



**TRANSPORT
SCOTLAND**
CÒMHDHAIL ALBA

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BIODIVERSITY REPORTING DUTY

2018 - 2020



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Executive Summary

This **Biodiversity Duty Reporting** document is the third such report prepared by Transport Scotland since the requirement was first stipulated under the terms of the **Wildlife and Natural Environment (Scotland) Act 2011 (WANE)**. The document covers a three year period from January 2018 until December 2020 and encapsulates the processes employed by Transport Scotland, the national transport agency, and its partners at Network Rail in support of the Scottish Government's commitment to the protection and enhancement of our nation's rich biodiversity.

The document provides a flavour of the range of works Transport Scotland is involved with, primarily through the road and rail delivery divisions, and a selection of the outcomes achieved for the benefit of the nation's ecological resource. The report acknowledges the important national and global context regarding the decline of biological diversity and its inextricable connection to climate change. It then discusses how regard for biodiversity is embedded into the processes guiding the management of Scotland's strategic transport networks as well as forming a key element in the various stages through which new national transport infrastructure is developed and delivered in Scotland.

The report also looks at how the Agency has adopted processes to help mitigate the very significant global changes affecting our planet and the impact these are having on our fragile ecosystems. The agency is leading in a number of initiatives aimed at reducing these impacts whilst working in partnership with other organisations at home and abroad to ensure the protection of biological diversity remains a key focus for the future.

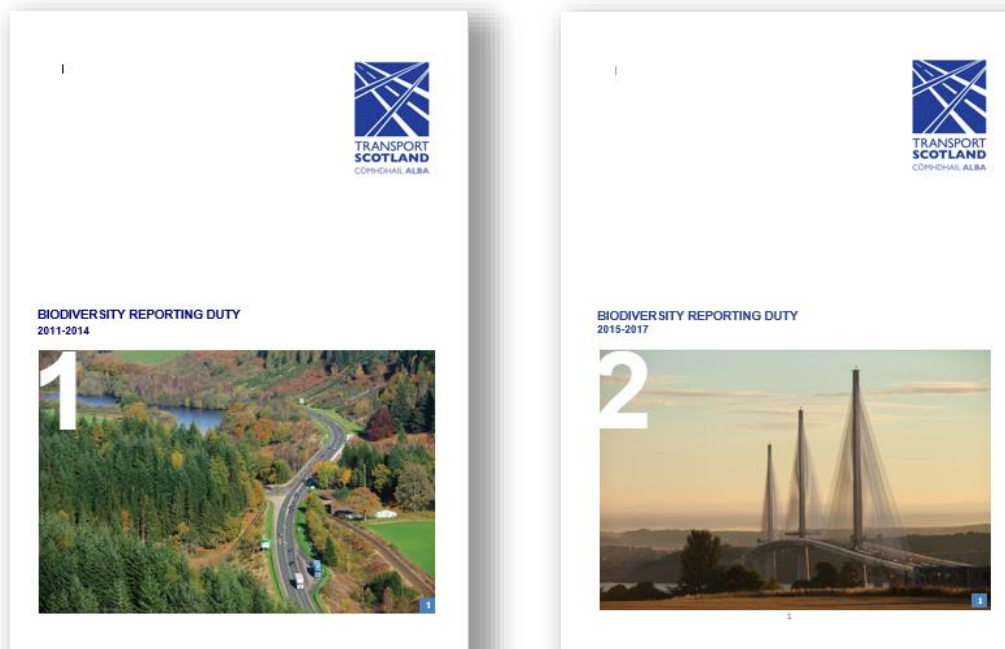


Figure 1 – The previous two biodiversity duty reports for 2012 - 2014 and 2015 - 2017

Introduction

Context

The term 'Biodiversity' refers to the variety and variability of life around us and includes every species of plant and animal on the planet - the genetic material that makes them what they are, and the communities that they form ([Scotland's biodiversity, 2020](#)). These communities, habitats and natural systems cover every part of the world, with the component parts reflecting the local conditions. Sometimes this leads to the formation of unique ecosystems found in very specific situations whilst, conversely, some habitats and the communities they support are replicated in many different parts of the globe.

