ENGINEERS IRELAND

Protecting Biodiversity
The role of engineers

Issues Paper

July 2021

Contents

Cover photograph credit: Noel Reddy

1 Background

1.1 Declaration of a Climate and Biodiversity Emergency

In March 2020, following a motion at the Engineers Ireland Council, Engineers Ireland declared a Climate and Biodiversity Emergency. Speaking at an event to mark World Engineering Day for Sustainable Development then President of Engineers Ireland, Marguerite Sayers, highlighted that:

> *"Engineers Ireland recognises that climate breakdown and biodiversity collapse are the most serious issues of our time. The Council of Engineers Ireland acknowledges the considered opinion of the scientific community that transformational action is required to achieve meaningful outcomes. The planet has ecological limits and a finite biocapacity, and a paradigm shift is required to realign humanity's ecological footprint within this capacity. Indeed, with our existing technologies and fossil fuel dependence, we will fail to achieve our existing commitments. Engineers Ireland is adding our voice to those of professional bodies and other organisations around the world by declaring a Climate and Biodiversity Emergency. We will be a leading voice for sustainability and our members will take action to address the impact of the emergency".*

The declaration also states that Engineers Ireland members will, in taking action to address the Climate and Biodiversity Emergency, "collaborate with scientists, environmentalists, government, their advisors, public service, other professions and civil society".

Figure 1: Marguerite Sayers, President of Engineers Ireland, declaring a climate and biodiversity emergency on behalf of the institution

Each year Engineers Ireland produces a report on the engineering profession in Ireland which captures the latest trends in engineering employment, perspectives and education. The report is prepared based on surveys of more than 2,000 engineers, 1,000 statistically-representative members of the public, 150 engineering leaders and 90 engineering academics. This extensive engagement is complemented by the analysis of data collected by State agencies and collaborations with engineering educators and researchers.

Engineering 2020 asked those surveyed if engineers have an ethical responsibility to tackle climate change and biodiversity loss. The vast majority (88%) of engineers agreed that engineers have an ethical obligation to tackle climate change and biodiversity loss (Refer Figure 2). Almost three-quarters (74%) of the public agreed with the statement, while 18% responded that they neither agree nor disagree. Public level of agreement rises to 84% for members of the public with some connection to engineering, such as working in / studying engineering or having a family member working in / studying engineering.

Engineers have an ethical responsibility to tackle climate change and biodiversity loss

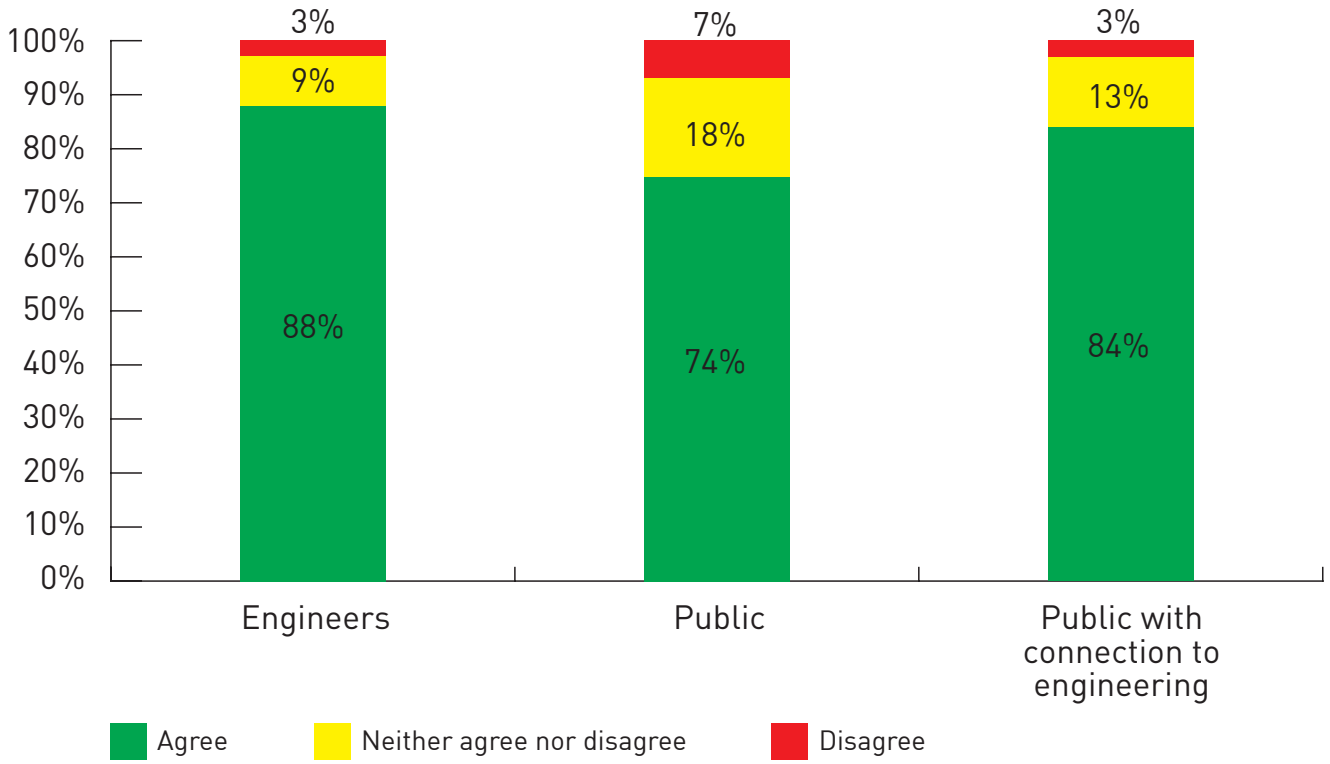


Figure 2: The majority of respondents across all groups surveyed agreed that engineers have an ethical obligation to tackle climate change and biodiversity loss, Engineering 2020

1.2 Sustainability Framework

The Council of Engineers Ireland approved a Sustainability Framework for the institution in July 2020. The framework aligns Engineers Ireland's sustainability actions with its core objectives under the headings:

- Learn (professional formation and development),
- Live (operations),
- Lead (advocacy and regulation) and
- Link (collaboration).

The Sustainability Framework includes a set of initial actions which have been developed in consultation with our members and staff. The Sustainability Framework is being delivered alongside the Engineers Ireland Strategy 2021-23 and progress is reported to the Council and Executive Board. Further actions are constantly being developed and undertaken as Engineers Ireland's work in this area develops.

EI's approach to sustainability includes the resilience of our built and natural environment in the face of extreme weather (climate adaptation), the need to reduce emissions related to our buildings, vehicles and infrastructure (climate mitigation), biodiversity protection and enhancement, and achieving the UN Sustainable Development Goals.

The UN Sustainable Development Goals are at the heart of the 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015. The 17 goals provide a shared blueprint for peace and prosperity for people and the planet, now and into the future. They are also an urgent call for action by all countries - developed and developing - in a global partnership. The goals recognise that "ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests"[1].

[1] https://sdgs.un.org/goals

Figure 3: The 17 UN Sustainable Development Goals

1.3 Sustainability Grand Tour

Leading from the declaration of a climate and biodiversity emergency and the launch of the sustainability framework, and in response to a call from Engineers Ireland for project proposals to support national recovery, a webinar series called the 'Sustainability Grand Tour' (SGT)[2] was launched in January 2021.

The free-to-attend weekly webinar series ran until May 2021 and was a collaboration between 10 sectors of Engineers Ireland: West, South East, Cork, Northern, Midlands, GB and North East Regions, Energy, Environment and Climate Action Division, Roads and Transportation Society, and Academic Society. The 19 webinars provided 16 hours of free Continuing Professional Development (CPD) for Engineers Ireland members and others with an interest in sustainability.

