NEWPORT'S SENSE OF NIGHT... AND LIGHT

NEWPORT LIGHTING MASTERPLAN | 2021

Credit is due to many people who contributed to this document.

Project and stakeholders team:

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The Working Group:

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- Lynda Huxley, Swift Conservation Ireland
- Fiona Hopkins, Mayo Dark Sky Festival Director
- Liz McManamon, Newport Business Association
- Deirdre Cunningham, Heritage Officer, Mayo County Council
- Noelle Angley, Architect, Mayo County Council
- Ann Moore, Administrative Officer, Mayo County Council
- Ged Dowling, Terra Firma Ireland
- Stephen McVeigh, Civil Engineer
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An Chomhairle Oidhreachta
The Heritage Council

An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

"This project received funding from the Heritage Council and the Department of Culture, Heritage and the Gaeltacht in 2020"

NOTE
Due to the pages' size it has not been possible to incorporate scaled drawings into this document. Pictures are included for illustrative purposes only, if not otherwise declared.

Prepared for Newport, Co. Mayo

LDW LIGHTING DESIGN WORKSHOP
CORRADINI / PALANDELLA

Mayo Dark Skies

Comhairle Contae Mhaigh Eo
Mayo County Council

Dark Sky Ireland

TERRA FIRMA

Swift Conservation Ireland
www.swiftconservation.ie

1. INTRODUCTION

1.1 EXECUTIVE SUMMARY

This Lighting Master Plan, funded by the Heritage Council, seeks to provide best practice design and guidelines for artificial lighting in the town of Newport, County Mayo, the gateway town to Mayo International Dark Sky Park. This is the first plan of its kind in Ireland, driven by the needs of the community. It is intended to form a template for other areas seeking dark sky status or wishing to implement a lighting policy.

The strategies within these pages are intended to act as a reference tool for councillors, town planners, engineers, architects, residents and community groups. Our goal is to provide practical solutions as well as a solid base for setting feasible technical and aesthetic guidelines for coordinating future lighting plans.
If the designs detailed within this plan are implemented, Newport, County Mayo, will become the first Dark Sky Friendly town in Ireland.

Guiding principle
The guiding principle of this document is that lighting should be designed elegantly and in a natural way, as if it has always been there.

Community Engagement

Information and evidence are key to making effective decisions that place the community at the core of the process. In preparing this document we have engaged a number of community groups in the Newport area encompassing interests of the residents and business community. We have featured the themes of environmental education, wellbeing, heritage, and sustainable tourism.

The goals for this plan are:

- Increase comfort and a sense of safety for the community
- Compliance with National Lighting Standards
- Reconnect values of the night and natural darkness
- Provide an ecologically sensitive lighting scheme for the town
- Enhance the nocturnal atmosphere of Newport after dark
- Improve street lighting uniformity
- Reduce energy use
- Enhance Dark Sky Tourism Potential

Strategy and Principles

This plan complies with the principles of the International Dark Sky Association which are as follows:

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.

For example, wet surfaces 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.

COLOUR – Warmer-coloured lighting should be used whenever possible.
Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.

This report also references guidelines laid out in European Standard EN 13201-1:2015 adhering to the street lighting classes appropriate to the Newport area, Institution of Lighting Professionals "Guidance note for the reduction of intrusive light", GN01.

Recommendations

This plan provides key actions and recommendations on lighting design for built heritage structures, private domestic lighting, commercial lighting and public street lighting. Recommendations for landscape, festive events and sports events are also provided within the section on "Controlling Light Pollution".

Suggested Priority of Interventions:

Following an evaluation of existing lighting practices, the needs of the community and the goals of this plan, the following priorities arise from this plan:

Urgent – Implementation of lighting designs for the Viaduct Bridge spanning the Newport River, and St Patrick's Church on Barrack Hill.

Medium - Public lighting on residential and commercial roads intersecting with the N59 in the town of Newport are listed as a medium priority intervention, with dark sky specifications provided.

Longer term - public lighting on the N59 through the town has recently been replaced, at the time of this publication, with compliant warm toned fixtures at a Correlated Colour Temperature ("CCT") of 2700 kelvin. Should any retrofits be required to these lights, they should be in keeping with the strategy and guidelines provided in this plan.

It should be noted that the installation of these lanterns has been welcomed by the community and is a leading example of lighting a national road in the country.

Sustainable Development Goals

The concept of a dark sky policy aligns with a number of the UN's Sustainable Development Goals as detailed later in this document. Recognition of these alignments will assist local authorities in future decision making on planning for artificial light in our communities.

Summary

Unlike other sources of pollution, taking action to combat light pollutioncan have an immediate effect. If the recommendations with these pages are carried out; a restoration of natural sky conditions in the Newport area by a mere 10% will lead to approximately five hundred more stars becoming visible in the surrounding countryside, plus improved conditions for nature, a reduction in energy consumption and security for the natural asset that is Mayo Dark Sky Park.

Within the pages of this document you will find the following:

- An assessment on the existing lighting in Newport, identifying problematic areas;
- Evidence of community consultation with letters of support from local associations, environmental groups and stakeholders;
- An evaluation of the need for appropriate levels of artificial light and the impact of excessive light;
- Designs for lighting the key structures of Newport Church and Viaduct Bridge together with nightscape renders showing light designs within the town;
- Recommendations for light policy and best practice to qualify as a **Dark Sky Friendly Town**

1.2 A MESSAGE FROM OUR PATRON, DUNCAN STEWART

I am delighted that the Heritage Council have found this project worthy of funding. Light pollution threatens the future of Mayo International Dark Sky Park and the natural heritage of this ecologically sensitive region.

Newport is an historic town, providing a natural habitat both by day and by night. This, along with its proximity to Wild Nephin Ballycroy National Park and the Nephin Beg mountain range form a unique wilderness in Ireland, including the Marine Institute's research facility and Fishery at Burrishoole catchment, which is one of Ireland's premier Lough fisheries for salmon.

Newport also acts as a 'gateway' to a unique tourism destination and nature experience, which is complemented by this valuable sustainable initiative. It is a very appropriate place to demonstrate sensitive artificial lighting that is compatible with its Dark Sky designation, helping to protect and restore its native insects and wildlife.

Light pollution is destroying natural darkness with severe consequences. Scientists link light pollution to global insect decline, the death of millions of migrating birds, increased carbon emissions, and disruption of human wellbeing. This Lighting Master Plan will benefit nature and enhance the 'dark sky' experience for visitors and the local community alike with examples of sensitive lighting. It will also act as an exemplary demonstration for other Irish County Councils to follow and could become a 'game-changer' for outdoor lighting techniques across Ireland.

I congratulate Mayo County Council on embracing this initiative, by replacing and installing low-kelvin light fittings on the approach roads into Newport and I look forward to their continued works to transform Newport into Ireland's first dark sky friendly town.

My This is the first community driven plan of its kind to consider redesigning the nocturnal landscape – often overlooked yet our revolving world depends on darkness.

- It will enhance the built heritage of the town, whilst also preserving natural heritage in tandem with community needs and wellbeing.
- It provides a framework of collaborative work including the local authority, international experts, evidence-based research and community needs.

Mayo is leading the way on this unique dark sky initiative, and with the support of the Heritage Council, this is presented as a 'living lab' and a transferable plan for other areas to follow. I compliment the Heritage Council for their support for this project.

Duncan Stewart
Producer 'Eco Eye' TV series

This photo was taken prior to the N59 lighting upgrades, showing a mixture of light sources and glare from white LEDs.

1.3 FOREWORD

The Friends of Mayo Dark Skies is a voluntary group, established by local people from Newport, Mulranny and Ballycroy to promote the goals of Mayo International Dark Sky Park and to raise awareness of light pollution. Our motto is *"Let's raise children who can name more stars in the sky, than stars on the screen".*

We wish to acknowledge The Heritage Council for enabling us to commission the designs and specifications within this Lighting Master Plan and we are very grateful for their support. Our working group dedicated many hours on a very tight deadline for research, consultation and the contribution of content for this plan and we sincerely thank them for their time and expertise. In particular, may we thank Professor Brian Espey for the ongoing support he has shown to our project here in Mayo and the countless hours he has contributed to the technical detail found within these pages.

Finally, may we express our thanks to the lighting design team led by Roberto Corradini and Marco Palandella. Completing this work remotely and during the pandemic period, has been a challenge for us all but especially to the team based in Italy. Having visited Newport on just one occasion in the past, their passion for dark skies of Mayo is very evident.

Why is this plan necessary?

There is no doubt that artificial lighting has its place in our world and is invaluable to our businesses, homes, roads and recreation. However, when used inappropriately or excessively, artificial lighting can cause light pollution. Many of us are not aware that light pollution has adverse effects on the environment, our health, biodiversity, and through energy waste, on our climate.

In the UK over 80% of the population can no longer view The Milky Way from their home due to light pollution. In Ireland, over 50% of the population has also lost sight of this natural night sky phenomenon and this figure is rising rapidly due to the increase in domestic, commercial and public lighting over recent years.

Without taking action to protect our night sky heritage, there is a risk of losing it due to the growth of light pollution.

The recommendations provided within this plan, promote informed change through evidence-based research solutions to create harmony and social ambience in our nocturnal environment. As such, we promote the Danish lifestyle concept of "Hygge" which means a cosy, warm and welcoming environment. In Irish we refer to this as "**Teolaí**".

This encapsulates the spirit of our dark sky ethos and the tone for the content in the forthcoming pages.

Georgia MacMillan
For and on behalf of the Friends of Mayo Dark Skies

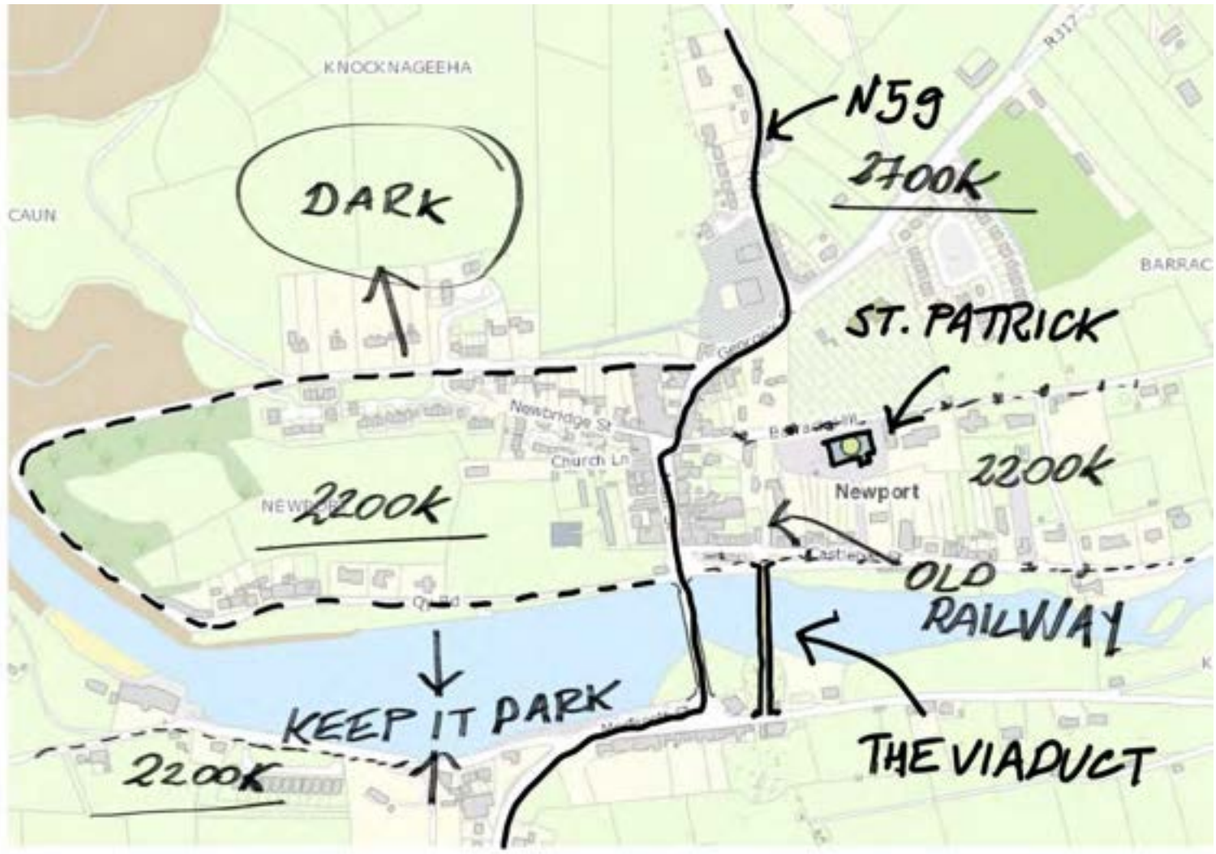
Foreword from the Lighting Designers

Recognising the threat of light pollution to the night in West Ireland, a group of enthusiasts within the Friends of Mayo Dark Skies, a community group affiliated with the Dark Sky Ireland network and a chapter of the International Dark Sky Association asked Marco Palandella and Roberto Corradini, Italian lighting designers of Lighting Design Workshop, to address the issue. Thanks to the financial support of The Heritage Council – An Chomhairle Oidhreacthta we joined the team in September 2020 and began a concentrated effort on research about biodiversity, heritage, traffic, lighting, astronomy, learning the development in dark sky philosophy and illumination science allowing us to share this Lighting Master Plan.

Interestingly, the short time allowed for some amazing results. Our project team shared the views of various stakeholders aiming to find a bespoke solution for Newport. Thus these Guidelines are intended to be consistent with the ongoing dark sky movement and help to protect, maintain and improve the beauty of the dark sky, which is enjoyed by Ballycroy National Park visitors and, at the same time, improving the quality of life in Newport's urban and rural environmental settings.

Finally, we want to recognise the visionary leadership of the Friends of Mayo Dark Skies. Since we first met, they have sought to preserve the beauty of the night sky at all of this wonderful part of Ireland. Our work has been continuously shared with them utilising their insights and cultural experience of the territory and, therefore, we hope the benefits of this Lighting Master Plan can be shared with other Irish towns.

Roberto Corradini & Marco Palandella
November 23, 2020



1.2 INTRODUCTION TO NEWPORT

The beautiful Heritage town of Newport is situated in the barony of Burrishoole, County Mayo, on the shores of Clew Bay. The Newport River (also referred to as the Black Oak River) flows through the centre of the town before entering the Atlantic Ocean. There are pleasant walking paths along its grassy banks, continuing over the iconic Seven Arches viaduct bridge, built in 1892 to carry the Westport to Achill railway line, which ceased operating in 1937. Newport town is a fantastic base for exploring the many natural and built heritage sites as well as walking and cycling routes in close proximity.

One of the neighbourhood walks to the west of the town passes through Princess Grace Park by the edge of the Black Oak river. The park commemorates the Hollywood actress Grace Kelly who had a special connection to the area as her paternal grandfather hailed from the townland of Drimurla near Newport. He emigrated to Philadelphia in 1887, where he founded one of that city's leading construction companies and made his family's fortune. Grace's path through life eventually brought her back as royalty to the Newport area in 1961 accompanied by her husband, Prince Rainier Grimaldi of Monaco. During a number of visits to Newport in the 1960s and 1970s, Princess Grace became familiar with the birthplace of her forebears and even purchased the family homestead. Many Newport people fondly recall meeting the Princess when she visited Newport.

Of a number of beautiful buildings in Newport the most dominant is St. Patrick's Church, which was built in 1918 in the Irish Romanesque Style and has an entrance doorway that is modelled on the one in Clonfert Cathedral, Co. Galway. The highlight of the church is the stained-glass window at the East end by the famous artist Harry Clarke. The church dominates the skyline from all approaches to the town and with the appropriate lighting the architecture of this magnificent building would be greatly enhanced.

Grace Kelly The photo is from MGM and before her 1956 marriage
Metro-Goldwyn-Mayer, Public domain, via Wikimedia Commons

Other features of interest in the neighbourhood of Newport include the ruins of the fifteenth century Burrishoole Abbey just outside the town. The Abbey was founded in 1469, but was abandoned in 1698 with the expulsion of the Catholic clergy under the penal laws. It is situated in an idyllic setting on the shores of Clew bay and provides a convenient venue for the Newport Astronomy Club to host observation evenings.

For those seeking more active holidays two major routes in the vicinity are of interest. The Great Western Greenway is a 42km cycling and walking route which follows the old railway line from Westport to Achill and passes through Newport over the Seven Arches bridge. The Greenway is a major tourist attraction which has brought many visitors to the area and provided income to the local community.

For walkers, there is the 39 km waymarked Bangor trail which starts in Newport and finishes in Bangor Erris, Co. Mayo. This challenging trail follows an old drover path (a path for moving livestock) which may date to the Iron Age. The trail passes through all types of terrain, including the most remote mountain range in the country, the Nephin Beg Mountains. The remoteness of this location allows hikers to experience a solitude no longer available elsewhere in Ireland. Part of The Bangor Trail traverses through Wild Nephin Ballycroy National Park, which is home to Mayo International Dark Sky Park.

Photo source OSI.ie

Photo by Mike Kinsella

Countryside view from the heart of Newport town. Photo by Ged Dowling

1.5 DARK SKY VISION

"No one will protect what they don't care about; and no one will care about what they have never experienced"

Sir David Attenborough

In May 2016, a Gold Tier standard of International Dark Sky Park was awarded to Wild Nephin Ballycroy National Park, accredited as Mayo International Dark Sky Park (Mayo Dark Sky Park). The dark sky certification process is modelled on conservation programmes, such as UNESCO World Heritage Sites and Biosphere Reserves and a Gold Tier award is the highest possible accolade, meaning that Mayo is now internationally recognised as one of the best places in the world to view the wonders of the night.

Newport is the gateway town to Mayo Dark Sky Park and this flagship project to create a Master Lighting Plan will safeguard the future of the International Dark Sky Park, which has become a valuable sustainable tourism asset to the area. The plan also aspires to become a leading example of nightscape design.

Saving energy is not enough: the plan must address the needs of biodiversity together with social ambience and create an attractive design for Newport after dark. This vision will allow all members of the community to safely enjoy the town's unique architectural heritage, against a beautiful backdrop of a natural night sky, free from light pollution.

The project vision extends to public lighting and we have worked closely with Mayo County Council. We applaud their decision to rollout ecologically sensitive/dark sky friendly lighting on the N59 surrounding the Mayo Dark Sky Park, with warmer toned lighting of improved quality in order to protect this sensitive environment. This lighting project is the first of its kind in the country and shows great commitment to the region and to preserving the dark skies of Mayo.

Since 2016, the Mayo Dark Sky Festival has been hosted in the town of Newport, as well as the neighbouring communities of Mulranny and Ballycroy (known collectively as the "Dark Sky Communities"). The festival celebrates the night skies of Mayo with a three day experience exploring the realms of Science, Astronomy, Cultural Heritage and the Environment in a fusion of events for all the family to enjoy. This much-loved event is a highlight on the county calendar, attracting significant business and visitors to the area during the off-season period. Adapting Newport's lighting to "dark sky friendly" complements the festival ethos of a welcoming, sensitive environment and showcases the town's built heritage for visitors to enjoy, creating an excellent base to explore Mayo Dark Sky Park.

Half the Park is After Dark
Commissioned Artwork by Tyler Nordgren, 2020

Ballycroy National Park
Visitor Centre

Mayo Dark Sky Park

Robert Lloyd
Praeger Centre

Claggan Mountain
Coastal Trail

Achill Sound

Mallaranny

Newport

N59

R319

R312

R316

R317

R311

This map illustrates Newport's proximity to the Mayo Dark Sky Park along with our neighbouring Dark Sky Communities

1.7 SCIENTIFIC PERSPECTIVES

"It is indeed a feeble light that reaches us from the starry sky. But what would human thought have achieved if we could not see the stars?"
Jean Perrin [French Physicist, 1879-1942]

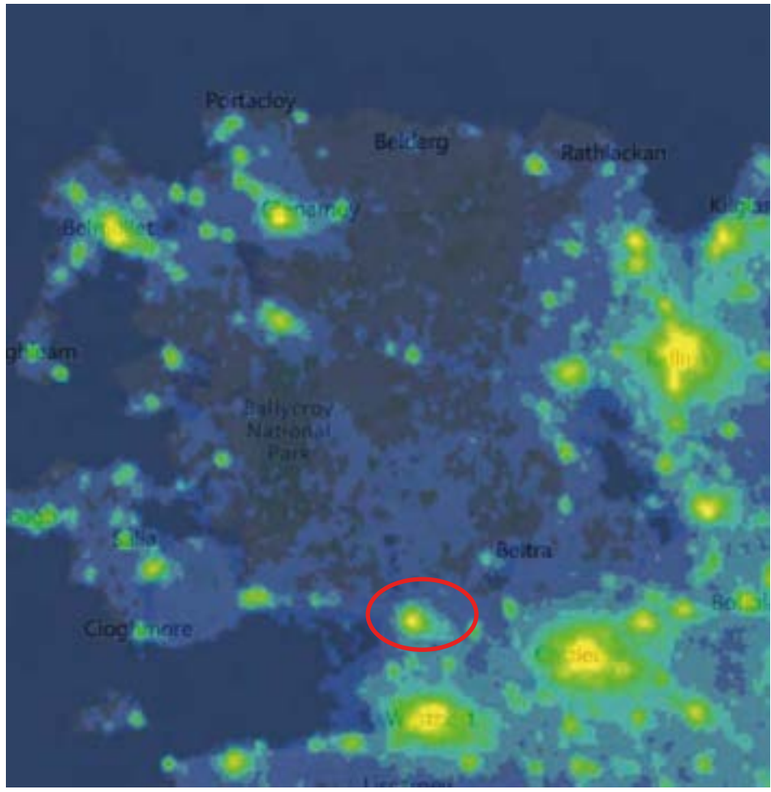
Although our proposal addresses lighting changes only within the town of Newport, these will have an impact on the visibility of the environment and night sky farther afield. In terms of light impact, Newport is not the only contributor to light pollution in the area surrounding Mayo Dark Sky Park although it is the brightest town within ten kilometres of the National Park boundary and so is an important player in the preservation of the dark sky conditions in its surroundings

The development of Mayo Dark Sky Park has showcased the beautiful natural skies of Mayo and has had a major impact in the county. However, just like other resources, this sky needs to be carefully maintained and managed if it is to remain pristine as it is very sensitive to artificial light contamination. As anyone who has looked up at the skies within the Park, it is a basic fact is that there are many more faint stars than bright ones, with most of these making up to four or five thousand stars which are potentially visible in a dark rural sky.

The light from stars, diffuse clouds and the Milky Way, which has travelled hundreds or thousands of years to us or from galaxies, which has traversed space for millions of years, is exceedingly weak when it reaches Earth. Because of the feebleness of these faint objects, even a small percentage of emission from a poorly-constrained light will drown the natural sky under a haze of artificial light. Even a relatively small increase in background light levels can have a dramatic effect in terms of the appreciation of the night sky. Poorly controlled light, such as produced by older light fixtures and/ or poorly controlled blue-rich light, to which our night vision is especially sensitive, is particularly detrimental and leads to a dramatic decrease in the sky's appearance to the unaided eye.

In a more positive vein, a decrease in sky brightness through a reduction in light pollution leads to a linear increase in the number of visible stars and light pollution is unusual amongst pollution sources in that an improvement will lead to an immediate effect. As an example, near Newport every reduction in the light output – and hence improvement in the natural sky brightness – by 10% will lead to approximately five hundred more stars being visible in the surrounding countryside.

A reduction in light level can be achieved by improved shielding of existing lights, but the best improvements are obtainable with better designed modern luminaires, reducing the time of use, and using light with a smaller blue content: our proposal aims to improve the lights of Newport on all three counts. Blue-rich light, such as is produced



A colour-coded version of the light emitted to space in 2016

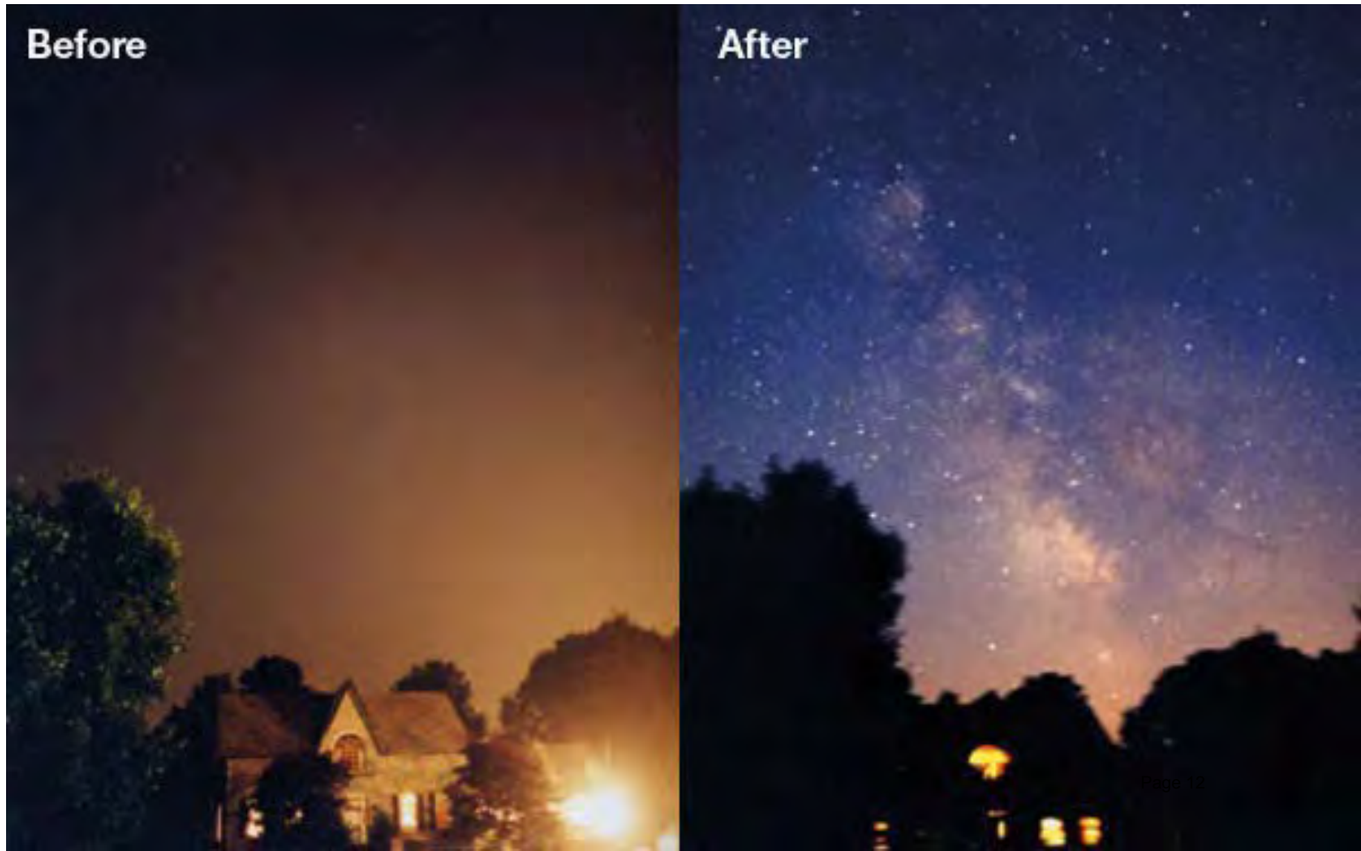
by conventional LED lighting, scatters strongly in the atmosphere and this is the effect that leads to the clear daytime sky being blue due to scattered sunlight. Our proposal requires the use of better controlled emission as well as less blue ("warmer") lighting over most of the town. Within the town limits the reduced glare, better spectrum, and controlled emission will lead to improved appreciation of the sky above the town.