It is undeniably the case, however, that all ecosystems are interconnected in some way, and even the most remote habitats can be affected by changes occurring elsewhere on the planet. This has happened repeatedly for over a million years through fluctuating changes in the level of atmospheric gases, the amount of precipitation and the global temperature. In the past, these climate changes have occurred over long periods of time and this has allowed species to adapt and change through processes of natural evolution.

Due to the impacts and ever-growing population levels of the most successful species on Earth – humans – these climatic changes are now occurring at an alarming pace ([Convention on Biological Diversity](#)). Natural levels of gases such as methane, carbon dioxide and ozone (greenhouse gases) are being greatly increased by emissions from human activities leading to rising global temperatures. This is having a critical impact on climatic conditions, driving rapid changes in the habitats and ecosystems that species all around the world rely on for survival.

Ecosystem Services

Understanding the level of human impact on the environment was the purpose of the [Millennium Ecosystem Assessment](#) commissioned by the United Nations in 2000. The resulting report, published in 2005, introduced the concept of Ecosystem Services - the many and varied benefits to humans provided by the natural environment and from healthy ecosystems. It provided clear evidence that, over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history. Whilst this has resulted in improvements in human well-being and economic development, it has been at the cost of a substantial and, in some cases, irreversible loss in the diversity of life on Earth.

“The environment acts, through function, upon the organism and conversely the organism acts, through function, upon the environment. “

Sir Patrick Geddes 1854-1932

The growing threat to Biodiversity and the Ecosystem Services it provides has been widely recognised by governments across the world and there has been much attention on the need to deliver collective remedial action to address the decline. In Scotland, the government brought in the [Nature Conservation \(Scotland\) Act 2004](#), requiring all public bodies to further the conservation of biodiversity so far as it is consistent with the delivery of their responsibilities.

This requirement was further supplemented by the [Wildlife and Natural Environment \(Scotland\) Act 2011](#) (commonly referred to as the WANE Act) which requires public bodies in Scotland to provide publicly available reports on the actions which they have taken to meet this biodiversity duty. The reporting cycle is on a three year basis and the following document represents the third such report for the period between January 2018 and December 2020.

The Climate Emergency

In April 2019, Scotland's First Minister formally recognised a global climate emergency, making Scotland the first country in the world to formally declare such a position and ensuring that the nation has the remit to respond to the growing threats this brings. Since then, a new [Climate Change Act](#) has been adopted by the Scottish Parliament in 2019, setting a net-zero emissions target for all greenhouse gases by 2045, and new incremental targets for 2030 (to 70% reduction) and 2040 (to 90% reduction).

These are bold and challenging targets and it is hoped that Scotland's lead will encourage other nations, both domestic and foreign, to match this commitment. At the time of writing it is understood the UK government is on the verge of announcing similar greenhouse gas reductions. The [UK Climate Change Committee \(CCC\)](#) has stated that realising net-zero emissions targets across the country as a whole will require an integrated, multi-sectorial approach including behavioural or societal changes. The Scottish Government recognises this need and the response has been to engage in broad consultation to ensure national understanding of the challenges and the opportunities.



“The transition to a net-zero society is an investment in our present and our future. It will require collective action across our Public Sector Bodies, along with meaningful and open conversations between our communities, businesses and public sector organisations. The transition brings both opportunities and challenges and I believe that constructive dialogue, underpinned by meaningful action, should be central to our approach.”

[The Global Climate Emergency - Scotland's Response](#)

Roseanna Cunningham

MSP - Cabinet Secretary for Environment, Climate Change and Land Reform

Biodiversity Decline

In 2019 a group of 50 conservation organisations joined together to produce a detailed report to assess the condition of wildlife in the UK. [The State of Nature report](#) used a wide range of terrestrial, freshwater and marine species (almost 8,500) as indicators of change across the country. There are some positive headlines with some species, particular bird indicator species, showing successful recoveries in population numbers following previous decline. However, it is clear from the findings that the general trend is negative with a 13% decline in species since the 1970s – a figure that has worsened by 6% in just the last 10 years (this figure rises to 12% in Scotland).

