WPD INNOVATION
Transforming the electricity network

Wildlife Protection

NIA Project Closedown Report
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September 2019 – March 2022

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1. Executive Summary

The Wildlife Protection project was an Ofgem Network Innovation Allowance (NIA) project carried out between September 2019 and March 2022. This project had three main aims, which were to understand how wildlife interacts with overhead networks and what the impact of these interactions are, design and develop a wildlife protection risk assessment app for use on overhead networks, and develop and test a range of mitigation solutions. The need for this to be carried out comes as network operators face a large number of wildlife interactions every year, and the range seen can lead to unplanned interruptions to customer supplies, damage to electrical plant and equipment and injury or death to wildlife. The project was created under the Energy Network Association's (ENA) Collaborative Energy Portfolio (CEP), and EA Technology won a tender to be the main partner for the delivery of the project.

The project was carried out across six phases. The first carried out research, and included identifying species of animals that interact with the network, and what potential for impact they have. It also identified existing mitigation methods and devices, and outlined what standards and policies are in place in the UK and across other countries. Within the UK, there was found to be no overarching requirement, but instead some geographically specific regulations. This then fed into the later stages of the project.

The project developed a range of solutions for mitigating wildlife interactions, and these were tested in a twelve month trial on sites across our network and the project partner's trial site (EA Technology). Although some defects were seen in the equipment over this time, no interactions were seen at any site, implying that the mitigation has been successful in carrying out its primary role.

Following the project, the measures introduced are beginning to form part of our Business as Usual (BaU) processes. Updates to our replacement and construction methods for overhead lines have been made, and some of the devices now form part of updated policy and standard technique documents, as well as being available from our stores. Furthermore some high risk pole configurations have been modified so they represent a lower risk of interaction have been developed and now implemented. We regard this project therefore as a successful and welcome addition to the list of recent projects making it into the business.

The project successfully met all of its objectives and success criteria, and was completed under its original budget, with savings accruing from equipment donated by device manufacturers, and delays in CEP finance recharge meaning project costs could not be charged to the project. The project required two changes during the course of its delivery, one to timescales, and another to scope additional workshops with manufacturers to disseminate on learning and benefit from the chance to steer industry direction on wildlife protection measures.

2. Project Background

Wildlife interactions with overhead lines (OHL) can result in unplanned interruptions to customer supplies, damage to electrical plant and equipment and has the potential to injure, if not kill wildlife. Whilst the vast majority of wildlife interactions with overhead power lines pass without incident, at a system level, the impact upon customer's security of supply, in terms of the number of incidents and their associated unplanned outage durations can be significant.
For many, wildlife interactions which disrupt power supplies are considered to be unfortunate, undesirable and often inconvenient. However, for those directly involved within the conservation of rare bird species the effects of wildlife contacts with live electrical systems can be much more costly.

This project was initiated by the member organisations of the Energy Networks Association in an attempt to gain a better understanding of the wildlife interactions which affect electrical transmission and distribution systems around Great Britain and Ireland, and to seek to develop cost effective approaches, toolsets and mitigations to reduce the number and associated impact of wildlife contacts with high voltage overhead lines that have a detrimental impact to wildlife and the electrical networks.

This project was carried out in six stages:

- Stage 1 – Research
- Stage 2 – Design and Development of Mitigation Methods
- Stage 3 – Build and Type Testing of Mitigation Methods
- Stage 4 – Design, Develop and Produce a Risk Assessment App
- Stage 5 – Real World Trial of Risk Assessment Software App and Mitigation Measures on 11kV OHL Network
- Stage 6 – Reporting on Outputs

This project was run under the Collaborative Energy Portfolio, and was funded under Ofgem's Network Innovation Allowance funding mechanism. Following a competitive tender process, EA Technology were awarded the contract to carry out this work, and therefore acted as the main project partner throughout.

3. Scope and Objectives

The project has met the objectives set out when the project was registered as demonstrated in Table 3-1 below:

Table 3-1: Status of project objectives

Objective	Status
Understand how wildlife behaves and interacts with overhead lines so as to determine those environments where lines, structures, equipment and configurations are most susceptible to inadvertent wildlife contact.	✓
Design, develop and produce a set of detailed mitigation measures to mitigate the risk of wildlife interaction with Electricity Overhead Networks.	✓
Identify where materials, plant and equipment could be redesigned or modified cost effectively to make them less susceptible to contact flashover.	✓
Develop a Risk Assessment Software App to assist in identifying the current risk and the resultant risk once specified mitigation measures have been put in place.	✓
Provision of guidance documents on carrying out a Risk Assessment, specification and purchase of appropriate mitigation measures.	✓

4. Success Criteria

The project has met all of the Success Criteria set out when the project was registered as demonstrated in Table 4-1 below:

Table 4-1: Status of project success criteria

Success Criteria	Status
Production of a research paper that outlines those lines, structures and configurations most susceptible to wildlife contact and in the environments they are sited.	✓
Production of a suite of suitable UK and Ireland specific mitigation measures and an accompanying report which details material specification, type test requirements, installation methods and maintenance requirements.	✓
Production of a Risk Assessment Software App that could identify the current risk and the resultant risk once specified mitigation measures have been put in place. This includes the production of strategic and functional guidance on how to use the Risk Assessment Software App.	✓
Real-life trial of the Risk Assessment Software App, purchase and application of the UK and Ireland specific mitigation measures on a typical 11kV overhead circuit and recommendations using an example circuit. i.e. For a circuit, use the tool to assess the risk, use the report recommendations to determine appropriate mitigation methods, apply the appropriate mitigation measures and use the tool to quantify the risk once effective mitigation methods have been put in place.	✓
Production of a functional report that will take the learning from all stages to provide both operational and strategic guidance on carrying out a Risk Assessment, specification and purchase of appropriate mitigation measures, methods of application of those mitigation measures and subsequent maintenance requirements.	✓

5. Details of the Work Carried Out

The Wildlife Protection project was carried out in five stages of work followed by overall reporting. The work carried out in each of these stages has been demonstrated in the following sections.