The effect of full cutoff lighting will result in reduced light travelling into the surrounding countryside due to restricted emission near or at the horizontal, reducing the overall light background beyond the town boundary. However, to obtain the best views of the sky the human eye needs to be dark-adapted in order to make use of our sensitive night vision. Since this vision is blue-sensitive any (bluish) white lighting – such as that from most LED road lighting with a correlated colour temperature (CCT) of 4000 Kelvin – will have an impact on this dark adaptation. Indeed, it is this sensitivity to the blue-light emissions which results in the impression of overbrightness and glare of such lighting when compared with older sodium lighting. The LED lighting recently installed along the N59 has a dark sky impact approximately 30% smaller than that of the majority of LED lighting currently being installed nationally, and the LED lighting proposed for residential areas will be only 50% of that level. When light is dimmed or the timing trimmed, this will reduce light levels further during these times. Within Newport itself, the additional benefit of these improved lights is the reduction of the blue light which can suppress the body's sleep hormone melatonin, to half or one quarter of that for a 4000 Kelvin LED light.

The combination of reduced light travelling beyond the town boundary and a reduced blue component will therefore have an important impact in the sky above the surrounding countryside by reducing the apparent light dome over the town and also enabling a better view of the dark sky above the National Park area.

Photographs taken from the same position showing the appearance of the sky before (left) and after (right) the 2003 Northeast blackout in the USA, a massive power outage that affected 55 million people.

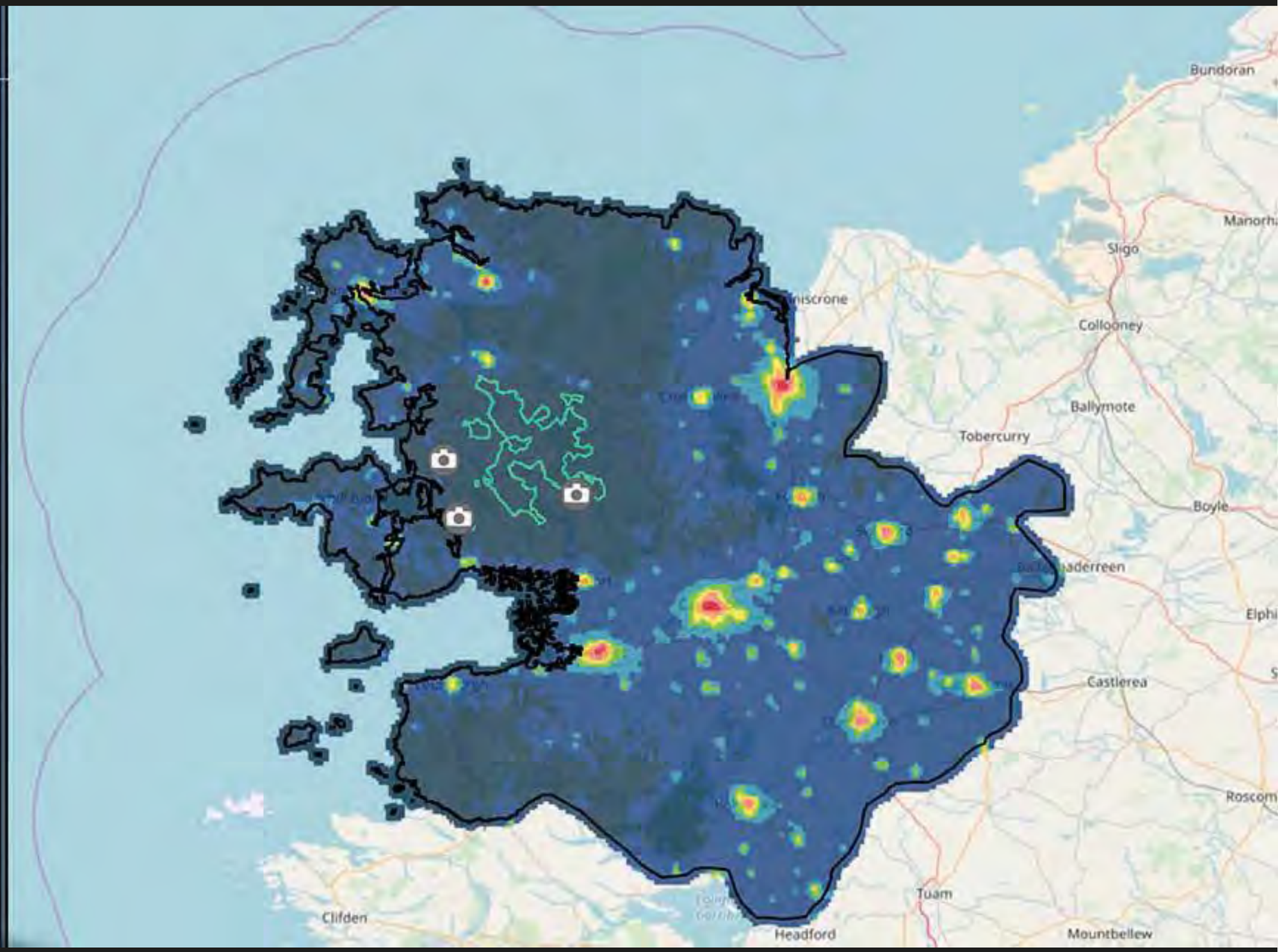
Photo by of Todd Carlson



Protecting the Night Skies of County Mayo

It's time to protect the Night

There is no doubt that artificial lighting has its place in our world and is invaluable to our businesses, homes, roads and recreation. However, when used inappropriately or excessively, artificial lighting can cause light pollution.



The current status of the light pollution in Mayo is provided by the map at:
www.mayodarkskypark.ie/learn/light-pollution-map

15th Century Burrishoole Abbey, site of Newport Astronomy Club's night sky observing sessions.

2. CONSULTATION

2.1 STAKEHOLDER CONSULTATION STATEMENTS

Inform, Engage and Support Communities in the Protection of the Night Sky

As this project is driven by the needs of the community in and around the town of Newport, a consultation phase was critical to analyse the needs of the various stakeholder groups and secure the support of the community.

The statements in the following pages represent the diverse interests behind this plan, yet are underpinned by a common objective to promote and enhance the nightscape of Newport.


St. Patrick's Church


Castlebar St. "Weavers Row"


Railway Viaduct Black Oak River


Main Street Newport

Photos: David Moran

Our Community Groups

Burrishoole Parish
The parish of Burrishoole is very proud of our magnificent church which from its elevated location on Barrack Hill has been a feature of the Newport Skyline for over 100 years. Its commanding structure is both a testament to the faith of our people and a symbol of the central place that faith continues to play in our lives. We are proud of our Church and of what it means to our community and its illumination at night is a comfort and sight of great beauty for the local community. However, as a parish we are very concerned about the environment and are therefore keenly aware of the detrimental effect the current lighting system is having on the natural life surrounding the Church and the natural skyline. We are pleased to learn of the Light Management Plan for Newport and give it our full support.
Getting artificial lighting levels right is important for the parish; we think it will improve safety for drivers and pedestrians alike while giving our local wildlife a greater chance of survival.
Having seen some of the proposed designs for our church it is clear they will only enhance the architectural features while allowing the beautiful night skyline to remain as God intended it.
There is an increasing interest in our environment and the attraction of our night skies which has been manifest by interest in the Dark Sky Festival. This festival has brought many new visitors to the area which is of great advantage for the town and its businesses. We think it is important that we do all in our power to ensure that the Dark Sky designation is maintained and improved and so give the Light Management Plan our full backing. It is hoped we can lead the way in showing other areas the benefits of living in harmony with nature.

Newport Business Association
Newport Business Association welcomes the proposed Newport Lighting Masterplan. Newport is an exceptionally beautiful heritage town, which has benefitted greatly from the Dark Skies Project thanks to our location in close proximity to the Mayo Dark Sky Park in Wild Nephin. The business community acknowledges the hard work put in by the team behind the plan. The Lighting Master Plan will enhance the town in many ways, and the businesses in the town are excited to see Newport become a model town for best practice in environmentally friendly lighting.
We are delighted to see that different lighting options can be used in different parts of the town, taking into consideration biodiversity, energy conservation, tourism and social & heritage ambience, as well as effective lighting on approach roads and main shopping/ business streets.
We look forward to having a proactive engagement in relation to the lighting Plan & we are available to meet as appropriate to discuss options and to facilitate smooth implementation & rollout of the plan.

Newport and District Development Company (NADDCo)
NADDCo is delighted to support the Friends of Mayo Dark Skies' mission to develop a dark sky friendly lighting plan for Newport. As a company we have worked diligently for over 25 years to develop Newport in a sustainable way, helping to make it a better place to live in, work in, and visit, and we see the clear benefits of improving the current lighting, not only for our residents, but also for our visitors, local businesses and potential investors.
We view our beautiful heritage town as the gateway to Wild Nephin and Mayo Dark Sky Park and, with one of the largest astronomy clubs in the country located in the town, we are very keen to support any initiative that aids in their local stargazing events.
NADDCo also manages the local community tourist office and, through this, we have witnessed first-hand the increase in interest from visitors in our stunning skies. We see it as a heretofore untapped resource and wish the group every success not only with developing the plan, but in implementing it in the town in the not too distant future.

Burrishoole Community Partnership
We are pleased to support this Lighting Master Plan for Newport and the work of the Mayo Dark Skies group. Our plans to build a new community centre in Newport are now underway and hope to be able to open the doors of the new building in late 2021. We plan to incorporate the recommendations for dark sky friendly lighting into our new build and look forward to welcoming future dark sky events.

Newport National School
Newport NS welcomes the plan to adapt the lighting in Newport to eco-friendly lighting. Our school has benefitted from hosting many educational events associated with the Dark Sky festival in the past.
The school is embarking on a building programme in early 2021, part of which will include the reconfiguring of our lighting plan to dark sky friendly lighting.
We are delighted that this initiative is gaining traction and are happy to support it.

Cuan Modh Day Centre
Cuan Modh and St Dominick's Housing Association are delighted to support the Friends of Mayo Dark Skies' Mission and Lighting Masterplan plan for the town of Newport. We already provide a lighting policy around the Centre, which reduces pollution and saves energy, while also keeping our tenants and visitors safe. We wish success to the group in developing the implementation of its plans in the not too distant future.

Dr. Brian Lennon
As someone who works as a GP in Newport Health Centre, I would like to add my support to this initiative of Friends of Mayo Dark Skies to improve the lighting in the town. The Mayo Dark Sky Festival has been a tremendous success for the town in recent years and it would be fitting that Newport would lead the way in developing an eco-friendly lighting system. The Health Centre in Newport is owned by the HSE and adequate lighting is necessary for health & safety and security reasons, but I feel a more energy efficient and ecofriendly lighting system is compatible with these objectives.

Newport Tidy Towns
Newport Tidy Towns are pleased to learn of the Lighting Master Plan and welcome the plan to adapt the lighting in Newport to reduce light pollution and save energy. It is important to our group because artificial light interrupts the natural cycle of both plants and ecology. These artificial lights are concentrated along roadsides, hedgerows, and in gardens of the town environments, which represents a significant threat.

Newport Astronomy Club
Newport Astronomy Club is very pleased to support the Friends of Mayo Dark Skies' initiative to develop a dark sky friendly lighting plan for Newport.
The club uses Burrishoole Abbey (approximately 2.5km from Newport) as the site for its regular observing sessions and is very conscious of the light spill from the town. Any improvement is to be greatly welcomed, not only for the benefit of the club but also to improve the appeal of the whole area as a dark sky destination.

Newport Historical Society
Newport Historical Society feels that the lighting of two of the most historic structures in the town, the railway bridge and St. Patrick's Church adds significantly to the visual impact of the town after dark. However the present lighting has deleterious effects on wildlife and causes light pollution.
We would be in favour of the Lighting Management Plan, provided the bridge and church are still illuminated.

Conservation Groups

Wild Nephin Ballycroy National Park/ National Parks & Wildlife Service (management of Mayo Dark Sky Park)
The town of Newport is an important gateway into the Wild Nephin Ballycroy National Park and Ireland's first Dark Sky Park. This lighting management project is not just important for maintaining the Gold Tier Award received by the Mayo International Dark Sky Park, but it also demonstrates best practice in environmental management where communities are minimising light pollution and lessening their impacts on the environment. Dark Sky friendly lighting is important for maintaining more natural conditions for our nocturnal biodiversity and will prevent light trespass into the Dark Sky Park. Recent improvements to the N59 road lighting around the Dark Sky Park, e.g. Ballycroy village, are already very noticeable, where shielded warmer toned street lights are protecting the night sky. The Newport lighting management plan will be a further beacon to other towns and villages in the vicinity of the Park, who will see the positive results of more environmentally friendly lighting that will protect our pristine skies.

Bat Conservation Ireland
Bat Conservation Ireland supports the 'Friends of Mayo Dark Skies' initiative to develop a wildlife-friendly lighting plan for Newport, Co. Mayo. Artificial light at night negatively impacts on many wildlife species. A number of Irish bat species avoid lit areas, possibly as a result of increased predation risk and because their eyesight is adapted for low and dim light conditions, among other reasons. In addition, artificial light at night can profoundly impact on the life cycles of bats' insect prey.
Therefore, Bat Conservation Ireland welcomes a lighting plan that takes into account the needs of wild species by avoiding the use of artificial light where it is not needed, and where it is needed, by appropriately applying best practice guidelines such as those developed by EUROBATS and/or BCT (UK).

Swift Conservation Ireland
Swift Conservation Ireland is in full support of the 'Friends of Mayo Dark Skies' initiative to produce a model adaptive lighting plan for Newport town in Co. Mayo that is sensitive to the surrounding environment and appropriate in the context the Mayo Dark Sky Park.
The use of high-intensity lighting not only has a negative effect on Swifts but on other species of bird and wildlife such as moths and bats. With regard to Swifts, they come to Ireland to breed and thus ensuring successful breeding is extremely important to the long-term survival of the species. Over centuries, they have adapted their nest site location and today over 90% of their nest sites are located in old buildings in our urban areas. High-intensity lighting shining onto a building and from a building where a nest site is located, can hinder the entry and exit of the parent birds to the nest to feed their young. Furthermore, many Swift chicks fledge after dark and they have this one and only opportunity to leave the nest and fly away successfully. If they are hindered in any way and become grounded they will usually be doomed to die because few Swifts can take off from the ground - they have evolved for a life on the wing.
Therefore, Swift Conservation Ireland fully supports a town lighting plan for Newport that will be sensitive to the feeding and breeding requirements of all urban wildlife and that can potentially be replicated in all towns across Ireland.

BirdWatch Mayo
The Mayo Branch of BirdWatch Ireland are delighted that 'Friends of Mayo Dark Skies' have identified the need for developing wildlife friendly & eco lighting for Newport.
Clew Bay is an internationally important area for birdlife, especially in relation to overwintering and migration. It is internationally accepted that artificial light can impact negatively on circadian rhythms and bird's ability to migrate successfully due to disorientation caused by inappropriate lighting. These disruptions can mean the difference between a bird's success and failure to survive.
Any positive changes in the delivery of lighting for Newport will have beneficial impact on the birds of the area and should be encouraged.

The Vincent Wildlife Trust
Vincent Wildlife Trust supports the Lighting Master Plan for Newport being developed by The Friends of Mayo Dark

Skies. All our bat conservation work in the west of Ireland is focused on the lesser horseshoe bat, which is extremely sensitive to artificial light, so we welcome initiatives to reduce the extent and nature of outdoor lighting. There is now a substantial body of evidence showing how illuminated areas are barriers to the movement of bats, which prevents them from accessing suitable roosting sites or foraging areas. A darker environment will benefit a range of wildlife, including other bat species, invertebrates and birds that migrate at night.

Marine Institute Furnace, Newport, Mayo

Based in Furnace, just outside Newport Town, the Marine Institute welcomes the plan to adapt the lighting in Newport to more Dark Sky and eco-friendly lighting. Artificial lighting is known to impact on many aquatic ecosystems, including hatching and migrating salmon, migrating eels and feeding bats. We welcome any initiative to reduce such impacts. The Institute has recently adapted the lighting of its premises in Furnace to dark sky friendly lighting.

Leave No Trace Ireland

Leave No Trace Ireland is pleased to support the Lighting Master Plan for Newport being produced by The Friends of Mayo Dark Skies, who work to reduce light pollution and protect the night sky for present and future generations. This plan will include the design of sky friendly lighting for St Patrick's Church and the Viaduct Bridge and provide a vision for lighting that is aesthetically pleasing, safe and better for biodiversity and the environment.

This project will contribute to safeguarding the accreditation of Mayo International Dark Sky Park, a valuable asset in sustainable off-season tourism, as well as being an excellent conservation project. Leave No Trace Ireland wishes the project well and hopes that the continued work of the Friends of Mayo Dark Skies will result in a transferable plan for best practice in environmentally sensitive lighting that will benefit many communities in the future.

Local playground in Newport's town centre

Tourism | Local Authority | Professional Groups

Fáilte Ireland (Wild Atlantic Way)

We are fortunate in Clew Bay to have many unique and compelling visitor experiences which will help us position the area as a great place for visitors to come and explore. One of these is, of course, Wild Nephin National Park and the Mayo International Dark Sky Park.

Fáilte Ireland has conducted extensive research into the potential of dark skies tourism and while niche, it can significantly increase tourism revenues in the largely rural areas they are located as well as in the gateway towns surrounding the parks, particularly in the off-season.

As a consequence, it is vitally important that we move to protect the integrity of our Gold Tier International Dark Sky Park and secure this designation into the future. As the gateway town to Mayo International Dark Sky Park, Newport is perfectly positioned on the Wild Atlantic Way to support the growing interest in astro-tourism. Well-designed lighting will enhance the visitor experience to the town after dark and help protect the natural resource that is Mayo International Dark Sky Park. Fáilte Ireland is pleased to support this plan to create a vision for lighting at night in the town of Newport. This is also highlighted as an important action in the up-coming Clew Bay Destination and Experience Development Plan which is due to be published in Q1 2021.

Mayo County Council

Mayo County Council welcomes the development of the Newport Lighting Masterplan. The international recognition of Mayo Dark Sky Park is a tribute to the combined efforts of the communities, businesses and organisations. The heritage town of Newport is the gateway to Mayo Dark Sky region and the Lighting Masterplan represents a significant milestone.

The plan will help provide guidance to enhance the cultural heritage and natural beauty of the Newport area.

Mayo County Council will continue to collaborate and engage on this positive and sustainable community project.

Electric Skyline Limited (Public lighting contractors)

Electric Skyline fully supports and is delighted to be associated with the 'Friends of Mayo Dark Skies' initiative.

This is a very unique project that would not have come to fruition without the hard work and dedication of local Mayo people and state agencies that worked so well together. To be internationally recognised as one of the best places in the world to view the wonders of the night in our very own County Mayo is something all involved should be very proud of. The scenery in Mayo is second to none during the daylight and now the Dark Sky project also reconnects us with the natural beauty of the night.

As the Public Lighting contractor for the area we will ensure all design and new lighting supplied and installed by Electric Skyline will comply with requirements for dark skies by using energy efficient lights that are both kind to the environment and aesthetically pleasing.

Axo Architects

As architects of the recent extensions to Newport National School, and the architects appointed to design the next extension phase of the school (the provision of two additional classrooms), Axo Architects is delighted to support the Friends of Mayo Dark Skies' Newport Master Lighting Plan, and our intention is to ensure that the lighting elements of the new extension will comply with the recommendations of the Lighting Plan, with regard to intensity, direction and timing, as well as location. We are also keen to build in swift nest boxes at the construction phase.

Neighbouring Dark Sky Communities

Mulranny Tourism

Mulranny Tourism supports the Newport Lighting Management Project as it is very important for maintaining the Gold Tier status of The Mayo Dark Sky Park which is increasingly attracting 'Astro' Tourists to Mulranny and its neighbouring towns and villages during the off peak season. Mulranny is a gateway village to the Mayo Dark Sky Park and is part of its 'Dark Sky' community. Three European designated Natura 2000 sites converge at Mulranny and the environmental impacts of light pollution on the plants and animals contained in these sites are as yet unknown, though effects of light pollution are numerous and are becoming more known over time. The Newport Lighting Master Plan will also encourage Mulranny and all neighbouring towns and villages in the vicinity of the Park, in collaboration with the Mayo Dark Skies Group, to develop their own lighting management plans as they will see the positive environmental results of this project.

Ballycroy Community

We are proud to be a founder member of the dark sky community groups supporting Mayo International Dark Sky Park. The beautiful night skies over Ballycroy and our neighbouring dark sky communities is a rare sight for many visitors who travel to Mayo to enjoy an evening of stargazing away from the bright lights of an urban environment.
It is therefore essential that we protect this natural resource from the growth of light pollution. The proposed Lighting Master Plan for Newport will help protect Mayo Dark Sky Park for present and future generations to enjoy and we fully support it.

Newport's River – a harbourside view towards the Viaduct bridge and town centre.

Newport National School

2.2 POPULATION PROFILE AND COMPARATIVE STATISTICS

To examine the potential impact of light changes on the residents of Newport (population 626 in 2016), census records were reviewed to obtain population and age grouping statistics and these were compared to those for Balla, a similarly sized town in Mayo (population 769 in 2016). The histograms of the age profiles for both locations are shown in Figure 2.2.a, 2.2b and indicate an ageing Newport population, particularly with residents of 65 or over. This result is significant for our current project as contrast and glare become significant issues for ageing eyes and hence care should be taken to minimise glare and encourage uniformity in any lighting design.

A further comparison we can make is in relation to the light emissions from both towns which we take to be representative of light pollution levels. Satellite data for 2019 shows that Newport, despite having 80% of the population of Balla, has approximately 50% higher light emissions. However, despite the higher light output, the potential for improvement in conditions around Newport is higher as Balla's proximity to Castlebar results in higher overall skyglow conditions beyond the town's immediate control. Conversely, although conditions are worse in Newport they are more susceptible to improvement through local light changes and controls.

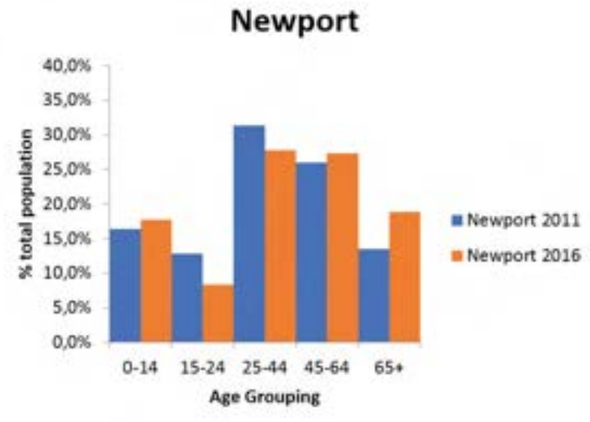


Figure 2.2a
Age profile for Newport showing an increase in the age profile of the population between 2011 and 2016.

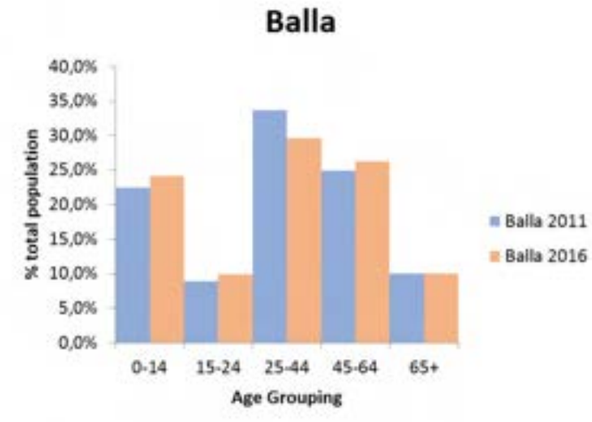
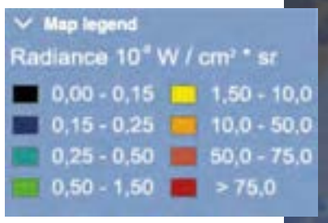
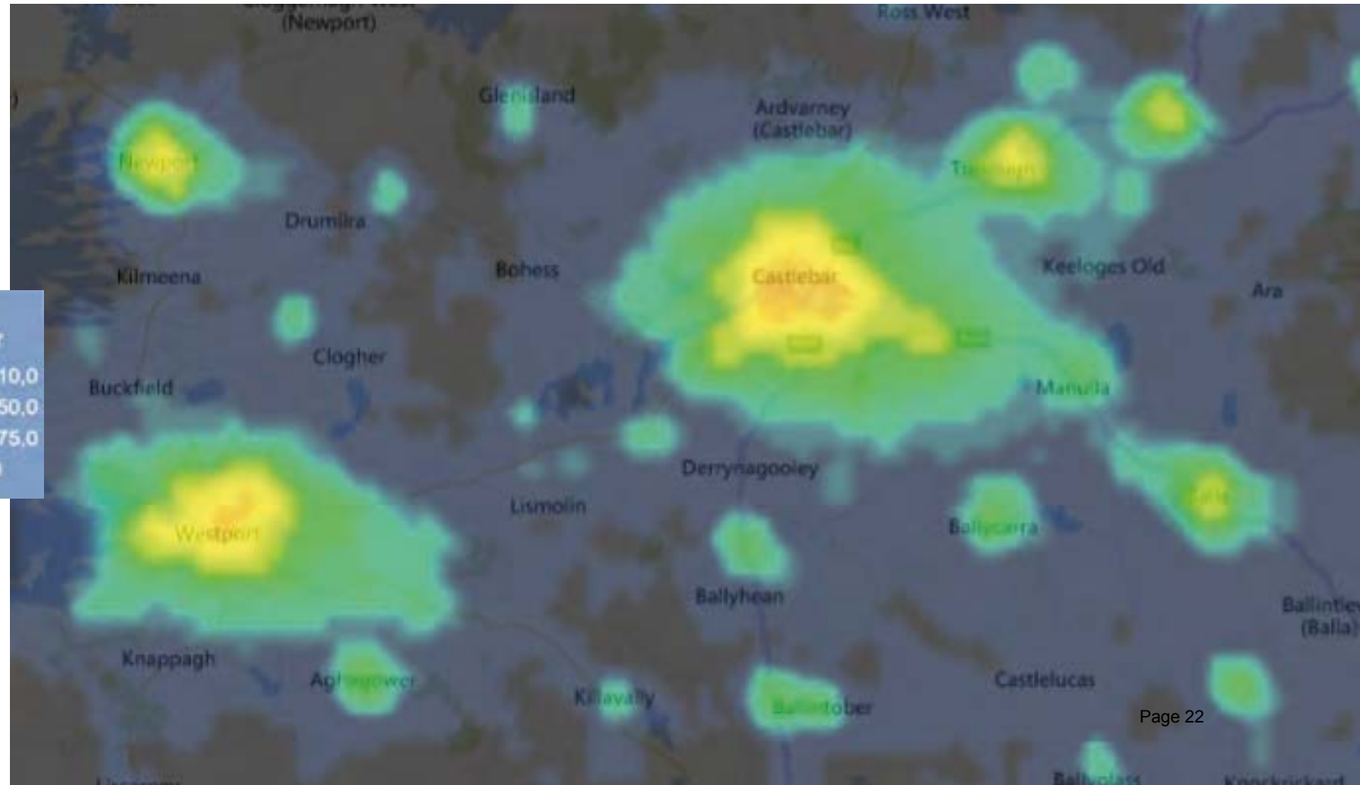


Figure 2.2.b
A similar age profile for the town of Balla showing a relatively stable age profile.



Satellite observations showing light emission from the Newport to Balla region. Note the relative darkness in proximity to Newport and the concentration of light from its town centre.