The conclusion is that the UK's wildlife is changing rapidly, in terms of abundance, proportion and locality. This decline has been largely driven by habitat loss as a result of land management changes, however other significant factors include rising pollution levels, hydrological change, the increase in invasive non-native species and, crucially, climate change.

The impact of these factors as direct drivers of rapid change in biodiversity was further highlighted in 2019 by the Global Assessment Report on Biodiversity and Ecosystem Services prepared by [The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services \(IPBES\)](#). However, arguably the most persuasive and certainly the most widely accessible account of the ever increasing decline in global biodiversity and the related impact of climate change came this year in the televised witness statement delivered by Sir David Attenborough, [A Life on Our Planet](#). The statement paints an alarming picture of the loss of a massive proportion of our wilderness within the space of one lifetime. It is a sobering assessment of the impact mankind has had on the finite natural world that we live in and which we need to sustain us. Sir David suggests a number of direct changes that we need to adopt now to help restore the natural balance, however, the most important factor he states is the urgent need to restore Earth's biodiversity that has been lost over the last few decades.

The link between the Climate Emergency and Biodiversity has been recognised by the Scottish Government in the [Environment Strategy for Scotland: vision and outcomes](#). The February 2020 publication identifies the need for a joined-up response to achieve the strategy's six outcomes, including securing positive effects for biodiversity by ensuring:

- Scotland's nature is protected and restored with flourishing biodiversity and clean and healthy air, water, seas and soils.
- We play our full role in tackling the global climate emergency and limiting temperature rise to 1.5°C. A healthy natural environment is key to achieving net zero, with nature-rich areas rich in carbon, and nature-based solutions helping to lock in carbon and provide resilience against the impacts of climate change.

The government has established an Environment, Natural Resources and Agriculture research programme to support study into new areas and respond to the challenges presented by the global climate and nature crises.

The programme has a budget of nearly £50 million per year and recent plans include the establishment of a Scottish Centre of Expertise in Biodiversity, helping to provide key information within the public sector for combating biodiversity loss

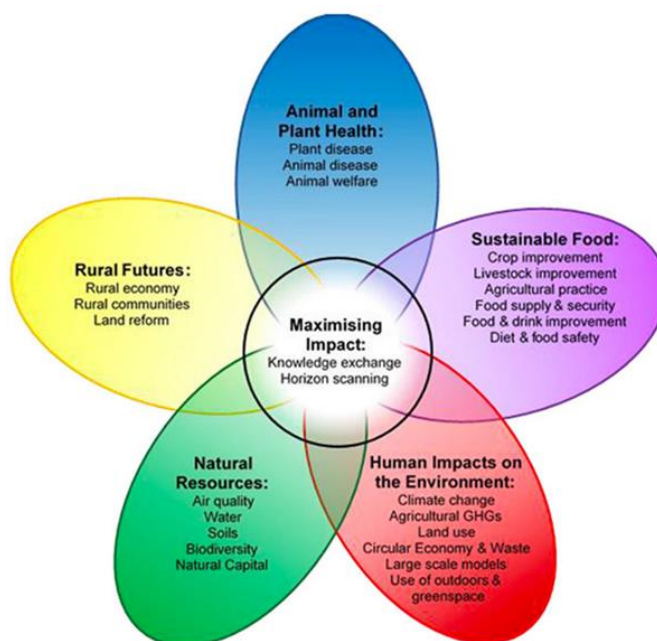


Figure 2 - Environment, Natural Resources and Agriculture research programme – Research themes and topics – Scottish Government

This, then, is the challenge we face and the context surrounding the legislative requirements laid down by the Nature Conservation (Scotland) Act and the WANE Act. The protection and enhancement of Scotland’s biodiversity is now recognised as a critical element in the race to build a more sustainable future, before it is too late and the choices are no longer in our hands.