5.1. Background Research

Stage 1 of this project involved carrying out research on wildlife interactions with overhead lines. This included defining which species of wildlife interact with lines in the UK and Ireland, the way in which the interactions are taking place, and the factors that influence the likelihood and severity of interactions. This identified that there is not likely to be a one size fits all solution for providing wildlife protection, and that the focus of mitigation measures can either be placed on either the performance of the network, or the protection of rare birds of prey and conservation.

In its research, the project considered what had been done in this area outside of the UK. Experience in Spain, Portugal, the USA and Canada is more wide ranging and detailed than with in the UK, principally due to the fact that legislation which mandates the protection of wildlife specifically relating to overhead lines has been established for a number of years.

As the term wildlife is very wide-ranging, the project first sought to determine which types of wildlife which were known to have interacted with their high voltage overhead lines in recent years. This was carried out in consultation with the ENA member DNOs involved in the project, and led to the following list of species:

Table 5-1: Species Considered

Wildlife Grouping	Species Identified
Small Birds	Sparrow / Starling, Woodpecker
Medium Birds	Corvids / Magpies / Crows, Ducks
Large Birds	Heron / Stalk, Swans / Geese
Medium Birds of Prey	Kestrels, Owls
Large Raptors	Eagles, Buzzards, Kites
Vermin	Mouse / Rat, Squirrels
Suidae	Boar
Large Livestock	Cattle / Cows / Bulls, Horses

On a daily basis there will be thousands of interactions between animals and overhead lines. Thankfully the vast majority of interactions, pass without incident or harm and there will be no record or evidence of the event having taken place. However, unfortunately a number of wildlife interactions do result in injury, fatality, unplanned interruptions to customer's supplies, and damage to plant and equipment. It was found that wildlife interactions with overhead lines can broadly be categorised into 2 main interaction groups: those involving direct contact with live electrical components, and those that do not. Typically these include the following interactions:

- Non-electrical interactions:
  - Scratching/Pole Rubbing
  - Nibbling & Undermining of wood poles
  - Woodpeckers
  - Nesting
- Electrical interactions:
  - Collision
  - Breaching
  - Perching, Bridging and Shorting

Figure 1 Electrical Interaction: Starlings on an 11kV section pole

Figure 1 Non-electrical Interaction: A cow rubbing up against a wood pole overhead line

The research aspect of this project also looked into current legislation in place to ensure that the construction, operation and maintenance of high voltage power distribution systems does not adversely affect the local environment or its biodiversity. This found that both UK and European high level legislation exists, but Wildlife Protection is generally formed of statutory designations, which can be applied to specific sites, locations, species or their habitats. Within the UK, the main examples found were as follows:

- The Wildlife & Countryside Act 1981
- The Conservation (Natural Habitats) Regulations 1994
- The Conservation of Habitats and Species Regulations 2010
- The Countryside and Rights of Way Act 2000
- The Natural Environment and Rural Communities Act 2006
- The Town and Country Planning (Trees) Regulations 1999
- The Hedgerows Regulations 1997

In order to proceed with the remainder of the project, the project team split out the wildlife species to be considered into four groups based on their interaction effect. These groups were defined based on the effect of interaction on wildlife population and conservation, and the effect of interaction resulting in network reliability issues. This can be seen represented on the figure below:

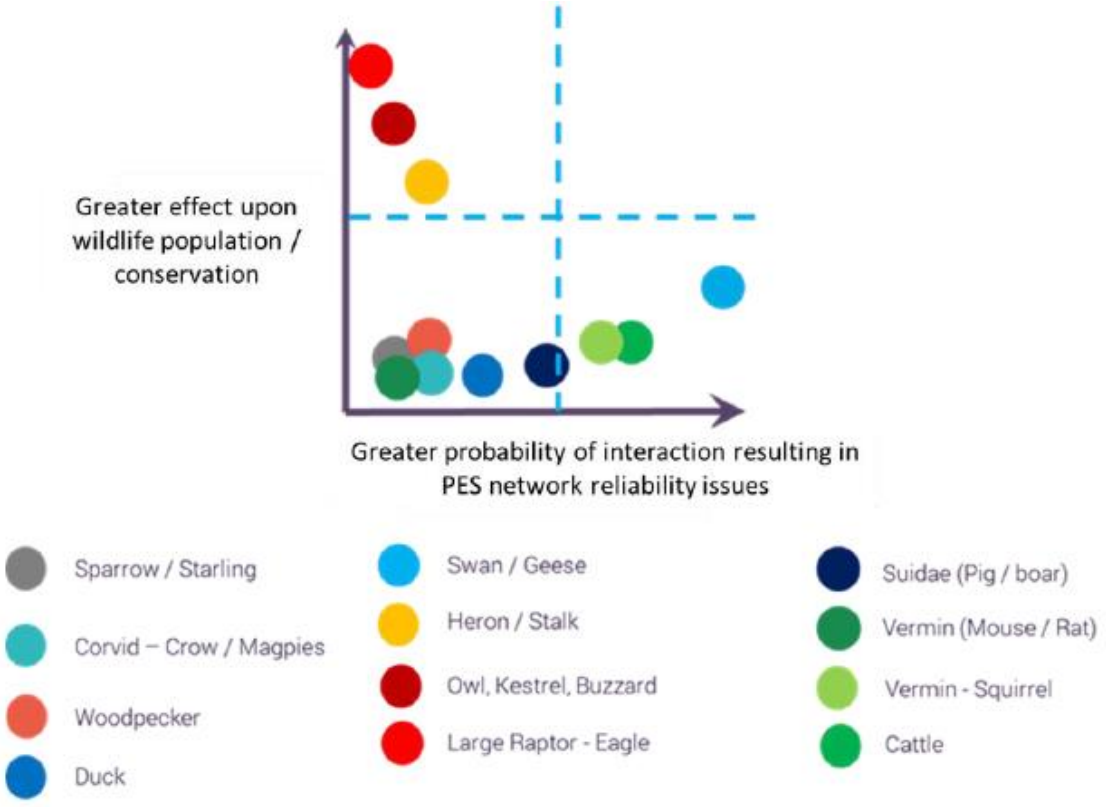

Figure 2 Scatter plot showing the effects of wildlife interaction with overhead lines in terms of effect on wildlife population and effect on reliability of Public Energy Supply (PES)

Further information on the wildlife species, legislation, and collision impacts can be found within the wildlife protection stage 1 report (www.westernpower.co.uk/projects/wildlife-protection)

5.2. Design and Development of Mitigation Measures

Stage 2 of this project involved identifying and designing solutions for the mitigation of wildlife interactions. This built upon work carried out in stage 1, so involved identifying solutions for the species previously set out within section 5.1. It was found that a number of existing products were available to support this, due to the societal need for these measures to exist. Examples of these can be seen in the following subsections:

Mitigations against pole rubbing/scratching

Cattle, horses and other livestock are known to use overhead line structures as convenient scratching posts. Whilst this method of interaction tends not to present an issue when considering steel towers or large lattice structures, this type of interaction can exert a sufficiently large mechanical influence upon wood pole overhead lines so as to cause conductor clashing. This can cause electrical short circuiting, wood pole wear, and conductor damage which can result in an increased likelihood of unplanned outages to customer supplies in the future.

The primary considerations which formed the basis of the proposed mitigation activities/investment options were centred on segregation and animal preference. A number of methods of mitigating pole rubbing/scratching were considered, including: modification of fence lines, installation of sacrificial fences, pole guards, and proving scratching alternatives.

Figure 3 an example of livestock guards to protect tree saplings

Figure 4 an example of livestock/cattle brushes

Mitigations against bird flight collision

Flight collisions with overhead lines are most prolific in birds with high wing aspect ratios such as swans, geese and herons. In-flight contacts with overhead lines can result in injuries that can range from minor cuts and abrasions to full head-on high-speed impacts with potentially more serious injuries and concussion. Birds which have made contact with overhead line conductors may then suffer further injury from impacting the ground following a fall from height immediately following collision.

The key considerations which bring the most benefit to mitigations with this type of overhead line interaction are those of obstacle avoidance and line visibility. The first options considered in this areas included undergrounding the lines to avoid obstacles all together, and ensuring suitable placement and routing is sensible.

Improving visibility of overhead conductors was another key consideration for selecting mitigation methods. A number of similar bird flight diverters are available to achieve this.

Figure 6 an example of a static bird flight diverter

Figure 5 an example of a swan flight diverter

Further devices were considered and detailed within the Wildlife Protection stage 2 report, including those to mitigate against vermin interaction and electrocution. This can be found on the project webpage (www.westernpower.co.uk/projects/wildlife-protection)

Whilst compiling the list of mitigation measures, the team looked to disregard any that were not suited for use on distribution networks. These solutions were not included for a variety of reasons, including training of raptors to

recognise overhead lines, which was deemed to likely be unsuccessful due to the likelihood of a bird following its natural instinct rather than training. Another example of this was Bird Scarers, which rely on audible alarms to deter wildlife. It was deemed that the maintenance required for these is impractical, with the need to check operation and replace batteries being significantly greater than traditional bird diverters.

The project recognises that network operators would not be able to adopt a protect at all costs stance on wildlife protection, so in the assessment of mitigation methods adopted an 'ALARP' (As Low As Reasonably Practicable) philosophy. This took into account the time, trouble and financial implications surrounding the introduction and adoption of new materials, plant, equipment, work processes and practices. This led to development of the Wildlife Mitigation Evaluation Assessment (WMEA) methodology, with a focus on the following key areas:

- Mitigation Effectiveness
- Mitigation Cost
- Network Implementation Friendliness
- Robustness of Mitigation
- Type Testing
- Mitigation Maintenance Requirement
- Mitigation Effect on Network Service Life
- Mitigation Effect on Network Reliability
- Impact on the Public

This assessment approach identified a ranking of mitigation methods, and it was found that the most effective but not always most cost effective solutions included undergrounding of overhead lines, increasing fence lines to avoid scoring, alternative construction methods, and introducing sacrificial barriers.

Full details of this methodology, and the devices defined can be found within the wildlife protections stage 2 report (www.westernpower.co.uk/projects/wildlife-protection)

5.3. Product Specification

Following the solution identification and design work described above, the project team moved on to creating a product specification document. The aim of this was to provide a comprehensive basis for future development of a national wildlife protection product specification, and to provide some additional information that is intended to assist potential product manufacturers and suppliers understand the nature of both the electrical systems to which devices are connected and to appreciate the range of environmental conditions within which wildlife protection products would be expected both to be applied and to operate. A further aim was to ensure that any network operator would be able to use this document when approving mitigation methods for use on their system.