The Sustainability Grand Tour brought together thousands of Engineers Ireland members to explore the role of engineers in developing sustainable cities and communities. Webinars covered a diverse range of topics including, transport, construction, housing, and the UN SDGs. A closing event on 13 May provided for reflection on what has been learned along the way with a focus on lessons for public policy.

The SGT covered a wide range of themes related to engineering and sustainability. As there has been increasing interest in, and awareness of, the biodiversity crisis the organising group felt this was an important topic to cover. More details on the biodiversity event held as part of the SGT are provided in Section 2 below.

[2] https://www.engineersireland.ie/Professionals/Communities-Groups/Sustainability-Grand-Tour-Series

1.4 The Biodiversity Crisis

The biodiversity crisis is a global crisis and similar to climate breakdown the global situation is challenging and the international community is not on track to meet any of the 2010 Aichi goals[3].

National Biodiversity Action Plan 2017-2021

The NBAP defines Ireland's vision for biodiversity as follows:

That biodiversity and ecosystems in Ireland are conserved and restored, delivering benefits essential for all sectors of society and that Ireland contributes to efforts to halt the loss of biodiversity and the degradation of ecosystems in the EU and globally.

The NBAP sets out why biodiversity is so important:

Humans rely on biodiversity for our health and well-being and to support many of our economic activities.

Biodiversity provides us with, for example, clean air, water, food, fuel, medicines, recreation, spiritual enrichment and protects us from extreme weather. It supports pollination and soil fertility, and regulates our climate.

EPA State of Environment report, November 2020

The EPA State of Environment report, published in November 2020, provides a warning as to the scale of biodiversity loss and the fact that the impacts of biodiversity loss are not fully known:

"We are also witnessing the erosion of ecosystems and biodiversity on an unprecedented scale. We seem unable to stem the tide of nature's destruction and may not fully understand its full impact until it is too late."

National Biodiversity Forum Report, February 2021

The National Biodiversity Forum's (NBF) February 2021 report concluded that environmental indicators still show "a very disturbing picture of losses and declining trends" in addressing Ireland's biodiversity emergency of the past five years. The report also concluded that Ireland does not adequately fund "even basic environmental compliance" while the "biggest transgressor of environmental law in Ireland is the State".

Figure 4: There has been a 96% decline in breeding pairs of curlew since the 1980s

[3] https://www.theguardian.com/environment/2020/sep/15/every-global-target-to-stem-destruction-of-nature-by-2020-missed-un-report-aoe

Media Reports Sharp Rise in Dead Whales and Dolphins Washing up on Irish Beaches, March 2021

In March 2021, the media reported on a sharp rise in dead whales and dolphins washing up on Irish beaches. Ireland is extremely lucky to have such significant marine areas but we are not meeting commitments in terms of protecting marine areas and marine life. Overfishing, and the impacts of by catch, is a major issue but offshore wind farms have potential to cause harm also, there is also potential for them to be positive for marine life if done properly. Ireland's coastal territory is ten times our land territory and engineers are one of the most active cohorts in the marine environment. Ireland had committed to designate 10% of its seas as Marine Protected Areas and to end over-fishing by 2020. As of April 2021, Ireland has designated just 2.3 per cent of our vast marine area for special protection.

Birds of Conservation Concern in Ireland, Bird Watch Ireland, April 2021

In April 2021, Bird Watch Ireland published the latest review of the Birds of Conservation Concern in Ireland which reported a 46% increase in the number of red-listed species, those of highest conservation concern. Curlews, shown in the picture, are the unfortunately well known face of declining bird populations in Ireland. A 96% decline in breeding pairs in just 30 years is shocking.

Joint Oireachtas Committee on Environment and Climate Action

The Joint Oireachtas Committee on Environment and Climate Action[4] has been hearing from biodiversity experts regarding the biodiversity crisis in Ireland over recent weeks. The presentations to the committee highlighted the seriousness of the situation and the huge challenges faced in efforts to halt biodiversity loss.

Legislators must act urgently to stem biodiversity loss, committee told

Investing in nature 'doesn't cost the earth, but it gives us and the Earth a chance'

Biodiversity experts warn ecosystems are 'in collapse'

Updated / Tuesday, 4 May 2021 23:51

Figure 5: News reports on biodiversity presentations to the Joint Oireachtas Committee on Environment and Climate Action, May 2021

[4] https://www.oireachtas.ie/en/committees/33/environment-and-climate-action/

2 Introduction

The 'Protecting Biodiversity – The Role of Engineers' initiative was launched in February 2021 as part of the Sustainability Grand Tour (SGT).

The initiative was led by an organising group made up of members of the West Region, South East Region, and the Energy, Environment, and Climate Action Division.

An SGT event as part of the initiative was held on 5 May and can be viewed online[5].

Figure 6: Protecting Biodiversity - The Role of Engineers, Webinar, 5 May 2021

2.1 Consultation Process

In determining who to consult with the organising group identified three key groups:

- Organisations focused on biodiversity
- Ecologists / Environmental Specialists working in the engineering / construction sector
- Local Authority Heritage / Biodiversity Officers

A set of four objectives were identified for the consultation process:

- Identify issues related to engineering and biodiversity
- Document case studies
- Identify potential solutions and ways Engineers Ireland and members can support
- Collect relevant references / resources

The consultation process with each group is summarised below.

2.1.1 Organisations Focused on Biodiversity

As outlined in section 1.1 above, the Engineers Ireland declaration of a Climate and Biodiversity Emergency in March 2020 states that Engineers Ireland members will, in taking action to address the Climate and Biodiversity Emergency, "collaborate with scientists, environmentalists, government, their advisors, public service, other professions and civil society".

The organising group felt that engagement with representatives of the organisations who are working directly on biodiversity on a daily basis would be the most effective way to bring in external views on the role of engineers in protecting biodiversity. It was acknowledged that there are many organisations whose work impacts biodiversity, or who may have a strong involvement in the biodiversity sector, but for whom this is not the core focus of their work and it was agreed that there may be a need for subsequent consultation with these groups.

[5] https://www.youtube.com/watch?v=o2CWdE2DELo&list=PLUlqY3dRClXo9A38Hxu5XtnZRJUHZnpKw

The groups consulted with over the course of the initiative are as follows:

- An Taisce
- Environmental Protection Agency (EPA)
- Coastwatch
- National Parks and Wildlife Services
- Inland Fisheries Ireland
- Irish Peatland Conservation Council (IPCC)
- NUIG Hedgehog Survey Team
- Irish Wildlife Trust
- Dark Sky Ireland

Other organisations who were contacted, but with whom it was not possible to organise a consultation, include Bird Watch Ireland, the National Biodiversity Data Centre, the Native Woodlands Trust, and Bat Conservation Ireland. It is hoped that future work by Engineers Ireland on biodiversity will be able to facilitate consultation with these groups. Engineers Ireland is mindful that there has been serious underfunding of environmental and biodiversity related organisations in Ireland. It is acknowledged that many of these organisations are very stretched resource wise, and they are now having to tackle a growing range of issues that are becoming ever more urgent as the loss of biodiversity intensifies.

2.1.2 Ecologists / Environmental Specialists Working in the Engineering / Construction Sector

Ecologists / Environmental Specialists working in the engineering / construction sector were invited to complete a survey with questions covering the four objectives outlined in section 2.1 above. The Chartered Institute of Ecology and Environmental Management (CIEEM) and the Environmental Sciences Association of Ireland (ESAI) promoted the survey through their networks. In total 23 responses were received.

2.1.3 Local Authority Heritage / Biodiversity Officers

Through the Local Authority Heritage Officers network, input was received from local authority heritage / biodiversity officers from Wexford, Kildare, Donegal, Monaghan, Kilkenny, and Cork County Councils. Input from Dublin City Council was received through the survey.

