.
Berryfield House	12	Wiltshire council correspondence (email)	Castlemead Care	October 2011	Bat roosts including lesser horseshoe have been recorded at Berryfield
Land off cemetery lane	13	Ecological Assessment, Land off Cemetery Lane, Bradford on Avon (ethos environmental planning)	Redcliffe Homes	September 2019	Three activity transects conducted between October and November 201 Greater and lesser horseshoe bats recorded on statics on site.
Land North of Cemetery Lane	13	Bat Survey Report, Land North of Cemetery Lane (ethos environmental planning)	Not listed	October 2014	11 activity surveys and three emergence surveys were conducted between May and October 2014. 11 species of bat were recorded foraging and commuting along site boundaries including greater and lesser horseshoe bats. No signs of roosting bats were identified on site.
Land north of cemetery lane	13	2016 Update to Ecological Assessment Land North of Cemetery Lane. (ethos environmental planning)	Not listed	November 2016	3 activity surveys conducted between July and September 2016. Seven bat species were recorded across the site including greater and lesser horseshoe bats.
AB Dynamics North Site	14	ABD North Building (engain)	Ab Dynamics	October 2018	Surveys found greater horseshoe bats commuting along Holt Road

Site	Map Location	Report	Client	Date	Findings
Bellaway	15	Reserved Matters 17/03822/REM correspondence		October 2017	Lesser horseshoe bat activity detected on statics. Horseshoe bats known to commute along cemetery way. The presence of a summer roost of unknown bat species was identified in an attic at crown court (BA15 1BG)
Holt Road	16	Holt Road Bradford on Avon, Ecological Appraisal Review and Protected Species Report (Engain)	Spitfire Properties LLP	August 2014	Six activity surveys were conducted between June and October 2014. 10 species of bat were detected including greater and lesser horseshoe bats.
Holt Road	16	Land at Holt Road Bradford on Avon Bat Survey Report (engain)	Spitfire Properties LLP	May 2015	Six activity surveys were conducted between April and May 2015 to identify how bats crossed Holt Road. Six species of bat were identified crossing Holt Road including greater and lesser horseshoe and unidentified myotis (which could have been Bechstein's) Most crossed at the woodland edge of Kingston Farm.

APPENDIX C: LIGHTING PHOTOGRAPHIC GAZETEER

Plate 1. Business and Shop Lighting on St Margaret's Street

Plate 2. Example Street Lighting on St Margaret's Street

Plate 3. Street, Building , Architectural and Domestic Lighting Around St Margaret's Car Park

Plate 2. Architectural / Aesthetic Lighting

Plate 3. Pathway Lighting at Westbury Gardens

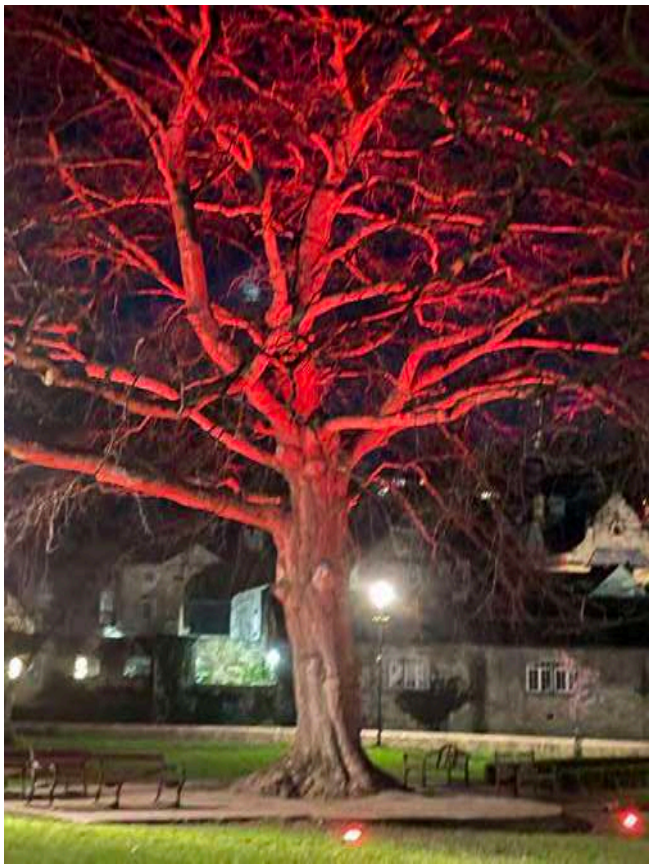


Plate 4. Architectural / Aesthetic Lighting at Westbury Gardens

Plate 7. Street, Security, Domestic and Moonlight Along Bridge Street

Plate 8. Restaurant/Amenity, Architectural / Aesthetic and Moon Light Near The Town Bridge