To ensure this document is fit for all mitigation measures that form part of the project, it is split into four main subsections. This includes general requirements that apply to all devices and their materials, and is followed by more specific requirements and testing procedures.

General product specification requirements

The general requirements section of the specification document outlines the needs of products in the following areas:

- Legal compliance
- Design suitability for the range of overhead line designs in the UK
- Application
- Longevity
- Operating temperate range
- Wind speed withstand capability
- Altitude range
- Additional stress on overhead lines
- Maintenance requirements
- Solar radiation requirements
- Pollution resistance
- Fixings and means of attachment

- Earthing connection

Requirements for animal preference orientated protection products/devices

To support the requirements above, further details have been provided for the following anti-collision devices:

- Aerial warning devices
- Bird flight diverter
- Active devices (e.g. audible)
- Wildlife decoys and deterrents

Figure 6 Example wildlife decoy

Requirements for anti-electrocution type products/devices

To support the requirements above, further details have been provided for the following anti-electrocution devices:

- Covers, shrouds and tubing
- Access barriers
- Guano shields

Figure 7 Example bushing cover

Additional requirements for animal preference orientated protection products/devices

To support the requirements above, further details have been provided for the following animal preference orientated protection devices:

- Cattle brushes and livestock oilers
- Nesting platforms

Figure 8 Example nesting platform

The full product specification document, including information on type testing, can be found on the wildlife protection project webpage (www.westernpower.co.uk/projects/wildlife-protection).

5.4. Design, Develop and Produce a Risk Assessment App

Stage 4 of the project involved the design and development of a risk assessment software app. The purpose of this app was to demonstrate the impact on risk from wildlife when applying appropriate risk measures. The app itself was developed within excel with 42 mitigation measures set out. In carrying out the assessment, decision trees are used for each construction type, and for varying scenarios, an example of this can be seen below for a H Pole below.