Credit: Chaosheng Zhang

2.2 Scope and Limitations

This project was carried out by a small group of volunteers from the Engineers Ireland's West Region and South East Region Committees, and the Energy, Environment, and Climate Action Division committee. Biodiversity is a vast topic and the group could not comprehensively cover all aspects, or talk with every expert in the field. The 'Protecting Biodiversity – The Role of Engineers' initiative is considered a starting point for Engineers Ireland in terms of contributing to efforts around biodiversity and to building knowledge and awareness on biodiversity within the engineering sector.

In defining the scope of work for this initiative, the organising group chose to focus the consultation on organisations whose focus is biodiversity, ecologists / environmental specialists working in the engineering / construction sector, and local authority heritage / biodiversity officers. The purpose of the consultation was to understand how the role of engineers in protecting biodiversity is perceived by these stakeholders, to outline the key issues and to identify good practice.

The organising group acknowledges that there is an ever increasing wealth of knowledge and experience on biodiversity within the engineering sector. It is recommended that a further round of work on this topic would focus on consultation with organisations such as the Office of Public Works (OPW), Transport Infrastructure Ireland (TII), Irish Water, ESB, etc. to explore their Biodiversity Action Plans and how they envisage monitoring and adapting these going forward. This could also document experiences to date in adapting project design processes to incorporate biodiversity, training engineers, etc. This would in itself be an extensive consultation process.

We are extremely grateful to the Local Authority Heritage Officers network for facilitating consultation with heritage / biodiversity officers from local authorities across the country. It is acknowledged that not all local authorities were consulted with and that further engagement on this topic with all local authorities would be beneficial. It was also highlighted during the consultation process that many local authorities do not have Biodiversity Officers. Engineers Ireland supports the National Biodiversity Action Plan proposal to ensure that a Biodiversity Officer is employed for each local authority. This would be extremely beneficial for engineers working in local authorities ensuring that in-house expertise is available and contributing to building a multi-disciplinary approach to project design and implementation.

Credit: Chaosheng Zhang

3 Issues Identified

The following sections present a summary of the issues and challenges identified through the consultation process. The summary does not distinguish between the input provided through the different strands of the consultation process. Individual participants in the consultation process are not identified and in general, input received is presented as a general summary of the wide range of information and experience shared. .

3.1 Biodiversity as an opportunity, not a constraint

Across all consultations there was a sense that within the engineering sector, biodiversity is still often viewed as a constraint rather than an opportunity. Biodiversity is not a constraint and should not be seen as a box-ticking exercise.

It was highlighted that there are exciting opportunities for the engineering sector to contribute positively to protecting biodiversity but the sector also faces reputational risk if it does not adapt.

> It was raised in a number of consultations that the Covid-19 crisis has been used as the basis to proceed with works without the required level of environmental input / monitoring due to limitations in movements under the Covid-19 restrictions.

There is a need to move beyond aiming for 'no net loss' to biodiversity in engineering projects, to aiming for a 'net biodiversity gain' approach in project objectives. This requires a change in mindset where we are not just aiming to implement the project and where possible to add in some efforts around biodiversity. The design should set out from the beginning to ensure net biodiversity gain, or at the very minimum to ensure no net loss to biodiversity. It would also be beneficial for biodiversity to be incorporated into everyday processes for engineers no matter what the project is. Every aspect of an engineer's work should be carried out in an environmentally sound way and engineers need to be provided with the skills and knowledge to keep this at the forefront of their work.

Nature needs to become part of how projects are developed. All engineering projects are put through a cost benefit analysis (CBA) but the criteria involved do not reflect nature and the environment. The Department of Public Expenditure and Reform has published guidance for all state funded projects on how to include carbon intensity in the CBA but there is no equivalent for nature. As a result the impact of a project on nature and biodiversity is not taken into account in the same way as cost. An example of this is the nil valuation assigned to public open space in terms of optioneering or route selection for infrastructure. This biases toward more environmentally destructive options for major infrastructure, i.e. locating site compounds within St. Stephen's Green, a historic park with mature habitats, rather than using paved areas, due to the nil cost assumption. Nature and biodiversity need to be given due regard during project appraisal. Natural Capital Ireland are working in this area, using the concept of natural capital to frame "the world's resources like plants, animals, water, and minerals as assets or stocks that yield a flow of benefits to people"[6].

To halt the loss of biodiversity through development, a project should leave the environment in a better state than before. Aiming for Biodiversity Net Gain should form the basis of all engineering projects. A new British Standard for Biodiversity Net Gain is soon to be published and it was recommended that an Irish standard be developed. Retaining/bolstering existing habitats should be the core of a project rather than compensation or replacement. Where removal of habitat is unavoidable, the replacement habitat proposed often doesn't make up for the one lost or it is not of a similar value e.g. a hedgerow which connects into the wider landscape forming wildlife corridors is removed and replaced with a circle of trees in the middle of a site. This means that habitat connectivity is lost. In terms of aquatic habitats, soft engineering or creation/restoration of natural features is often overlooked or excluded very quickly without any detailed consideration or reasoning. There is also a problem where hard engineering, being more expensive, commands higher fees and is deemed a 'major project' by virtue of cost. This may result in a cheaper, more effective, soft solutions which are better for the environment being overlooked. Having environmental criteria and targets defined in the project brief would support the illustration of the true cost-benefits.

[6] https://www.naturalcapitalireland.com/

It can be very difficult to achieve biodiversity and climate targets when the project design is set in stone and then biodiversity has to be stitched around it as a secondary process.

3.2 Changing what and how we design

3.2.1 How we design

Ecologists are often brought in once the design has been relatively fixed and then asked to provide input, or else brought in early on to complete required surveys but then not involved with how those surveys are incorporated into the design. Collaborative and meaningful engagement early on would result in a stronger design and would build on the skills and expertise of all involved. Multi-disciplinary design teams will lead to better designs and a more comprehensive design process. The Sustainability Grand Tour included some good examples of this from active travel / public realm improvement projects where multi-disciplinary teams were key to the project's success.

Collaborative and meaningful engagement is also relevant for those not in the design teams. This should consider how biodiversity expertise is drawn upon at local level and how environmental concerns are engaged. Many respondents said that there are flaws in the implementation of concerns raised in consultation processes. One organisation which took part in the consultation shared that they review the design and submit a response. At the next stage of consultation, the design is again reviewed to assess if their submissions have been incorporated. If they have not been incorporated, they will write again to highlight this but that's the limits of process. Another organisation raised that they often submit input during the planning process and then have no idea if it is useful or understood. They had the feeling that engineers see their input as just complaining because they don't feel there is space for genuine engagement.

It was highlighted that for significant infrastructure projects, ecologists are often consulted, even if at an early stage, on the basis of the 'Lands Made Available' (LMA). Generally, the LMA for a project will be based on minimum requirements in terms of engineering, rather than the ability of the project to deliver biodiversity net gain. Earlier ecological input could, for example, expand the extents of the LMA to include potential biodiversity enhancement areas and improve a project's contribution to protecting and promoting biodiversity.It could also adjust how Sustainable Urban Drainage Systems (SUDS) capacity might be designed. A SUDS pond that will have real wildlife value as well as assimilative capacity may need to be significantly bigger than one that simply has to have sufficient capacity to reduce downstream flooding. It was suggested that the value of early environmental input would be more clearly understood if project briefs were set up with more focus on maximising biodiversity and environmental gains.

Citizen science was a topic that was raised many times in the consultations. The engineering sector should have more engagement with, and respect for, citizen science and what it can offer engineering design. One example given was of a citizen science project which conducted daily monitoring of a river to understand flood risks.