Plate 9. Lighting Over the River Avon by the Town Bridge

Plate 10. Street and Architectural / Aesthetic Lighting by Holy Trinity Church

Plate 11. Location/Safety Lighting Highlighting an AED

Plate 12. Street and Domestic Lighting off Southway Road

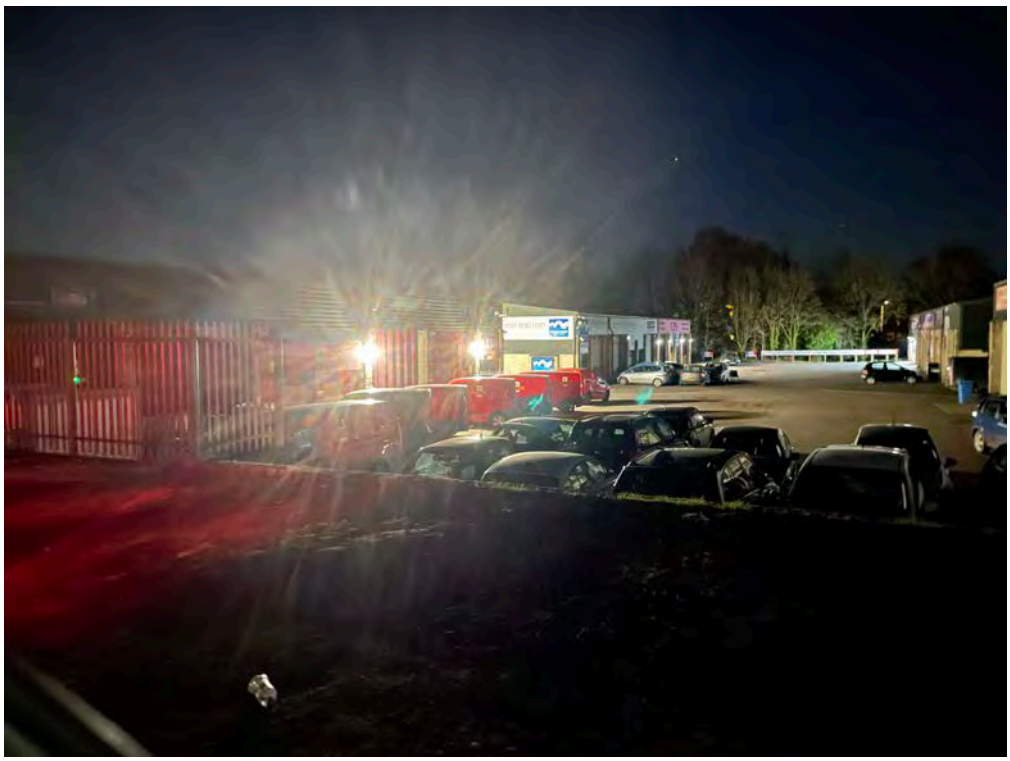


Plate 13. Business / Security Lighting at Treenwood Industrial Estate

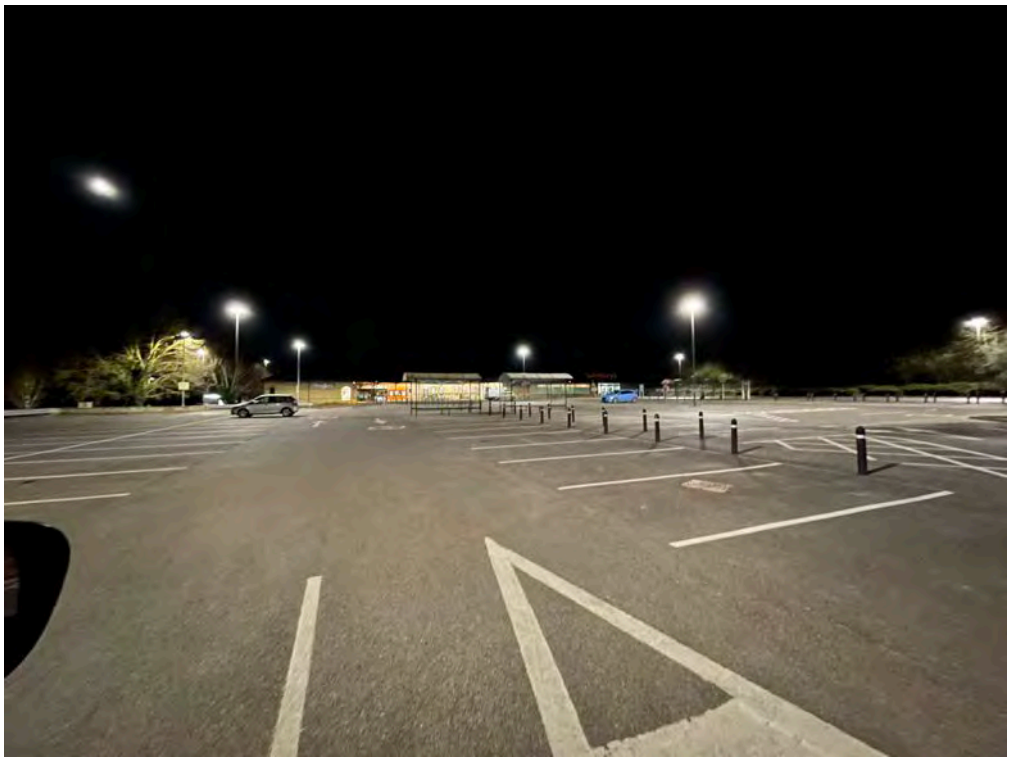


Plate 14. Car Park /Security/Shop Lighting at Sainsbury's Car Park

Plate 15. Business / Security Lighting on Bridge Street

Plate 16. Very Bright Street Lighting on Cottle Avenue

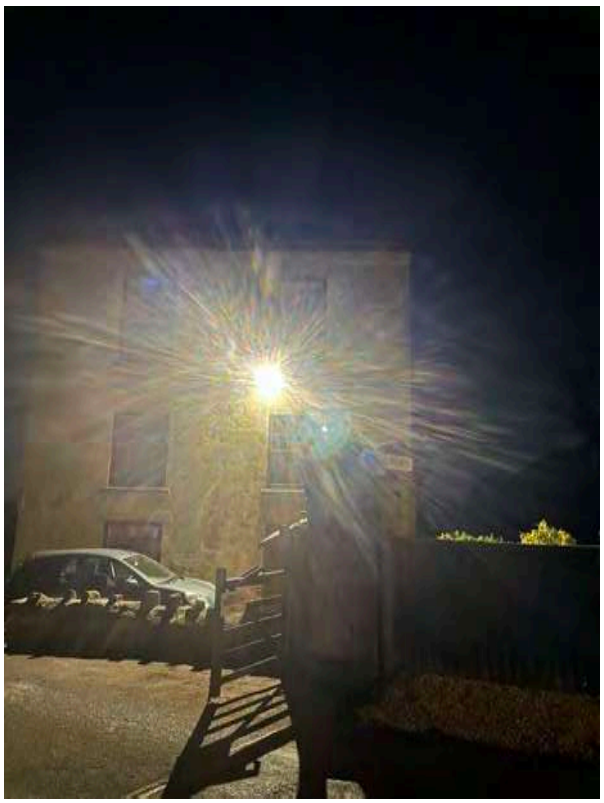


Plate 18. Example of Domestic Security Lighting

Plate 19. Street Lighting on Winsley Road

Plate 19. Illuminated Section of Path in the Tory's

Plate 20. Street and Bus Stop Lighting on Winsley Road

Plate 21. View over Bradford on Avon Emphasizing Lighting (including moonlight)