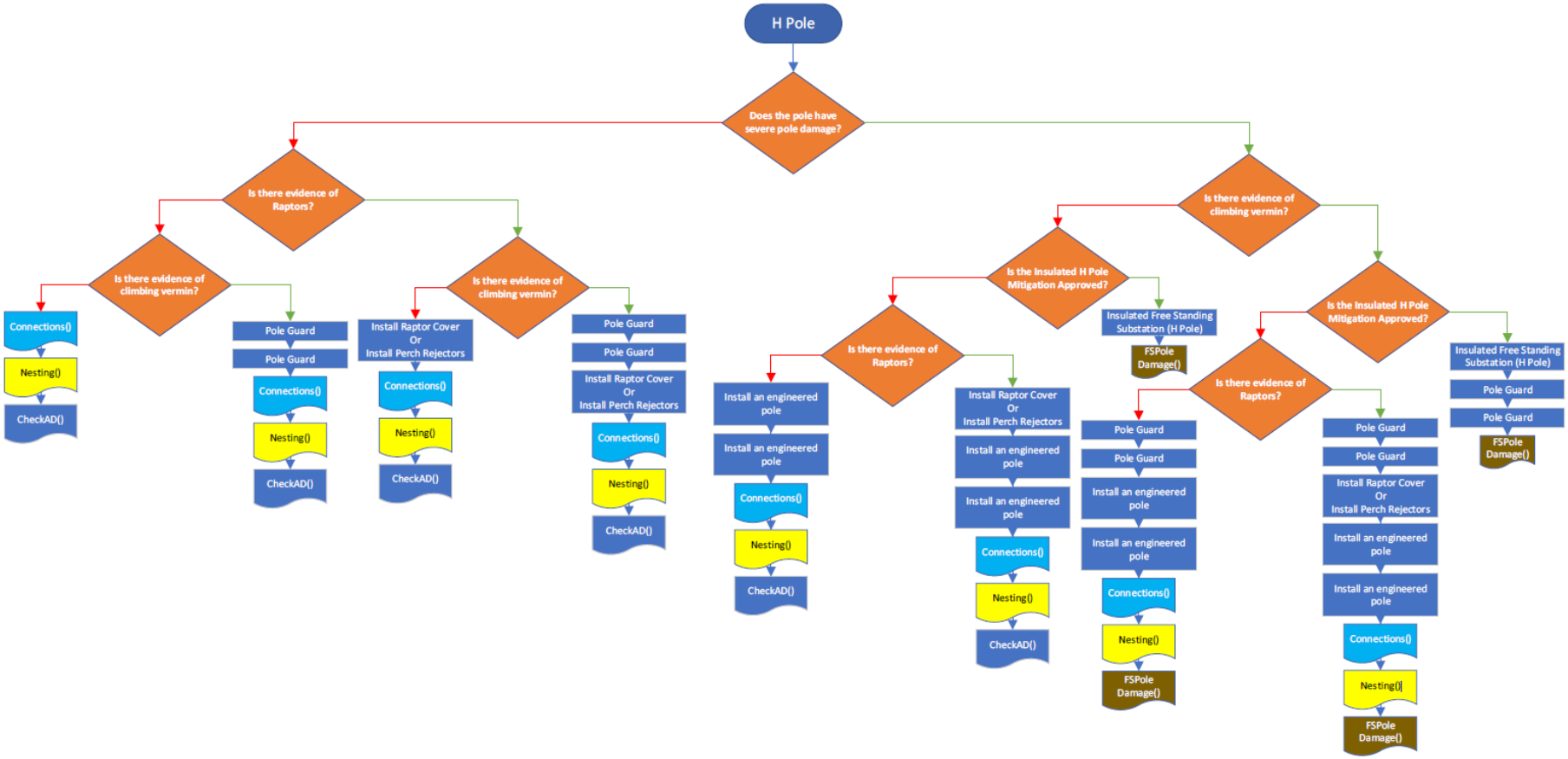

Figure 9 H Pole Decision Tree

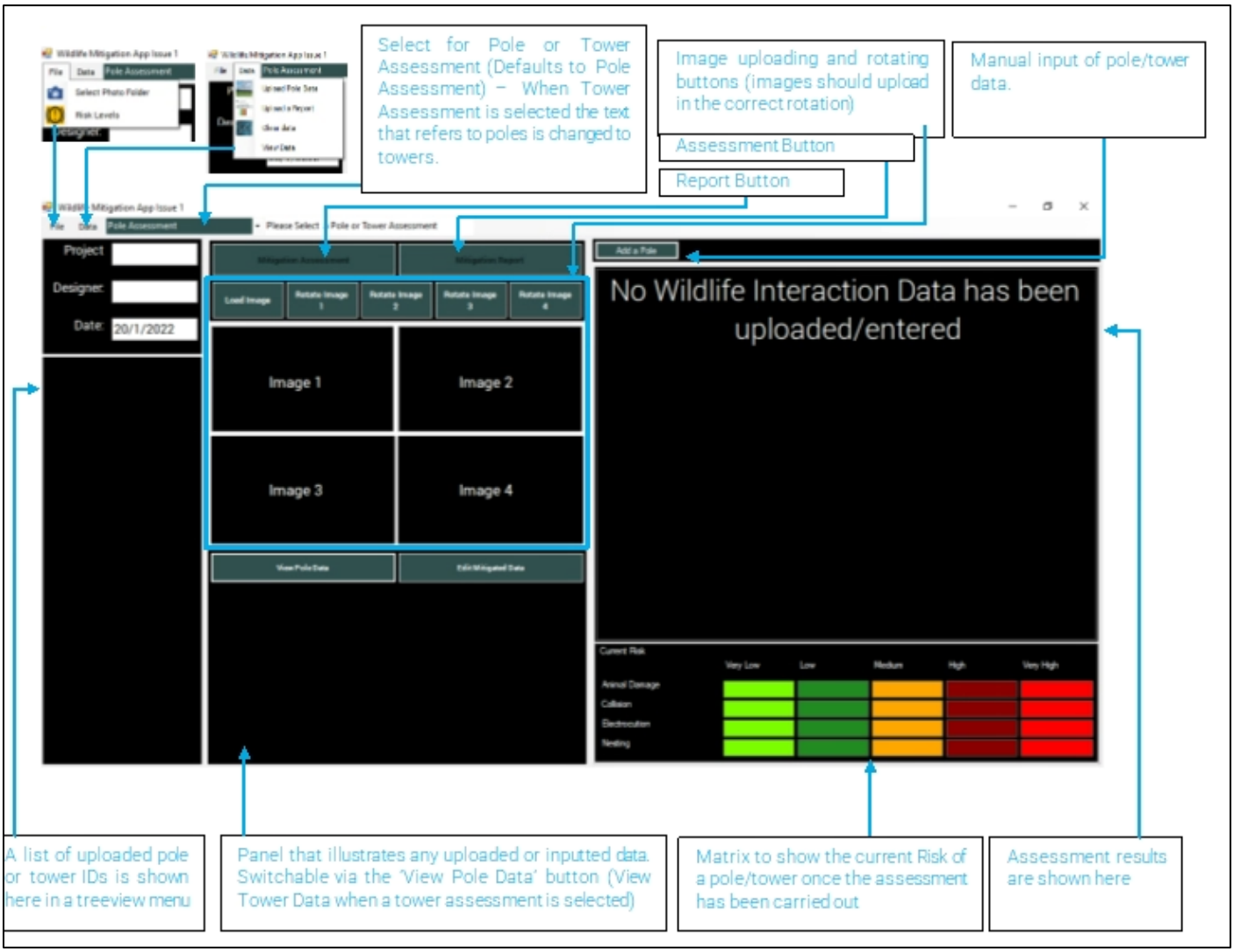

Figure 10 Risk Assessment App Start-up Page

The outputs from this are provided within a spreadsheet document, known as the wildlife report. This is split into two sections, one for pole assessments and another for tower assessments.

The app developed is available for use following the project, and interested parties should make contact to request the user guide and latest build version by contacting wpdinnovation@westernpower.co.uk

5.5. Build and Real World Trial

The final stages of this project included a 12 month real world trial of mitigation methods on our 11kV network. The aim of this was to trial solutions identified earlier within the project, and allow time for wildlife interactions which demonstrate effectiveness of the installations and longevity of the equipment.