2.3 BIODIVERSITY

The small picturesque town of Newport nestles on the north-east corner of Clew Bay, with the Newport River (also known as the Black Oak River locally) flowing through the centre of Newport town, merging with the sea to form a very fine protected harbour. Clew Bay and part of the Newport River are each designated as a Special Area of Conservation (SAC). This designation is part of the Natura 2000 network and indicates an area of European importance and covers aquatic and shoreline parts of Clew Bay as well as the river and environs upstream.

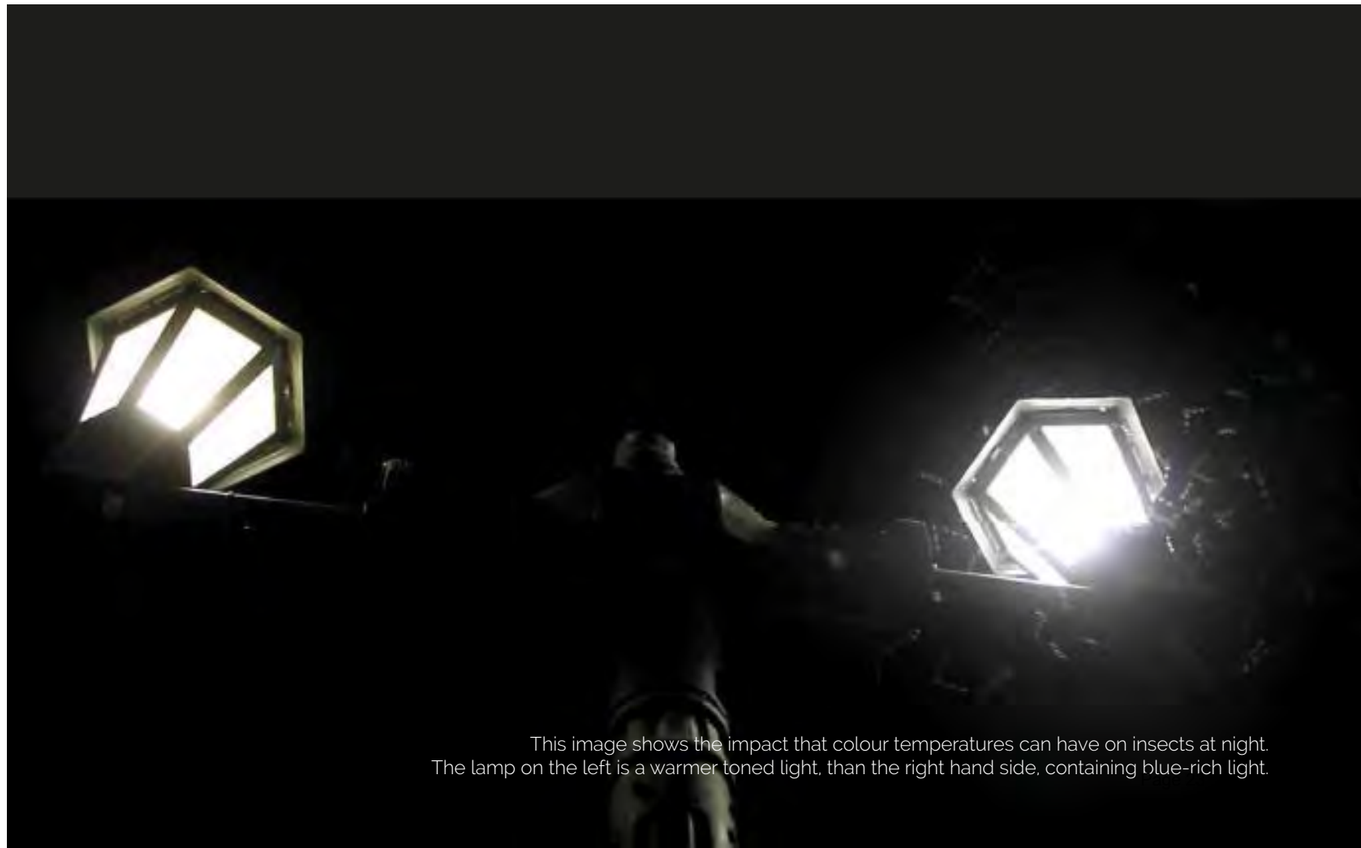
Light pollution has ecological implications on a whole range of bird, bat, plant, aquatic and insect life. Most wildlife is sensitive to blue light, although some species are better adapted to cope with higher and/or bluer light (Pendoley et al, 2020). The result of changes from natural light can be a reduction in biodiversity and damage to ecosystems. In recent studies, species of grass and weeds have been found to be affected by LED lighting, leading to follow-on changes in insect populations (ffrench-Constant et al 2016).

In addition to the impacts on many individual species, light pollution can also affect biodiversity (Bennie et al 2018).

Newport supports a wide range of habitats due to its coastal position. Within the town boundary is Newport River and its estuary and within three kilometres of Newport, both Furnace Lough and Lough Feagh are important ecological areas containing sensitive insect and fish life.

Habitats include marine and coastal habitats and a diversity of terrestrial habitats from grasslands to woodlands. Newport River and estuarine habitats support Atlantic Salmon (Salmo salar), Sea Trout (Salmo trutta) and the Freshwater Pearl Mussel (Margaritifera margaritifera). Both salmon and sea trout have been shown to be sensitive to light conditions, with both smolts and adult salmon being sensitive to light down to 0.2 lux. To put this in perspective, the light from a full moon is 0.3 lux. Other species such as the European eel (found in nearby Burrishoole) synchronise migratory patterns with the new moon; the darkest phase of the lunar cycle.

Map showing areas of ecological importance, overlaid with LED positioning
Red Dots = 2700 K N59
Amber Dots = proposed 2200 K



This image shows the impact that colour temperatures can have on insects at night.
The lamp on the left is a warmer toned light, than the right hand side, containing blue-rich light.

Swift photo credit - Michael Casey

In terms of importance, the Atlantic Salmon is a species, which is already in decline and the Pearl Mussel is an endangered species. Lighting on the Viaduct spanning the Newport River has been carefully considered in order to protect biodiversity of the species that pass along, or make their home in, the river. These are compelling reasons to illuminate the riverside area sensitively.

Walkways through the woodland that forms Princess Grace Park provide a view of the town and the river as well as of a good variety of native trees. Some of these trees are very mature and possibly dating from the 18th century when Newport House was built. This woodland is just a few minutes away from the town centre and provides an excellent amenity, providing a chance for people to reconnect with nature. Learning about different species deepens appreciation for the inter-connectedness of nature and shows how plants and animals depend on others for their survival. This Lighting Master Plan provides a guide for adequate levels of illumination for the community, whilst protecting the species that are sensitive to light, particularly blue-rich white light. Moths and other night flying insects have been long-overlooked in terms of their importance as pollinators and the resulting potential impact on plants due to light pollution. Note also that light attraction or avoidance also has an impact on species distribution in the surroundings. As the number of those insects in adjacent darker areas is altered from that expected under dark sky conditions biodiversity as well as overall numbers can be affected.

Over two thirds of mammals are active after dark as are many other species. . It is well known that many species of bats are sensitive to light, either being attracted where there is a source of prey, or avoiding lights due to the fear of predation. Light barriers can block access routes from roosts to feeding areas and have an impact far beyond the lit area. There is a variety of bat species in Newport including Common and Soprano Pipistrelles, Leisler's, and Daubenton's. The Pipistrelles can be seen flying around soon after dusk and are easily identified by their rapid twisting flight: they frequently roost in houses, but also in hollows in trees and ivy. Daubenton's bats can be seen foraging on insects over the river after dark. The Leisler's bats echo-locating call may sometimes be heard as it is just about audible to human hearing. All nine Irish bat species are protected under Irish and EU legislation.

A solution to both insect and bat light sensitivity is to use better controlled lighting with a warmer spectrum and also lower intensity. Of special interest to this plan is the visiting population of Swifts (Apus apus) that arrive in Newport to nest in the façade of St Patrick's Church each year. Swifts spend most of their lives in the air, sleeping and feeding on the wing and only landing when at their nesting site. Swifts breed between the months of May and September and spend the rest of the year in southern Africa.

The Lighting Master Plan takes account of current lighting impacts such as the floodlights installed at St. Patrick's Church, which directly illuminate the swift nests.

2.4 HERITAGE OF NEWPORT

In 2020 Newport was 300 years old. The intervening years have wrought much change to the town, however, there is much that remains of the old town's architecture. It is interesting to trace the evolution of the town through its buildings and infrastructure.
The town was founded by the Medlycott landlords through their lessee, a Captain Pratt, in the early years of the 18th century. The site of the town was chosen by Captain Pratt because of its green field nature and its potential for shipping. Although subject to tidal influences, the quay can provide up to 4.5 metres of water, enough for 18th century trading ships of 500 tonnes or less. This meant that Newport harbour could be used for docking when shallower ports such as Westport were unsuitable.

Newport is rich in architecture dating back to the Georgian period. Overlooking the quay from the north is Newport House, a fine building constructed by the O'Donel family who superseded the Medlycotts as the major landlords in the area from the late 18th century through to the early 20th century. Nearby, Main Street shows its Georgian heritage through some of the old doorways which are still visible and also the exquisite stone work which can be seen on DeBille house. South of the river the oldest of the original 18th century artisan houses remain on Medlicott Street and their exposed stone facades testify to their great age. These dwellings were originally occupied by Quaker linen workers from 1719 who set up a linen industry that thrived until the early part of the 19th century when it fell into decline with the rise of the town of Westport to the south.

One of the iconic sights of Newport is the railway viaduct. This magnificent red stone seven arch bridge was constructed in 1896 to carry the rail line from Westport to Achill. For a time the trains trundled across the bridge carrying passengers and freight back and forth, but by 1937 the economic viability of the line was in serious doubt and it closed. In 2010 the first stage of the line was reopened as a walking and cycling trail to boost tourism and today the 42km long Great Western Greenway, linking Westport to Achill provides the longest such trail in Ireland.

Over the centuries, there were numerous people who contributed to the importance of the town. Many of these people were responsible for the buildings we see today. Newport's greatest benefactors in the early 20th century were Martin Carey, a local merchant, and the Parish Priest of the time, Canon Michael McDonald. Mr. Carey's lasting memorial is St. Patrick's Church of 1912, designed by R. M. Butler in the Celtic Revival style, which derives from 13th century Hiberno-Romanesque, tempered by the simplifications of the Modern Movement.
The frontispiece is inspired by the doorway of Clonfert Cathedral. Another lasting legacy is that of Father McDonald who gave his life insurance gratuity towards the commissioning in 1926 of the three-light east window, now regarded as the final masterwork of the Irish stained-glass artist Harry Clarke.

Newport's Seven Arches Railway Viaduct

This plan has focused on two noteworthy sites of built heritage within Newport town; St Patrick's Church and the Seven Arches Viaduct. Both are listed heritage structures (see below) and are worthy of illumination. The view of St Patrick's Church which sits on Barrack Hill approximately 30m above the river is an iconic sight on approaching the town, visible over a wide area. This view is synonymous with Newport town and is often cited as a "homecoming" beacon to the diaspora returning home to the area. Hence the importance placed upon a sensitive and appropriate design for lighting the structure at night.

Whilst there are many other protected structures and recorded monuments within Newport town, our study focused on the lighting for those two detailed below. Others may be found in National Records of Monuments and Architectural Heritage.

View looking from the original railway station over the Seven Arches Viaduct. The building on the right is still standing and has forms part of lighting design renders found later in this document.

Photo sourced from Newport Heritage Society

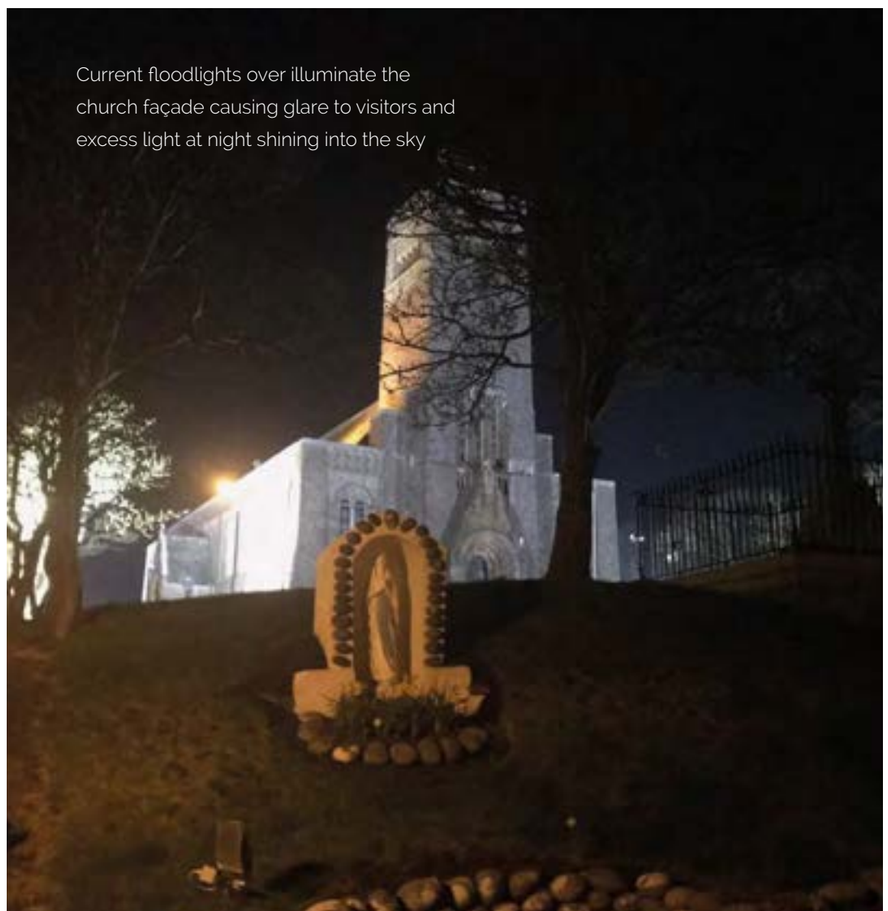
Photo by Ged Dowling

Photo by Ged Dowling

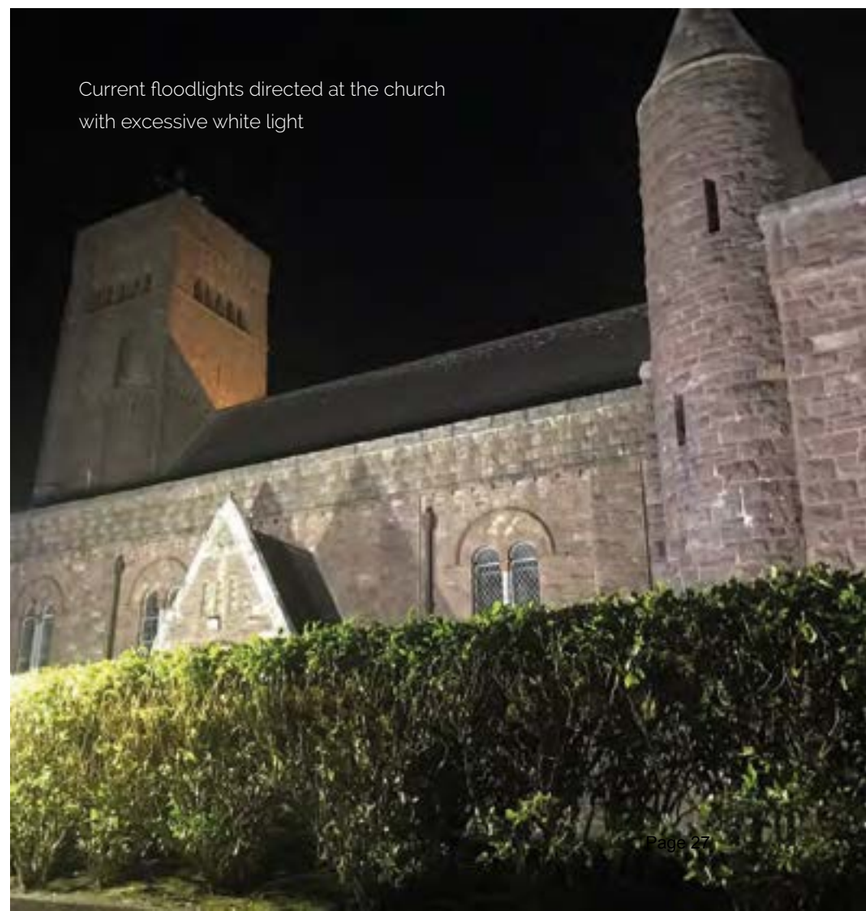
Saint Patrick's Catholic Church
NEWPORT, Newport, County Mayo
Reg No: **31208021**
Rating: National
Categories of Special Interest:
Architectural Artistic Historical Social Technical
Original Use/In Use As: Church/chapel
Date: 1910 – 1920

Saint Patrick's Church is not only a national monument of Ireland, It is a living building that serves the community of believers and conveys a message of peace and tolerance; also, it is a place with very specific use: the celebration of Liturgical Services and a space of personal prayer.

Even with the focused lights turned off, the effect of the spill light from public lighting is shown on the Church facade and surrounding.



Current floodlights over illuminate the church façade causing glare to visitors and excess light at night shining into the sky



Current floodlights directed at the church with excessive white light

2.5 DARK SKIES IN SUSTAINABLE DEVELOPMENT

The Sustainable Development Goals (SDGs) are a universal call for transformation of our world to improve lives and prospects of people and the planet. The 17 Goals were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development.

The concept of a dark sky policy aligns with a number of the SDGs. As this plan has taken a holistic approach to designing lighting for a nocturnal environment and community, it is appropriate to highlight the applicable connections which are listed below.

Recognition of these alignments will assist local authorities in future decision making on planning for artificial light in our communities

UN Sustainable Development Goals

Goal 3: Good Health and wellbeing
Light pollution is detrimental to human health and wellbeing. Dark sky activities can promote improved health through, connection with nature, biological rhythms, positive emotions, a sanctuary from technology and the opportunity to enjoy clean air and skies free from light pollution.

Goal 4: Quality Education
Dark skies can provide inclusive and equitable education to promote lifelong learning. It brings new opportunities for teaching astronomy, light pollution, rural tourism and wellbeing.

Goal 5: Gender equality and women's empowerment
Bridging the gender divide is especially important in STEM fields and astronomy has been used as catalyst in this process in many countries.

Goal 7: Affordable & Clean Energy
Public lighting in Ireland is typically on from dusk to dawn every day (approx. 4,100 hours per year). This can account for the majority of a local authority's spend. Also 16% of residential electricity is used for lighting. In many cases, energy for light is lost to light pollution, a dark sky lighting policy can align with renewable energy alternatives to power environmentally sensitive lighting and reduce light waste.

Goal 8: Decent work and Economic Growth
Dark skies promote sustained, inclusive and sustainable economic growth and rural employment for all throughout the year.

Goal 9: Industry, Innovation and Infrastructure
Dark skies promotes investment in sustainably managed projects and fosters innovation in rural areas.

Goal 10: Inequality
Dark skies promotes equality in peripheral and remote communities with opportunities for capacity building and training, rural development and sustainable tourism.

Goal 11: Sustainable Communities
Dark Skies Tourism promotes local businesses (guest houses etc) and communities. It also fosters links with Sustainable Energy Community programmes, promoting local stewardship and collaboration.

Goal 13: Climate Change
Artificial lighting is a significant part of energy consumption for local authorities, communities and businesses. Adopting dark sky friendly policies can contribute to climate action.

Goal 14: Life under Water/Oceans
Studies have shown that excess artificial light has a detrimental impact on marine species and aquatic ecosystems as well as coastal wildlife. Dark Sky programmes promote best practice lighting to reduce this impact and provide informed choices for alternative lighting.

Goal 15: Life on Land / Biodiversity
Light pollution harms many ecosystems; migrating and nesting birds, pollinators, nocturnal species and tree species. Adopting dark sky policies helps reduce this negative impact and restores our natural cycles of day and night.

Goal 17: Partnerships
Mayo Dark Skies project continues to promote inclusive partnerships with community groups, regional authorities, at national and international level built upon shared values and common interests to preserve and protect our night skies for future generations.

3. EVALUATING THE NIGHT

3.1 THE VALUE OF THE NIGHT – CIRCADIAN RHYTHM

From a historical perspective, the coexistence between light and darkness links people to the sky. In ancient times myths and religious beliefs, rituals and symbols were built on cosmic orders associated with the rise of the Sun and the Moon. The stars and the planets were intimately related to celestial cycles and, immersed in nature, our ancestors were able to read a starry sky like a book.

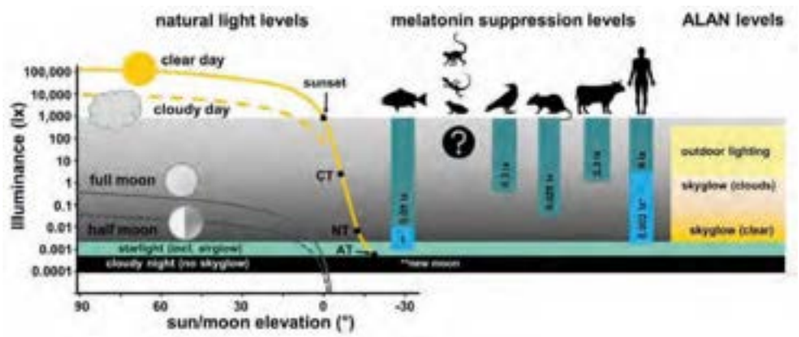
In our brightly-lit modern times, darkness is a natural resource that we must preserve and protect. For some, the connection with a natural night sky is even a spiritual contemplation. Artificial lighting can have profound effects for human health and wellbeing, so it is imperative for both politicians and lighting designers to understand the direct biological influences of light and, in particular, the human response to light/dark cycles.

Complex ecosystems are also threatened by the careless use of artificial lighting as biological adaptation to the day/night cycle has evolved over billions of years, whereas the adoption of high brightness electric light is only about 150 years old.
Protecting the darkness of the night sky positively impacts on wildlife, different types of flowers and trees, aquatic species, insects and even migratory birds. The circadian rhythm (from Latin circa meaning "around" and diem meaning "day") is a natural process that regulates the sleep-wake cycle. This cycle repeats approximately every 24 hours and is driven by an internal clock, which takes its synchronisation with the external world through the daily light/dark pattern. Exposure to light before or after sleep affects the synchronisation of our circadian rhythm: exposure to light after waking advances the circadian rhythm (delays sleep), while exposure before sleeping delays it. Jet lag is a common symptom of a disruption in our circadian rhythm.

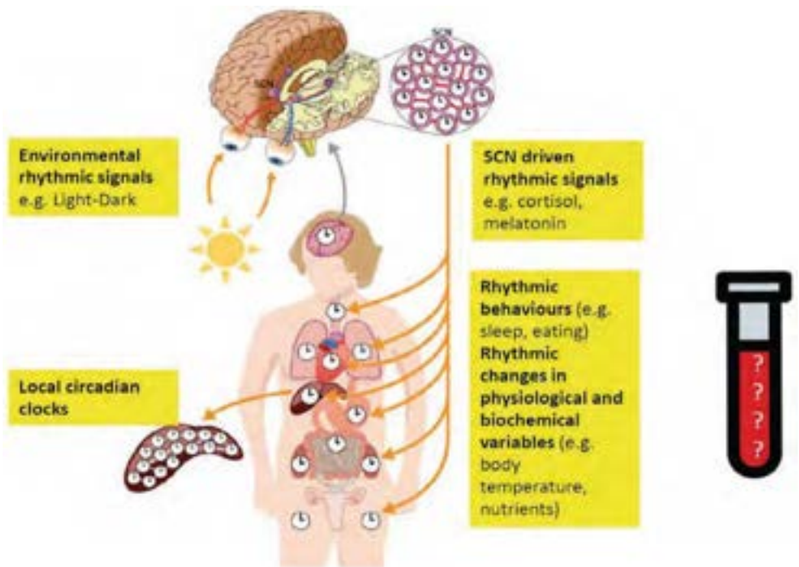
Light stimulates biological responses, including the production or suppression of melatonin (the "hormone of darkness"), a key player in circadian regulation. The production of melatonin can be suppressed by artificial lighting at night, affecting the quality of sleep, which if prolonged can lead to physiological disorders including migraine, diabetes and hypertension.
The nightly "down time" signaled to the body by the onset of darkness is of paramount importance as it facilitates the body's repair mechanism. There is a growing literature that indicates that when people do not get good sleep at night, it interferes with the correct production of human hormones, potentially leading to a higher incidence of breast and prostate cancer (Haim and Portnov, 2013).

Recent research finds that, if lighting is used, it is best to limit the disturbance to the circadian rhythm by using long wavelength sources. This translates to visually warm tones of light, closer to the natural light of a candle. The concept of "hygge" or "teolaí" is a useful way to illustrate this. Additionally, there should be no direct view of the source and illuminance levels should be low, in order to limit the glare of the luminaire.

From the above discussion, it is clear that unintended consequences of light pollution on our physiology can lead to increased health care costs whereas conversely, preserving the darkness of a night sky can is an economic resource for sustainable tourism in Newport and other local key areas. With an attractive design for lighting at night, there is a huge potential for Newport which is yet to be discovered.



Image; Grubisic et alii, Minimum levels reported in the literature to suppress melatonin (MEL) in vertebrate groups relative to light levels by natural and artificial light (ALAN) sources, 2019



from Dijk, Structure of the human circadian timing system, 2020

3.2 EXISTING PUBLIC LIGHTING

Outdoor spaces are often illuminated more than necessary and a review of existing lighting practices is appropriate. Light reflected by lit areas such as roads, football fields, and car parks generates skyglow; a glow often seen above towns, caused by light escaping upwards to the sky, often aggravated by the presence of poorly shielded lighting sources. In order to minimise light pollution and light trespass, outdoor lighting must be designed carefully. The social and environmental needs of the area need to be taken into account as many problems arising from light pollution are connected to glare and light spill from poorly fitted fixtures.

Examples of existing light fittings
Images from Google street view

1. Quay road – Type 1 HPS 70 - 100 W
2. Quay road – Type 2 HPS 70 - 100 W
3. Quay road – Type 3 HPS 70 - 100 W
4. Blackoak Rise HPS 70 W
5. Castlebar St. HPS 70 - 150 W
6. Pedestrian walkway

Newport is a visually attractive town and at night it has the potential to be exceptionally beautiful with some consistent and well-designed lighting. Our review provides an opportunity to rethink the vision for Newport at night, particularly as many of the existing light fittings are old and use outdated technology.

Currently lighting in Newport consumes approximately 26 kW of electricity with approximately 75% of public lighting provided by high pressure sodium sources (70 W – 100 W and 150 W) and the rest provided by more recently-installed LED lighting.

In taking some reasonable measures to plan our lighting, as we would do for any other resource, we can avoid over lighting and enhance conditions for drivers and pedestrians alike.

There are opportunities too for improvements in residential and outdoor lighting, providing more efficient, effective and less intrusive outdoor lighting.

This picture was taken prior to the N59 upgrades, showing unshielded sodium lighting and glare.

Compare the street lights in the two photographs.
The top left photo shows the effect of new 2700 K lighting.
The top right photo shows the previous unshielded sodium lighting. The comparison shows that glare and skyglow has been considerably reduced. However there is still room for improvement in scattered areas.

Excess light on walkway can unintentionally create dark shadows and blind pedestrians.

Biodiversity needs cycles of darkness and light. This photo was taken at 1am and clearly shows harsh overly bright conditions at night.

3.3 SUGGESTED PRIORITY OF INTERVENTIONS

To determine the priority of interventions in a public lighting system, we focus initially on the age and functionality of the lighting fixtures, together with their supports, poles and power supply cables. A detailed, thorough, analysis is necessary in order to evaluate the state of the system, including:

- the requirements of the community;
- the compliance or non-compliance of the system with current technical standards;
- its performance with respect to the reduction of light pollution;
- its impact on sensitive environmental areas.