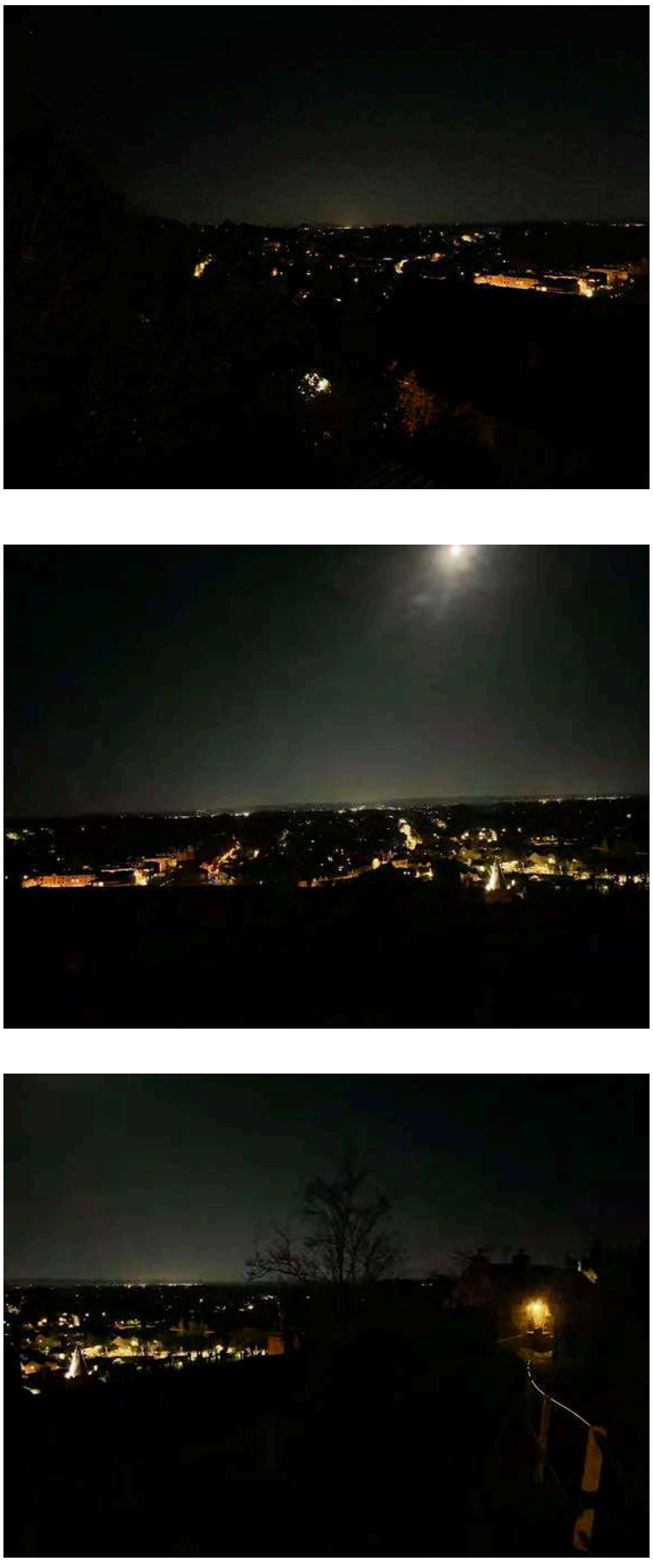
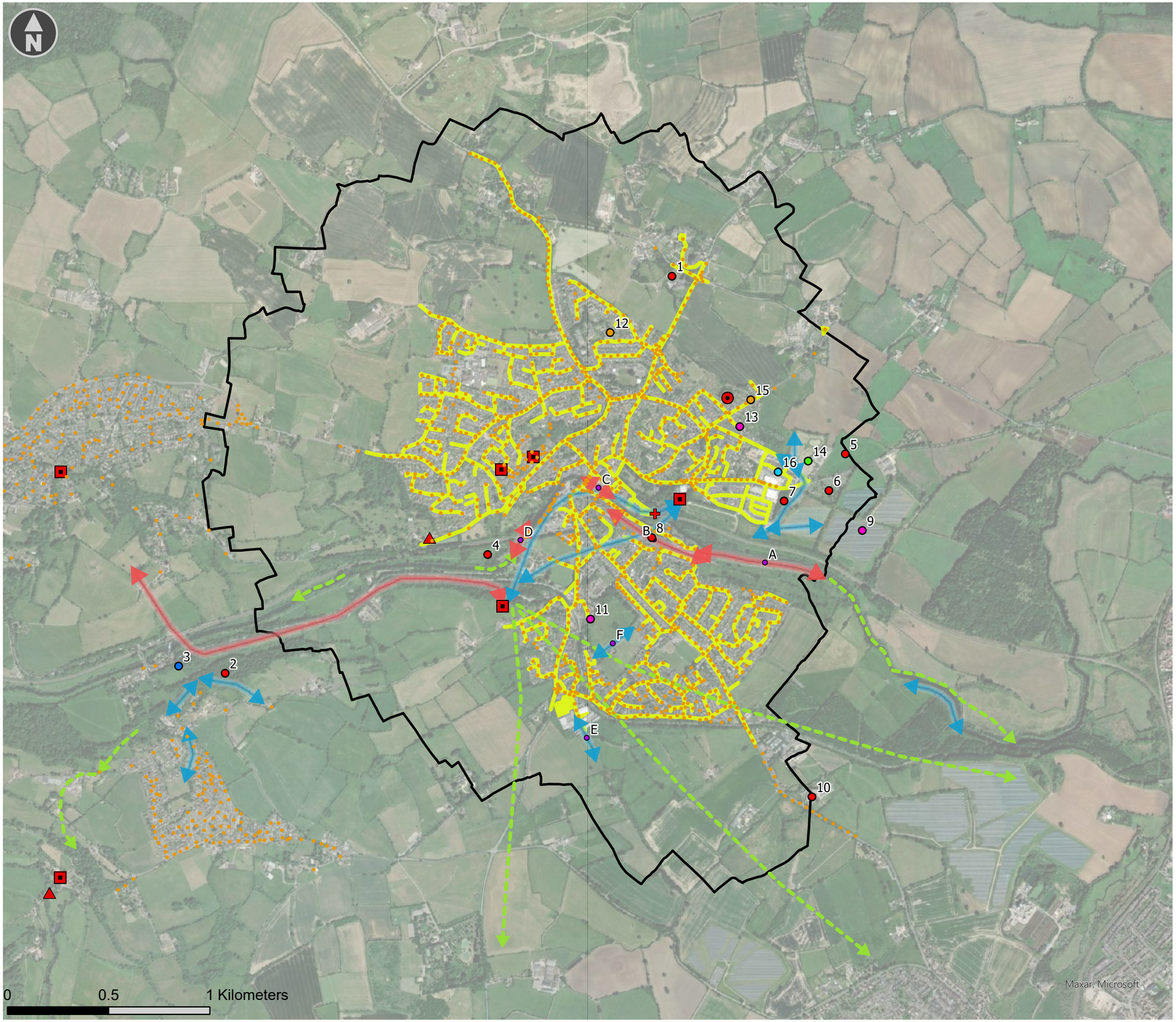


Plate 22. View over Bradford on Avon Emphasizing Dark Areas (including moonlight)

APPENDIX D: BOA ALAN SURVEY DATA AND MAP



JOHNS ASSOCIATES

- Bradford on Avon Council Parish Boundary
- Street Lights
- Artifical Street Lighting Buffer
- Greater Horseshoe Roost
- Large Lesser Horseshoe Roost
- Lesser Horseshoe Roost
- Lesser Horseshoe Maternity Roost
- Major Known Commuting Foraging Route
- Some Evidence of Commuting
- Speculative Route (Bats detected outside area in these directions)
- Notes

Bat Survey Locations and Species Recorded

- Daubenton's Bat
- Greater Horseshoe Bats
- Lesser Horseshoe Bats
- Lesser and Greater Horseshoe Bats
- Lesser and Greater Horseshoe, and Myotis/ Bechsteins Bats
- No Species Recorded

A - Lesser Horseshoe Commuting
B - Lesser Horseshoe Commuting
C - Lesser Horseshoe
D - Lesser Horseshoe (Potential Greater Horseshoe)
E - Greater Horseshoe Records
F - Lesser Horseshoe

CLIENT	Bradford on Avon Town Council
PROJECT	BOATC Draft Lighting Strategy
TITLE	Roosts and Commuting Routes - With Street Lights

SCALE @ A3	CREATED BY	CHECKED BY
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REFERENCE	**REVISION**	**DATE ISSUED**
J00730-004		24/3/2022

APPENDIX E: DRAFT BOATC LIGHTING POLICY

Bradford on Avon Town Council has identified a need to set out a robust Artificial Lighting at Night Policy to underpin its aims to ensure lighting is appropriate and sensitively designed, to reduce existing sources of light pollution and help minimise, manage and positively influence the impact of any new lighting.

To maximise the opportunity to achieve this objective the Policy has been designed to guide public decisions on new lighting and help private householders and businesses make the right lighting choices. This includes transportation & highways, planning and building control processes, retail, leisure and tourism sectors, crime prevention and security, or beyond public and regulatory decisions to individual household or business premises where lighting can be erected without formal consent.