3.2.2 What we design

The need to integrate nature based solutions featured in many responses to both the survey and in the consultation stages with the organisations who engaged with us, for example:

> "Engineers need to have a better understanding of nature based solutions and learn to apply these. In coastal and river areas, hard engineering works can no longer be considered appropriate and there is a need to work with nature to ensure positive outcomes. This is particularly important given the changes in weather patterns as a result of climate breakdown."

Many respondents called for urgent reform of the arterial drainage act as a starting point in moving away from what many viewed as outdated practices that are still being applied. It was suggested that engineering needs to catch up and embrace nature based solutions to ensure improved outcomes, both in terms of biodiversity / environment and engineering. There are areas where little natural or specifically designed attenuation is in place to ensure a greenfield run-off rate. The result being that the drainage systems and our rivers are surcharged with excessive volumes leading to flooding events. There is huge potential to use natural wetlands as a nature based form of attenuation, more research

is required in this area, to realise the full extent of options that may be viable. At least 25,000 kms of rivers will be restored into free flowing rivers under the 2030-EU Bio Strategy and the engineering sector will have to work with this. Inland Fisheries Ireland is in the process of surveying nearly 70,000 potential barriers (culverts, weirs, bridge apron, etc.) in waterways across Ireland. As of the end of 2020 21,376 structures were assessed and 5,482 are potential barriers. This is often to do with the culverts being undersized and not replicating the original river cross sectional area. This results in an increase in flows which migrating fish find hard to navigate due to increased velocities. Engineers have a role to play in working with fisheries experts to design structures that do not create barriers for wildlife in our rivers. Many of the species in our waterways are of global conservation concern and are protected under EU legislation. Therefore, Ireland has a legal obligation to address this issue.

The design brief for new Flood Relief Schemes carried out by the OPW and Local Authorities now incorporates the requirement to assess the potential for Natural Water Retention Measures and bring forward as part of the project design process where they will contribute to the flood reduction in the scheme area or reduce the scale of structural protection works required.

On the coastal side, if the natural movement of sand dunes is impeded through application of hard engineering solutions it will result in more issues along the coast. It was felt that Engineers Ireland has a big role to play in growing awareness in the engineering world on the value of nature based solutions and working to address some of the challenges engineers may face in designing nature based solutions. One of these challenges is that the Irish Federation of Insurers currently need an engineer to sign off on 100 year flood defences. So with the implementation of nature based solutions in relation to flooding, the required certainty, scientific evidence and sign off would not be in place and nature based solutions are not recognised. There have been examples already in Ireland where nature based solutions have been rejected in favour of more traditional flood defences on the basis of the challenge in getting the required insurances in place[7].

Many respondents felt that engineering guidance for designing flood management / relief works requires revision, in collaboration with meteorological experts, to align with current trends in our climate. It was suggested that design solutions are going to have to be quite different and there was concern that there is not enough future proofing of major infrastructure projects. It was acknowledged that this may be as a result of restricted financial envelopes, but the result is that infrastructure is very quickly overwhelmed and nature pays the price.

The Government has established an Inter-Departmental Group on Managing Coastal Change Strategy to scope out an approach for the development of a national co-ordinated and integrated strategy to manage the projected impact of coastal change to our coastal communities, economies, heritage, culture and environment. The Inter-Departmental Group is jointly chaired by the Department of Housing, Local Government and Heritage and the OPW and will bring forward options and recommendations for the Government to consider.

An issue that came up across the consultation process was developers driving project planning rather than government. For example with offshore wind farms there is no single government led survey to plan the location of off shore wind farms. This results in multiple private companies carrying out their own surveys which are very disruptive to sea life and this is a duplication of work. The selection of locations for off shore wind farms will dictate whether this new phase in renewable energy development will be positive or catastrophic for marine life. With onshore wind farms there are issues with developers deciding on quality and location of replacement habitat. This is an important process but it was felt that there is not enough oversight of this process which results in limited impact. Where engineers are working on the design of wind turbines there may be opportunities for collaboration with environmental experts to try to address the impact wind turbines can have on bats and birds (both onshore and offshore). Landscape architects also have a vital role to play in terms of landscape and visual impacts.

[7] Tamara Hochstrasser and Megan Best 'NbS in Ireland: A systems-based response to combined socio-environmental challenges', talk for CIEEM, 2021

Greenfield development has much more impact on biodiversity in terms of ripping up existing habitat areas. Design considerations should take this into account. There is a need to consider green space design and how to ensure best possible design for people using green space but also ensuring that it works for biodiversity which will in turn contribute to our health and well-being. In urban areas this may involve making use of even very small spaces – swift nest or bat roost bricks, green roofs, etc. In urban areas this may need to be making use of even very small spaces, roofs, etc. Some examples of this are provided in Section 4 Case Studies below.

3.3 Monitoring and accountability – meeting our obligations

A common theme in the input received through consultations and surveys was that many engineers do not have sufficient knowledge of the legal requirements related to protecting the environment and are unaware of their obligations in relation to this. It was acknowledged that these are vast, complex, legal documents. But engineers need to have some knowledge at least of what the legal requirements are. However, it is not just engineers that need to have this awareness. There are legal implications on everyone involved in a construction project and all need to be aware of their obligations.

Whilst the environmental processes involved in engineering projects are stronger than ever it was highlighted that these are very front loaded and there are limitations in terms of monitoring and accountability. There was a sense that the environmental assessment processes are often seen as just a requirement to be carried out rather than a meaningful and concerted effort to protect the environment. They are generally carried out by ecologists / environmental scientists and engineers simply take the mitigation measures and incorporate those into the design process. If engineers were engaged with the process earlier, and had a stronger understanding of the reasoning behind mitigation measures, there may be reduced incidences of mitigation measures not being applied, and potentially more valuable opportunities for biodiversity enhancement being identified.

An Ecological Clerk of Works (ECoW) is a professional that will work on site with a contractor to advise on protecting biodiversity features, provide practical and site-specific assistance on how to achieve compliance with environmental legislation, and oversee ecological mitigation works. The ECoW role is now starting to become part of contracts for Irish construction projects and is already quite prevalent in the UK. The Chartered Institute of Ecology and Environmental Management (CIEEM) is developing an accreditation process for ECoWs in order to assure quality for contractors, developers and competent authorities and to provide individuals with a competence-assessed qualification that they can take with them as they progress their career. More information can be found here.

In terms of monitoring and accountability, the major issue is that if environmental destruction happens in an engineering project, it has happened and often cannot be meaningfully corrected and there are very limited repercussions. For example illegal quarries, where it takes months to address the use of an illegal quarry and in the mean time the contractor may just move on to using another illegal quarry because there are no major repercussions and it's easier in terms of completing the project to proceed like this. There were many cases given as examples during the consultation process where mitigation measures agreed at planning were then ignored in the construction and there were no / limited repercussions as a result.

Habitat loss and fragmentation came up in almost all consultations and survey responses. It is a huge issue with far reaching impacts. It was noted that Ireland does not have a national landcover map which impacts planning and monitoring of habitats. It was highlighted that whilst obligations on developments to replace lost habitat can be positive, replacement habitats often don't make up for the one lost because they are not of similar value. For example, if a hedgerow which connects into the wider landscape forming wildlife corridors is removed and replaced with a circle of trees in the middle of a site this is not replacement of like for like. This would be like removing a stretch of the M50 and replacing it with an unconnected roundabout in an adjacent field. It was also noted that many housing estates are named after the trees / habitat that they replaced.