Following our analysis of the needs of the community and the environment from the information available during the consultation phase, the priorities for action to reduce the levels of light pollution are indicated on the following map. The priority areas are colour coded with the most urgent interventions are highlighted in red, medium priority areas in orange, and those already in the implementation phase are highlighted in green.

Urgent Priority
As discussed in this document, the most iconic vista of Newport at night, is the view of St. Patrick's Church, and the 19th century Viaduct spanning the Newport River. In both cases, the implementation of new lighting is urgently required and prioritising a new lighting system for these two magnificent examples of built heritage is critical for the successful implementation of this vision plan.

St Patrick's Church is currently floodlit with inappropriate lighting, causing significant light pollution, which is exacerbated considerably during cloudy conditions. This light pollution is visible for miles around the town, and can even be seen on the approach road to the Mayo Dark Sky Park (see illustration).

The Seven Arch Viaduct Bridge has also been fitted with floodlights in the past, though owing to the positioning of the lights, they have been easy targets for anti-social behaviour and are no longer in operation. The floodlighting lighting, as well as the posts on the viaduct itself, detract from the visual appearance of the architecture.

We have an opportunity to review the lighting design for the viaduct and create a design that is appropriate for the heritage structure, is sensitive to biodiversity of the river and enhances the features of the structure as an attractive icon at night for Newport.

Medium Priority
The medium priority areas include most residential streets and roads leading off the N59, most of which are old low pressure sodium lanterns, due for upgrade to improve energy efficiency. There is an opportunity to upgrade these fixtures to meet the goals set in this lighting plan. We recommend that special attention is given to light fixtures close to sensitive habitats (see biodiversity section) and along the waterfront, to prevent excess reflection.

Low Priority
Areas on the N59, which are already in the implementation phase of dark sky friendly lighting, are highlighted in green as a lower priority of intervention.

Photo taken by visitor Nyet - entitled "Dante's inferno", showing the impact of light pollution from Newport town.

RECOMENDED PRIORITY OF INTERVENTION

URGENT

MEDIUM

LOW

3.4 LIGHTING FOR SAFETY

Public lighting refers to the design of artificial lighting for all elements in the urban environment, especially for street lighting. Historically, public lighting was primarily provided for a number of purposes, including for the safety of citizens and the security of their property, to boost the local economy by permitting after-dark activities and also to improve the aesthetics of the night-time environment. Initially lighting was generally low-level and uneven, but the introduction of electric light permitted improved lighting to spread around the world.

The first provincial town in Ireland to have public lighting was Carlow as early as 1891, although Birr town also claims the distinction, both examples being powered by hydroelectricity. However, nationwide electrification took many more years to complete and the first electricity pole of the rural electrification scheme was erected in 1946 in north County Dublin. The enormous project took many years and has become a significant part of Ireland's social history. In 1964, the village of Ballycroy, home of Mayo Dark Sky Park's visitor centre, became the last place in the country to be connected under the ESB's initial phase of rural electrification.

Lighting for safety is defined by the minimum amount of light needed to support basic visual activity, pedestrian movement and object identification at eye level in order to provide a sense of security, but also better vision for for pedestrians and road users. Increasing the perception of safety is one of the most important factors for the development of public lighting technologies. With regards to this, the requirements are to obtain sufficient illumination level and uniformity with light of a type to permit easier discrimination of colour.

In terms of light level, the luminance levels of public lighting follow the European Norm requirements which aim to promote public safety. Proper luminaire selection and placement will improve uniformity and contrast, reduce shadows and reduce glare. The Lighting Master Plan of Newport recommends removing all the existing high pressure sodium ("HPS") luminaires and replacing them with LED luminaires.

The recommended colour temperature should be 2200K and 2700K for LEDs, depending upon road classification. Adoption of these LEDs will increase the light quality, providing for better colour rendition and visual clarity which will both improve the "feeling" of the town and also add in public perceptions of safety (in quantitative lighting terms, the colour rendition index, CRI, will be improved from 25 to 70). The move towards more efficient LED lighting will also reduce the energy cost of lighting in terms of both economics and carbon use as well as reduce maintenance.

The removal of older sodium lighting, which contain small amounts of mercury, will also reduce environmental hazards.

Future public investments must therefore address the continual improvement of the system over time in a holistic sense to maximise the perception of safety rather than just in terms of increasing the amount of light through the provision of more light luminaires and/or higher wattages.

Brush Street Lights West 25th Street and BroadWay, 1881

3.5 GOALS OF THE LIGHTING MASTER PLAN

The Lighting Master Plan for Newport presents a palette of solutions for the future of the town for consideration by council members, planners, architects and community associations. Its objective is to create an attractive plan for Newport town after dark, allowing all members of the community to safely enjoy Newport's unique architectural heritage, whilst also appreciating the beauty of a natural night sky.

As the outcomes from this project could have a major impact on the citizens of Newport, we have consulted with a diverse group of representatives from business as well as community and environmental groups in the preparation of this plan. By adopting this approach, we obtained a solid base for setting feasible technical and aesthetic guidelines for future planning.

Our overall guiding principle is that lighting should be designed elegantly and in a natural way, as if it has always been there. The trick is not to "over light" Newport, but to add light where it is needed, when it is needed, and in the correct quantity for the purpose intended. If correctly done, the results can enhance the safety, visibility and social ambience of the town at night.

Heritage and historic buildings need to be lit respectfully and in keeping with the aesthetics of the history of the town, enhancing their original visual identity and leaving a lasting impression on both residents and tourists.

Environmentally sensitive areas such as the Black Oak River, Princess Grace Park and other green areas in the town are important for their natural value, and this plan aims to minimise the effects of light on flora and fauna, w hilst still highlighting the unique character of the area.

The spirit of place

When a lighting designer approaches a new project, especially designing the lighting for a town, the first questions are asked about the characteristics and peculiarities of the place: where it is situated, why is it there? What is its history, its culture? And so on… The overall "feel" or character of a location, i.e. its distinctive atmosphere, is encapsulated as the spirit of the place.

Urban planning has seen many different approaches to how a city should look and, in the past, the view of the urban landscape (streets, buildings, squares, gardens) was driven by the daytime perspective. Natural light from the distant sun shapes the appearance of our towns and cities with both direct and diffuse light (and shadows) varying with the seasons, changing our appreciation of the environment according to the variation in shadows and colours of the sky.

Approximately one hundred and fifty years ago urban areas began to use artificial light for the purpose of safety. This newer artificial form of lighting, coming from lower heights, resulted in light and shadows that differ from daytime, revealing new scenes and urban landscapes. Along with the introduction of general street lighting, electric light made it more popular and easier to light monuments and hence lighting and light proliferated together.

A mere fifty years ago, the night was still considered the most important time to rest, but increasingly, the way we utilise the night changed. Nowadays nighttime has become associated with the desire to go out, have fun, meet friends and socialise. In response to this, local government, commerce, industry and education responds to the needs of citizen's' economic and social life by providing lighting at night.

While this move to a 24/7 culture has developed in the last twenty years the way we understand the night has changed again. Recent sensitivities in our views of public lighting require a shift from a focus on quantity to a much more sophisticated approach to lighting which also considers quality. This is the ethos that guides us through the Lighting Master Plan for Newport.

What are the goals for Newport's nocturnal landscape?

This lighting plan aims to achieve community benefits with the following aims:

- Increase visual comfort and a sense of safety for the community
- Compliance with National Lighting Standards
- Reconnect values of the night and natural darkness
- Provide an ecologically sensitive lighting scheme for the town
- Enhance the nocturnal atmosphere of Newport after dark
- Improve street lighting uniformity
- Reduce energy use
- Enhance Astrotourism Potential

This image shows the two phases of public lighting installations within the study area. Yellow shows N59 (installation in progress).

Amber shows proposed lighting for the remainder of the public lights within the study area of Newport town.

4.1 STREET TYPOLOGIES

For our lighting plan we needed to address the appropriate lighting regulations governing the amount and type of light relevant to each area of the town and for this we referenced the general guidelines for the level of road lighting as laid out in European Standard EN 13201-1:2015. This document aims to provide good visibility for night-time users of outdoor public traffic areas and to support traffic safety, traffic flow and public security. Based on these precepts we discuss below the methodology used in our work.

Street lighting classes: In order to plan the details of the required lighting we first needed to determine the level and type of lighting that provides for the visual needs of road users (vehicle drivers, cyclists and pedestrians) in particular types of road areas and environment. The EN 13201 document provides a set of criteria which can be used to determine this **lighting class** for each area based on photometric requirements for the road users, noting that such light levels may vary over the day or the season and depend on the amount of traffic. All documents clearly state that the illumination of an area (road, park, etc.) is a decision of the local community, state, county, country, etc. Hence there is some freedom in the choice of light levels and method applied at the local level.
Each general category is divided into six subclasses depending on the geometry of the relevant area and on the traffic and time-dependent circumstances with the appropriate lighting class has to be selected according to the function of the road, the design speed, the overall layout, the traffic volume, traffic composition, and the environmental conditions. Based on such a detailed assessment of conditions an exact lighting class can be assigned which then determines the details of the amount of light (illuminance) as well as the uniformity of illumination, etc. Variations to the calculated road categories may be required based on the experience of a Road Traffic Engineer with knowledge of local conditions and it is permissible to adopt a lower lighting class than the current default.

We followed the methodology of EN 13201 to develop the lighting categories appropriate to the Newport area. These categories then provided a basis for subsequent calculations, risk analyses and all other activities envisaged for the street lighting project during the subsequent design phases. In summary, three basic types of road class are defined inside the project boundary and are labelled **M**, **C**, and **P** according to the definitions of EN 13201. Before discussing our detailed assessment of the road categories we outline below the general characteristics of these classes.

M class roads are intended for drivers of motorised vehicles on traffic routes which allow for moderate to high driving speeds. The only M class road in the Newport area is the N59 which passes South-to-North through the town.

C class roads apply to roads where the traffic composition is mainly motorised, but where conflict may occur due to intersecting vehicle streams and/or in areas frequented by pedestrians, cyclists, or other road users. Areas showing a change in road geometry, such as a reduced number of lanes, or a reduced lane or carriageway width, are also regarded as conflict areas. Their existence results in an increased potential for collisions between vehicles, between vehicles and pedestrians, cyclists and other road users, and/or between vehicles and fixed objects.

P class routes are intended predominantly for pedestrians and cyclists for use on footways and cycleways, and drivers of motorised vehicles at low speed on residential road, shoulder or parking lanes, and other road areas lying separately or along a carriageway of a traffic route or a residential road, etc. The visual tasks and needs of pedestrians differ from those of drivers in many respects. Speed of movement is generally much lower and relevant objects to be seen are closer than those important for drivers of motorised vehicles. Only a small proportion of streets inside the study area (approximately 5%) can be classified as P.

European Standard EN 13201-1:2015 defines a parameter system for a detailed description of all typical lighting situations in road traffic. Using the European standard the lighting requirements can be determined according to the specific conditions of the roads. Various lighting parameters, such as the geometry of the traffic area, type of traffic use and environmental influences are used to identify lighting classes for which qualitative and quantitative lighting requirements are described.

Details of the approach to lighting classes is provided in **Appendix B**

STREET TYPOLOGIES
EN 13201-1:2015

NATIONAL SECONDARY ROAD
Class M - for motorised traffic

PRIMARY
Class C - for conflict areas

SECONDARY
Class C - for conflict areas

RESIDENTIAL
Class C - for conflict areas

OTHERS
Class P - for pedestrian and low speed areas

OTHERS
Class P - for pedestrian and low speed areas

4.2 LIGHT DISTRIBUTION

The entire lighting master plan for Newport follows the International Dark Sky Association (IDA) recommendations. The IDA guidelines are intended to aid in the selection of lighting that is energy and cost efficient, yet ensures safety and security, protects wildlife, and promotes the goal of dark night skies. These are:

- USEFUL – All light should have a clear purpose.
- TARGETED – Light should be directed only to where needed.
- LOW LIGHT LEVELS – Light should be no brighter than necessary.
- CONTROLLED – Light should be used only when it is useful.
- COLOUR – Warmer-coloured lighting should be used whenever possible.

Light fixtures and light control

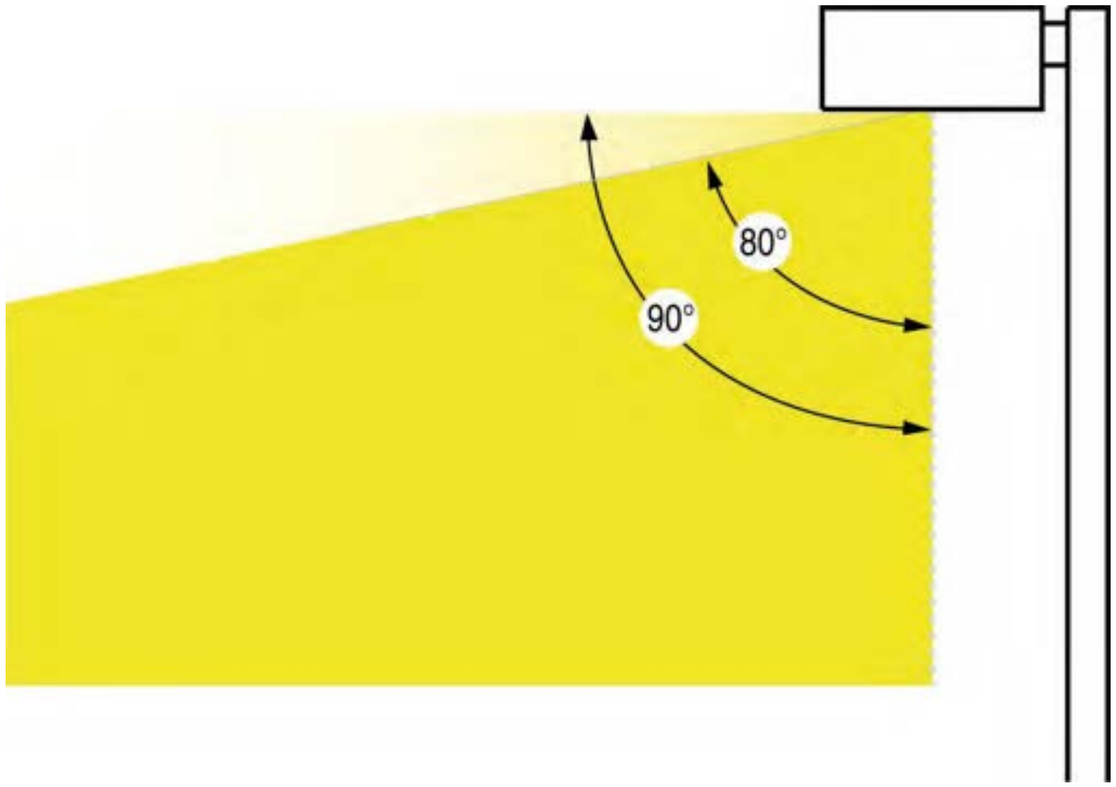
To reduce the environmental impact of the lighting in Newport, all new fittings will be of the Full Cutoff type. We provide some clarification below on the meaning and importance of FCO fixtures, in comparison with others currently in use.

All the new fittings for street lighting will be Full Cutoff

The term **Full Cutoff (FCO)** has and is being used to describe luminaires that have no direct uplight (no light emitted above horizontal) and this is the standard to be achieved for new lighting.

However, in addition to that limitation, the Illuminating Engineering Society of North America (IESNA) definition also requires luminaires to comply with the glare requirement limiting intensity of light from the luminaire in the region between 80˚ and 90˚. It has been found that light at these angles is detrimental to the surrounding environment as it propagates into the surrounding countryside, far away from the region of intended use and can also contribute to local glare. As an example of the application of this idea, Highways England uses a weighting scheme for new UK road lighting schemes which penalises lighting which does not meet the FCO requirement.

At this point we should distinguish between the terms Full Cutoff and fully shielded as they are often used interchangeably, though the terms are not equivalent. Fully shielded luminaires emit no direct uplight, but have no limitation on the intensity in the region between 80˚ and 90˚ and hence may not be as beneficial to the environment. We should also clarify here that a luminaire with a flat lens does not necessarily qualify as a full Cutoff luminaire. While this may be true sometimes, it is not always the case. Depending on the structure of the luminaire, reflections off the housing may result in some amount of upward directed light from the luminaire.



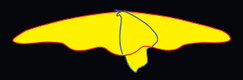
Picture from Douglas Paulin's Full Cutoff Lighting: The Benefits, 56, LD+A/April 2001

It is very important to choose the right optical system for each task.

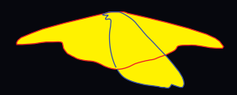
The world is full of different roads and strict street lighting requirements. With the addition of many different LED package preferences and mechanical size limitations, the possible combinations multiply exponentially. Today there are many specific light distributions for road lighting to meet the requirements of a specific lighting design without producing excess light outside the area of intended use.

Examples optics for street lighting, from LEDiL

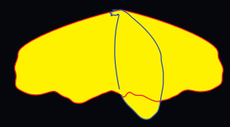
BEAMS FOR STREET LIGHTING



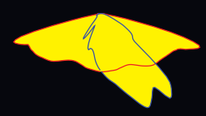
SCL
Type II/III (long), ideal for pedestrian paths and residential roads



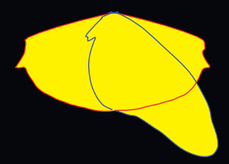
ME ★
Excellent longitudinal luminance uniformity fulfilling EN13201 M-class requirements



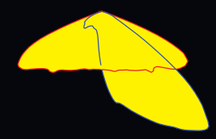
ME-N ★
Designed for high poles, fulfilling EN13201 M-class requirements



ME-WIDE1 ★
Fulfilling EN13201 M-class requirements, added house side backlight



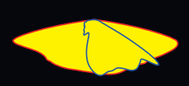
ME-WIDE2 ★
For staggered pole setups fulfilling EN13201 M-class requirements



MEW ★
Extremely low glare fulfilling EN13201 M-class requirements for wet road surfaces in North Europe

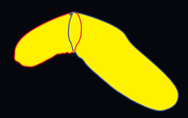
LN1 ★
For EN13201 M-class requirements with high poles or where road width ≤ the pole height

LM1 ★
For EN13201 M-class requirements where road width ≥ the pole height



LW1 ★
For EN13201 M-class requirements where road width > the pole height

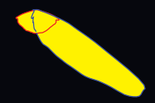
PX
Double asymm., pedestrian crossings, right side traffic



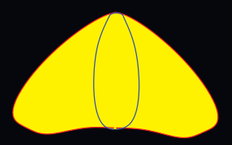
PXL
Double asymm., pedestrian crossings, left side traffic

FN
Narrow forward throw beam for area lighting

FT
Forward throw beam for area lighting



FS
Forward throw beam for area lighting



B2
For area lighting and applications demanding a wide oval beam pattern

C
For area and street lighting such as parks and pedestrian walkways

★ for luminance based road standards

4.3 LIGHT SOURCES

Looking at the landscape of Newport during daylight hours, it is clear that the town has a connection with nature and through its green spaces. After dark, there is an opportunity to customise artificial lighting to maintain that connection.

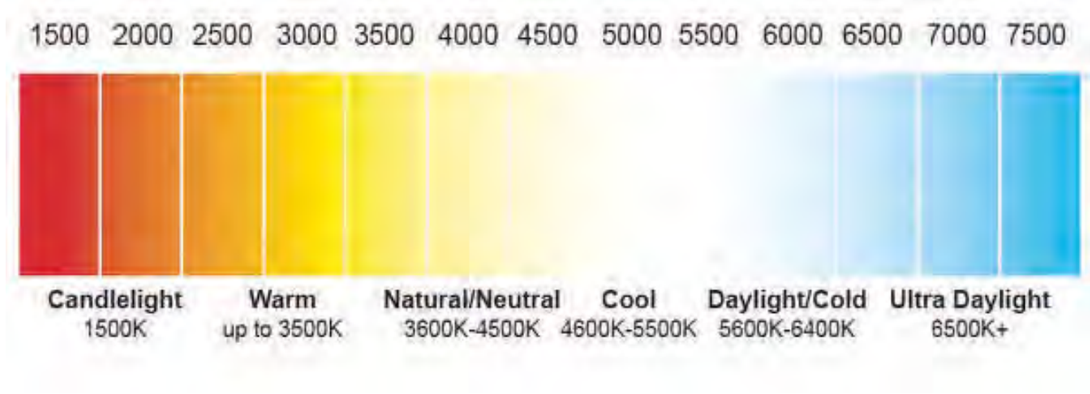
The color tint of white light is measured in Kelvins (K), a scale in which warmtoned white light has smaller values (1800-3000K) and cold toned light has larger values (5000K and higher). Between 3300 and 5200K, light is said to be "neutral" in tone.

Traditional incandescent lighting has a temperature of above 2700K, warm toned light. Today in Newport the 75% of public lighting is supplied by high pressure sodium sources.

New light sources should be amber / yellow light of 2200 K LED with a minimum required CRI of 60. As nocturnal insects are often attracted to light sources that emit large amounts of UV radiation, that LED source also helps to reduce the problem of insect attraction.

Efficient LED light sources with minimum blue-rich light content should be selected to maintain energy efficiency, long life and require low maintenance.

At the time of writing this plan work is underway to upgrade the N59 lighting fixtures under the management of Transport Infrastructure Ireland (TII). These fixtures will be dark sky compliant and use colour temperature of 2700K / CRI 80.



Colour Scale of White Light (K)

Choice of Light Colour

The importance of choosing the correct spectrum or colour of lighting to reduce environmental impact has been discussed earlier, with the recommendation that light not have a high blue content. In addition, control of the lighting colour can alter the "feel" of the lighting design and create a much more pleasing and integrated effect. After dark, the opportunity exists to customise the artificial lighting and maintain a connection with the natural world, while enhancing the warmth and providing a feeling of welcome.

Correlated Colour Temperature (CCT): The colour tint of white light is measured in units of temperature called Kelvins (K), representing the temperature of a heated body that will have the same appearance as the light in question. Warm-toned light has smaller values (1800-3000K) and cool-toned light has larger values (5000K and higher). In this scale the temperature of a candle flame is slightly less than 1000K and traditional incandescent lighting has a value of 2700K, with both being warm-toned lights. Between 3300 and 5200K, light ranges from "neutral" to "cool" in tone, with light of 4000K appearing similar to how moonlight appears to our night-time vision.

The appearance of colours under lighting - the Colour Rendition Index (CRI): It will be appreciated that altering the colour of the illuminating source will affect the appearance of any objects illuminated - as an example, a red object illuminated by a blue light source will appear dark, and vice versa. Although the appearance of lighting can be similar to the eye, the exact distribution of energy in the spectrum of the light affects the colour rendition. To quantify this experimental measurements of colour test charts are used to assign a Colour Rendition Index (CRI) that quantifies how accurately colours are reproduced. CRI runs up to a maximum of 100, typified by high quality halogen lighting, as used in shops."

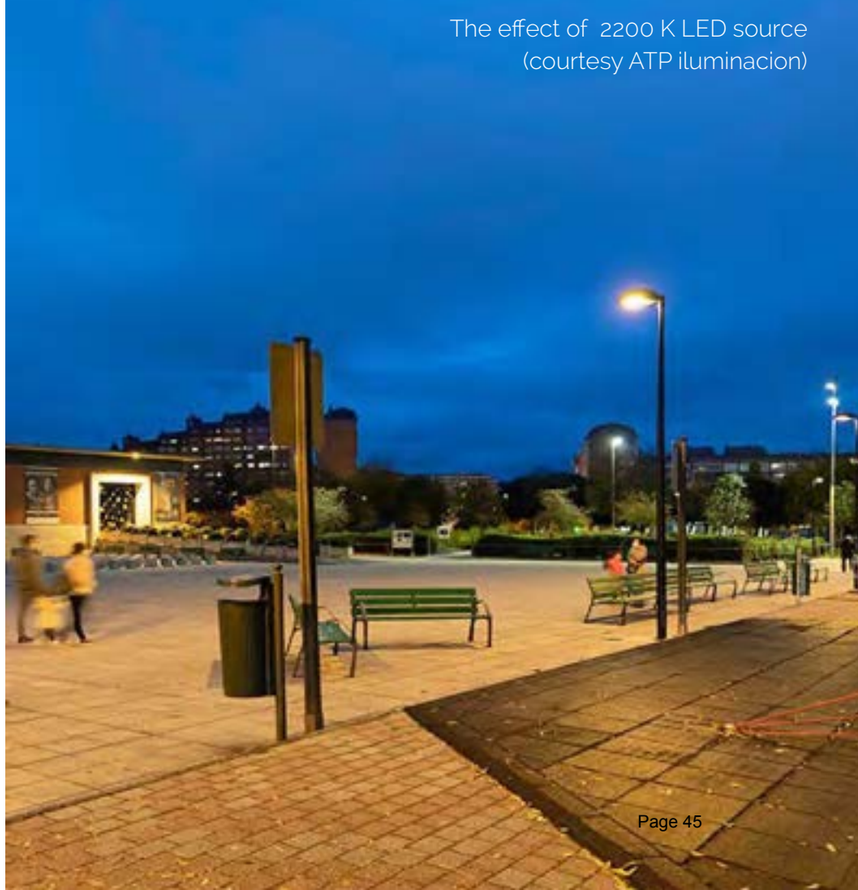
Older lighting such as orange low pressure sodium lamps have a very poor CRI as the light generated by the source is concentrated in one part of the spectrum, and even high pressure sodium (pinkish coloured) has a poor value due to the nature of the energy distribution. Currently 85% of the existing public lighting in Newport is supplied with high pressure sodium sources which have a CCT of approximately 2000K, but a CRI of only 18. We propose that new light sources should be amber/yellow LEDs with a smoother light distribution with CCT of 2200K and a minimum required CRI of 60.

Nocturnal insects are often attracted to light sources that emit large amounts of radiation at the blue end of the spectrum, but are less attracted to amber /yellow LED sources. This will therefore also have an effect on bat species that prey upon them. Hence, besides a warmer and more acceptable light with a better colour reproduction, the LED lighting we propose will also be less disruptive to wildlife and, for the reasons discussed earlier, produce less of an impact in the wider region and so increase appreciation of the night sky due to its reduced impact on night vision.