Located on the edge of the Cotswold Area of Outstanding National Beauty, inappropriate lighting in Bradford on Avon can affect the setting of the statutorily designated area, which has its own robust policy on lighting. Bradford on Avon is also rich with light sensitive wildlife, including legally protected species and habitats (e.g. bats and bat roosts), this includes statutorily designated sites and associated critical habitat used for feeding and commuting. The community also require appropriate lighting in the right places to facilitate a wide range of activities, safety and security. Finding the right balance between these aspects is key to successfully delivering appropriate artificial lighting at night.

The dark spaces of Bradford on Avon should be conserved and enhanced, with light pollution levels reduced wherever possible, or as a minimum, kept to current levels. Residents are encouraged to use curtains and blinds in any event to minimise light spillage from windows, use hooded and eco-friendly outdoor lighting and turn off when not in use.

New or replacement external lighting, and other externally projected lighting, should:

(i). Demonstrate the need to be installed for its intended purpose or as a result of significant community demand;

(ii). Maintain or enhance the measured pre-development lighting quality of the surrounding area[8];

(iii). Not be visible in the surrounding landscape (Cotswold AONB or its setting) and avoid or mitigate light spillage (see v);

(iv). Ensure no negative impact upon wildlife habitats, migration and feeding behaviour[9];

(v). Should meet or exceed the Institute of Lighting Professionals (ILP) Guidance for lighting[10] within Environmental Zones E01 (Natural and Intrinsically Dark) E2 (Rural Low District Brightness) and E3 (Suburban Medium District Brightness) depending on spatial location within the Parish.

(vi). Reduce carbon emissions and energy consumption; and

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[8] https://www.gov.uk/guidance/light-pollution

[9] https://cdn.bats.org.uk/pdf/Resources/ilp- guidance-note-8-bats-and-artificial-lighting-compressed.pdf?mtime=20181113114229

[10] https://theilp.org.uk/publication/guidance-note-1-for-the-reduction-of-obtrusive- light-2020/

(vii). Be subject to appropriate mitigation and control measures secured with consent conditions to prevent unnecessary light pollution. Examples include:

- reflect the latest best practise guidance on light types in terms of lumens, wattage, angle, height, colour warmth, etc.
- Switched on only when needed, use of 'curfew' (12pm – 6am) automatic timers, and night-time dimming;
- use of proximity infrared motion sensors, timers or any additional shielding or coving, including angling the front surface of lights to below the horizontal;
- use of different surface types to reduce the amount of reflectivity;
- screening or shielding to reduce the impact of reflectivity.

The spill of lighting from large open glass windows and sky lights often present a greater source of light pollution than well designed externally mounted lights. It is important to minimise the potential impact of such lighting by careful design of buildings and use of curtains/blinds to reduce light spill from internal lighting and incorporate suitable mitigation measures.

Where a proposal involves additional outdoor lighting, it should be accompanied by a statement that justifies why the lighting proposed is necessary for its intended use and that shows efforts have been included in the lighting designed to mitigate sky glow and light intrusion.

The Cotswold Area of Outstanding Natural Beauty Position Statement on Dark Skies and Artificial Light (March 2019) provides comprehensive guidance to help planners, developers, engineers and architects to determine whether lighting is appropriate and where it is needed designed to minimise negative impacts.

Because of the international importance of the bat population of Bradford on Avon, alongside other sensitive and important nocturnal animals, the Precautionary Principal should be adopted with a preference to avoid the introduction of additional lighting unless the need and the effects are robustly demonstrated (see footnote 7).

There is no statutory duty for local authorities in the UK to provide public lighting. When developing an opinion on whether new lighting delivers a net benefit, this should be demonstrated on a case-by-case basis supported by a suitable lighting assessment that properly assesses potential impacts on the locality and wider landscape and environment.

In applying this policy Bradford on Avon Town Council does recognise that artificial lighting does makes a positive contribution in certain built environments, especially to people's perception of safety and their ability to enjoy public spaces after dark. The growing awareness of the negative impacts of artificial lighting on wildlife populations, human health, wasted energy, loss of dark skies and landscape tranquillity, underpins a strong argument to limit additional lighting and to improve that already present.

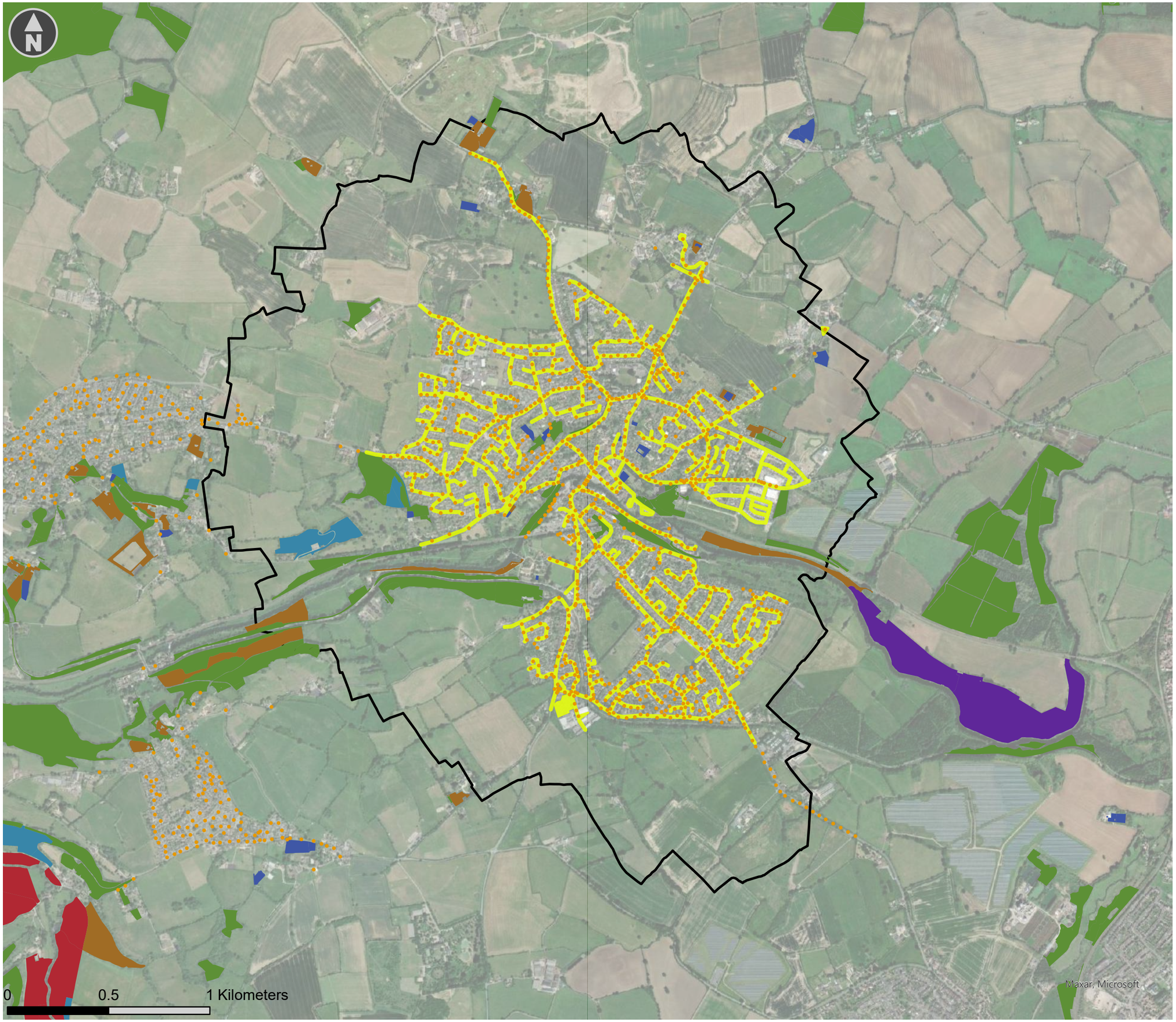
APPENDIX F: BOATC LIGHTING AND PLANNING TEMPLATE RESPONSES

Bradford on Avon Town Council is content that this planning application demonstrates a clear need for additional lighting associated with safety, security and amenity and supports the inclusion of minimal and well-designed/controlled lighting with minimal adverse effects on wildlife, people and landscape. It is content that it meets national and local plan policy requirements.