There was a lot of input regarding construction management practices. It was acknowledged that there is

increased awareness of the restrictions on certain works related to timing in the year but there remains a push to complete work as it suits the contractor. Construction management has to take into account nesting seasons, fish spawning times, etc. Noteworthy published articles regarding findings related to hedgerow cutting practices in February 2021. It was reported that between 2018 and 2020, at least 3,000km of hedgerow and verges were cut by local authorities during the prohibited season at a cost of over €1.4 million. Nearly all cases were carried out on road safety grounds, however, authorities were unable to provide documents on road safety assessments carried out[8]. It was suggested that the planning of tree works would be better if there were Tree Officers employed in local authorities, as is the case in most European countries. Some local authorities are implementing projects to protect hedgerows and verges – see Section 4.3 below.

Invasive species came up multiple times during the consultation process with a common theme that insufficient consideration is given to proper management of invasive species. Examples provided included contaminated spoil being moved to another site without any treatment, contractor being provided with a compound which had invasive species present resulting in the spread of the invasive species from the site compound, and time constraints hampering surveys.

For 'small scale' projects, e.g. river maintenance, bridge maintenance, drainage works, at local authority level there were many examples where biodiversity / heritage officers or ecologists are called on to provide input at the very last moment. The engineering team are often under pressure due to funding and / or timeframe constraints but earlier engagement on the ecology side would improve environmental results.

One recommendation was that post project environmental evaluation should be carried out for all engineering projects. It was felt that this would provide an opportunity to understand the reasons for any environmental damage that happened and to learn and improve for future projects. It was noted that there is a need to explore how the cost of carrying out such evaluations could be covered.

Credit: Noal Reddy

[8] https://www.noteworthy.ie/nw-shear-force-pt1-5359014-Feb2021/

4 Case Studies

As part of the consultation process, respondents were asked to suggest case studies that either illustrated the issues raised or presented an example of good practice that could inform other projects. The case studies shared are presented below.

4.1 Swift Conservation Project (Source: EPA State of the Environment Report 2020)

The Swift Conservation Project, which is a citizen science initiative, helps to protect Ireland's declining swift populations. Full-county swift surveys have been completed in Offaly, Westmeath, Laois and Tipperary, with more under way in Meath, Sligo and Wicklow. The surveys, with the support of local volunteers and Tidy Towns groups, record swift nest sites in towns and villages to establish the distribution of nesting swifts. The data collected allows planners and decision-makers to more effectively protect swifts at site level. Surveys will also be completed of swifts at Office of Public Works (OPW) Heritage Sites across Ireland. The results of these surveys will enable the OPW to more effectively manage sites where swifts are present and, in some cases, attract swifts back to sites where they have been lost.

4.2 NPWS M11 Mammal Underpass

The NPWS, working with Transport Infrastructure Ireland (TII), BAM, and Local Authority engineers, used trail cameras, telemetry, and markings to identify desire lines for mammals along the route of the M11 works. As a result of this desire line mapping, the NPWS were able to ensure that mammal underpasses were located along existing desire lines. The NPWS were also able to reduce the overall number of mammal underpasses which resulted in a cost saving for the project. Monitoring of the mammal underpasses by the NPWS has found that the results are very positive. The NPWS also worked with the project partners to adjust fencing along the route to increase protection for deer.

4.3 Life Lives on the Edge, Wexford County Council

The Life Lives on the Edge Project aims to enhance / rediscover the range of visible biodiversity that potentially exists along Wexford roads.

The project originated from the Roads Strategic Policy Committee and has involvement and support from the Roads and Planning Departments of Wexford County Council. The project is being implemented across four pilot study areas; Tagoat, Crossabeg, Scarawalsh, and Barntown

The areas of road verge that have been designated as part of the Life Lives on the Edge project vary in length and their boundaries have been defined by signposts at either end of the vegetated strips.

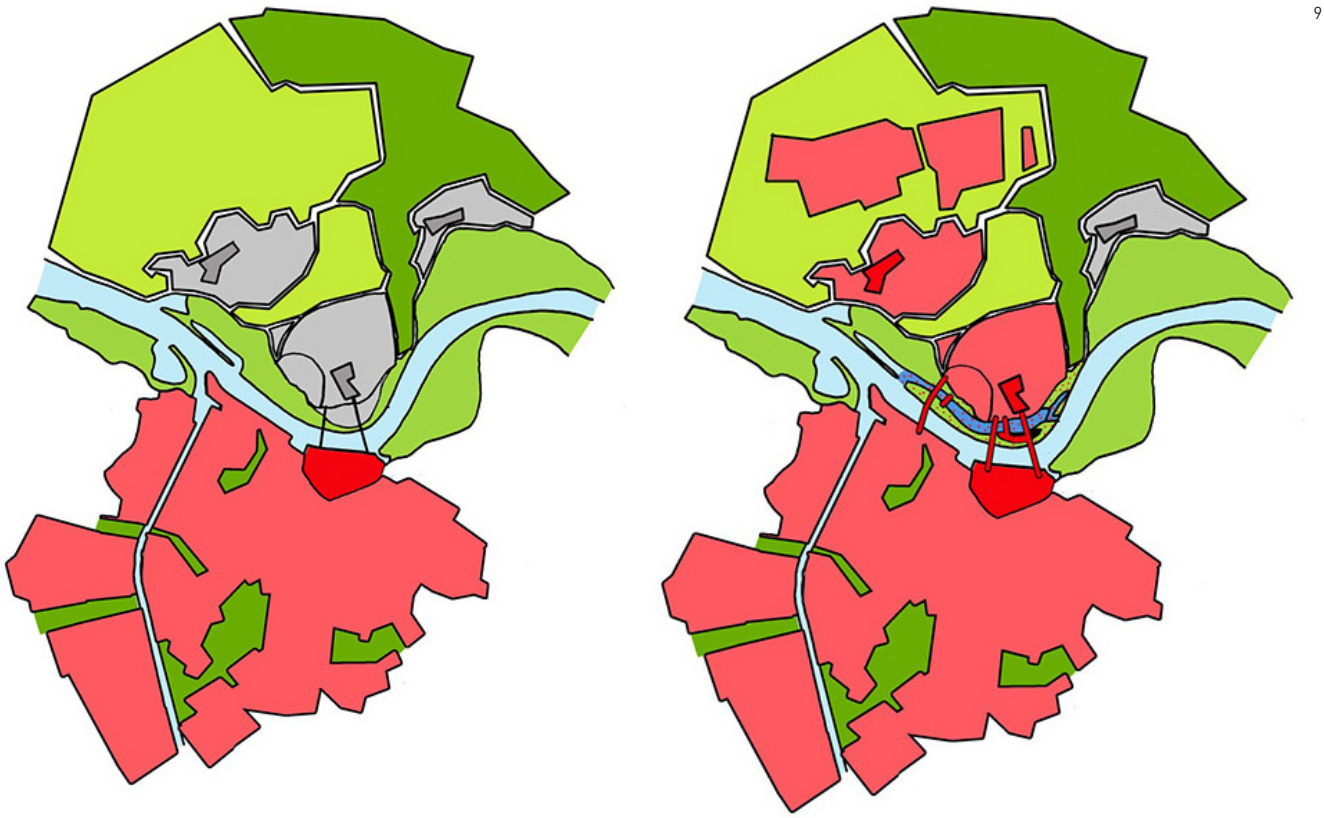
Figure 7: Example of a road verge that is part of the project (left), Life lives on the Edge project sign (ritght)

4.4 Room for the River, Government of the Netherlands

The Room for the River programme was launched by the Dutch Government in 2007. The main goal of the programme was to manage higher water levels in rivers by lowering the levels of flood plains, creating water buffers, relocating levees, increasing the depth of side channels, and the construction of flood bypasses. The programme consisted of over 30 projects and all were completed at the end of 2018.