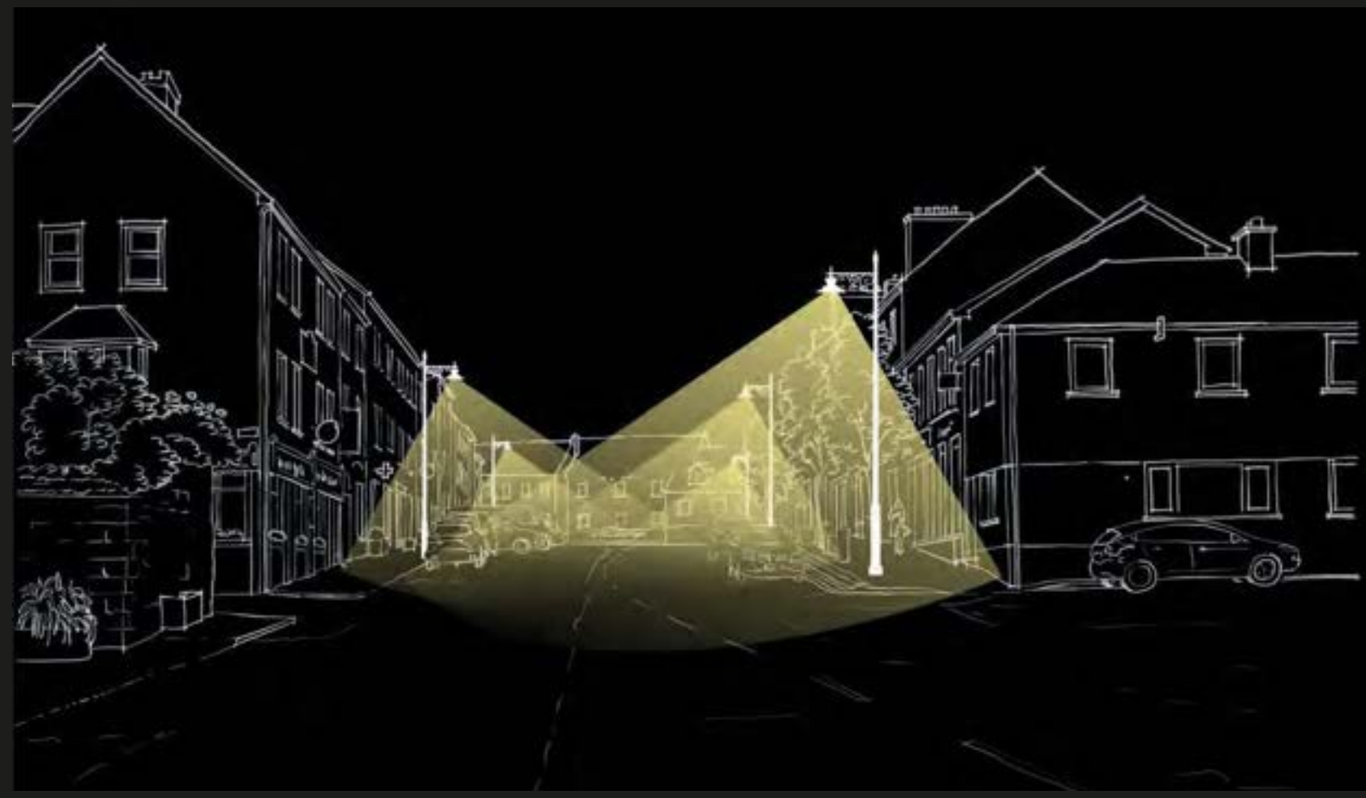
Our overall conclusion is that efficient LED light sources be used which should be chosen for energy efficiency, warm spectral distribution, long life and low maintenance.

We note that at the time of drawing up this plan, work is underway to replace all the lighting fixtures of the N59 under TII control with 2700K which are dark sky friendly. The Institution of Lighting Professionals (ILP) approves the colour reproduction as acceptable.

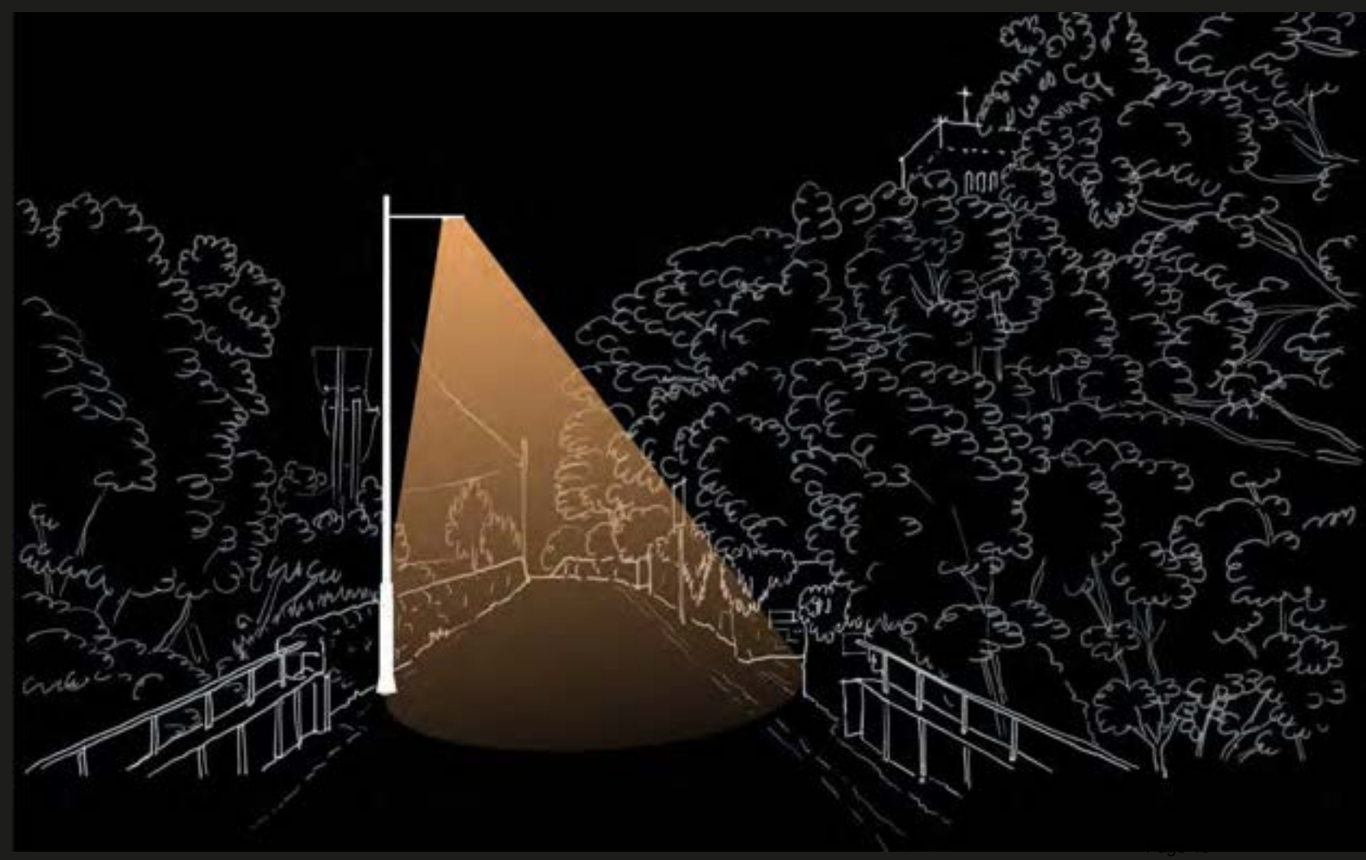
The effect of 2200 K LED source (courtesy ATP iluminacion)



The sketch illustrate a new street lighting 2700 K
LED source – on Main Street



The sketch illustrate a new street lighting 2200 K
LED source – on Blackoak Rise



4.4 CONTROLLING LIGHT POLLUTION

Light pollution, defined as light travelling beyond the region or outside the time of its intended use - is a problem at both the local and national levels. Light pollution consists of a number of different aspects:

- **Artificial sky glow -** the illumination of airborne particles by upward light that obscures the view of the sky and impacts astronomy and stargazing. The primary cause is poorly shielded lighting that emits light straight into the sky.

- **Light spill -** the unwanted radiation of light onto the property of others, particularly into interior spaces. The primary cause of light spill is poorly shielded lighting that permits light to be emitted at angles that can be considered a nuisance to neighbouring properties.

- **Glare -** the impact on vision occurring when poorly designed or excessive illumination causes visual discomfort or disability. The primary cause is too much lighting for the situation, and too much blue-rich light content, exacerbated by poorly shielded lighting emitting light directly into the eyes of the viewer. This light can cause a veil of light to obscure detail and so reduce visibility: this can particularly affect older people. At high light levels the eye's pupil contracts and pain is felt with the need to to look away from the source, again reducing visibility.

All forms of light pollution should be controlled in the town as poor lighting practises will have the greatest impact there, but the impact of skyglow can reach many kilometers from the source. All forms of light can contribute to light pollution and hence long-term public lighting plans should encourage cooperation with private residents and communities to develop comprehensive plans to tackle light pollution.

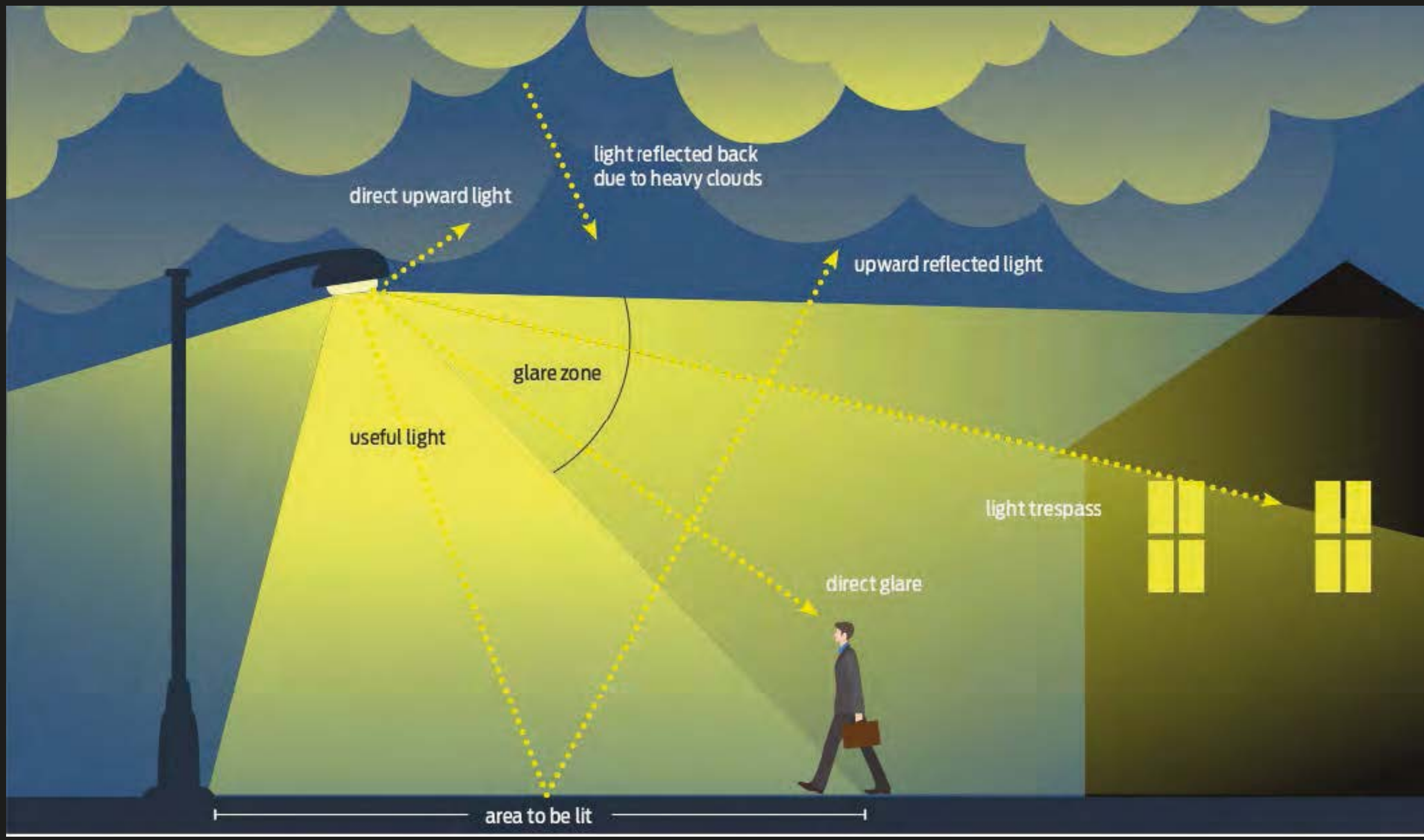
Significant improvements in the level of light pollution can be made with the use of well-shielded luminaires. The majority of luminaires should have solid sides and tops and direct all light below the horizontal plane: light close to the horizontal can propagate some distance into the environment and also contribute to local glare. There are very few exceptions to this shielding requirement, which include:

- **Landscape lighting:** the lighting of landscape features should be avoided as a general rule. In extremely special cases where landscape lighting is demanded, the smallest amount feasible should be used for the application. The light source per luminaire should not exceed 500 lumens and should be shielded.

- **Festive lighting:** it is possible to use LED string lights responsibly for decoration at seasonal and festive events by carefully selecting warm toned, subtle colouring. In the case of decorative festive lighting, often 'less is more' and when selecting lights, this plan advocates for the Danish concept of "Hygge" meaning, warm cosy and welcoming, ("Teolaí" in Irish). A An improvement in the level and colour of public lighting means that the colour and intensity of festive lighting can be reduced in order to obtain a better impact.

- **Outdoor Sports lighting:** the lighting must protects the dark skies while providing excellent illumination for the sports field. All luminaires must be designed such as to not to emit direct light above the horizon, unless required for the activity (i.e. aerial sports) being played.Their effectiveness should keep most of the light directed towards the playing field and shall not to be used for illuminating other area tasks. If lighting is desired in adjacent parking lots or other areas, those areas shall be illuminated by separate luminaires and systems not associated with sports field illuminance needs.

In the above cases, lighting should be switched off at an agreed time (suggested midnight) and not left on all through dusk to dawn hours. Individual projects should make every effort to employ the lighting standards as described in this document.



Avoid obtrusive light,
source: www.buildmagazine.org.nz

4.5 REDUCING COST, ENERGY AND CARBON USE

Trimming and Dimming

Public lighting can account for the majority of the local authority spending across the country and is now the target of government mandated reductions in order to meet cost and carbon reductions. Due to limitations in the operation of older discharge lighting (such as the ubiquitous yellow sodium lamps), conventional public lighting has depended on either time switches or photocells to control the periods of lighting, with the lighting being either "on" or "off". The introduction of modern LED lighting permits the use of adaptive lighting which can take the form of "trimming" or "dimming", with the former involving a reduction in the hours of operation and the latter requiring one or more periods of reduced light output.

Use of public light dimming is now standard in the UK – including Northern Ireland – with no light at all beyond curfew time being implemented in a large number of cases. While dimming for energy conservation in road lighting has always been quite controversial, especially when applied specifically to large cities, an extensive comparative study in the UK shows that there is no evidence for a change in road traffic collisions with the implementation of either dimming or the move towards whiter light. In the case of crime there is, however, some evidence for a decrease in crime rates following light reduction.

Guidance in when and by how much lighting levels can be adapted has come from the worldwide professional lighting body, the International Commission on Illumination (CIE, or Commission internationale de l'éclairage). This body has produced a document (CIE 115) outlining how dimming can be introduced by providing very simple criteria for altering the standard "lighting class" that suggests how brightly and uniformly the road needs to be lit and, at the EU level, document CEN 13201-1 was developed. This latter document facilitates the implementation of dimming for energy conservation if the other project quality criteria (for example uniformity) are not changed, preferably using real-time information about traffic volume, weather and real lighting levels, while the use of time-based systems should be limited in use to areas where conditions are easily predictable.

This image of lighting in Tucson shows energy savings can be made without significant changes in appearance. Note that uniformity of lighting levels, and hence safety, is maintained.

Source https://www.darksky.org/tucson-street-light-experiment/

Adaptive Lighting Technologies

With current lighting sources and electronics, traditional pre-programmed street lighting systems are considered "old school". A new generation of sensors that are capable of measuring the three essential parameters of traffic levels, weather conditions, and road surface luminance provides opportunities for new approaches in the design and operation of road lighting. Based on the measurements from these sensors, lighting level can vary at different periods during the night as well as in different seasons, compared to older lighting standards which lit the area to the maximum traffic or hazard level. These modern sensor technologies enable complex control systems to operate at a very low cost, both in terms of initial investment and ongoing costs while also taking into account any requirements stated by national and international standards.

In the case of towns where sudden and non-predictable activities might happen (events, sport related activities, security problems, weather, etc) the introduction of real-time monitoring enables immediate response to conditions, even where statistical data about long-term traffic conditions is lacking. By **continuously measuring the parameters** that affect traffic or safety, information on precisely how and when to dim becomes available. Currently there are two ways of managing adaptive lighting, depending on the information available:

Traffic Adaptive Installation (TAI) or a Full Adaptive Installation (FAI).

TAI uses a luminous flux control system in which only traffic numbers are measured in real time to determine the lighting level. In this approach the lighting class will be downgraded by one lighting class only when traffic is lower than 50% of the nominal value: whenever traffic is lower than 75% of the nominal value, the reduction can be by two lighting classes. The difference relative to non-adaptive lighting is the possibility to follow the traffic volume variations in real time, thereby allowing dimming to occur much earlier if conditions are met, while giving full safety and light when traffic numbers differ from that assumed when the lighting was originally designed. The lighting standard documents also state that for TAI purposes, calculation of traffic volume should be measured every 10 min, and dimming is allowed only whenever two consecutive samples are below the limit, but if only one sample is higher, then the brighter lighting level should be immediately applied. The limitation of this system are the fixed decision points, e.g. a TAI installation produces a step transition in light level only when traffic volume is lower than 50% of its nominal value and not, for example, when the traffic volume has reduced by 48%.

FAI requires the real time measurement of three parameters: **traffic volume, weather conditions, and road surface luminance.**

The influence of weather conditions on lighting is well known: wet roads increase non-uniformity of the road surface luminance and therefore dimming should not be allowed, fog reduces contrast and therefore the safety on the roads and snow causes glare.

Additionally, the influence of variations in the lighting installation such as dirt on luminaires or aged lamps, or variability of road surface properties due to age and wear, can be determined and taken into account by altering the lamp output to maintain the required luminance and uniformity, while also permitting higher dimming levels on a light-by-light basis.

Through measurement of the three parameters of traffic volume, weather and actual luminance a local authority is allowed to dim according to FAI rules which provides for the following reductions:

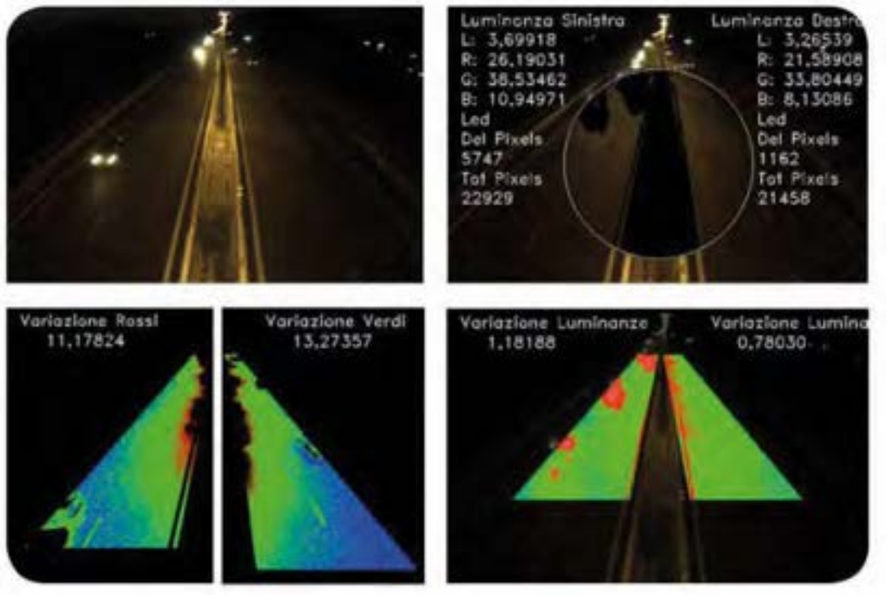
- Possibility to dim up to three lighting categories, when traffic is lower than 12.5% of nominal value and weather is good;
- Possibility to dim continuously, that is for example, dimming 20% when traffic is reducing by 10%, following a straight line through interpolating from the higher to the lower permitted luminous classes (i.e., max and min dimming level).

The clear advantage compared to TAI is evident, because TAI can dim only in steps. In the case of **FAI** systems, traffic volume has to be measured every minute and the value used for dimming should be the average over 10 readings (i.e., 10 min) based on a moving average. If three consecutive samples show a value greater than 20% relative to the last calculated value, an immediate alteration to the dimming level has to be implemented. The reason for such choices are:

- An average over 10 minutes is not appropriate to specific traffic situations occurring, for example, when a traffic light is present along the installation.
- The lowest lighting level is acceptable only when all the influencing parameters are well measured including road surface luminance and weather. Consideration should also be given that the cost of current technology limits the number of sensors that can be reasonably installed in a town for economic reasons. The limits due to the initial investment cost can be ameliorated through the lighting designer considering street areas that are uniform in character, hence dimming can be determined through the use of a limited number of sensors, with the same information for adjacent streets.

To realise a FAI system is needed to install a sensor to measure luminance, traffic, weather conditions – these are called LTM (Luminance Traffic Meter) systems. LTM sensors are able to count the vehicles passing a fixed location, with an accuracy of about 10%.

LTM example
Courtesy Reverberi Enetec



LTM working example
Courtesy Reverberi Enetec

By integrating traffic information with the ability to dim, it is possible to apply the reductions of lighting categories in real time. In this way, thanks to the regulation of the luminous flux as a function of traffic, it is possible to ensure that the lighting conditions of the road always adhere to what is prescribed by the standard.

Compared to the traditional pre-programmed time cycles, tests with such sensors has shown to be able to add an additional **50% energy savings** to what is already obtainable with conventional control systems, though the exact value is strongly influenced by the parameters pre-programmed into the decision-making algorithm. Such technology also considerably improves safety, because the dimming depends on the weather conditions at that time and with real-time traffic. Options are also available to communicate with external systems in order to provide an overview of the operation in real-time.

Following the goals of this lighting master plan (see point 3.5 for detail) will be very important to develop the new lighting system, using the Full Adaptive Installations (FAI) method as far as possible, whilst acknowledging some changes are already underway, such as the relighting of the N59. For the remaining roads within Newport, however, we recommend FAI controls which will allow the luminance level to be safely reduced further and consequently obtain a large reduction in light pollution as well as energy and carbon use.

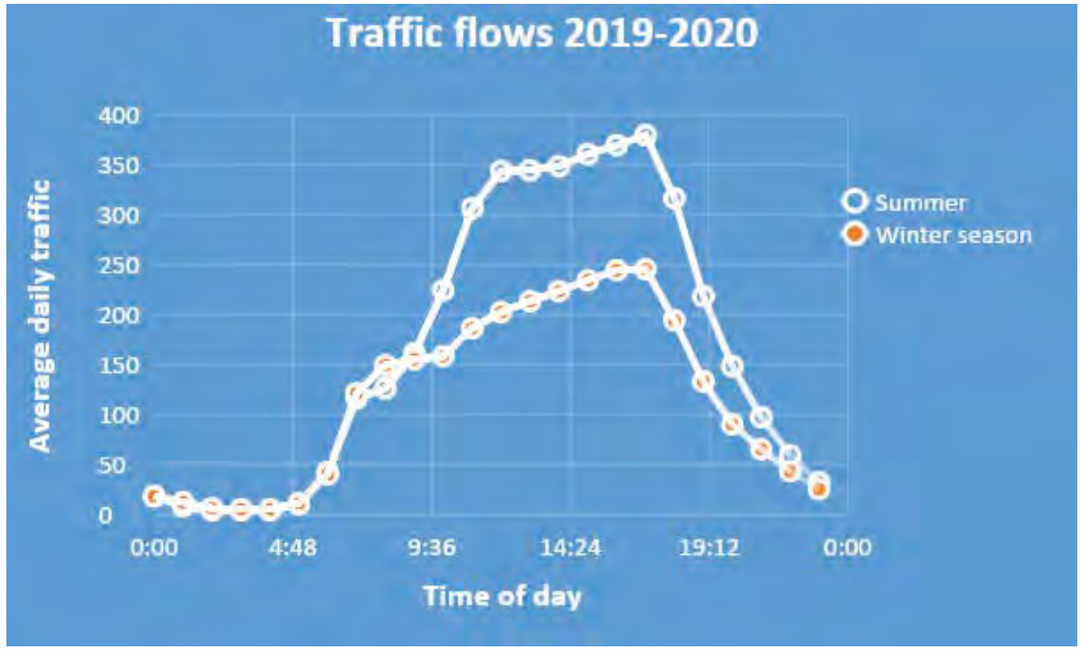
Dimming

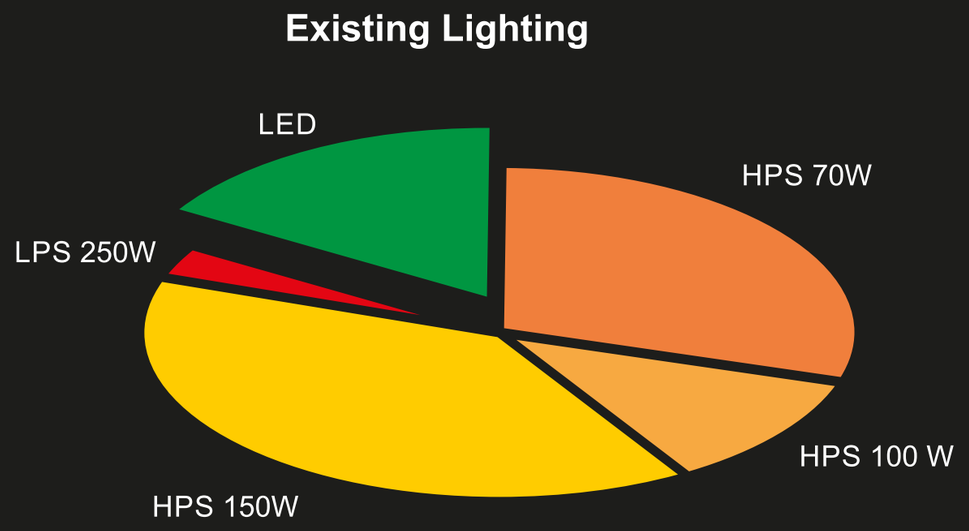
Lighting standards have evolved to allow for light reduction and energy savings through using lower lighting levels outside of busy traffic periods. Transport Infrastructure Ireland (TII) permits such dimming on the national road network and such regulations therefore also apply to the N59 route which runs through Newport town (Design document DN-LHT-03038).

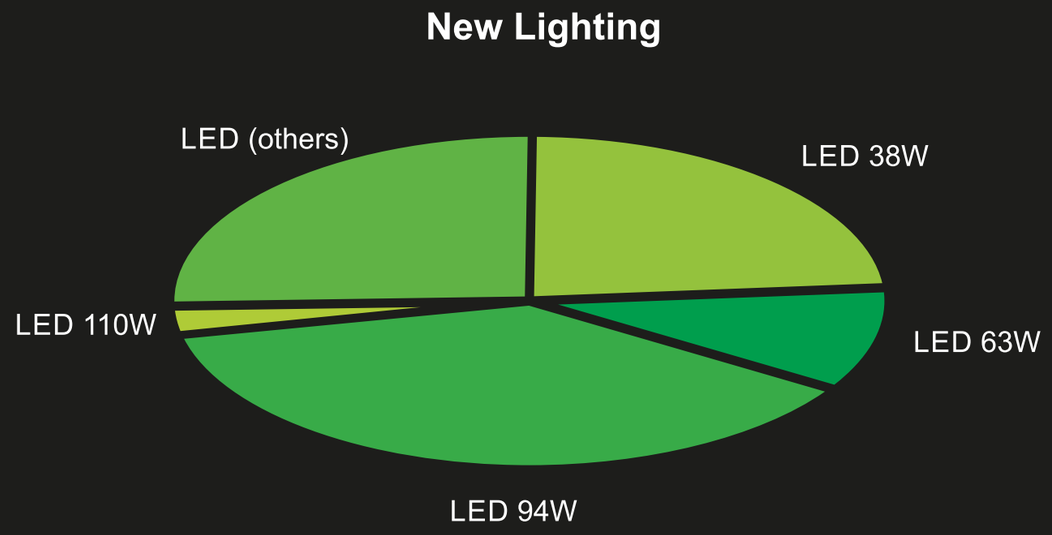
We obtained information on the traffic volume along the N59 from the National Roads Authority (NRA) website. These data are obtained from an automated instrument located between Newport and Mulranny, but provide an indication of the general N59 traffic volume passing through Newport town. As data are missing for the 2019 summer period, we used the data for 1 June – 31 August 2020, most of which occurred outside the lockdown period and compared this against the traffic information for the period 1 September 2019 – 31 March 2020, i.e. to one week after lock-down.