Bradford on Avon Town Council objects to this planning application on the basis that it does not include or specify minimal or well-designed/controlled lighting in a location that is currently unlit and the supporting documents do not specify a clear need for lighting based on safety, security and amenity. As such, it does not believe it meets national or local plan policy requirements.

Bradford on Avon Town Council objects to this planning application as it will result in an increase in light levels within a location associated with particular ecological and/or landscape sensitivities. In the absence of supporting documentation to demonstrate this will not be the case, through appropriate survey, modelling and mitigation, it is considered that the proposed additional lighting will cause harm and does not meet the requirements of national and local plan policy requirements or legislation.

APPENDIX G: OTHER DRAWINGS AND PLANS



JOHNS ASSOCIATES

Bradford on Avon Council Parish Boundary
Street Lights
Artifical Street Lighting Buffer

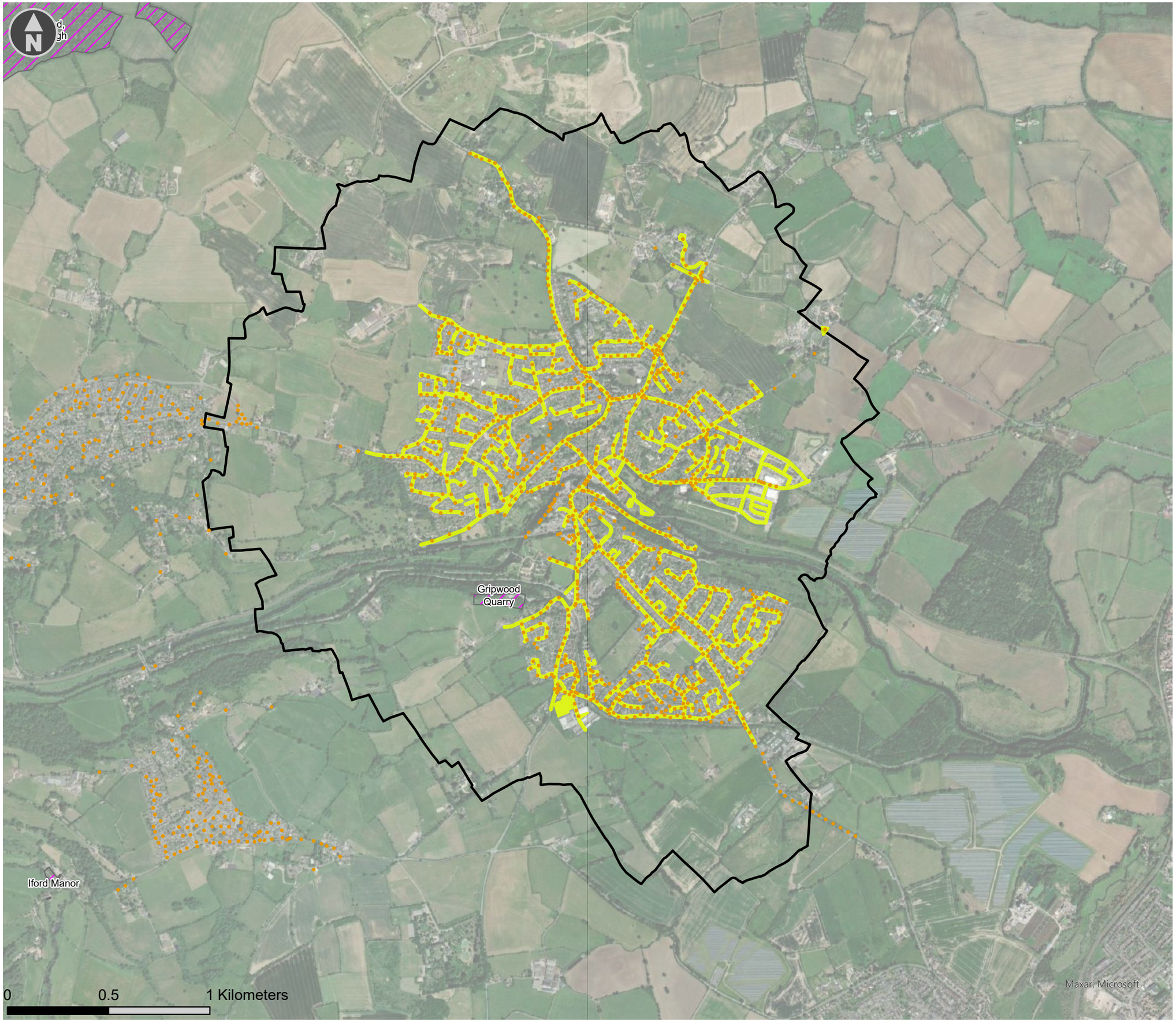
Priority Habitats Inventory (Natural England)
Coastal and floodplain grazing marsh
Deciduous woodland
Good quality semi-improved grassland
Lowland calcareous grassland
No main habitat but additional habitats present
Traditional orchard

CLIENT Bradford on Avon Town Council

PROJECT BOATC Draft Lighting Strategy

TITLE Street Lights and Priority Habitats

SCALE @ A3	CREATED BY	CHECKED BY
1:17,500	JS	MJ
REFERENCE	**REVISION**	**DATE ISSUED**
J00730-006		24/3/2022



JOHNS ASSOCIATES

- Bradford on Avon Council Parish Boundary
- Street Lights
- Artifical Street Lighting Buffer
- Sites of Special Scientific Interest (SSSI) © Natural England