About Transport Scotland

Transport Scotland is the national transport agency for Scotland. The agency is responsible for delivering a safe, efficient, cost-effective and sustainable transport system for the benefit of the people of Scotland. Our work is underpinned by a corporate plan that reflects the National Transport Strategy 2020 (NTS) which was published on 5 February 2020.

National Transport Strategy



Figure 3 - National Transport Strategy 2
 – cover graphic.

The second National Transport Strategy NTS2 is for the whole transport system (people and freight) and it considers why we travel and how those trips are made, by including walking, wheelchair use, cycling, and motorised transport - travelling by bus, train, ferry, car, lorry and aeroplane. It is a strategy for all users: those travelling to, from and within Scotland. The Strategy does not identify or present specific projects, schemes, initiatives or interventions, but sets out the strategic framework within which future decisions on investment will be made.

Specific interventions in support of the National Transport Strategy are determined through the Strategic Transport Projects Review. STPR-2 is the second Scotland-wide review of the strategic transport network across all transport modes. When published next year the Review will provide the framework of transport options, projects and interventions for the next twenty years. STPR-2 looks at how best to reduce the need for travel by unsustainable modes, how to better maintain and safely operate existing assets, and how to make best use of existing capacity before considering whether any new, targeted infrastructure needs to be built. Each potential option is reviewed robustly through the [Scottish Transport Appraisal Guidance \(STAG\)](#) which takes into account the Regional Transport Strategies, the [National Planning Framework:4](#) a number of equality and strategic environmental assessments and the sustainable investment hierarchy set out in NTS2.

In the last five years, reductions in greenhouse gases from the power sector have enabled Scotland to reduce its overall emissions. However, this has led to the proportionate share of Scotland’s emissions from transport increasing substantially. Transport is currently Scotland’s largest sectoral emitter, responsible for 37% of Scotland’s total greenhouse gases in 2017. A key challenge is to reduce these impacts to help deliver the net-zero target and this is one of the central themes of the new National Transport Strategy (2).