The three programme objectives were:

- By 2015 the branches of the Rhine will cope with a discharge capacity of 16,000 cubic metres of water per second without flooding;
- The measures implemented to increase safety will also improve the overall environmental quality of the river region;
- The extra room the rivers will need in the coming decades to cope with higher discharges due to the forecast climate changes, will remain permanently available



Before *After*

Figure 8: Before (left) and after (right) diagrams of the flood water management under the Room for the River project

[9] https://worldlandscapearchitect.com/room-for-the-river-nijmegen-the-netherlands-hns-landscape-architects/

4.5 Green Bridge, M17

The Green Bridge built as part of the M17 is specifically designed as a flight corridor to channel bats across the bridge, and is Ireland's first ever such structure. It allows lesser horseshoe bats to safely cross the motorway to feeding grounds at Coole Park and a roosting site at Kiltartan Cave which were separated by the motorway. The bridge was planted with hedgerow vegetation to guide bats to and from the bridge[10].

A Chartered Institute of Ecology and Environmental Management (CIEEM) talk with Dr Tina Aughney of Bat Conservation Ireland on Bat Roost Restoration and the "Green Bridge" on the M17/18 motorway is available to view online[11].

Figure 9: View of the Green Bridge on the M17

Figure 10: Aerial view of the Green Bridge on the M17

4.6 Newport Lighting Master Plan

Newport, County Mayo is the gateway town to the Mayo International Dark Sky Park. A Lighting Master Plan[12] has been developed, with funding from the Heritage Council, to provide best practice design and guidelines for artificial lighting in the town. The plan provides an ecologically sensitive lighting scheme for the town whilst also meeting the community's lighting needs. This is the first plan of its kind in Ireland and if the designs detailed within the plan are implemented, Newport will become the first Dark Sky Friendly town in Ireland.

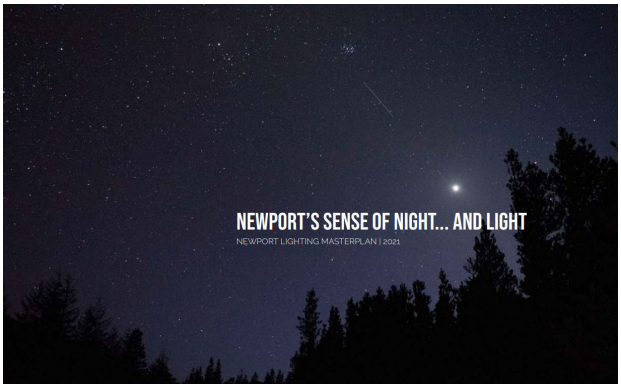


Figure 11: Newport's Sense of Night... and Light, Newport Lighting Master Plan

4.7 Grass roof at Gas Network Ireland's Networks Services Centre, Finglas

Gas Network Ireland's (GNI) Networks Services Centre, which opened in 2010, received a rating of 'Excellent' under the bespoke building BREEAM assessment procedures; the first office building in Ireland to receive an 'Excellent' rating under the 2008 standard. BREEAM is the world's leading design and assessment method for sustainable buildings.[13]

The building incorporates a grass roof as part of the landscaping and biodiversity measures.

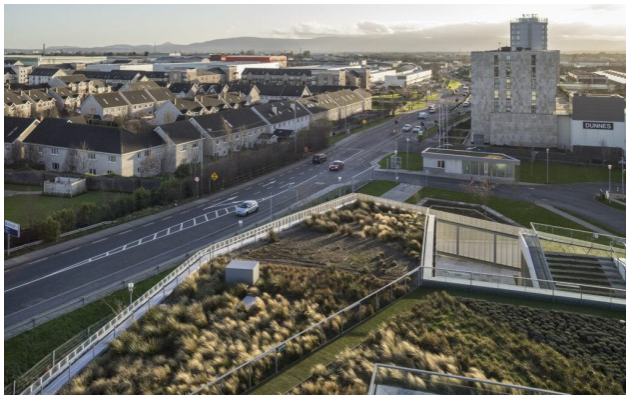


Figure 12: View of the roof of Gas Network Ireland's Networks Services Centre, Finglas

[10] https://greennews.ie/44587-2/
[11] https://cieem.net/resource/lunchtime-chats-with-dr-tina-aughney-bat-roost-restoration-and-the-green-bridge-on-the-m17-18-motorway/
[12] http://www.mayodarkskypark.ie/images/newsevent_articles/56/Newport_LMP_GM_2021.pdf
[13] https://www.gasnetworks.ie/corporate/company/our-commitment/environment/networks-services-centre/

4.8 Living wall at Trinity College Dublin Business School

Trinity Business School, which opened in May 2019,has the largest "living wall" ever built in Dublin. The 70sq m living wall is located on Pearse Street and comprises seven different species of plants carefully selected to suit its north-eastern aspect. As well as offering a stunning visual effect, living walls provide a welcome boost to the biodiversity of a facade and are recognised for their potential to add a valuable habitat for nature. Flowering plants provide pollen and attract a range of pollinators including bees and hoverflies and other insects. The living wall holds 96 plants per square metre with species including Liriope muscari, Asplenium scolopendrium, Helleborus niger, and Drypoterisaffinis[14].

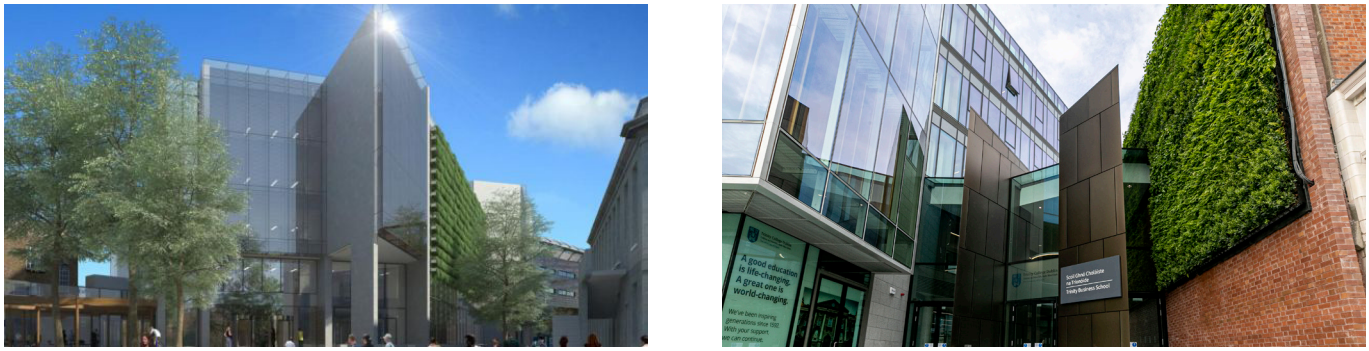


Figure 13: Views of the living wall at TCD Business School

4.9 The AmmoniaN2K Project, University College Dublin

Figure 14: Inside a poultry farm

The AmmoniaN2K project will quantify and assess the impact of ammonia emissions from intensive pig and poultry units on Natura 2000 sites in Ireland, in order to assist the EPA licensing of intensive agriculture installations, in particular to support Appropriate Assessments under the Habitats Directive; contribute to national inventory reporting and PRTR reporting; assist in the assessment of developments under Food Harvest 2020 and support work on trans-boundary air pollution. The research underway as part of the AmmoniaN2K project, includes three broad categories:

1. Local emissions monitoring and modelling
2. National modelling and assessment
3. Natura 2000 monitoring

4.10 Native Oyster Reef Restoration Ireland (NORRI)

The local community in Arklow, with support from Wicklow County Council, established Native Oyster Reef Restoration Ireland (NORRI) to initiate collaborative efforts to restore native oyster reefs, integrated with restoration of kelp habitats and other degraded coastal habitats. The NORRI Project received funding from the Rural Development program, LEADER grant and County Wicklow Partnership for "East Coast Oyster and Kelp Biodiversity Project". This work specifically addresses training and education for the local community on biomimetic restoration. Local Biomimicry LivingLabs will be established for testing in situ design of floating island structures in Wicklow Bay in support of integrated oyster and kelp restoration[15].