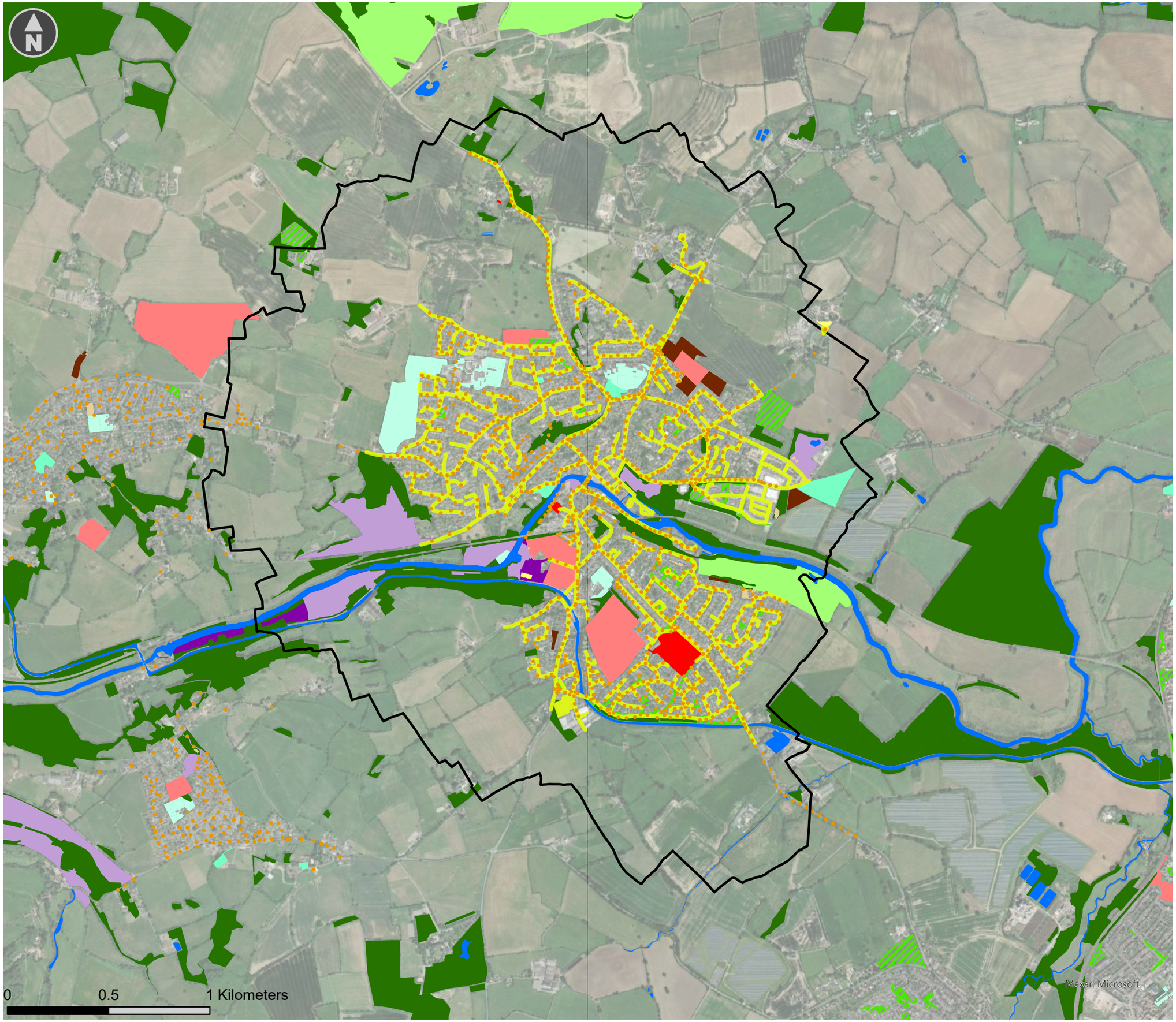
A - Lesser Horseshoe Commuting
B - Lesser Horseshoe Commuting
C - Lesser Horseshoe
D - Lesser Horseshoe (Potential Greater Horseshoe)
E - Greater Horseshoe Records
F - Lesser Horseshoe

CLIENT Bradford on Avon Town Council

PROJECT BOATC Draft Lighting Strategy

TITLE Street Lights with Designated Sites

SCALE @ A3	CREATED BY	CHECKED BY
1:17,500	JS	MJ
REFERENCE	**REVISION**	**DATE ISSUED**
J00730-007		24/3/2022



JOHNS ASSOCIATES

- Bradford on Avon Council Parish Boundary
- Street Lights
- Artifical Street Lighting Buffer

Green/Blue Infrastructure Category

- Access Land (CRoW)
- Activity Spaces Provision (Inc Bowling Greens, Tennis Courts)
- Allotments or Community Growing Spaces
- Cemeteries and Religious Grounds
- Golf Course
- Other Amenity Green Space
- Other Sports Facilities
- Play Space Provision
- Playing Fields
- Public Park - Country Park
- Public Park - General
- Water Courses and Surface Water Features
- Woodland

CLIENT Bradford on Avon Town Council

PROJECT BOATC Draft Lighting Strategy

TITLE Street Lights and GBI Data

SCALE @ A3	CREATED BY	CHECKED BY
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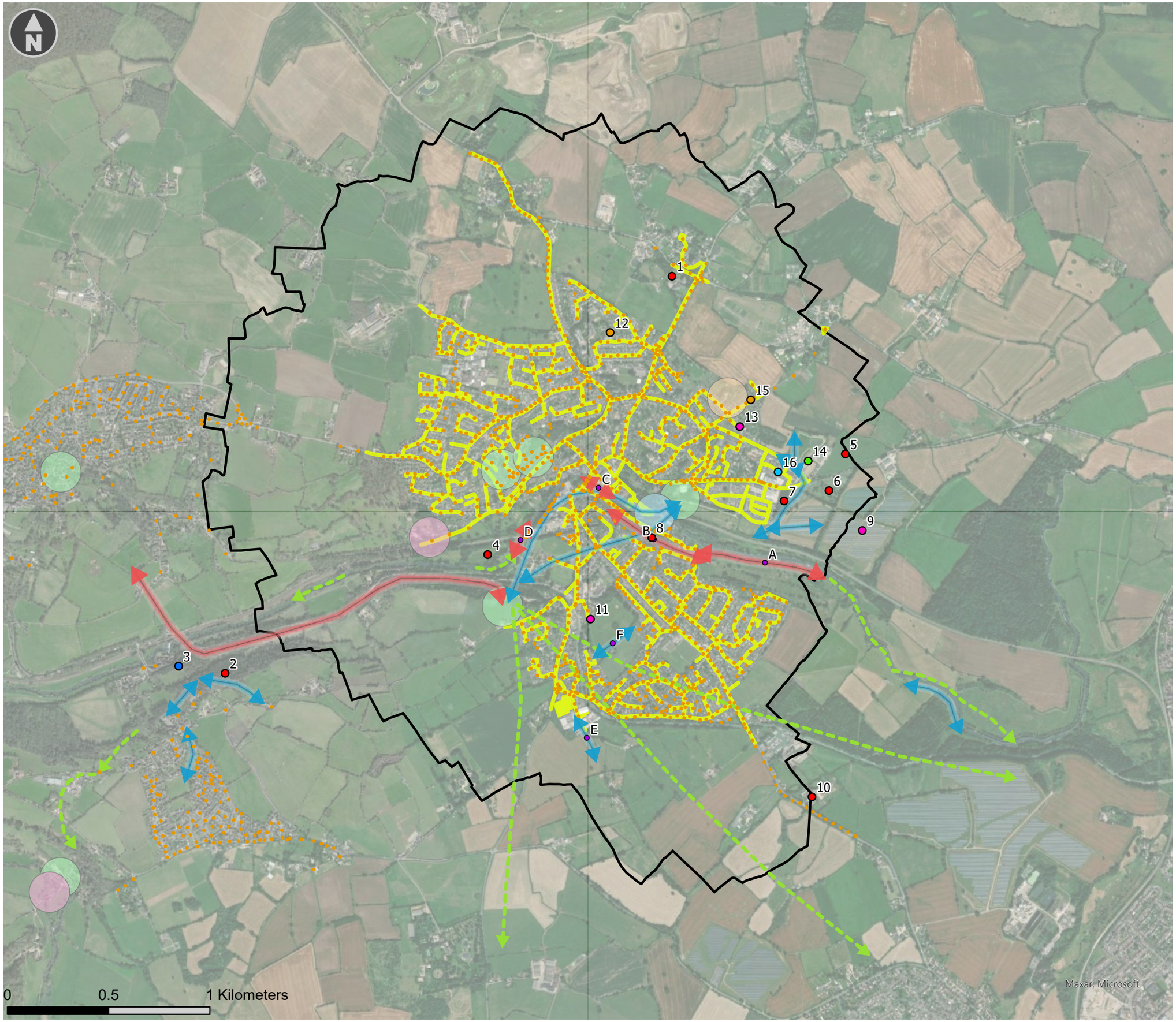
J00730-008		24/3/2022