Examination of the data shows that, as expected, the daily traffic volume is much higher in the summer months, with the increased traffic mainly during the daytime with a median increase in hourly traffic of 40%, peaking at approximately 70% around noon. In both summer and winter 99% of the daily traffic has passed before 10pm at night, suggesting that dimming of streetlighting can safely be considered from this time, particularly as traffic into or through Newport during the winter period would mainly consist of local traffic.

Source: Traffic flow data taken from NRA Statistics www.nratrafficdata.ie







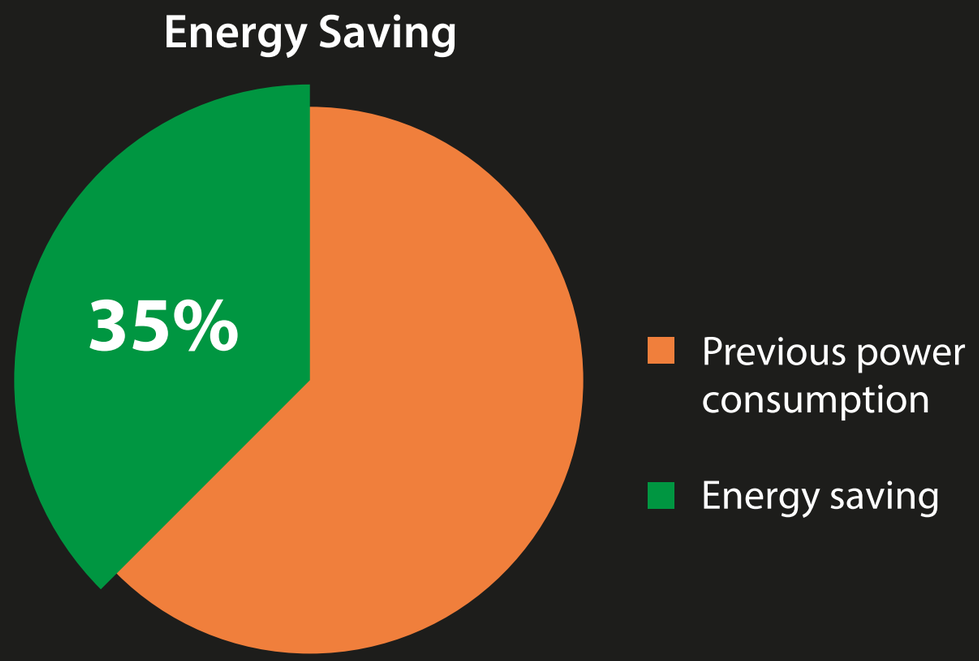
We surveyed the existing public lighting fixtures within the study area of Newport to produce the charts on this page.

Existing Lighting chart:
Represents segments showing the type of lighting currently in place as a percentage.

New Lighting chart:
Represents segments showing the LED equivalent lighting suggested according to the recommendations of this Lighting Masterplan.

Energy Saving chart:
Represents the potentially portion of saving compared to the existing public lighting consumption).

The estimation is made by comparing the existing sources, their flux and luminaire efficiency with equivalent LED fittings.



4.6 LED LIGHTING CONSIDERATIONS

Considerations about the energy saving, lighting system lifetime, efficiency and sustainability make the choice of LED technology a competitive alternative to other available light sources. We shall examine below some aspects of these effects with respect to the source's lifetime impact on the environment.

Light output: All lamp technologies suffer a decrease in lumen output for a given power consumption (i.e. a decrease in luminous efficacy) with time. This has been referred to as the factor of lamp lumen maintenance (FLLM) and can be compounded by potential light losses caused by dirt collecting on the optics (FLM). The amount of light produced from the light source at a defined timeframe is referred to as the Lamp Lumen Maintenance Factor (LLMF).

A characteristic of LEDs is that they generally do not fail instantly as some light sources do, but they slowly dim down as they age. In the LED's life the critical time is the point after which the LED light emits only 70% of its initial light, and not when it fails totally. This point is called L70 and is standardised by the industry to be a minimum lifetime of 50,000 hours. Currently there are some products on the market with lifetime better than the current typical value, with 80% (LLMF = 0.8) or more of the output remaining after the same 50,000 hours of life. As noted in the section on lighting controls, monitoring of the lamp output can be used to accommodate this decrease, though the lifetime of LED lighting is not so simple to guarantee as other factors are involved.

Efficiency: Despite the age of the technology, low pressure sodium lamps are very efficient when considered in terms of light output to electrical input with 140-170 lumens per watt (lm/W) obtainable. However, they suffer from emitting monochromatic orange light, have relatively short lifetimes of a few years, and contain mercury. High pressure sodium lighting has a more uniform spectrum, but still suffers from limited lifetime and relatively low electrical efficiency. In comparison, current LED technology currently has an efficiency at the bottom end of the low pressure sodium range when control electronics and optical losses are included.
However, the theoretical potential maximum efficiency of LED technology is roughly double the current value, together with a whiter light and with a lifetime two to four times longer than the older technology. We note that there is a marginal difference in efficiency (of the order of a few percent) between "neutral" LED lighting, which represents the majority of the LED lighting installed to date, with a correlated colour temperature (CCT) of 4,000K and a more friendly "warm" white lighting with CCT of the order of 3,000K or less, as currently implemented along the N59. This difference in efficiency is anticipated to reduce further in coming years as demand for lighting with a lower blue content grows.

Correlated Colour Temperature: Our recommendation for "warmer" (lower CCT) lighting is based on environmental, health and safety and aesthetic considerations. Most current white light LED luminaires currently use a blue LED together with a phosphor coating, similar to how fluorescent lamps work. This coating converts some of the energy to lower energy colours to give a more balanced light output across the spectrum. Formerly the highest efficiency lighting had a blue-rich light distribution, and lighting with a CCT of 5,000K - 6,000K is not uncommon in the USA which was an early adopter of the technology.

However increasing worries about the effects of such lighting, including from the American Medical Association and Public Health England, together with residents' complaints, has led to a trend to use light with a warmer spectrum. Although there is a slight decrease in efficiency between LEDs with a CCT of 4,000K (as formerly installed in Newport) and 3,000K or less, the gap is narrowing and can be discounted over the lifetime of the project. In the UK, for example, there is a move to the general adoption of LED lighting with CCT of 2,700K as a standard in residential areas.

Lifetime: There are many different components that may contribute to the failure of an LED component, such as the driver, overheating, poor electrical connections etc. The reliability of a particular LED-based luminaire should be considered as the sum of all the failure rates of the individual critical failure mechanisms and higher quality products partly justifies the higher initial investment in order to produce more efficient road lighting installations over an extended lifetime. Equipment with longer expected life and a corresponding longer warranty period would be a worthwhile investment and would decrease the frequency of premature failures.

LED lifetime is an important consideration for the local authority which is willing to pay a higher value for more efficient, but also longer-lasting and more controllable future-proofed lighting products. Although there are relatively cheap LED luminaires on the market, there is a price to be paid in terms of their quality, spectral output, efficiency and lifetime. More expensive and better characterised lighting will prove to be a better economic investment as it will require less attention and associated maintenance time as well as meeting the design requirements.

The main failure mode of LED luminaires is due to failure of the driver (power supply) electronics and operation at reduced output by trimming (curtailment of the period that the light is on) and dimming (reduction in light level) serves to reduce the strain on the supply and increase the potential lifetime. Additionally, LED lifetime is very much dependent on the chip's junction temperature under operating conditions, the generally mild climate of Ireland and the concentration of hours of operation to the cooler winter months argue towards the longer end of the projected lifetime of 50,000 – 100,000 hours of operation. It can be readily seen that in comparison with the lifetime of existing high pressure sodium lighting of 24,000 hours, LED light sources have two to four times the lifetime, equivalent to up to 24 years under Irish conditions. This extension of the luminaire lifetime reduces the overall environmental impact when raw material extraction and manufacturing processes and also end-of-life disposal are taken into account.

Other parameters affect the actual lifetime of LEDs: use scenario, product type & quality, rapid technological development and failures. The most common factors that affect the lifetime of LED lights are:

- Design of the luminaire (electrical parameters, heat transport, electrostatic discharge layout)
- Mechanical issues (heat transport, Electrical circuit, assembly)
- Environment of installation (temperature, moisture, pollution)
- Application (storage, soldering, handling)

These parameters should be taken into account when discussing the installation of LEDs, especially on a larger scale, in order to gain the confidence of the Council that expects that the products it is buying are well designed and will perform to its expectations.

Sustainability: While LEDs are publicly perceived to be environmentally friendly, a look at it from a life cycle approach offers an in-depth perspective. The Directive 2012/19/EU on waste electrical and electronic equipment (WEEE) requires that lamps and luminaires placed on the market should be recycled. This means that LEDs must also meet the targets set out by the directive in terms of collection and recycling rates. Disposal of old lighting equipment requires special consideration. LEDs are often collected with other light sources, which may lead to mercury contamination from broken fluorescent lamps.

By following a LED light through its life cycle, some concerns regarding the sustainability of such products, often founded in a lack of knowledge, can be addressed. Sustainability impacts from the four stages: raw material extraction, manufacturing, use and distribution, and end-of-life. It can be readily seen from this that when considering the overall impact of a product on the environment, the lifetime as well as its individual end-to-end impact must be considered: this was the background to the EU's Green Public Procurement (EU GPP) study.

There are several criteria that municipalities could put into tenders which could significantly reduce the end-of-life impact of LEDs. Some of these criteria are:

- design for easy disassembly without destruction
- reduction of the number of parts
- reduction in the use of adhesives
- design for replaceable parts
- use of easily identifiable materials with minimal variation in the type of material

Including criteria for modular design in tenders would allow for easy material separation upon arrival at recycling stations and allow for more efficient recycling.

LED lamp waste (source: LEDs Magazine.com)

Aerial view of Newport Harbour at dusk. Lights here are high pressure sodium which are not energy efficient. The planned replacements will have better controls to avoid light spilling upwards and into the environment.

5. APPLICATION GUIDELINES

5.1 DESIGN PRINCIPLES FOR GOOD LIGHTING

This section sets out some basic design principles for good lighting that should be considered in the preparation, design and improvement of a lighting system.

First principle - Install lighting only where it is needed. Begin with natural darkness in mind, and add light only for specific purposes and for the time required, and light only the required location.

Second principle - Lighting levels should be appropriate for the activity. Employ only the minimum amount of light that is needed at each location and turn the lights off when not needed.

Adaptive controls (to manage light timing, colour, dimming, motion sensors) are recommended to reduce light levels during hours of inactivity and to minimise unnecessary light output and energy consumption.

Third principle - Prevent stray light, including upward light that causes sky glow and sideways light that causes glare and light trespass. Lighting should be directed to ensure only the intended area is lit. All light fittings should be located, directed or shielded to avoid lighting anything but the target object or area.

Fourth principle - Avoid ornamentation in lighting except where absolutely necessary.

Even if ornamental lighting plays a significant role in architecture, when used outdoors it tends to create light pollution. Use low wattage sources, locate them discreetly in vaults/roofs and/or provide upward and sideward shielding.

Fifth principle - employ durable lighting equipment designed to withstand weather, long life, energy efficiency and low maintenance. The amount of light produced (in units of lumens), rather than the amount of energy (watt) used is the most important consideration in ensuring that an area is not over lit.
For residential installations, in almost all cases the total light output per luminaire should be less than 500 lumens, roughly equivalent to a 60 W incandescent bulb. In no case should the total luminaire output exceed 600 lumens, equivalent to a 11 W compact fluorescent bulb for any reason.

Sixth principle - interior lighting should be designed and controlled by choosing lower levels at night in order to ease the night transition from interior to exterior and for people's general wellbeing. Consideration should also be given to reducing light spill from internal light sources. This should include block-out blinds or curtains for transparent portions of a building, including sky lights.

Seventh principle - Use warm coloured light bulbs and, if LED types are used, CCT of 2700K and 2200 K are strongly recommended. Cool blue-rich high colour temperature bulbs, i.e. LED with CCT of 4000K or higher should be avoided, as they are less ecologically friendly.

Last principle - Switch lights off when not required. The use of automatic light fittings is recommended especially for extinguishing or dimming decorative lighting after 10:00 pm. Light fittings with timers that switch on at dusk and switch off by 10:00 pm are also encouraged.

5.2 DESIGN CRITERIA

Our design criteria used below examines relevant lighting themes for Newport to assist Mayo County Council in determining locations where lighting improvements may be needed, and to plan accordingly:

Sustainable Energy Community

Newport is currently undergoing implementation of a new public lighting scheme which will substitute the old low pressure sodium (LPS) luminaires with more efficient LED fittings. This is a good opportunity for rethinking the town illumination policy, adding visual interest to the centre and other landmarks, and minimising the energy consumption and the environmental impact. The unique character of the river and the town woodlands suggest a softness of lighting would be more appropriate for a sensitive urbanised but still natural environment.

This meets the criteria for other plans of relevant to Newport's future vision, such as the Sustainable Energy Community initiative and the Draft Town Design Statement.

Landmarks as Town Memories

Some buildings have an iconic landmark or cultural status and a community or historical significance. St. Patrick's Church and the old railway viaduct are the main visual elements and should be differentiated from the rest of the urban buildings to encourage the curiosity of tourists and maintain the community pride in these buildings. Lighting should be tailor-made to suit the scale of the building. Other cultural and social landmarks should be identified and enhanced with the appropriate balance of light and darkness for the specific point of interest, thus avoiding monotone lighting.

Composing a Visual Hierarchy

Floodlighting building façades is often presumed to be the easiest lighting option but this does not create visual interest nor accentuate the architectural features that define the qualities of a building. The differentiation of areas through the luminance, or intensity of lighting, should coincide with the hierarchy of the urban and natural elements. Visual hierarchy can be addressed through:

- relationship between the illuminated building and its adjacent spaces;
- contrast between illuminated and shadowed urban surfaces;
- creation of "layers" of illuminated space;

The principle is borrowed from art, creating the visual foreground, background and mid-ground with light intensity, scale, source, colour temperature, etc. The choice of light sources of different colour temperature can also be used for defining a visual order by differentiating the chosen surfaces. The resulting composition will appear as elegantly structured, three-dimensional and dramatic.

The Nocturnal Image as a Marketing Tool

A well conceived nocturnal image of Newport is an opportunity to convey a great variety of information as well as creating a safe, secure environment for nighttime visitors. The design of lighting recommended in this Master Plan shapes and defines the nocturnal identity of the town, adding value to its architectural aspect by promoting the spectacular sites while creating beautiful nocturnal atmosphere.

Newport also has the unique opportunity to create its own brand as the first dark-sky friendly town in Ireland. While reducing light pollution and protecting night sky, the town can develop its niche tourism asset (astrotourism) during months that are traditionally considered to be quiet times. This increases the offerings for visitors with a significant and a growing number of people interested in recreational activities such as camping, fishing, wildlife watching, hiking, and photography, and also of course the possibility of stargazing.

Orientation and Way-Finding

Significant research from as early as the 1970's has identified ways that lighting influences our visual environment. Orientation after sunset is extremely important, lighting should highlight the landmarks for easier navigation around the town but ensure that conditions are not blinding for the driver, cyclist or pedestrian. By designing a well distributed contrast between the lit and the shadowed areas, routes on walkways and pathways are more easily perceived. The Lighting Master Plan aims to contribute to a better definition of the recognisable areas of perception during darker hours, needed to improve navigation and orientation.

Visual clarity and accessibility

Making Newport a more accessible town after dark means designing a safer town for all and especially to take care of the elderly and those with special needs. In order to provide more intuitive way-finding and orientation, light can be designed to reveal a pleasant nocturnal environment by visually improving the hierarchy of streets, centre and residential buildings and the open spaces Artificial lighting can create an appropriate after-dark ambience.

by carefully illuminating the urban landmarks, enhancing the perception of their shape, dimensions, materials and details.

A pleasant and accessible environment can be supported by bringing a sense of order to the town: firstly avoiding glare (which is especially problematic for the aging eye), avoiding excessive contrasts between light and dark areas, controlling shadow and limiting confusing and unhelpful upward lighting. Creating a nocturnal town character can greatly benefit movement for residents and also provides a better opportunity to understand the culture of Newport.
Accessibility improvements should be reviewed periodically with community members, town architects, lighting designers and Mayo County Council.

Enhancing the Sense of Security
Studies suggest that improved street and town lighting decreases the fear of crime, including vandalism, burglary, theft or personal assault. Note that the perception of safety does not always correlate with actual crime levels and negative feelings will be more reported compared with positive. This does not mean over lighting, which can have an unintended effect for security measures by creating unnaturally dark areas adjacent to glaring light. The UK has implemented a move to whiter LED lighting and so provides a point of comparison. Findings from a large-scale UK survey of before/after effects in regions where LEDs have been introduced have shown, if anything, a slight reduction in burglaries together with no discernible change in road traffic collisions.

Good lighting begins with the control of glare in the field of view, helping to avoid obstacles or hazards (pedestrian crossings, steps, ramps, etc.) while walking or driving. Direct or reflected glare must be avoided in order to not compromise visibility for drivers, cyclists or pedestrians. Well designed lighting can provide an overall sense of security and assist in reducing the fear of night time crime. When possible, dimming lighting levels can also have a positive impact on behaviour to soften our senses at night. Glare and white light keeps the human physiology alert and awake, often at inappropriate times for social behaviour. In any landscaped area, a soft but well designed lighting scheme might be employed to help combat anti-social behaviours.

Where additional lighting is considered necessary for the purposes of security surveillance, this should be relatively low-wattage equipment directing light down and across the limited area of coverage. This approach is visually comfortable and unobtrusive to neighbouring properties.

Revealing the Town Potential
Using lighting to emphasise Newport's unique identity in the west of Ireland is an opportunity for promoting the town as a case study of good lighting and as a design tool to protect the dark sky. To design light means to design shadow and darkness.

The nocturnal structure of Newport can be visually enriched by architectural illumination, balancing the different areas with their individual character (town centre, public buildings, residential areas, river banks, natural landscape etc) and highlighting details and features of key landmarks and natural spaces. The scale of lighting will respond to the streetscape's character, and using a balanced intensity of light and darkness will create visual interest while reducing visual discomfort.

Costs and Maintenance
The cost of a lighting scheme must include both capital expenditure and running costs in order to achieve the most economical and cost effective outcome. A practicable and economic maintenance schedule should be defined to manage the requirements of the lamps (especially LEDs) in relation to installation life (electric system), hours of use, energy costs and recurring replacement times.

Other factors that affect the overall economics and convenience of a lighting scheme can vary due to the physical conditions of the mounting installation (i.e., vibrations, moisture, dust, ambient temperature, life of surface finishing). The process of maintenance may be especially problematic with LEDs where promises of extraordinarily long life are often offered.

Professional experience informs us that lamp lumen depreciation can be reduced to 70% or even as low as 50% of initial rating. A standardised selection of lamp types and sizes will help to simplify maintenance requirements, (without compromising visual requirements). A lighting energy management system can also be implemented to automatically monitor and record the status of each luminaire for maintenance and/or replacement.

Quality Criteria
The understanding of lighting intensity and its distribution is a functional cornerstone for lighting the natural and built environment.

As colour can have a significant impact of perception of a luminous environment, luminaires with a high colour rendering index (CRI) are recommended.

Glare from luminaires on public buildings should be addressed as this is an opportunity to provide examples of best practice.
Unnecessary light waste in lighting up buildings and natural elements (trees, shrubs, etc.) should be avoided.

Illuminated outdoor spaces must not disturb residential properties and lighting schemes of commercial or domestic buildings should follow the guiding principles of the International Dark Sky Association detailed earlier in this plan.

5.3 DESIGN CONSIDERATIONS ABOUT QUALITY OF LIGHTING

The purpose of lighting the built environment is to support the visual performance of tasks such as walking, driving, parking, etc. and also to support social and economic activities. When lighting acts well in conjunction with architecture and landscape, it helps to establish how we perceive the urban and natural environment.

Good lighting is not simply about how well we see, it is also about how we experience a space or understand its form and materials. The perception of light, or our judgment of the lighting of a natural or built surface, involves the following considerations:

Colour
Lighting offers a unique chance for representation of Newport town at night. A romantic warm light has more aesthetic values and a symbolic power for the urban appearance. Architectural lighting should not disrupt the aesthetic appearance of the buildings but instead enhance their architectural features.

A warm tone of lighting should be designed to give a visual coherence to street lighting and, at the same time, reduce the intensity of the light sources in order to avoid visual inconsistency with the surrounding buildings. This plan strongly recommends coloured light should be used in an architectural and sensitive manner – i.e. in a limited number of specific situations (pharmacy, etc.).

Contrast
Rather than opposing themes, light and dark should be perceived as complementary elements. On a wider scale, lit and unlit areas of the town must be complementary to create a unique and scenic nocturnal image. In residential areas a balance of light and shade can create a pleasant convivial ambience. The scale of light should help to reveal depth, shape and texture to provide visual delight.

Texture
The direction of light must be carefully designed to reveal details without altering the aesthetic appearance of material surfaces. Flat, diffuse lighting is often inadequate for assessing the fine texture of a surface, such as natural stone.

Urban vs Natural Scale
Just as many European towns and cities have updated their lighting installation for energy efficiency, Newport began a programme of replacing old street lamps with new LED ones. Newport is a small rural town with a national secondary road running through the town centre and several minor roads branching from it. The scale of its streets and buildings offer a feeling of intimacy and comfort to the visitor and resident.

Whilst from an engineering perspective the new LED installations can be comparable or better than the older low-pressure sodium lamps (in terms of energy consumption, illumination level, lifetime and lighting distribution), the effects of these changes must be carefully evaluated. The perception of town spaces is a matter of scale and the height and size of lamps play a key role in determining the appropriate proportions. Whenever possible, the lamps in streets and residential areas should be chosen on a smaller scale.

Spectrum
The spectrum is defined as the many different wavelengths of energy produced by a light source. The human visual system begins the process of seeing in the wavelength region between 380–780 nanometers, also called "the visible spectrum". The spectrum of the light source selected has a direct influence on the perceived pleasantness of an area, because it impacts on the subjective impression of brightness and thus the feeling of security.

Existing 2200 Kelvin HPS

This image shows the different between colour temperatures. Temperatures of 3000K and above contain excess blue rich light making the environment more suspectible to glare (especially in wet/cloudy conditions) and appear harsher to the human eye. Lamps recommended for Newport are 2700K (as installed along the N59), which will have an appearance between the HPS and 3000K example and 2200K, similar to existing HPS lighting.

3000 Kelvin

4000 Kelvin

5.4 DESIGN CONSIDERATIONS ABOUT QUANTITY OF LIGHTING

Light Levels - Illuminance
Illuminance (E) is defined as the quantity of luminous flux incident upon a unit area, expressed as lumens per square metre or lux (lx). The European Standard example EN:13201 recommends illuminance levels for vehicular, cycle, and pedestrian routes. Although illuminance is relatively simple to calculate and measure (knowing the luminous flux emitted by a light source) the visual system has complex physiological responses based on how light is reflected by surfaces and perceived by the eyes in the field of view. Daylight illuminance ranges from 5,000 to 100,000 lux (lx). On a moonlit night, it reaches 0.25 lx at most.

Light Levels – Luminance
Luminance measures the brightness of a surface or light source is expressed in candelas per square metre (cd/m2). Luminance is perhaps the most important objective in lighting design: balancing the differences in brightness and colour in the visual field need to be sufficiently pronounced to be perceived by the human eye.

The minimum contrast required for perception depends on the ambient brightness (adaptation luminance): the brighter the surroundings, the lower the contrast perceived. It must be noted the contrast sensitivity is reduced by glare. Eyes' adaption to different levels of brightness takes time: adapting from dark to light takes only seconds, adapting from light to dark can take several minutes.

Uniformity
Lighting uniformity is defined as the ratio between the minimum and average illuminance on a surface. For streetlighting maintaining the correct lighting level alone is not enough because the eye adapts itself to the higher average luminance and it may become difficult to detect objects against that darkest part of the road. Brightness also needs to be distributed evenly so that visual tasks (i.e. driving or parking) can be properly performed. In adaptive lighting installations, lighting levels can be dimmed when the traffic volume or the expected traffic volume decreases. It is important to note that only the lighting level should be lowered, not the uniformity.

Carefully designed street lighting can still be consistent with the European standard EN 13201-2: 2016 Part 2, whilst lighting to lower and more uniform levels, thus promoting better road safety.

Colour appearance and colour rendering

The selection of the source(s) of light is of primarily importance. Choosing the correct light source hugely impacts the perception of a place, especially when designing with LEDs because those light sources differ between manufacturers.

The colour of light produced by a source is briefly described by two parameters; the colour rendering index (CRI), that measures the subjective assessment of how well a given light source renders the appearance of a range of selected colours; and the correlated colour temperature (CCT) or similarity to daylight. The CCT is an objective value which can be calculated from the energy distribution of the emitted light and is the temperature of an incandescent source which has the same appearance. In simple terms this can be expressed as the whiteness of optical radiation on a scale from warm to cool, enabling a light source to be chosen for the atmosphere that it is designed to produce.

Light sources of a lower colour temperature result in a lower subjective impression of brightness than do those of a higher colour temperature. Conversely, light sources with higher colour temperatures have lower colour rendering index.

5.5 RECOMMENDATIONS FOR PUBLIC LIGHTING

Outdoor lighting, such as public lighting, has no built architectural enclosure to contain or capture the light. Defining the boundaries of the areas to be illuminated is critical to an efficient and cost-effective design. The designer must therefore make every effort to establish the lowest illuminance criteria appropriate to the intended purpose.

Luminaires with the appropriate well-controlled optics for the location should always be selected and installed for their best efficiencies and for limiting light trespass and glare. The resulting effects should also be quality checked in hours of darkness to ensure they are performing as intended.

Suggested Product Specifications for use

The following specifications for lighting fixtures are provided as suggestions to meet the recommendation of the Lighting Master Plan and should be used whenever possible.

Design Considerations for Public Lighting

Luminaires must be selected on the basis of optical control when lighting real architectural surfaces. Using high-wattage flood lights to illuminate a focal or task area instead of low-wattage luminaires is inappropriate.

Accent lighting of key elements or details of façades can influence the observers' perception of overall brightness and provide visual interest. Wherever possible, lighting should be directed downwards, not upwards.

Tall lighting poles (9 meters or higher) should employ a Full Cutoff with a short arm or shepherd's crook pole, if chosen for aesthetic purposes. Poles's luminaires are generally available in the market with optimal distribution patterns and should be carefully located to provide appropriate lighting levels and uniformity.

As a general rule, luminaires in the centre of parking areas should be avoided due to the access needs for cleaning and maintenance machines. We note that most of the parking areas in Newport are small enough to permit lighting from the perimeters.

Finally, in addition to the necessary calculations to prove that the lighting designed does not produce obtrusive light, a concept visualisation such as an electronic 3-D Model model is recommended for evaluating a "before and after" installation or replacement of new/ existing luminaires.

SCHRÉDER - AXIA 3

High Pole (7 to 12 m)
Straight-arm or crook arm, flared bell housing, full cut-off source. Adaptive LED luminaire ready.

Applications
parking lots, roadways, area lighting.

SCHRÉDER - HESTIA LED

High Pole (7 to 12 m)
Straight-arm or crook arm, flared bell housing, full cut-off source. Adaptive LED luminaire ready.

Applications
parking lots, roadways, area lighting.

THORN – ISARO PRO

High Pole (7 to 12 m)
Straight-arm, flat housing, full cut-off source. Adaptive LED luminaire ready.