[14] https://www.irishtimes.com/special-reports/trinity-business-school/sustainability-and-health-at-the-centre-of-the-architechture-of-new-business-school-1.3900497

[15] http://norri.ie/

4.11 Urban Planning and Nature Based Surface Water Management, Implementation Strategy Scoping Project

The Department of Housing, Local Government and Heritage (DHLGH), Local Authorities Water Programme Office (LAWPRO) and the County and City Management Association (CCMA) have established a project to actively promote the implementation of nature-based surface water management solutions to our cities and towns through new developments (greenfield and brownfield), as well as urban regeneration and, indeed, all projects that intervene in the urban fabric, using an urban design and plan led approach. A multi-disciplinary and cross sectoral approach will be required, encompassing all aspects of urban planning and design within the public and private sectors.

The project has been launched following consideration of the current second cycle of the River Basin Management Plans (RBMP) and, in particular, the issue of surface water management in urban areas, the DHLGH and LAWPRO, supported by the County and City Management Association (CCMA) are anxious to improve the national performance in this area, as part of the third cycle of the RMBP which runs from 2022 to 2027.

The project will develop an implementation strategy for the development of Water Sensitive Urban Design (WSUD) for the Irish context, which includes Nature Based SuDS. Nature based surface water management provides increased flood resilience as well as the protection or enhancement of water bodies, as required under the EU Water Framework Directive, and improved biodiversity. The newly emerging international approach of water sensitive urban design (WSUD) has been identified as a more integrated approach placing the management of surface water at the centre of urban planning and design.

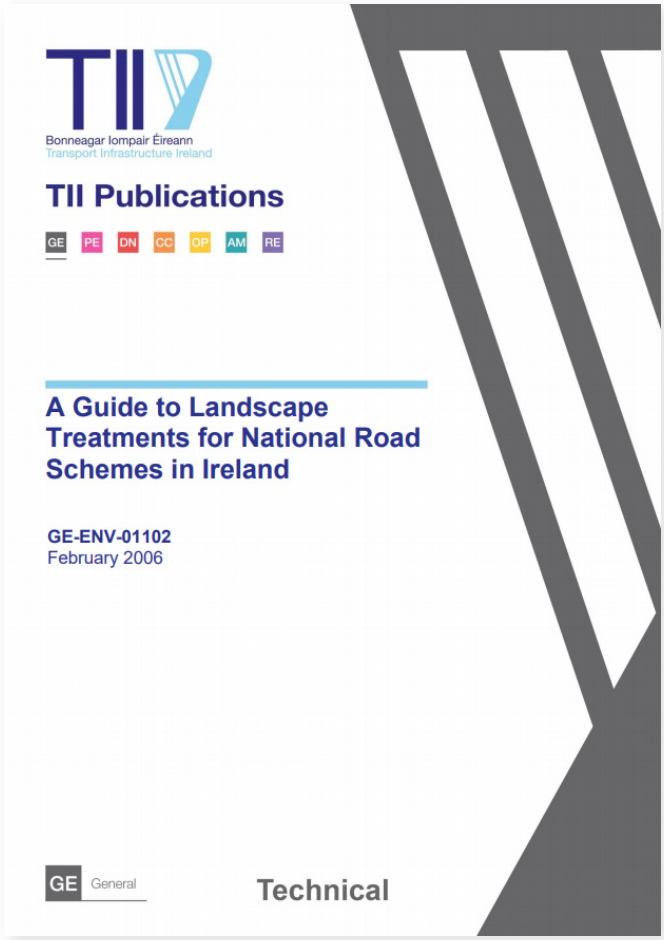
The project is currently engaging with all Local Authorities, state agencies including EPA, IFI, NPWS and OPW, Government Departments, TII and DMURS and the private sector to better understand how Water Sensitive Urban Design can be implemented more coherently in Ireland. The project will run for 6 months and report on its findings in time for the third cycle of the RBMP.

More information on the background leading up to the project is available at http://watersandcommunities.ie/nature-bases-suds/. This includes presentations given at the November 9th 2020 Webinar on Urban Planning and Nature Based Surface Water Management: From Theory to Practice organised in partnership with the Irish Planning Institute and Engineers Ireland.

Figure 15: The Raven Nature Reserve, Curracloe, Co. Wexford.

5 Reference Documents

One of the objectives of the consultation process was to collect relevant reference documents and resources that would be of benefit for engineers in understanding their role in relation to biodiversity and how to consider biodiversity in design, during construction, and post construction. Appendix A provides a list of reference documents suggested during the consultation process.



6 Recommendations & Next Steps

All organisations and individuals who took part in the consultation were interested to engage further with Engineers Ireland and its membership to support biodiversity. There were a wide range of recommendations that came up during the consultations and these are summarised below.

6.1 Field trips for engineers on biodiversity

Organising field trips on biodiversity for engineers was seen as the most direct way to provide engineers with opportunities to see and understand critical biodiversity issues. Several organisations who took part in the consultation process were interested to support with these events. Field trips would also represent an antidote to online events!

Dependent on Covid-19 restrictions, the Engineers Ireland South East and West Region committees are hoping to pilot field trips on biodiversity for engineers in 2021.

6.2 CPD events for engineers on biodiversity

There was a common theme across all consultations that engineers would benefit from access to CPD events on biodiversity. This should include a broad range of topics and formats, such as general, introductory webinar events, seminars focused on one or two specific topics, longer training courses on specific technical areas, and workshop / participatory style events.

The Engineers Ireland CPD team are already working on developing a new range of events on biodiversity with the first events expected to launch in September 2021.

In addition to CPD events, it was recommended that Engineers Ireland work with third level institutions to promote education on biodiversity and Nature Based Solutions at undergraduate level.

6.3 Raise awareness on biodiversity in the engineering and construction sectors

Raising awareness can happen in many different ways, but could include things like:

- Engaging biodiversity experts as part of STEPS EngineersWeek
- Continuous sharing of resources / reference documents
- Sharing case studies, particularly in the area of Nature Based Solutions
- Coverage of biodiversity in Engineers Ireland's communications channels
- Advocacy efforts related to biodiversity
- Collecting members' questions / concerns related to biodiversity and engaging with Sectors and biodiversity groups to prepare responses

One of the most important aspects of raising awareness is to take the opportunity to build a connection with, and respect of biodiversity and nature amongst the engineering sector. One of the experts who took part in the consultation process shared that *"if you can convey how difficult it is to protect just one species, one moth, one butterfly, then you convey how much needs to be done in terms of protecting biodiversity overall and how much of a role engineers have to play"*.

6.4 Continued collaboration on biodiversity

The Engineers Ireland Declaration of a Climate and Biodiversity Emergency in March 2020 stated that

"Engineers Ireland members will take action to address the impact of the Climate and Biodiversity Emergency. In this most important of missions, we will collaborate with scientists, environmentalists, government, their advisors, public service, other professions and civil society."

The 'Protecting Biodiversity – The Role of Engineers' initiative has been a fantastic example of collaboration with scientists, environmentalists, and civil society and it is hoped that this collaboration will be continued and strengthened. Continuing to build links with the Local Authority Heritage

Officer Network for example would provide strong platform for engagement on biodiversity, and other heritage issues, at local authority level. The Chartered Institute of Ecology and Environmental Management (CIEEM) provided significant support for the 'Protecting Biodiversity – The Role of Engineers' initiative and Engineers Ireland will be working to build on and expand this collaboration going forward.