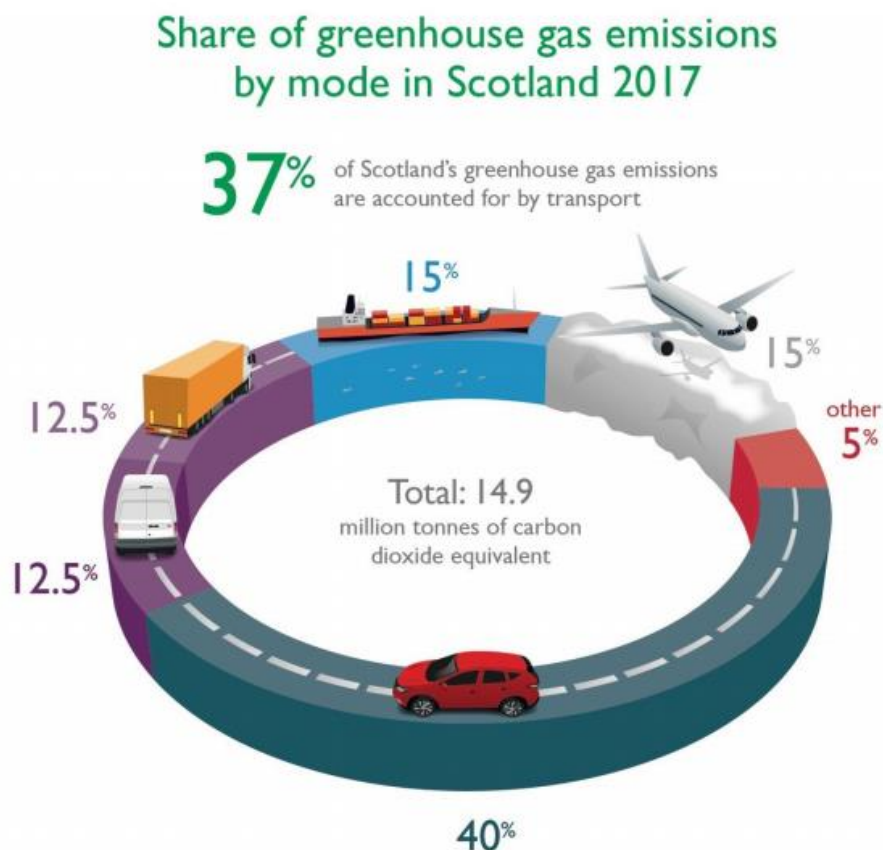


Figure 4 - Share of greenhouse gas emissions by mode in Scotland, 2017 as determined by the National Atmospheric Emissions Inventory 1990 – 2017.

The National Transport Strategy (NTS2):

“This Strategy advocates a Vision for Scotland's transport system that will help create great places – a sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland for communities, businesses and visitors.”




Michael Matheson MSP
The Cabinet Secretary for Transport,
Infrastructure and Connectivity

The NTS2 Vision is supported by **four** priorities:

- **reduces inequalities**
- **takes climate action**
- **helps deliver inclusive economic growth**
- **improves our health and wellbeing**

Each of these priorities represent the ingredients required for a sustainable transport network and none more so than the commitment to take responsible action to tackle climate change. The inextricable link with Biodiversity loss, outlined above, means that there is even more emphasis on the need to mitigate and adapt to the impacts Climate Change.



Takes climate action

- Will help deliver our net-zero target
- Will adapt to the effects of climate change
- Will promote greener, cleaner choices

Figure 5 - The four priorities of the NTS2 Vision, focusing on the components of the Climate priority.

The three main components of the Climate action priority all assist in providing an environment where biodiversity can flourish. Our transport system:

- **Will help deliver our net-zero target:** the **Climate Change Act** passed by the Scottish Parliament includes an increased ambition to reduce greenhouse gas emissions to 75% of 1990 levels by 2030, 90% by 2040 (i.e. the period covered by this Strategy) and net-zero emissions by 2045. Transport is currently the largest contributor to Scottish emissions and this will be tackled through a range of actions including an ambition to phase out the need for new petrol and diesel cars and vans by 2032, changing people's travel behaviour and managing demand.

- **Will adapt to the effects of climate change:** in Scotland we are already experiencing the impacts of climate change and we will adapt our transport system to remain resilient and reduce the harmful effects on future generations.
- **Will enable greener, cleaner choices:** over the next 20 years, Scotland will see a continued transformation in transport where sustainable travel options are people's first choice if they need to travel. We will design our transport system so that walking, cycling and public and shared transport take precedence ahead of private car use.

Corporate Delivery Plan

The Transport Scotland Corporate Plan 2017–20 included the following main aim:

An accessible Scotland with safe, integrated and reliable transport that supports economic growth, provides opportunities for all and is easy to use; a transport system that meets everyone's needs, respects our environment and contributes to health; services recognised internationally for quality, technology and innovation, and for effective and well-maintained networks; a culture where transport providers and planners respond to the changing needs of businesses, communities and users, and where one ticket will get you anywhere.



Figure 6 - Corporate Plan 2017 - 2020 - front cover

Environmental Sustainability is a crucial and integral aspect of Transport Scotland's activities, and over this Corporate Plan period there has been a significant emphasis on air quality and climate change.