Fifteen sites were used in the trial in areas known to have suffered the results of recent wildlife interaction. This allowed for the following interaction devices to be trialled:

Table 5-2: Trial Locations

Trial Site Reference No.	Location	Trial Site Type
1	EA Technology Mini-Line	Mixed products
2	Stainsby House, Derby	Products to Protect Against Electrocution
3	Lockington Hall, Derby	Products to Protect Against Electrocution
4	Ivybridge, Plymouth	Products to Protect Against Electrocution
5	Stoke Fleming, Plymouth	Products to Protect Against Avian Electrocution
6	Ash Hill, Exeter	Products to Protect Against Avian Electrocution
7	Coleshill, Birmingham	Products to Protect Against Avian Collision
8	Teacaddy Farm, Northampton	Products to Protect Against Avian Collision
9	Darfoulds, Worksop	Products to Protect Against Avian Collision
10	Forrest of Dean (33kv & 11kV)	Products to Protect Against Boar Scratching
11	Shottle Gate Farm, Matlock (11kv & LV)	Products to Protect Against Boar Scratching
12	Barnstaple	Products to Protect Against Cattle Rub
13	Carnfield Hall - South Normanton, Derbyshire	Products to Protect Against Electrocution
14	Noahs Arc Zoo, Wraxhall	Products to Protect Against Avian Electrocution
15	WPD Training Schools [Taunton & Tipton]	Product Assessment Site

Each site was established during October and November 2020, and was then monitored by local overhead teams for the duration of the trial. Monitoring was carried out both on-site and off-site to track the following factors:

- On-site monitoring
    - Regular site inspection
    - Detailed line patrols
    - The completion of applied product observation sheets corresponding to each product/device under test
- Off-site monitoring
    - Electrical system performance tracking
    - Monitoring of customer complaints

Across the sites it has been possible to collect findings of the devices, and this has demonstrated a number of defects that have occurred. These have included UV bleaching, mould formation, debris accumulation and surface contamination

Figure 13 Image of Pole Boar Guard Installations in the Forrest of Dean

Figure 14 Carnfield Hall Poleguard installation

Figure 15 Photograph of the completed trial installation

Figure 11 Drone installation of the Crocfast Bird Flight Diverters

Overall, the projects trials were deemed a success. Following the 12 months deployment, there were no reports of wildlife fatality, injury, or any loss of supply to customers. Learning has been documented in detail within the projects stage 5 & 6 report, and this can be used to support all network operators roll out of wildlife protection measures.

6. Performance Compared to Original Aims, Objectives and Success Criteria

6.1. Objectives

The Project has satisfied the original aims and objectives as detailed in Table 6-1:

Table 6-1: Performance compared to project objectives

Objective	Status	Performance
Understand how wildlife behaves and interacts with overhead lines so as to determine those environments where lines, structures, equipment and configurations are most susceptible to inadvertent wildlife contact.	✓	The first stage of the project involved carrying out research to understand how wildlife behaves and interacts with overhead lines. The outcome of this with a report documenting all of the findings.
Design, develop and produce a set of detailed mitigation measures to mitigate the risk of wildlife interaction with Electricity Overhead Networks.	✓	The second stage of this project designed developed and produced a set of mitigation methods which were used within the later trial stage of the project.
Identify where materials, plant and equipment could be redesigned or modified cost effectively to make them less susceptible to contact flashover.	✓	The third stage of the project involved writing a technical specification document, outline what future equipment and designs need to look like.
Develop a Risk Assessment Software App to assist in identifying the current risk and the resultant risk once specified mitigation measures have been put in place.	✓	The fourth stage of the project carried out the development of a risk assessment software app, which was circulated with the CEP group members and tested.
Provision of guidance documents on carrying out a Risk Assessment, specification and purchase of appropriate mitigation measures.	✓	The technical specification document produced during stage three provides guidance on the purchase of mitigation measures, and the app user guide produced during stage 4 documents the risk assessment process.

6.2. Success Criteria

The Project has satisfied its success criteria as detailed in Table 6.2:

Table 6-2: Status of project success criteria

Success Criteria	Status	Performance
Production of a research paper that outlines those lines, structures and configurations most susceptible to	✓	A paper detailing the research carried out on lines, structures and configurations most susceptible to

wildlife contact and in the environments they are sited.		wildlife contact was produced as the outputs of the projects first stage.
Production of a suite of suitable UK and Ireland specific mitigation measures and an accompanying report which details material specification, type test requirements, installation methods and maintenance requirements.	✓	The second stage of this project designed developed and produced a set of mitigation methods which were used within the later trial stage of the project, and would be suited to networks across the UK and Ireland. .
Production of a Risk Assessment Software App that could identify the current risk and the resultant risk once specified mitigation measures have been put in place. This includes the production of strategic and functional guidance on how to use the Risk Assessment Software App.	✓	A Risk Assessment Software App and guidance document was created during the projects fourth stage.
Real-life trial of the Risk Assessment Software App, purchase and application of the UK and Ireland specific mitigation measures on a typical 11kV overhead circuit and recommendations using an example circuit. i.e. For a circuit, use the tool to assess the risk, use the report recommendations to determine appropriate mitigation methods, apply the appropriate mitigation measures and use the tool to quantify the risk once effective mitigation methods have been put in place.	✓	A real life trial was carried out during stage five of the project. This involved application of devices across 15 sites. The Risk Assessment app was also tested by WPD policy, as well as being circulated with the wider CEP group.
Production of a functional report that will take the learning from all stages to provide both operational and strategic guidance on carrying out a Risk Assessment, specification and purchase of appropriate mitigation measures, methods of application of those mitigation measures and subsequent maintenance requirements.	✓	The technical specification document produced during stage three provides guidance on the purchase of mitigation measures, and the app user guide produced during stage 4 documents the risk assessment process.

7. Required Modifications to the Planned Approach during the Course of the Project

There were no changes to the outputs and method during the course of the project.

A change was required in order to accommodate the additional time that document review cycles take between multiple Distribution Network Operators (DNOs). Consequently, the project delivery sequence was rescheduled. This culminated in a six month extension to the project. A change requested was submitted and approved for this in line with WPDs change management approach governance.