As noted in Section 2.2 above, it is recommended that a further round of consultation on biodiversity should be carried out with a focus on organisations whose main focus is engineering such as the Office of Public Works (OPW), Transport Infrastructure Ireland (TII), Irish Water, ESB, etc. This could explore their Biodiversity Action Plans and how it is envisaged that these will be monitored and adapted going forward. This could also document these organisations' experiences to date in adapting project design processes to incorporate biodiversity, training engineers, etc.

6.5 Support Delivery of Actions in the National Biodiversity Action Plan

There is an opportunity for Engineers Ireland to act as a leader in encouraging engineering employers to implement biodiversity measures to support the delivery of actions in the National Biodiversity Action Plan. Engineering employers could do this by: preparing a biodiversity action plan for the company, supporting staff to volunteer with environmental organisations, providing training opportunities for staff, adopting a pollinator friendly approach to management of grounds around offices, encouraging staff to get involved with planting in the grounds around offices, and supporting staff to record flora and fauna and submit records to the National Biodiversity Data Centre.

Organisations who had already started to carry out some of the above highlighted during the consultation process that they had found this had a very positive impact on staff wellbeing and that involvement in these activities raised awareness on biodiversity which trickled down into staff member's professional work.

6.6 Engagement with Media

The media provides a multitude of opportunities and methods to raise awareness of the role of engineers in protecting biodiversity and to promote the work of engineers who are contributing positively in this area. One option would be for Engineers Ireland to consider partnering with a production company for an EcoEye episode (or episodes). Engineers Ireland could suggest themes / topics to be covered and the production company would then make a proposal based on these suggestions.

This could be a great way to get discussions on engineering issues into the public domain. It could also be a way to inform discussions around hot topics such as flooding and flood relief schemes and our transport system or to look into new construction materials or methods.

6.7 Engineers Ireland Excellence Award for Biodiversity

The Engineers Ireland Excellence Awards take place annually and were established in 2010 to showcase and celebrate engineering innovation and excellence. It is Engineers Ireland's flagship awards event for the profession and celebrates engineering leaders and teams who have demonstrated exceptional engineering vision and skills through their work.

The awards provide an opportunity to showcase and celebrate the invaluable contribution the engineering profession makes to society and applaud the innovation and quality of work produced by engineers both at home and abroad.

An Engineers Ireland award geared towards recognising excellence in terms of engineers who are protecting biodiversity was recommended. This would recognise and highlight those who are doing good work in this area, which would in turn inspire others. It would also provide a platform for engineers to be champions for change with regard to biodiversity. It was recommended that the judging for this award should include representatives from the ecology sector to ensure projects support best practice for biodiversity.

7 Conclusion

Engineers Ireland would like to thank everyone who took part in the 'Protecting Biodiversity – The Role of Engineers' initiative.The scale of input and support for the imitative has been incredible.

It is clear that the biodiversity crisis is serious and is having, and will continue to have, far reaching impacts on many aspects of our lives. Despite this grave situation, the consultation process was extremely positive with a strong focus on the opportunities that exist to tackle the biodiversity crisis.

The 'Engineering 2020' report, published by Engineers Ireland, found that engineers and the public overwhelmingly agree that engineers have an ethical responsibility to tackle biodiversity loss. Ensuring that we are following through on this ethical responsibility will require significant adjustments to engineering practice. This represents a huge opportunity but conversely there is huge reputational risk for the sector if it does not adapt as needed.

To date, the emphasis has been on value for money and project delivery. However, more and more our environment is being eroded and a balance needs to be struck between commercial value and biodiversity in terms of the final outcome of all engineering projects. It is our responsibility as engineers to ensure that our actions are sensitive to our environment and that our work does not result in biodiversity loss and environmental damage.

Engineers Ireland has already begun planning for new CPD events focused on biodiversity and will be working on other actions related to biodiversity over the coming months.

Engineers play an important role in shaping the world around us and it is critical that environmental considerations and achieving the best for society are always at the centre of our profession and the work of engineers. As a professional body with 25,000 members, Engineers Ireland declared a climate and biodiversity emergency in March 2020 and committed to act as a leading voice for sustainability. The Engineers Ireland Code of Ethics includes environmental and social obligations for members to promote and practice sustainable development considering the needs of present and future generations, to promote the importance of social and environmental factors to professional colleagues, employers, and clients, and to foster environmental awareness within the engineering profession and among the public. This work has never been more urgent.

> We need a world that is more sustainable, where profit is not put before communities. Where the slavery to economic growth is taken out of the equation. We need sustainable growth in our communities. We need sustainable livelihoods for our people. And we're taking huge risks – massive risks – with our future if we don't manage the planet in which we live. And we're being extremely irresponsible right now.
>
> *Dr. Mike Ryan, WHO, February 2021*

Appendix A

One of the objectives of the 'Protecting Biodiversity – The Role of Engineers' initiative was to collect relevant reference / resource documents on biodiversity that would be recommended for engineers. The following is a list of the documents recommended:

- National Biodiversity Action Plan
- Bird Watch Ireland, Saving Swifts
- Policy on Offshore Windfarm Development, Irish Whale and Dolphin Group, 2020
- Pollinator-friendly management of: Transport Corridors, National Biodiversity Data Series No. 19, 2019
- Pollinator-friendly management of Wind Farms, National Biodiversity Data Series No. 25, 2021
- Ecology Guidelines for Electricity Transmission Projects A Standard Approach to Ecological Impact Assessment of High Voltage Transmission Projects, EIRGRID, 2021
- Biodiversity Net Gain Good practice principles for development, CIEEM, 2016
- Biodiversity net gain. Good practice principles for development, A practical Guide, CIEEM, 2019
- Biodiversity net gain. Good practice principles for development, Case Studies, CIEEM, 2019
- Reviewing the evidence on mitigation strategies for bats in buildings: informing best-practice for policy makers and practitioners, CIEEM, 2018
- TII guidance documents providing a step by step approach to minimising impacts on badgers, bats, watercourse crossings and wetland archaeology prior to and during the construction phase of national road schemes: https://www.tii.ie/technical-services/environment/construction/
- Transport Infrastructure Ireland's Environmental Strategy
- A Guide to Landscape Treatments for National Road Schemes in Ireland, GE-ENV-01102, TII, February 2006
- National Biodiversity Data Centre records and publications, https://www.biodiversityireland.ie/resources/publications/
- Guidance Note 1 for the reduction of obtrusive light,Institute of Lighting Professionals, 2021
- All-Ireland Pollinator Plan 2021-2025, National Biodiversity Data Centre, 2021, additional resources also available here https://pollinators.ie/resources/
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes, National Roads Authority, Revision 2, June 2009
- Irish Water's Biodiversity Action Plan
- IUCN Global Standard for Nature-based Solutions, First Edition, 2020
- Guidance for using the IUCN Global Standard for Nature-based Solutions, First Edition, 2020
- Gardening for Biodiversity, Juanita Browne
- Connecting Energy, Protecting Nature. A Joint Birdlife Europe and European Environmental Bureau Briefing on Protecting Nature in the Delivery of Energy Infrastructure Projects of Common Interest
- https://crann.ie/projects/crann-hedgerow-project/

- Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities, Department of the Environment, Heritage, and Local Government, 2010
- Fish and Habitats: Science and Management Vol. 2. River Restoration Works – Science based Guidance centred on Hydropmorphological Principles in an Era of Climate Change, Inland Fisheries Ireland, 2020
- Environmental Guidance: Drainage Maintenance & Construction, OPW
- Urban Biodiversity Management in Ireland: Capturing the Experience of Practitioners, 2016
- HS2 London - West Midlands No net loss in biodiversity calculation Methodology and results, Department for Transport (UK), 2015
- Light pollution map
- Best Practice Public Lighting, Dark Sky Ireland
- Dark Sky Ireland Policy
- Planning for Watercourses in the Urban Environment, A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning, Inland Fisheries Ireland

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