JOHNS ASSOCIATES

- Bradford on Avon Council Parish Boundary
- Street Lights
- Artifical Street Lighting Buffer
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- Lesser Horseshoe Maternity Roost
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F - Lesser Horseshoe

REV	NOTES	DATE
A	Roost areas added	18/7/2022

CLIENT Bradford on Avon Town Council

PROJECT BOATC Draft Lighting Strategy

TITLE Roosts and Commuting Routes - With Street Lights

SCALE @ A3	CREATED BY	CHECKED BY
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REFERENCE	**REVISION**	**DATE ISSUED**
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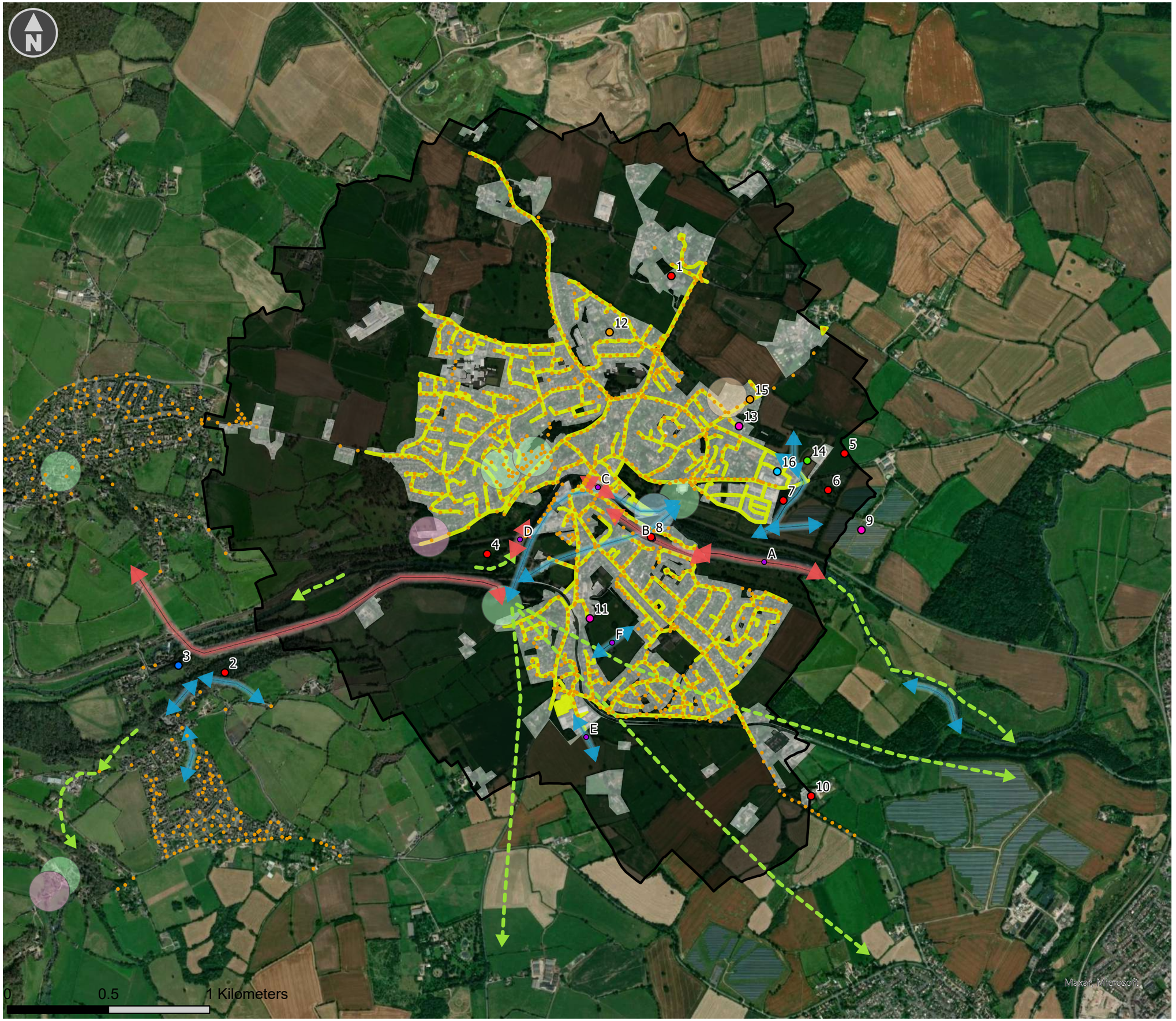

JOHNS ASSOCIATES

- Bradford on Avon Council Parish Boundary
- Street Lights
- Notes
- Dark Zone Areas
- Minimal Lighting Areas (Following BoA Lighting Strategy)
- Artifical Street Lighting Buffer
- Greater Horseshoe Roost
- Large Lesser Horseshoe Roost
- Lesser Horseshoe Maternity Roost
- Lesser Horseshoe Roost
- Major Known Commuting Foraging Route
- Some Evidence of Commuting
- Speculative Route (Bats detected outside area in these directions)

Bat Survey Locations and Species Recorded

- Daubenton's Bat
- Greater Horseshoe Bats
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REV	NOTES	DATE
A	Roost areas added	18/7/2022