Protecting Scotland's physical and natural environment is a key element of the Transport Scotland ethos and this is recognised in corporate commitment **no. 12**:

Demonstrate environmental sustainability through the delivery of environmental protection, community benefit and climate change mitigation/ adaptation across our operations, projects and maintenance activities. Projects and interventions will:

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- deliver community benefits
- manage air, noise and carbon emissions
- prepare for and adapt to climate change
- protect historic environments and support biodiversity

As other sections in this report demonstrate, the Agency has delivered good progress over the last three years against the above targets, but there is more work to do. The recently published National Transport Strategy (2) Delivery Plan covers the initial two years of the 20 year Strategy (2020 – 2022). This allows the plan to focus on those corporate actions required in the immediate term to address the impacts of the Coronavirus pandemic, whilst still recognising the commitment made by Scottish Government in declaring a Climate Emergency and the effects this is having on our natural environment.



Figure 7 - Transport Scotland NTS2 Delivery Plan – front cover

The National Transport Strategy 2 Delivery Plan sets out for the first time Scottish Government actions for delivering the Vision and Priorities for the future transport system, as set out in the Strategy. The Plan supports the delivery of a sustainable transport sector that reduces inequalities, takes climate action, delivers inclusive economic growth and improves health and wellbeing.

Biodiversity Duty 2018 - 2020

Climate change, and the related effects on our natural resources, is at the core of Transport Scotland’s actions. Each directorate within the agency considers the impacts of climate change in all operational and policy decision making.



Figure 8 - Scotland's Railway - Biodiversity Duty Report 2018 - 2020 – prepared by Network Rail

The following sections relate primarily to the management of the Trunk Road Network, its maintenance and development. The response relating to Scotland’s rail network is included in a separate, interlinked document prepared by Network Rail entitled: **Scotland's Railway Biodiversity Duty Report 2018 - 2020.**

Climate Change Adaption

Scottish Ministers have a statutory requirement - defined in Section 53 of the Climate Change (Scotland) Act 2009 - to lay an adaptation programme before the Scottish Parliament that sets out the government’s objectives in relation to adaptation to climate change and the timed proposals and policies for meeting those objectives.

The Programme seeks to address the risks identified in the [Climate Change Risk Assessment 2022 - \(UKCCRA\)](#) which is laid before the UK Parliament every 5 years, with the third version to be published in 2021. UKCCRA clearly highlights that without additional action to prepare for the future risks, over and above what is happening today, Scotland faces significantly worsening impacts from climate change over coming decades.

To meet these statutory requirements the Scottish Government has recently published [Climate Ready Scotland: Scottish Climate Change Adaptation Programme 2019-2024 \(SCCAP2\)](#), which is a five-year programme of policies and proposals for Scotland to adapt to climate change. Transport Scotland was a key author of the policies and proposals related to the transport sector.

SCCAP2 takes an outcomes-based approach, derived from both the UN Sustainable Development Goals and Scotland's National Performance Framework and sets the following vision:

We live in a Scotland where our built and natural places, supporting infrastructure, economy, and societies are climate ready, adaptable, and resilient to climate change.

Within the adaptation programme, Transport Scotland has key responsibility for delivering a number of Outcomes, including:

‘Our natural environment is valued, enjoyed, protected and enhanced and has increased resilience to climate change’.



Figure 9 – The Scottish Climate Change Adaptation Programme (2) takes an outcomes-based approach as illustrated in the adjacent diagram from the Scottish Government report.

Low Carbon Economy

Transport Scotland's [Carbon Management Plan: 3rd Edition](#) covers the Agency's operation emissions and Network energy emissions (the latter is associated with the lighting of the Trunk Road Network). This plan sets our corporate carbon emission baseline along with associated targets and projects until the end of 2020, with the overarching goal to reduce emissions within our sphere of influence.

During the course of the financial year 2019/20, Transport Scotland's combined emission have decreased by 23% when compared to the previous year. When compared to the baseline year, Network Energy emissions have been reduced by 70%, surpassing the target by 45%. Operational Emissions reduced by 29%, surpassing the target by 9%. This equates to an overall combined emissions reduction of to a 67% compared to the baseline. Work has begun on developing the 4th Edition which will be published in 2021.