Applications
parking lots, roadways, area lighting.

SCHRÉDER - ISLA LED

Short-height Pole (3 to 5 m)
Adaptive LED luminaire ready.

Applications
residential area, Walkways, parking lots, bikeways, area lighting

THORN - LEGEND

Short-height Pole (3 to 5 m)
Adaptive LED luminaire ready.

Applications
Residential area, Walkways, parking lots, bikeways, area lighting.

I GUZZINI – I WAY ROUND

Bollard (1 m tall)

Applications
Low level lighting of walkways (generally near buildings)

THORN – PIAZZA II LED

Wall lamp
Adaptive LED luminaire ready.

Applications
Recreational building walls near doors and along walkways (adjacent to structures).

NERI ILLUMINAZIONE - KUMA

Decorative shapes (4 to 9 m)
LED luminaires with short arms or or crook arm. Adaptive LED luminaire ready.
As an alternative to the other shapes, especially if matching existing lighting systems.

NERI ILLUMINAZIONE - MIZAR

Decorative shapes (4 to 9 m)
LED luminaires with short arms.
Adaptive LED luminaire ready.
As an alternative to the other shapes, especially if matching existing lighting systems.

5.6 RECOMMENDATIONS FOR RESIDENTIAL & COMMERCIAL PREMISES LIGHTING

For lighting mounted on buildings it should be noted that luminaires are visible by both day and by night so their appearance should be architecturally appropriate to their environment.

By day the luminaire should be an elegant part of the building and by night the illumination from functional non-glaring lighting with proper shielding results in the lighting effect being visible, though not the source of light itself (i.e. the bulb).

In the following images we provide some examples of recommended luminaires with guidelines on their appropriate application.

When mounted correctly they will provide lighting representative of the spirit of this Lighting Master Plan and can meet the objective of Fully Cutoff lighting.

SIMES - LOFT TONDO

WEVER & DUCRÈ - PALOS WALL 1.0

Entrances/ Wall

Note: Downlights grazing a near-white wall provide diffuse light for rendering visitors' full frontal body for easy identification of faces and clothing

WEVER & DUCRÈ -SWAM 1.0

ALDO BERNARDI - GIULIETTA SPRINT

Portico, social areas

I GUZZINI – I TEKA

BEGA – CODE 33 816 K3

Façades, downlighting

WEVER & DUCRÈ - ORIS OUTDOOR 1.3

GHIDINI – SEGNO WALK 45

Site ramps, stairs, and steps

SIMES - SKILL

SWAM FLOOR 1.0

Garden

Note: Time clocks should be used to extinguish lights at a reasonable curfew.

I GUZZINI - WALKY

DISANO – PORTOFINO LED

Paths, circulation areas

Design Considerations for Private Lighting

Residential applications are quite individual and personal to a homeowner's taste and requirements.

Most traditional luminaires create excessive upward light. The choice of non flickering 2700K LED-or 2200K LED fixtures (the warmer, the better), full Cutoff optic style, using CRI=80 sources are strongly recommended.

This simple choice will result in the improvement of lighting levels and the minimization of glare impacts.

Pole mounted luminaires and bollards are typically available in wide distribution beams and should be located to provide appropriate lighting levels and uniformity, whilst also being careful not to position lights too high.

The schemes below offer design solutions to minimise light spill above the horizontal plane. If there are circumstances requiring upward light, it should be justified with software calculations and in real scale mock-ups to ensure that the light will not spill into the night sky.

Design Considerations for Retail / Commercial Premises

Lighting on shop fronts and on commercial premises is more effective if directed downwards to illuminate window contents and the name of premises. Strip lighting is not recommended unless it is recessed into reveals, as the sight of a bare bulb is often harsh and uninviting for the onlooker.

- Low wattage, well-directed lights save money and do a better job.
- Use full Cutoff fixtures so light does not escape above the horizontal - Unshielded bulkhead lights, no matter how low their luminosity, should never be installed.
- Mount lighting for externally illuminated signage at the top of the sign, directed downwards only.
- LED Lighting – chose warm temperature colour tones "warm-white" (less than 2,700 kelvins)
- Consider using a Passive Infra Red (PIR) motion sensor light to illuminate an area only when needed.
- Angle the light downwards to illuminate to avoid light intrusion onto neighbouring property or allowing glare into the public area.
- Security Lights – less than 600 lumens and maximum 150W (higher power creates more glare & dark shadows)
- Do not "over" light. This is a major cause of obtrusive light and is a waste of energy.
- Dim or switch off lights during times of low footfall such as 12-5am.

The installation of security-style floodlights would greatly benefit if they are tilted down, until the glass is horizontal and thereby meeting the equivalent effect of a fully shielded luminaire. Most floodlights have symmetric reflectors which direct equal amounts of light in both directions, but asymmetric reflectors are preferred to restrict light travelling beyond the region of intended use.

ILLUSTRATIONS OF LUMINAIRE ACCESSORIES FOR LIMITING OBTRUSIVE LIGHT

Lighting Fitting | Accessories

Projector

External Louvre

Projector

External Louvre

Projector

Sheild

Recommendations for lighting built heritage

The use of artificial lighting, particularly flood lighting, on historical heritage buildings can be excessive and a significant contributor to light pollution, energy waste and a contributor to ecological pressures. Many Heritage buildings have themselves become habitats used by protected wildlife. In some cases the architectural beauty of the buildings design is literally overshadowed by excessive lighting in a way the original architect would never have designed.

To reduce light pollution and energy waste, lighting should be used appropriately and only where deemed necessary and when the lighting effect can be appreciated, i.e. not in the early hours of the morning.

Ornamental lighting of public buildings, monuments and public spaces must prevent light from falling beyond the area intended to be lit and should not be directed skywards. Architecturally sensitive tones such as passive, warm coloured lights should be considered before blue-rich white lights. Lights should be adapted to the size and location of the object intended to be lit. If necessary, visors, shields, deflectors and cowls should be installed to guarantee lighting is limited to only the area of focus and localised lighting rather than floodlighting should be prioritised.

Considerations for Lighting Heritage/ Public Buildings:

Many heritage buildings were designed with natural light levels in mind. Consider the distance and general direction from which the object or building is typically observed.

Design Considerations for Lighting Heritage /Public Buildings

- Avoid floodlighting, spot lighting or "symbolic" beacon lights. Allow the possibility of natural starry light to form the background canvass of architecture. Light should be designed as part of an architectural feature and used creatively.
- The light source (eg fixture bulb) should not be visible if light is installed correctly to enhance the features of a building.
- Avoid potential inconveniences to other users of the surrounding area (intrusive light, glare).
- Consideration for Wildlife (eg. Migratory birds, bats, moths, nesting birds and other species impacted by artificial lighting).
- Ornamental lighting position, aiming and optics.
- Lighting levels according to recommendations and the colour of the object to be lit.
- Energy saving, timers and installation switch-off.
- Light fixtures installed near rivers (e.g. bridges) and waterways will need special attention to take account of water reflection and the impact of light on aquatic life.


TOWER - 1ST
2nd - FAÇADE
BRIDGE - 3rd
4th
- PLAYGROUND - 5th
LDW
2020
0301

Probably the most famous panorama of Newport is this view of St Patrick's Church and the Seven Arch Viaduct Bridge. This conceptual design aims to showcase the beauty of the town by using an environmentally sensitive lighting strategy to illuminate the architectural features.

St Patrick's Church is not only a listed national monument, it is a living building that serves the spiritual needs of a community, conveys a message of peace and unity; and is a place of prayer. The lighting designer's first objective is to satisfy the needs of the parishioners. The lighting thus should be treated with respect and not with commercial style 'staged' effects. Appropriate lighting can enhance the texture of the building, in terms of the stonework, sculpted detail, and stained glass.

To protect the integrity of this built heritage, the proposed lighting fixtures will be integrated with the architectural structure. With the selection of appropriate colours for the fixtures they will be camouflaged so as not to detract from the visual beauty of the structure.

A night time perspective
(note: most of the lights pictured here are no longer in operation)

Current floodlights directed at the church with excessive white light.

The proposal recommend wall grazing lighting upwards.

Lights are positioned using non intrusive bracketing on the stone lip.

Allowing sublet warm lighting to illuminate the walls

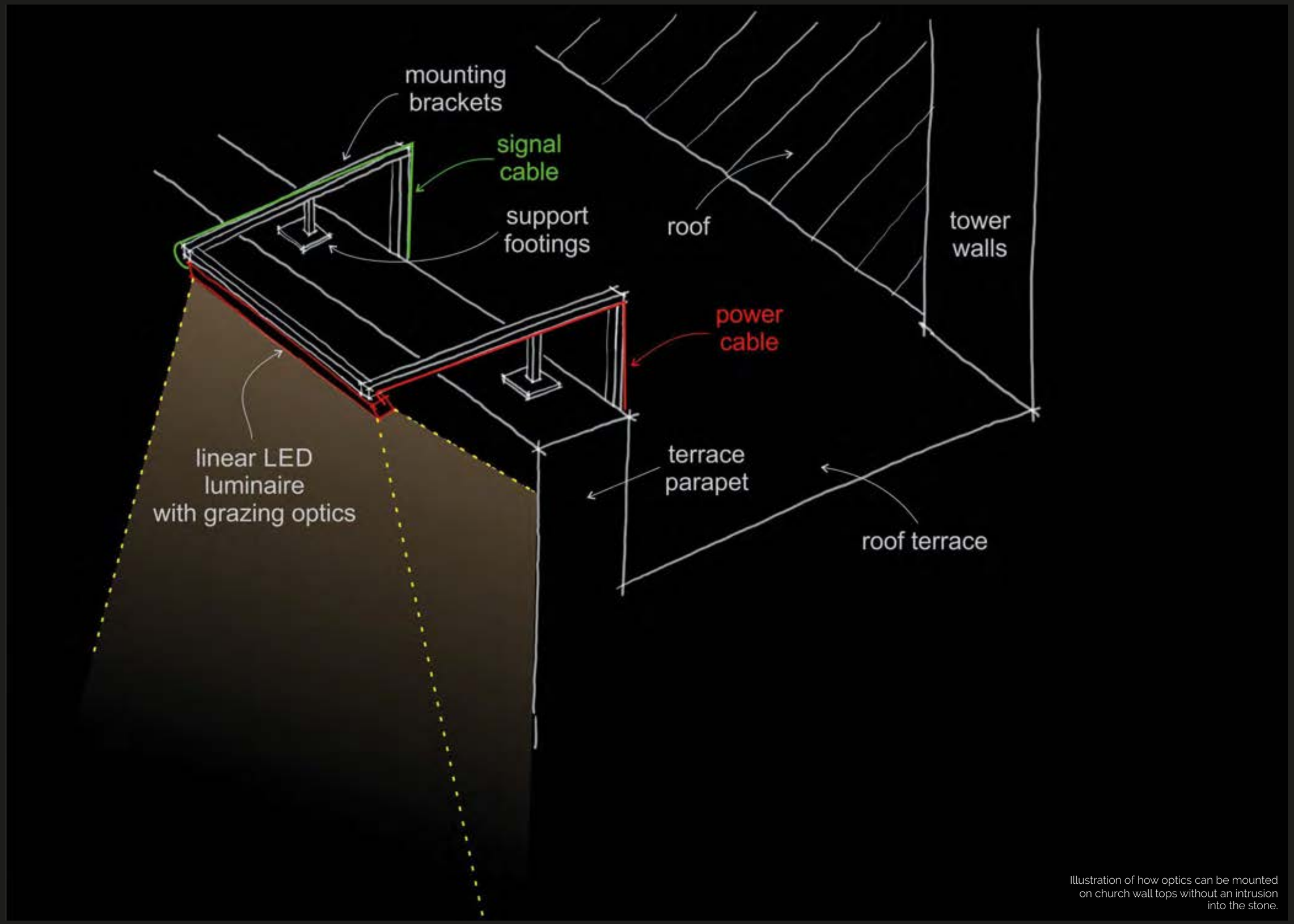
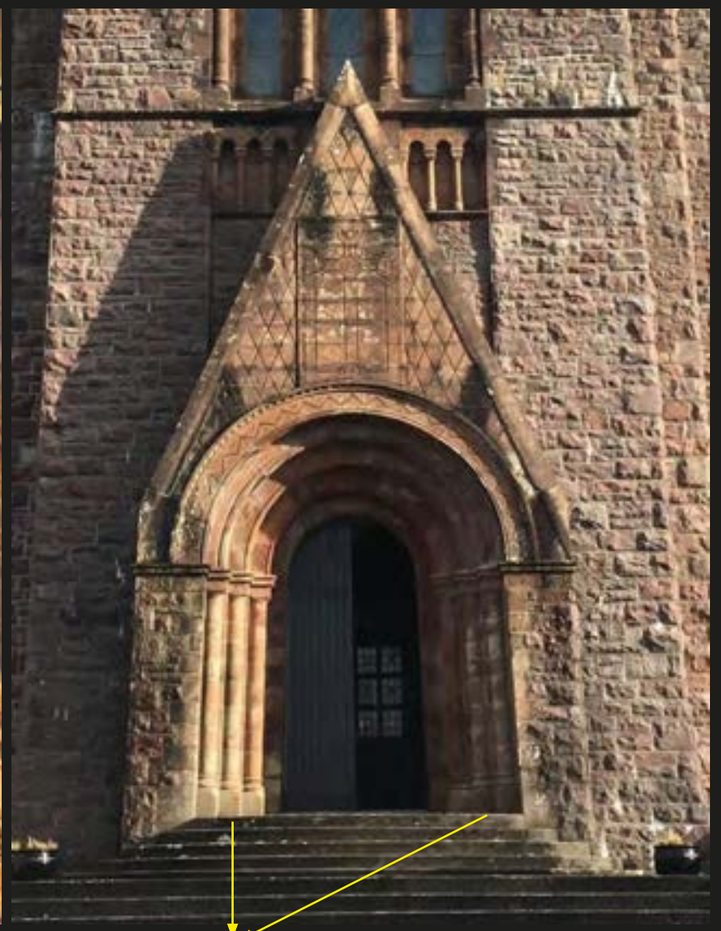


Illustration of how optics can be mounted on church wall tops without an intrusion into the stone.

Impression of St Patrick's Church, lit at night to complement the building and environment

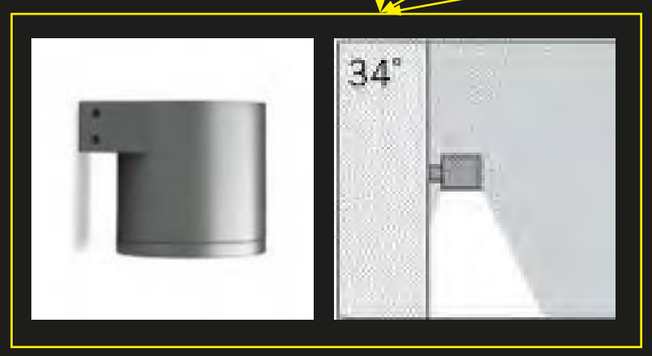
This image shows the downlights enhancing the stone of the church.
Also the famous Harry Clarke Window is sensitively lit from inside to bring the colour through for the parish to enjoy on an evening stroll.

Cathedral of Reims/F
accent lighting effects



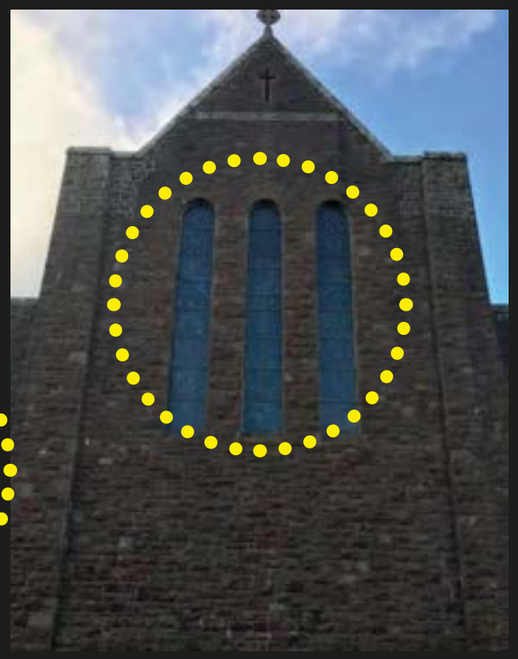
The main gate accent lighting's fixture, and an example in a gothic Cathedral.

New cut-off lighting for the entrances.



The Harry Clarke-designed windows are a key architectural feature of Newport Church.

They can be enhanced and made more accessible if lit from inside the church during the night.



Conceptual presentation
Letting the light shine down from the heavens....

This image shows the front of the Church with light warming its facade, whilst glowing light from the stained glass is also visible.

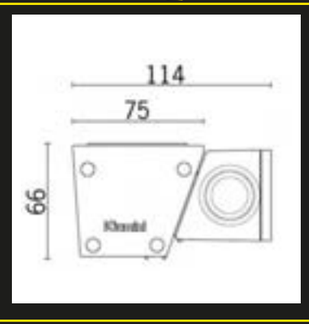
Keeping artificial light on the ground allows the astral views to shine down behind the church

Another of Newport's Iconic Heritage Structures, listed and protected...

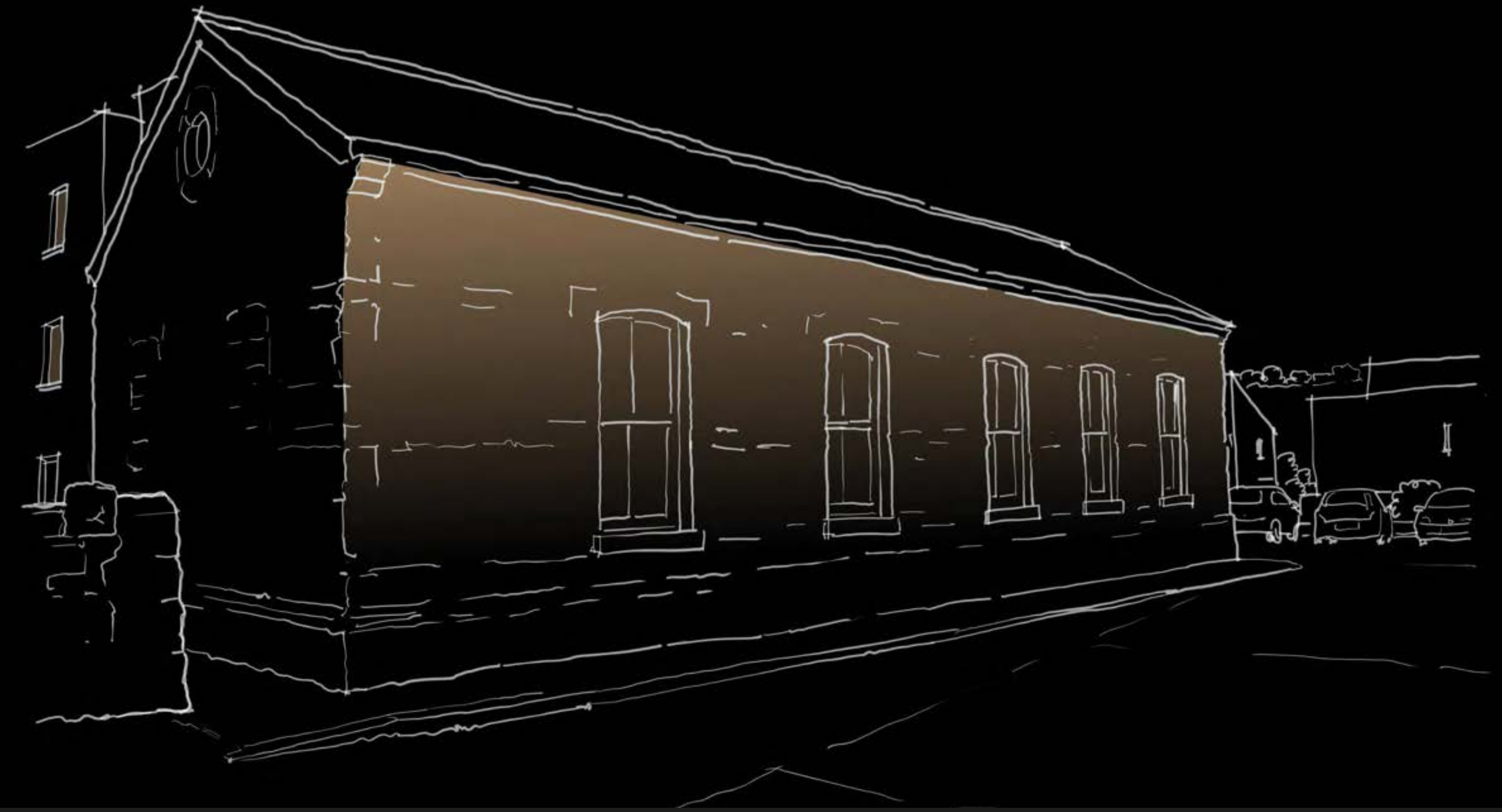
VIADUCT Newport, County Mayo
Reg No: **31208018**
Rating: National
Categories of Special Interest: Architectural Technical
Original Use: Viaduct
Date: 1890 - 1895

The proposal for the new lighting is to firstly simplify the installation and put in evidence the Viaduct in a discrete way.

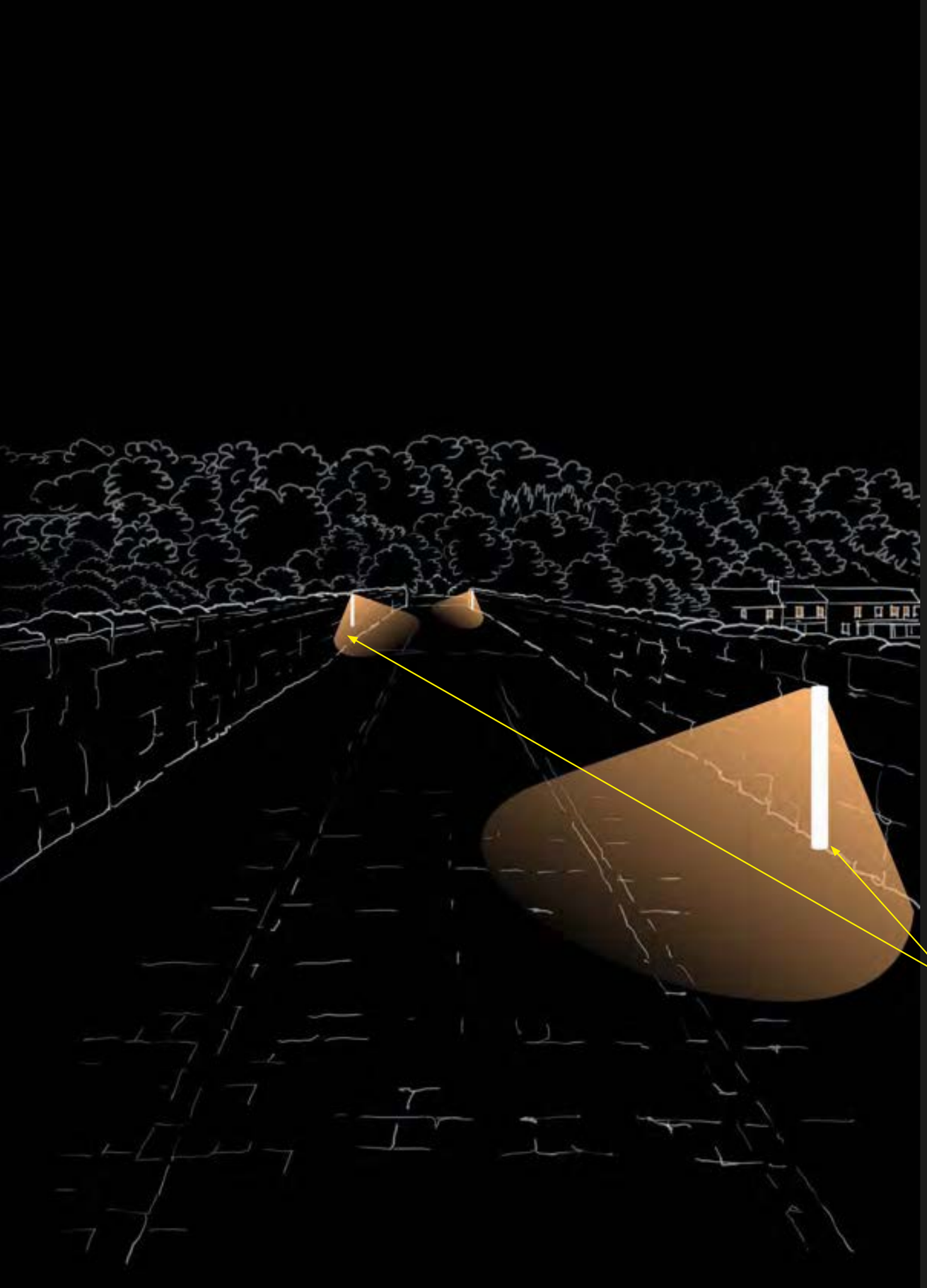
This photo was taken some years ago.
The position of the luminaires have attracted vandalism and are consequently no longer in operation.

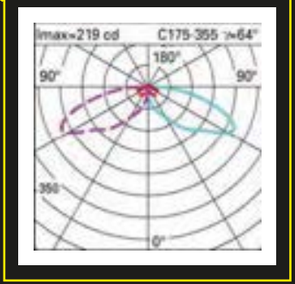


Linear LEDs with wall grazing optics are recommended, in 2200 K warm white light.
They can be installed with simple brackets and fixed on the pillars under the arches.



Old railway area – Wall grazing 2700 W to create a luminous backdrop.





Bollard LEDs with 180° beam optic, in 2700 K warm white light, can substitute the poles actually installed on the walkway.

Bollards allow to keep lighting reasonably low and it is possible to create an effect of back light on the parapet while, at the same time, removing visual clutter

Old railway area – New lantern fully cut-off with asymmetrical optics 2200 K under adaptive lighting and bollards 2700k following the line of the Viaduct

Old railway area – New lantern fully cut-off with asymmetrical optics 2200 K under adaptive lighting

Conceptual presentation
Letting the light shine down from heavens
whilst our natural and built heritage is
enhanced, yet lives in harmony

CONCLUSION

This document has represented the needs of the community with respect to light at night in tandem with the objective to protect the natural environment including the night sky over Newport. A number of themes have been explored to address the interests of the stakeholders affected by this project and the lighting designers have created a vision for light at night in the town, with special focus on the iconic landmarks that define the visual impression of Newport.

Themes Explored:

- Business/Local economy
- Community
- Biodiversity/Environment
- Heritage
- Sustainable Tourism
- Mayo Dark Sky Park
- Safety and Security Concerns
- Social & Cultural environment (Ambience)

The designs enhance visual and environmental sensitivities and recommendations on lighting levels have been made according to data available on habitats around Newport, taking into account road safety requirements.
This plan acknowledges the good work being implemented by Mayo County Council in replacing all fixtures with dark sky compliant warm-toned light of 2700 Kelvin on the N59 National Secondary Road surrounding the Mayo Dark Sky Park.
It is anticipated that dimming profiles will be implemented in the future to further reduce energy costs during times of low traffic volumes.

We strongly recommend the further reduction in colour temperatures where and when possible to remove the blue-rich content while still meeting acceptable colour reproduction.

Anecdotally, we have received a very positive response to lighting retrofits on the N59 from the local community, specifically in relation to the visual effect of lower colour temperatures improving the atmosphere. We hope that the completion of this phase will become a trigger to bring the remainder of this vision plan into fruition for Newport and our neighbouring communities.

Finally, the adoption of adaptive lighting technologies would be a forward-thinking move which would provide further savings in the longer term, while providing the flexibility to accommodate to changes in traffic conditions.