CLIENT Bradford on Avon Town Council

PROJECT BOATC Draft Lighting Strategy

TITLE Dark Zones

SCALE @ A3	CREATED BY	CHECKED BY
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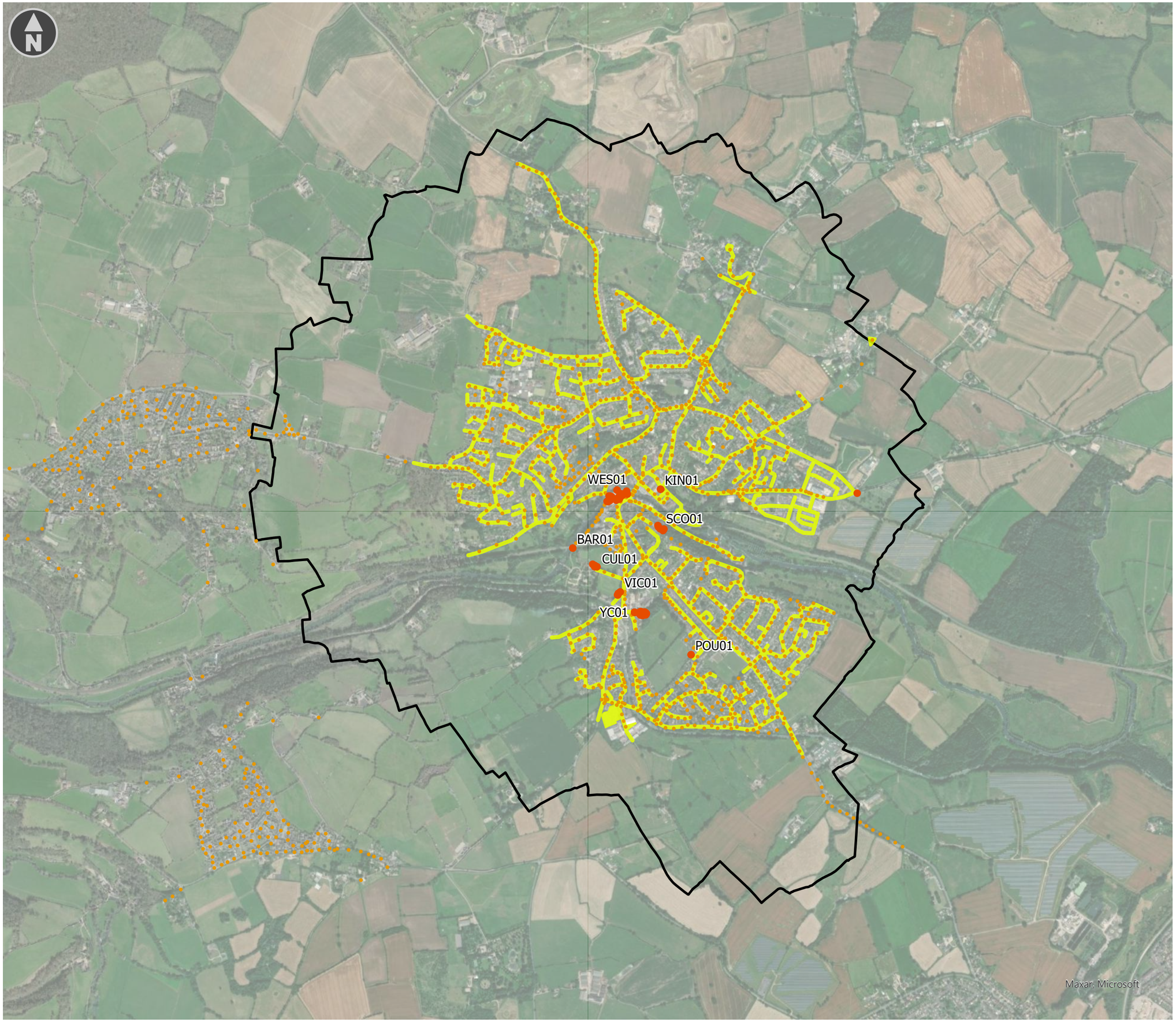
REFERENCE	**REVISION**	**DATE ISSUED**
J00730-0011	A	18/7/2022



JOHNS ASSOCIATES

- Bradford on Avon Council Parish Boundary
- Artifical Street Lighting Buffer
- BoATC External Lights
- Street Lights

CLIENT	Bradford on Avon Town Council
PROJECT	BOATC Draft Lighting Strategy
TITLE	BoATC Owned External Lights

SCALE @ A3	CREATED BY	CHECKED BY
1:17,500	CA	TP
REFERENCE	**ISSUE/REVISION**	**DATE**
J00730-012A		21/7/2022

JOHNS ASSOCIATES

- BoATC External Lights

CLIENT	Bradford on Avon Town Council
PROJECT	BOATC Draft Lighting Strategy
TITLE	BoATC Owned External Lights - Areas of Interest

SCALE @	**A3**	**CREATED BY**	**CHECKED BY**
		CA	TP
REFERENCE	**ISSUE/REVISION**		**DATE**
J00730-012B			18/7/2022

PHOTOGRAPHS OF BOATC EXTERNAL LIGHTING LOCATION

Barton Farm BAR01

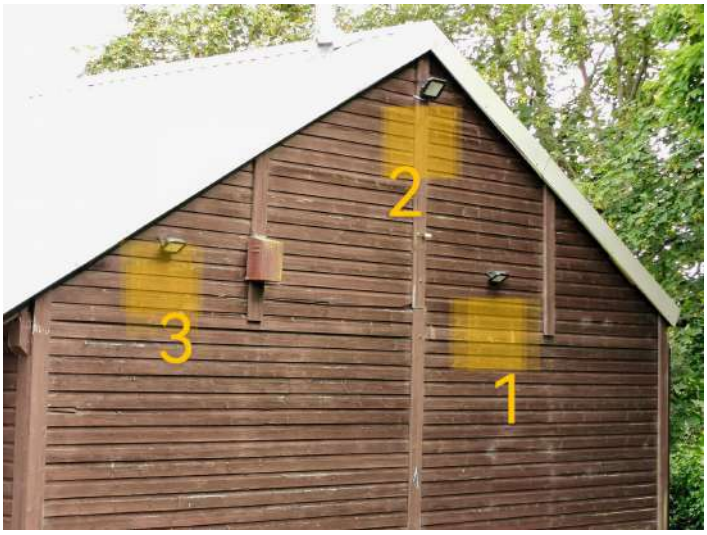
Cemetery CEM01

Culver Close CUL01

Kingston House KIN01

Poulton POU01

Scout Hut SCO01-03



St Margaret's Hall SMH01-03

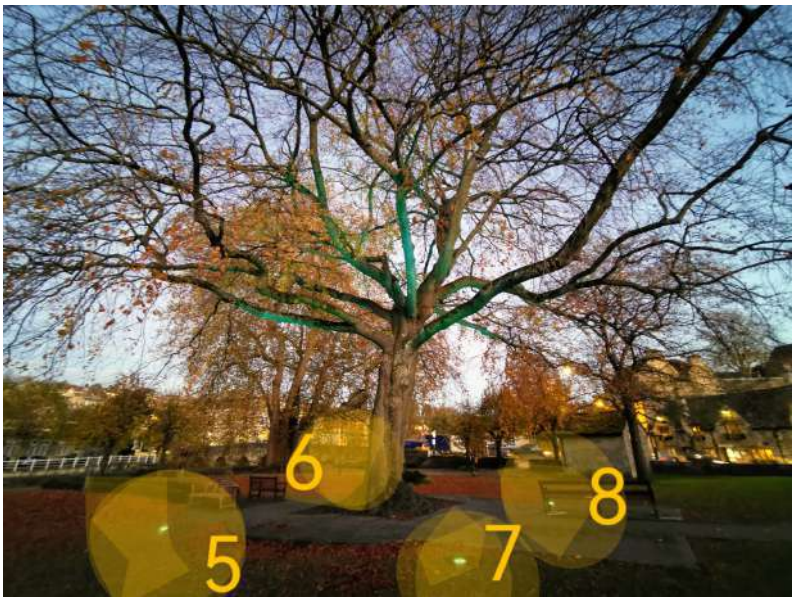
St. Margaret's Toilets SMT01

Tourist Information Centre TIC01

Victory Field VIC01

Westbury Garden WES01

Westbury Garden WES05



Youth Centre YC01