In September 2018, the Scottish Government announced its intention to phase out the need for new petrol and diesel cars by 2032 placing Scotland among the world's leading countries in the shift away from fossil fuels for light vehicles. This commitment has just been matched by the UK government with the recent announcement by the Prime Minister to phase out the sale of new single fuel combustion engine vehicles by 2030.

Scottish Ministers have reinforced their intentions to tackle climate change, improve air quality and ensure Scotland is a net-zero carbon society. Within Transport Scotland, the Low Carbon Economy Directorate has a clear focus in facilitating and contributing to these outcomes, with the following vision and outcomes:

Vision: A transformative shift to sustainable, low carbon mobility

Outcomes:

- Scotland is at the forefront of markets for Ultra Low Emission Vehicles
- Scotland is a global destination for innovation and investment in sustainable, low carbon mobility
- People and places benefit fairly from the shift to sustainable, low carbon mobility



Figure 10 – the Transport Scotland Corporate Plan supports the move to ultra-low emission vehicles

Transport Scotland freight policy officials have also promoted freight modal shift through Scottish Government support such as the Freight Facilities Grant, Ports Mode Shift Grant, Mode Shift Revenue Support and Waterborne Freight Grant. These grants are issued with the aim of achieving more sustainable transport options to reduce climate change and benefit the environment, with rail and sea transport generally considered cleaner than aviation and road-based options.

Air Quality

The ongoing development of **Low Emission Zones (LEZs)** in Scotland has been a key task in recent years. This year, however, the unprecedented impact of the COVID-19 pandemic resulted in necessary changes to priorities across government. In light of the 2020 deadline for LEZ introduction no longer being practicable, a new indicative timeline for LEZ introduction across Scotland four largest cities was announced. LEZs will now be introduced in Glasgow, Edinburgh, Dundee and Aberdeen between February and May 2022, with the introduction of LEZs in Glasgow, Scotland's largest conurbation, now well underway.



Figure 11 - Air quality is a significant issue and requires strong leadership to affect positive change.

The introduction of LEZs, coupled with the regulatory powers to be provided by the **Transport (Scotland) Act 2019** (to be laid before Parliament on the 20 January 2021), is likely to contribute to the agency meeting the carbon reduction targets that are required to tackle Climate Change. This will be through the one of the co-benefits of the encouragement of cleaner vehicles and those which emit no emissions at all.



Figure 12 – Transport is currently Scotland's largest sectoral emitter, responsible for 37% of Scotland's total greenhouse gases in 2017



A good example of partnership working and funding provision in this area is the support the agency has provided to bus operators of all sizes to retrofit their fleets ahead of the introduction of LEZs.

Transport Scotland has provided £9.75 million via Phase 3 of the [Scottish Bus Emissions Abatement Retrofit Fund](#) this year to support 594 buses and coaches to be retrofitted with specialist exhaust technology.

Figure 13 – Bus operators are being encouraged and assisted to improve the emissions from their fleets. Image from the Transport Scotland Corporate Plan.

Flooding

Climate change is causing significant flooding on the trunk road network. The latest modelling predicts even milder, wetter winters, with increased risk of major flooding and the potential for significant disruption of the transport network. This has direct consequences for many social and economic functions, but may also impact habitats and bring considerable hardships for terrestrial wildlife.



Figure 14 – Flooding, due to increased annual rainfall, has a significant impact on terrestrial habitats (Image courtesy of NatureScot).

Transport Scotland has comprehensive arrangements in place to mitigate the risks presented by severe weather and robust plans to deal with any incidents, which occur. Severe weather events in early August 2020 had a significant impact on Scotland's transport network. The rail network closed at Stonehaven during recovery from the recent tragic derailment; and severe rainfall in the Polmont area led to flooding which closed the Union Canal and the Edinburgh - Glasgow via Falkirk railway, both of which are subject to significant repair works.

One of the most prominent impacts on the trunk road network, which is due to the combined effects of excess precipitation and local geomorphic conditions, are the continued problems of landslides within Glen Croe affecting the A83. The agency is working hard, in partnership with others, to mitigate the impact of these frequent events, including preparation for a challenging woodland planting on the steep slopes above the trunk road.