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APPENDICES

APPENDIX A - SWIFT REPORT

The Common Swift "Apus apus" and how it can be affected by high-intensity lighting at the Nest Site

Adapted from a report by Lynda Huxley of Swift Conservation Mayo, November 2020.

Introduction
The Common Swift (Apus apus) is the only species of swift that occurs in Ireland and is a familiar summer visitor. Swifts come to Ireland to breed between the months of May and September each year and spending the rest of the year in Southern Africa. Swifts spend almost their entire life on the wing, flying 24 hours a day even when feeding and sleeping, and the only time they land is at the nesting site.

Throughout its breeding range the Common Swift population has declined, mostly caused by loss of nest sites when buildings have been renovated or demolished. In Ireland this decline has been estimated to be close to 50% since the 1980s. However, through the conservation efforts of Swift Conservation Mayo in providing nest boxes and protecting existing nest sites the swift population in County Mayo has increased by at least 16% in the last 6 years.

Nesting locations
Originally swifts would have nested in cliff faces, but when humans constructed stone buildings they started to nest in them because they appear just like a cliff face to a swift. As a result, at the preset day more than 90% of swift nest sites are found in our urban buildings. The types of buildings that contain swift nests are usually stone buildings dating from around the 19th century, however nests also occur in other buildings when suitable. On the whole, modern buildings rarely contain swift nest sites because today's building designs and techniques strive to make buildings without any crevices and thus there are little or no spaces for nesting.

Swifts are known as 'hidden nesters' because their nest is hidden away inside a building, either on top of the wall plate (which they usually enter by climbing behind the fascia board) or in a gap in stone work. As the nest is hidden there is usually no sign of nesting swifts on the outside of the building, nor evidence below it as they do not leave faecal droppings to betray its location.

The importance of nesting sites is twofold: once the swifts have found a nest site they nest there for life which can be for up to 12 years, and they usually nest in colonies so most buildings contain more than one pair. The result is that suitable nesting sites can be occupied by generations of nesting swifts for hundreds of years.

Swift behaviour
Swift behaviour is unlike that of other birds as they have evolved to fly and so do not land on roofs, wires or branches. They thus only use their strong claws to cling onto vertical walls and to climb into their nest sites.

Because of their adaptation to a life on the wing, swifts find new nest sites whilst flying at very fast speeds, listening out for birds at existing nesting sites and skimming close to the parts of buildings where these are located. Swifts approach their nest site at great speed (around 60kph) and hence need a clear flight path to the nest entrance which is usually a small gap in stone work that can be as small as 29mm x 65mm across. Therefore, considering both the speed of approach and the small size of the entrance hole to the nest site, an unobstructed view when flying towards and into the nest is vital. When exiting the nest site swifts need to drop down to build up air speed and lift in order to fly away (similar to a person jumping off a cliff on a hang-glider) and for this reason nest sites are usually at 5m or higher. Exiting the nest is thus a dangerous time for the swifts and they usually look out of the nest site entrance before launching themselves to make sure there are no predators around and to look for any obstacles to avoid.

When the parents are feeding their young in the months of June, July, August and early September, they are often active collecting balls of insect food from between 5am to 11pm. For this reason, any high-intensity light shining onto the nest entrance may make a safe exit of the nest site very difficult for them as they will most likely be blinded, just as it would be for us trying to exit a building with a bright light shining into our eyes.

While entering and exiting the nest may be difficult for adults, those most at risk are the swift chicks when they fledge, i.e. leave the nest for the first and only time. When most bird species fledge they are

able to do this as a gradual process as they are able land on a nearby branch or ledge. However, the swift chick only gets one chance as it must launch itself from the nest entrance successfully and be able to fly off immediately. These chicks must therefore have enough space to drop out of the nest and then fly off gaining height and so must be able to see any obstacles in the flight path. After their departure a young bird will never return to it and neither will it be fed by its parents – it must now fend for itself. In fact, the fledged swift chick will be flying non-stop for around 3 years, flying to Africa and back each year, until it is sexually mature and wanting to find a nest site of its own and start breeding.

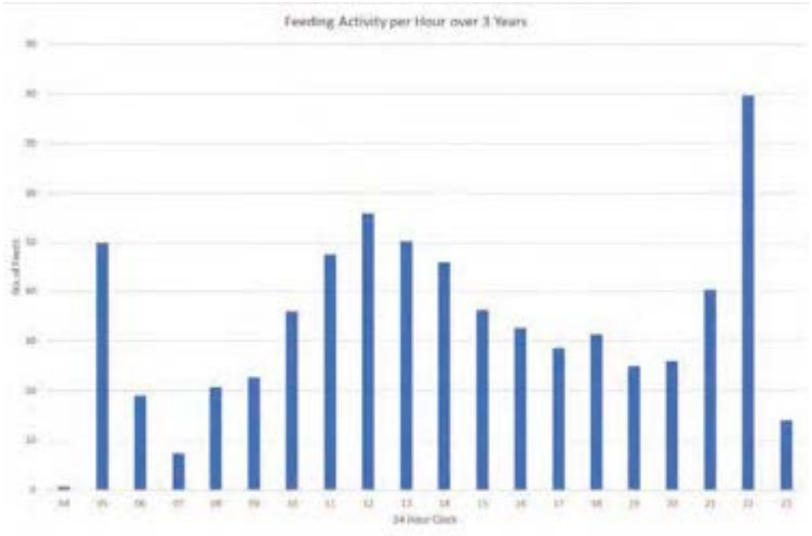
To reduce the risk of predators, swifts will fledge at night, when it's dark and they are better protected from predators such as birds of prey. We can see that these chicks are therefore most at risk from any high-intensity lighting facing onto their nest site because they may be blinded by the lights and may not be able to see clearly. Any errors in judgement which lead to a swift chick ending up on the ground will most likely lead to its death as their adaptation to a life on the wing has led to long wings and short legs which means that they cannot usually take off from the ground.

High-Intensity Lighting Shining on a Building

From the above discussion we can see that approaching and entering such a small nest site entrance at such speed requires good visibility and great accuracy. Therefore, high-intensity lighting located close to or above the nest site entrance and, therefore, obstructing visibility could lead to failed attempts to enter the nest site. This would be of particular significance when the parents are feeding their young.

Swifts normally feed from dawn to dusk with a peak in feeding behaviour at dusk when insect activity peaks at around 10pm. This means that the adults will be entering and leaving the nesting area much more regularly than any other time of day, often entering the nest site for the night when it is almost complete darkness where they will spend the night with their chicks. Therefore, any high intensity lighting shining from or onto a nest site may negatively affect the entry and exit of the nest site and may have a corresponding negative impact on the health of the chicks. Also, as noted above, even when reared successfully, bright lights can also have an impact on the fledglings when they depart the nest. Lights which dazzle the chicks or make them more visible to predators, will have a big impact on the species' success as they only have one chance of success.

Given the decline in species numbers, we must aim to reduce lighting levels near swift nesting sites, particularly light directed towards walls, such as architectural lighting.



The graph below shows the pattern of feeding activity recorded from the swift nest box research project at the Galway-Mayo Institute of Technology (GMIT) in Castlebar, Co. Mayo, Rep. of Ireland.

In summary

It is vitally important to identify the exact location of nest site entrances on buildings where Swifts are known to nest.
We must then try to ensure that high intensity lighting will not be shining onto or from the nest site entrance to ensure that:

- the parent swifts can enter and leave the nest safely when feeding the chicks.

- we must ensure that a fledging swift chick can exit the nest safely on the one and only time when it will fly from the nest.

SWIFT CHICK PEERING OUT OF NEST SITE ENTRANCE AT NEWPORT CHURCH

APPENDIX B - LIGHT LEVELS

The EU standard for road lighting is The EU standard for road lighting is defined by a set of five documents EN 13201-1 to EN13201-5 and the associated documentation provides a guideline for selecting the correct lighting classes and all other related aspects.
These documents are applicable to fixed lighting installations intended to provide good visibility to users of outdoor public traffic areas during the hours of darkness to support traffic safety, traffic flow and public security. In particular, Tables 1, 3, 4 of EN13201-1 and Table 2 in the EN 13201-2:2016 document it is possible to define the right class for each area. In relation to this we note, as pointed out in the recent EU Green Public Procurement document (see p.6):

'The standard only provides recommendations on road class definition and associated lighting levels - it is not legally binding per se. The decision to light a road or not and, when it is decided to light a road, the actual choice of the lighting level is to be decided by the local authority or road authority and should respect any local or regional planning laws and/or, where relevant, national lighting plans.
In order to reduce light pollution, the selection of the class should always be made using the principle "As Low As Reasonably Achievable" (ALARA) at any moment of time.'
With the analysis of the parameters in table 1, 3, 4 and table 2 inside the standard is possible to define the right classes.

Table 1 — Parameters for the selection of lighting class M

Parameter	**Options**	**Description a**		**Weighting Value VW** (a)
Design speed or speed limit	Very high	v ≥ 100 km/h		2
	High	70 < v < 100 km/h		1
	Moderate	40 < v≤ 70 km/h		-1
	Low	v ≤ 40 km/h		-2
Traffic volume		Motorways, multilane routes	Two lane routes	
	High	> 65 % of maximum capacity	> 45 % of maximum capacity	1
	Moderate	35 % -65 % of maximum capacity	15 % -45 % of maximum capacity	0
	Low	< 35 % of maximum capacity	< 15 % of maximum capacity	-1
Traffic composition	Mixed with high percentage of non-motorised			2
	Mixed			1
	Motorised only			0
Separation of carriageway	No			1
	Yes			0
Junction density		Intersection/k	Interchanges, distance between bridges, km	
	High	> 3	< 3	1
	Moderate	≤ 3	≥ 3	0
Parked vehicles	Present			1
	Not present			0
Ambient luminosity	High	shopping windows, advertisement expressions, sport fields, station areas, storage areas		1
	Moderate	normal situation		0
	Low			-1
Navigational task	Very difficult			2
	Difficult			1
	Easy			0
(a) The values stated in the column are an example. Any adaptation of the method or more appropriate weighting values can be used instead, on the national level.				

As example Table 2 — M and C lighting classes of comparable lighting level for different values of Q0 for the road surface

Lighting class M				**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
Lighting class C if Q0 ≤ 0,05 cd•m-2•lx-1				C0	C1	C2	C3	C4	C5
Lighting class C if 0,05 cd•m-2•lx-1 0,08 cd•m-2•lx-1	< Q0 ≤		C0	C1	C2	C3	C4	C5	C5
Lighting class C if Q0 > 0,09 cd•m-2 •lx-1		C0	C1	C2	C3	C4	C5	C5	C5

The performance requirements of each street classes are defined in the Standard EN 13201-2:2016 and can be used to define a finer classification of the applicable road class. Based on the experience of the Authors of this document, in the spirit of encouraging further lighting design debate, the indications below may be helpful as non exhaustive suggestions:

The rest of the roads and streets inside Newport can be classified as C - for conflict areas		
Class	**Horizontal illuminance**	
	***E* in lx [minimum maintained]**	**Uo [minimum]**
C4	10,0	0,40
C5	7,50	0,40

Few little streets (5% of the town's road net) only can be classified as P for pedestrian and low speed areas		
Class	**Horizontal illuminance**	
	***E* in lx [minimum maintained]**	**E_{min} in lx [maintained]**
P5	3,00	0,60
P6	2,00	0,40

The N59 road can be classified as M for motorised traffic values of Q0 for the road surface						
Class	Luminance of the road surface of the carriageway for the dry and wet road surface condition				Disability glare	Lighting of surroundings
	Dry condition			Wet	Dry condition	
	L in cd/m² [minimum maintained]	Uo [minimum]	UI[a] [minimum]	Uow[b] [minimum]	TI in %[c] [maximum]	EIR[d] [minimum]
M3	1,00	0,40	0,60	0,15	15	30

a Longitudinal uniformity (UI) provides a measure of the conspicuity of the repeated pattern of bright and dark patches on the road surface and as such is only relevant to visual conditions on long uninterrupted sections of road and should therefore only be applied in such circumstances. The values stated in the column are the minimum recommended for the specific lighting class, however, they may be amended where specific circumstances appertaining to the road layout or use are determined by analysis or where specific national requirements appertain.

b This is the only criterion for wet road conditions. It may be applied in accordance with specific national requirements. The values stated in the column may be amended where specific national requirements appertain.

c The values stated in the column TI are the maximum recommended for the specific lighting class, however, they may be amended where specific national requirements appertain.

d This criterion shall be applied only where there are no traffic areas with their own lighting requirements adjacent to the carriageway. The values shown are tentative and may be amended where specific national or individual scheme requirements are specified. Such values may be higheror lower than the values shown, however care should be taken to ensure adequate illumination of the areas is provided.

NOTE 2 The average luminances and illuminances specified in tables 1, 2, 3, 4, 5, 6 are maintained values.

NOTE 3 The road surface luminance is the result of the illumination of the road surface, the reflection properties of the road surface and the geometrical conditions of observation. Conventions are given in EN 13201-3 and EN 13201-4, aiming at driving along stretches of road with viewing distances of between 60 m and 180 m.

NOTE 4 The average luminance (L) reflects the general luminance level at which the driver performs. At the low level of lighting used for road lighting, performance improves with luminance in terms of increasing contrast sensitivity, increasing visual acuity and amelioration of glare.

NOTE 5 The overall uniformity (Uo) measures in a general way the variation of luminances and indicates how well the road surface serves as a background for road markings, objects and other road users.

NOTE 6 The longitudinal uniformity (UI) provides a measure of the conspicuity of the repeated pattern of bright and dark patches on the road. It relates to visual
conditions on long uninterrupted sections of road.

NOTE 7 The threshold increment (TI) indicates that although road lighting improves visual conditions it also causes disability glare to a degree depending on the type of luminaires, lamps and geometric situation. The calculated TI values represent a young driver. As the underlying cause of glare is scattering in the human eye, it should be taken into account that the scattering in the human eye tends to increase with the age of the person. The increase is individual and may be
low for some, by a factor of two for others and can be high for persons suffering from untreated cataract conditions.

NOTE 8 Lighting confined to the carriageway is inadequate for revealing the immediate surrounds of the road and revealing road users at the kerb.

NOTE 9 In some countries, the road surface is damp or wet for a significant part of the hours of darkness. For a selected wet condition, an additional requirement to the overall uniformity (Uo) can be made to apply to avoid a serious downgrading of the performance for some of the damp periods.

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APPENDIX D - GLOSSARY

Based on the experience of the authors of this document, in the spirit of encouraging better understanding of lighting design issues we provide a brief, non-exhaustive, glossary which may be helpful. Included in this glossary are definitions for a number of basic terms and words used in the lighting community. For further information and formal definitions please see discussions in standard dictionaries, encyclopedias, the IES Lighting Handbook, and other lighting industry references.

Note that some of these definitions are quite subjective and are offered here as guidance only.

A

Ambient light: The general overall level of lighting in an area.

Accent lighting: Lighting used to emphasize or draw attention to a special object or building.

Adaptive Controls: Devices such as motion sensors, timers and dimmers used in concert with outdoor lighting equipment to vary the intensity or duration of operation of lighting.

Architectural (or façade) lighting: The illumination of the exterior of a building

Artificial Light: Light, ranging in wavelength from the ultraviolet to the near-infrared, that is caused, directed, or used by humans for any purpose.

Average luminance or average illuminance: The average values are all based on a maintained average which means the lowest average value to which the installation will fall before lamp replacing and luminaire cleaning takes place as part of a maintenance regime cycle.

B

Brightness: The strength of the sensation that results from viewing surfaces from which the light comes to the eye.

Bulb or lamp: The source of electric light. To be distinguished from the whole assembly (see luminaire). The word lamp often is used to denote the bulb and its housing.

C

Candela: A candela is the base unit of luminous intensity and is defined by the Commission Internationale de l'Eclairage (CIE), the professional body which sets most international lighting standards. Formerly this was based on a standard candle and, although more strictly defined now, is approximately similar to this.

Color rendering: The effect of a light source on the color appearance of objects in comparison with their color appearance as seen under normal, i.e. clear sky, daylight. The difference in colour rendering can be particularly well seen when looking at colours under older low pressure sodium (orange) streetlights.

Color Rendering Index (CRI): A measure of the accuracy with which a light source of a particular CCT renders a set of test colors in comparison to a reference light source with the same CCT. A high CRI provides better illumination with the same or lower lighting levels. It is important not to mix lamps with different CCTs and CRIs. Both should be specified when ordering lamps.

Colour Temperature (of a light source) also referred as Correlated Colour Temperature (CCT): A general expression related to the whiteness of optical radiation on a scale from "warm" to "cool". More technically, it is the absolute temperature of a hot (blackbody) radiator whose spectrum best approximates the spectrum of the light source in question. The temperature units are expressed in SI units of kelvin (denoted by the symbol K). The higher the temperature in Kelvins, the "cooler" (bluer) the light is. CCT values are typically provided in lighting manufacturer data sheets or are printed onto LED light sources. For comparison a "warm white" lamp would have a CCT of approximately 3,000K, whereas summer sunlight together with the light of a blue sky would have a CCT of approximately 6,500K. Note that CCT is a means to compare the apparent colour of light sources: the spectrum of the light source may be very different. An example of this is the view of a sunset on a modern LED display screen as the colour is produced by combining the narrow-band light of three individual red, green, and blue wavelengths, while the colour of a sunset comprises a whole continuum of colours from blue to red. For older incandescent lamps the CCT is roughly the temperature of the hot filament.

Contrast (of luminance): The ratio between the luminance values of adjacent surfaces. In other words, the light reflected from one surface, compared to the light reflected from another surface. Note that human vision depends mainly on contrast effects, rather than overall intensity.

Cutoff angle (of a luminaire): The angle, measured up from the nadir (i.e. straight down), between the vertical axis and the first line of sight at which the bare source (the bulb or lamp) is not visible.

Cutoff fixture: A Cutoff fixture is intended to limit the amount of light passing above a certain angle. The definition adopted by the American Illuminating Engineering Society (IES) is: "Intensity at or above 90° (horizontal) no more than 2.5% of lamp lumens, and no more than 10% of lamp lumens at or above 80°. Emission close to the horizontal is particularly detrimental to the surrounding environment and contributes strongly to light pollution, producing sky glow.

D

Dark adaptation: The process by which the eye becomes adapted to a luminance less than about 0.03 candela per square meter, which is approximately the light cast by a candle on a vertical surface 1.6m (4 feet) away. In really dark sites dark adaption can take roughly half an hour to occur, depending on age and health. Under truly dark skies illumination may be roughly one million times fainter than under bright sunlight. Near most white or blue lighting the eye never truly is dark adapted.

Dimmer: Dimmers can reduce the input power requirements and the rated lumen output levels of in- candescent and fluorescent lights. Fluorescent lights need special dimming ballasts and dimming incandescent lights reduces their efficiency.

Diffused lighting: Diffuse lighting occurs when the light on the working plane or on an object is not incident predominantly from a particular direction.

Diffuser: A device used to distribute light from a source.

Disability glare: Glare resulting in reduced visual performance and visibility due to light from a source which is much brighter than its surroundings shining in the eye. It is often accompanied by discomfort.

Discomfort glare: Glare that produces discomfort, but does not necessarily diminish visual performance.

F

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

Fixture Lumens: A light fixture's light output after processing of emitted light by optics in that fixture.

Fixture Watts: The total power consumed by a fixture. This includes the power consumed by the lamp(s) and ballast(s).

Floodlight: A fixture designed to "flood" a well defined area with light.

Full Cutoff (FCO): This term is used to describe luminaires that have no direct uplight, in other words no light emitted above horizontal, and hence zero upward light. Any glass in a FCO fixture will be flat to the horizontal.

Fully Shielded fixture: A fixture that allows no emission above a horizontal plane passing through the fixture.

G

Glare: Intense and blinding light that reduces visibility. A light within the field of vision that is brighter than the brightness to which the eyes are adapted.

H

HID: High Intensity Discharge, such as used for low- and high-pressure sodium lamps.

High-Pressure Sodium (HPS) lamp: This is a HID lamp where radiation is produced from sodium vapor at relatively high partial pressure, though this is usually 100 torr, or one eight of atmospheric pressure.

I

IDA (International Dark-Sky Association):
This is the recognised authority on light pollution and is the leading organization combating light pollution worldwide. Since 2001, IDA has been pursuing the Dark Sky Places program, encouraging the preservation and protection of dark-sky areas. Mayo Dark Sky Park achieved its accreditation under the IDA Dark Sky Places programme.

Illuminance: The quantity of luminous flux, or power, incident upon a unit area, expressed as lumens per square metre or lux.

ILP: The Institution of Lighting Professionals, a UK-based professional body involved in setting and establishing standards for good practice across the UK and Ireland.

Incandescent lamp: Light is produced by a filament heated to a high temperature by electric current as opposed to, say, a high intensity discharge (HID) lamp.

L

Lamp: The light-emitting portion of a fixture, usually called the "bulb" in common parlance. This may include light emitting elements built into a fixture (e.g., a number of LEDs in a single unit), but is not inclusive of any reflective materials used to direct light.

Lamp Life: The average life span for a specific type of lamp. The lamp life is quoted in terms of the time at which half of the installed lamps will fail.

Lamp Lumen Maintenance Factor (LLMF): The amount of light produced from the light source at a defined timeframe, generally the time to when the output has decreased to 70% of its rated value.

LED: Light emitting diode, a solid state electronic technology with relatively high efficiency and long lifetime.

Lighting Controls: Devices used for turning lights on and off or for dimming.

Light Intrusion: Light entering or illuminating windows beyond the intended area requiring illumination.

Light Pollution: Any adverse effect or impact attributable to artificial light at night.

Light Quality: A measurement of a person's comfort and perception based on the lighting.

Light Spill: Unwanted spillage of light onto adjacent areas and may affect residential properties or ecological sites, plants and animals.

Light Trespass: Light falling where it is not wanted or needed. See also – Light Spill, Obtrusive light.

Low-Pressure Sodium (LPS) lamp: A discharge lamp where the light is produced by radiation from sodium vapor at a relatively low pressure (about one millionth of atmospheric pressure). The light is monochromatic (all at one wavelength) and has a deep orange colour and hence does not provide good colour reproduction, although this light has a low environmental impact. LPS lamps are electrically inefficient.

Lumen: A unit of luminous flux defined as the flux emitted within a unit solid angle by a point source with a uniform luminous intensity of one candela. See also Candela, Lux

Luminaire: A complete electrical unit used in lighting any electronics and electrical connections required. The luminaire can also include reflectors and/or glass features that alter the path of the light. Also called a light fixture or lantern.

Luminance: The luminous intensity (or brightness) of a surface or source expressed in terms of light per unit surface area weighted for the eye's daytime visual response and hence relates to how a human eye perceives the light source. The international unit of luminance is the lux defined as one candela per square metre (cd/m2). Under a clear sky, daylight levels reach up to 7,000 cd/m2, while under a dark sky they are as low as 0.001 cd/m2.

Luminaire Efficiency: The ratio of the light emitted by the luminaire to the light emitted by the enclosed lamps.

Lux: The international unit of luminous flux, or power, per unit area, or illuminance. The lux is defined as one lumen per square meter. A residential street may have light levels of 35 lux or so below the light, while the full moon will light the ground at 0.3 lux or so, i.e. one hundred times fainter. Under an overhead direct sun light levels can reach 120,000 lux. See also Luminance

M

Moonlight: The luminous flux emitted by the moon received at the Earth's surface which has a typical value of 0.3 lux under a clear sky at Full Moon.

O

Optics: The components of a luminaire such as reflectors, refractors, protectors which make up the light emitting section.

P

Photocells: Sensors that turn lights on and off in response to natural light levels. Some advanced models can slowly dim or increase the lighting.

Photometry: The quantitative measurement of light level and distribution. Manufacturers provide photometric measurements so that the intensity and distribution of the emitted light is known to the lighting designers.

Projector: A special luminaire designed to provide a concentrated pattern of light.

Q

Quality of light: A subjective ratio of the pluses to the minuses of any lighting installation.

R

Reflector: An optic that achieves control of light by means of reflection (using mirrors).

Refractor: An optic that achieves control of light by means of refraction (using lenses).

S

Semi-cutoff fixture: An IES definition for which the light intensity at or above the horizontal from the luminaire is no more than 5% of the lamp lumens, with no more than 20% of the lamp lumens at or above 10˚ above the horizontal as drawn through the bottom of the lamp installation.

Shielding: The portion of lighting fixture which covers the fixture's lamp(s). A fully shielded fixture is constructed so that in its installed position all of the light emitted is projected below the horizontal plane passing through the lowest light-emitting part of the fixture. Essentially, the shield is built so the fixture's lamp is not visible at all below the shield.

Sky glow: The brightness of the night-time sky caused by both horizontal and upward components of light from direct and reflected light from the Earth's surface. The brightness of sky glow is dependent on both the amount of upward light and the presence and density of atmospheric particles and their distance above ground level and so is weather-dependent. Sky glow can extend some ways from the light source(s) and can be seen as a glow over towns and cities.

Skylight: The variable brightness value of daytime sky caused by sunlight scattered by particles of dust and vapour in the earth's atmosphere. Skylight can reach values in excess of 7,000 candelas per square metre under a typical clear sky.

Spotlight: A fixture designed to light only a small, well-defined area with a relatively narrow beam.

Stray light: The emitted light that falls away from the area where it is needed or wanted. See Light trespass.

T

Task Lighting: Task lighting is used to provide direct light for specific activities without illuminating the entire area. Task lighting uses light levels which are higher than in the general surroundings.

V

Visibility: The quality of being perceived by the eye, involving been seen effectively. This is the goal of night lighting.

W

Wall Washing: A technique that entails uniformly lighting a wall from top to bottom in a smooth graded wash, hiding any imperfections by eliminating their shadows. The result is that the wall has a "flat" or uniform appearance.

Wall Grazing: This is typically used to add interest and accentuate textured surfaces (such as St. Patrick Church's stone walls). The fixture is positioned very close to the wall in order to bring out the wall texture through the use of highlighting and shadowing.

Wattage: The nominal electrical load rating of a lamp, excluding any allowances for associated operating gear losses. SEAI guidance lists these as typically 10% of the nominal luminaire wattage value for conventional control gear for HPS lighting and 20% for LPS lighting. For LEDs (or for modern electronic control gear for LPS and HPS lamps) the load wattage is the same as the nominal value for the luminaire.

APPENDIX E - CONTACTS & PHOTO CREDIT

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InternationaDark Sky Association | www.DarkSky.org

Lighting Design Workshop - Palandella & Corradini | www.lightingdesign-workshop.com

Leave No Trace Ireland - Maura Lyons, CEO | https://www.leavenotraceireland.org

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Photo credits: Brian Wilson, Darragh McGee, Mike Kinsella, Ged Dowling, Terra Firma

Historical texts: Joe McDermott, Newport

Ballycroy Stars

We came to Ballycroy that night
Far from the veil of light that we have drawn
From dusk to dawn across the ancient tracery of stars.
We came to seek them out.
To seek the stars that made all things.
Our stardust eyes
Searched. And there...
Between the scattered rags of cloud
Driven south across the polar star and sinking Moon,
Capella nursed her Kids beside the faintly offered stream
That is the Milky Way.
The rising tangle of the Pleiades
Cleared Nephin's dark and sodden brow,
Light flying here four hundred years, announcing winter.
Chill constellations
Calling 'see us' as the clouds allowed.
And I was calmed.
And later took the wonder back to those
Who cannot see these lights
To tell them of immensity,
Of what moves there above the veil of wasted light.
To tell them of the ancient night
We saw at Ballycroy.

Bob Mizon MBE

This poem was inspired by the Mayo's night skies whilst attending the 14th European Symposium for the Protection of the Night Sky, hosted by the Friends of Mayo Dark Skies in Mulranny 2019.