Additional work was also scoped during the course of this project to carry out an in person workshop between ENA members and wildlife mitigation device manufacturers. This was able to ensure the projects findings and recommendations could be disseminated well to manufacturers, and was made possible due to the donation of trial equipment from manufactures. Further details on this can be found within section 8.

8. Project Costs

Final costs to WPD for the project can be found within Table 8-1 below:

Table 8-1: Project Spend

Activity	Budget	Actual	Variance
WPD Project Management	£29,423	£28,683	-2.52%
EATL Project Delivery	£75,261	£28,788	-61.75%
Trial and Equipment Costs	£25,112	£7,620	-69.66%
Contingency	£10,761	£7,920	-26.40%
Total	£140,557	£73,011	-48.06%

The variance shown is due to the following:

- Due to the nature of this being a CEP project, and the need for costs to be split between licences, EATL Project Delivery costs were first invoiced to the ENA, prior to being recharged to all DNOs. This was not fully carried out during the projects timescales.
- Trial and Equipment costs have been reduced due to equipment being donated to the project by manufacturers, and WPD local teams carrying out installs without cost to the project where items are set to stay in place and become BAU items. Costs in this area have been reallocated to allow for workshops with manufacturers to take place, in line with discussions from within the ENA CEP and Project Specific groups.
- Contingency spend has been used for regular reporting between EATL and WPD to ensure project progress is tracked effectively.

9. Lessons Learnt for Future Projects

The key points of learning from the project have been summarised in table 9-1 below. Some points are recommendations at this stage and will be progressed with the ENA Members over the coming months. This is with the aim of policy and training changes.

Table 9-1: Project Learning

Area	Learning Detail	Outcomes and Recommendations
Throughout	The accuracy of wildlife / overhead line interaction reporting is not considered to be particularly accurate, as events are not always fully investigated, and it is not always possible to identify a direct root cause of events.	ENA member organisations should consider the development and introduction of a more granular information collection system/process which will enable network operators to carry out effective wildlife species identification before proposing wildlife mitigation measures
WP1	The effects of wildlife interactions with overhead power lines can have a marked effect upon the populations of some wildlife species	ENA member organisations should consider wildlife awareness training to raise the profile of conservation
WP1	Network operators already have a large range of options available to them when seeking to improve network performance/system reliability. Many of these solutions can be used to reduce rates of wildlife interaction and improve the outcomes of wildlife interaction	ENA member organisations should develop a tool kit of wildlife protection measures for use within their respective regions. This has already been carried out by WPD and was discussed at the final project meeting with other DNOs.
WP1	ENA member organisations do not have established methods or techniques by which they evaluate the effectiveness or value of wildlife interaction mitigation investments	ENA are considering the inclusion of wildlife conservation in key policies, procedures and business cases relating to overhead powerlines, this is scheduled to take place in 2023.
WP1	Overhead lines which are supported by pin insulators in a flat horizontal formation present a particularly high risk to large birds and raptors. Structures such as loop poles or transformer poles which support carry-over jumpers are considered to be the most dangerous	ENA member organisations should consider the adequacy of existing overhead line specifications in relation to wildlife protection. Specific consideration should be given to loop poles, and the potential adoption of Canadian style cross-arms. WPD has already redesigned some of its poles and introduced these as BAU so as to reduce the overall risk of interaction
WP1	The conclusions drawn from research studies are deemed to be credible	The findings and conclusions of previous research were included within the subsequent phases of this project. Specifically the 2014 ENW report when considering the development of a wildlife app
WP1, 5, & 6	Wildlife interactions with HV overhead lines would be considered to be a suitably emotive subject which, if not carefully managed, is likely to generate a high volume of unwanted social media attention, bad publicity and reputational damage directed towards ENA member companies.	ENA member companies are directed to recognise and acknowledge the potential threat posed by social media specifically in relation to wildlife interaction with electrical power systems. ENA member companies are advised to carefully consider the risks associated with inaction and adopt a more proactive approach to wildlife protection.

WP2	Many of the current processes and procedures used by ENA member organisations did not consider wildlife protection as one of the main priorities when engaging in activities involving overhead lines	A review of the current processes and procedures which surround overhead lines within WPD was carried out to ensure that the subject of wildlife protection is a key feature
WP2	There does not appear to be an electricity supply industry standard for wildlife protection devices, wildlife protection mitigation schemes, or their application to either electrical transmission or distribution systems in Great Britain	Electricity industry standards which cover the entire spectrum of wildlife protection products and mitigation schemes should be developed for use with Great Britain. These standards should be accompanied by detailed guidance notes which pertain to the application of wildlife protection(s)
WP2	There does not appear to be an electricity industry standard for the design of freestanding transformer poles or cable connected H-poles/Loop poles which takes wildlife interaction into consideration.	Industry standards for the design of freestanding transformer poles or cable connected H-poles/Loop poles which take wildlife interaction into consideration should be developed as a matter of urgency. The adoption and subsequent use of these improved standards will reduce an unacceptably high risk to wildlife and reduce rates of mortality WPD has already redesigned its general arrangement drawings for free standing transformer poles and introduced a requirement that all new poles are built to the new drawing.
WP2	The Wildlife Mitigation Evaluation Assessment tool developed as part of this project should provide an appropriate starting point to enable ENA project member organisations to undertake more detailed organisationally specific analysis.	A number of outputs derived from within the Wildlife Mitigation Evaluation Assessment tool were includes in the Wildlife Risk Assessment Application associated with stage 4 of this project.
WP2	Clear conflicts between the mitigation approaches for different species exist – for example wildfowl and birds of prey	This demonstrated that mitigations must be carefully selected in areas where different species are present.
WP2	Mitigations identified should be included within any wildlife mitigation decision support tool or ‘app’ which may be developed in future project works.	ENA project members advised the EA Technology project team which wildlife mitigations were to be included within the real world field trials.
WP3	There wasn’t a UK standard for wildlife protection products designed or intended for use within the utility or high voltage electrical distribution sector	The information contained within the wildlife protection specification requirements document was included to develop a general ENA standard for wildlife protection products
WP3	There is an extremely wide range of wildlife products, applications, and materials available, and it has not been possible to identify appropriate product quality or type tests for every product type variant. This makes the task of determining a definitive specification requirement impossible.	ENA member companies engaged with willing product designers, manufacturers and suppliers to improve and develop the products and materials from which wildlife protection products are made
WP3	The area of wildlife product type testing required further development.	ENA member companies are considering the need for and feasibility of developing standards for wildlife protection scheme effectiveness
WP5&6	ENA member companies have traditionally been guided by the manufacturers and suppliers of	ENA member organisations are encouraged to directly challenge the claims made by the

	wildlife protection products and devices, whose claims historically have often been unsubstantiated	manufacturers and suppliers of wildlife protection products. This should include, but is not limited to, specific design features, forecast product longevity, effectiveness and application recommendation.
WP5&6	Wildlife interaction considerations did not feature within the majority of ENA member company's standard overhead construction specifications, and are therefore unlikely to form part of the primary decision making criteria when making investment decisions	ENA member companies will include the subject of wildlife protection in regular meeting agendas of national overhead line working groups, standards committees and other appropriate meetings/forums to raise the subjects' profile, share successes, consider international designs, and transfer best practices

10. The Outcomes of the Project

Stage one of the Wildlife Protection project successfully carried out research on the types of wildlife that interact with overhead networks, the impact their interactions have, before moving on to demonstrating existing measures that are available and the standards in place to support these. This confirmed that there are currently no standards in place within the UK that support protection against wildlife interactions, but there is a clear need for schemes to be in place. Following this, the project went on to design and test measures for mitigation wildlife interactions on the network, including electrical and non-electrical interactions, and those from the ground as well as in the air. This led to the following main conclusions and recommendations:

- This project has been able to identify a range of cost-effective wildlife mitigations which can reduce both the likelihood and potential effects of wildlife interaction with HV overhead lines.
- The range of wildlife interaction mitigations identified contain both long standing engineering solutions and more modern ecologically based approaches.
- The project found that wildlife protection schemes should be clear about which species they are targeting, and the specifics of their interaction modes.
- The project has been able to develop a risk assessment app, which can support the selection and justification for implementing wildlife protection schemes.
- The approach to wildlife protection schemes needs to become proactive for it to be successful, implemented at construction or asset replacement stages, and would benefit from being supported by a specific national standard document.
- A national standard document would remove the need for networks to be guided by manufactures and suppliers of wildlife protection products and devices, whose claims historically have often been unsubstantiated.

Overall the project can be deemed a success, with significant parts being transferred into our BAU processes both during and following the project. Please see Section 13 for details.

Full learning and outputs from the project have been disseminated via the WPD innovation webpage reporting, allowing other DNOs to benefit from the learning generated without the need for duplication of any work.
www.westernpower.co.uk/projects/wildlife-protection

11. Data Access Details

Data from the project is help within the projects reports, which are held on the projects webpage:
www.westernpower.co.uk/projects/wildlife-protection

12. Foreground IPR

The project has been carried out under the standard NIA Intellectual Property Rights (IPR) conditions, therefore all outputs can be shared.

Reporting was carried out during the course of the project. These reports can be found on the projects webpage: www.westernpower.co.uk/projects/wildlife-protection

The Risk Assessment App and its user guide, which has been discussed within section 5, is available upon request to wpdinnovation@westernpower.co.uk

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13. Planned Implementation

The outcomes of Wildlife Protection have already begun being rolled out into Business as Usual. The successful trial of the mitigation methods, has provided the learning needed on which devices can be rolled out, how they can be installed and how they will act during their life on the network. For this reason, some of the items deemed most appropriate during the trials are now available within our stores system for use on the network, updates have been made to Overhead Line policies and Standard Techniques to support their use, and other internal communications have been made.

Other changes have already begun to be made to the way we build, replace and refurbish our overhead structures following learning from the project. This includes:

- Only installing electrical jumper connection to connecting items of electrical plant using covered conductor to significantly reduce the likelihood of wildlife electrocution.
- Review of overhead construction design to make it more wildlife friendly including extending the height of the pole, and leaving extended pole top spaces unfurnished, which would allow birds such as raptors who use the structures upper portion as a vantage point, to land on the pole top without fear of bridging electrical clearances and being electrocuted.

Following the projects closure, it is planned that the work carried out will be used to develop a national standard for wildlife protection measures. This will ensure that all network operators have a standard which can be used to purchase wildlife protection devices, and will ensure that manufactures have clear guidance in the design and build of relevant products.

14. Contact

Further details on this project can be made available from the following points of contact:

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Glossary

Abbreviation	Term
Ofgem	Office of Gas and Electricity Markets
NIA	Network Innovation Allowance
ENA	Energy Networks Association
CEP	Collaborative Energy Portfolio
BAU	Business as Usual
OHL	Overhead Line
RA	Risk Assessment
PES	Public Energy Supply
WMEA	Wildlife Mitigation Evaluation Assessment
DNO	Distribution Network Operator
WPD	Western Power Distribution
HV	High Voltage
ALARP	As Low as Reasonably Practicable

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