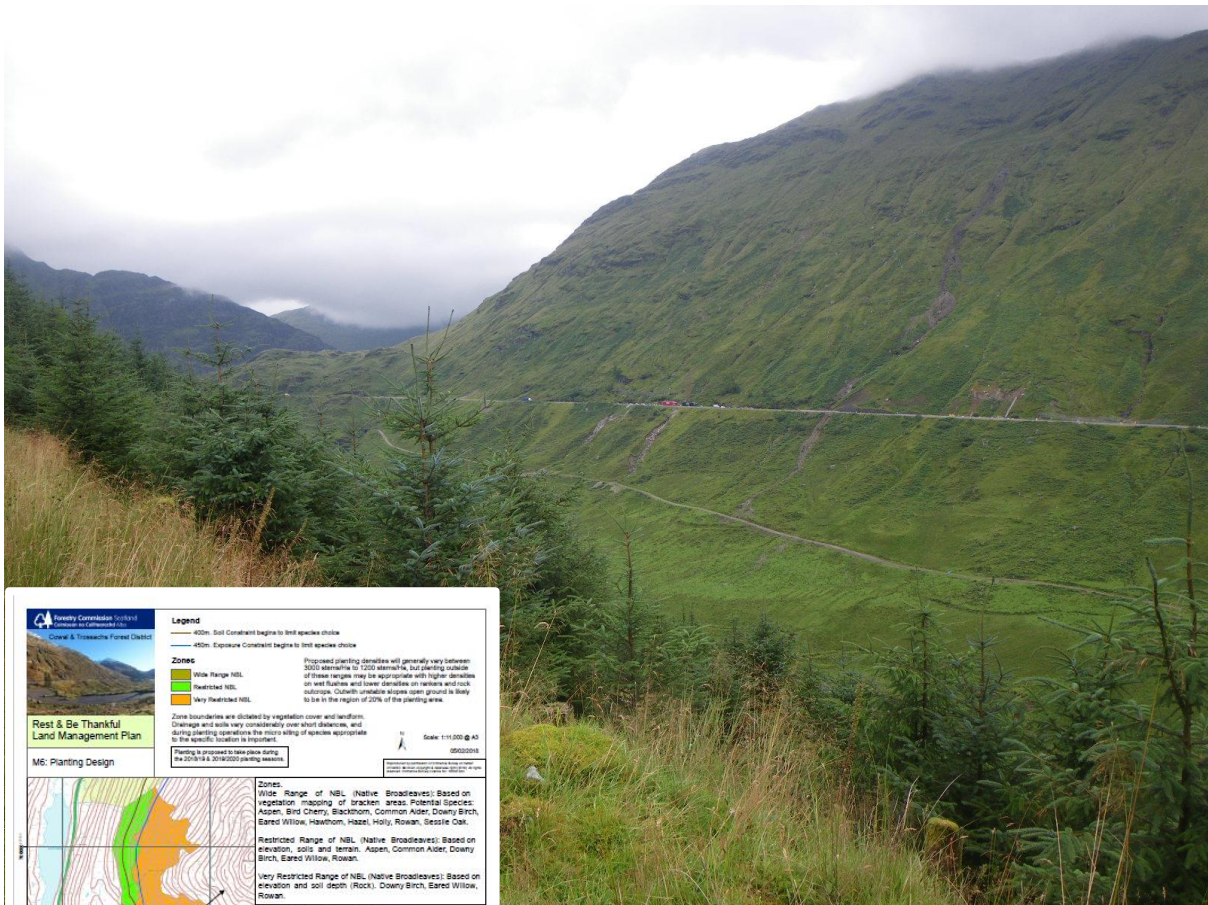


Figure 15 – the steep and mobile slopes of Beinn Luibhean above the A83 trunk road near the Rest and be Thankful

Figure 16 – a planting scheme has been prepared and is due to commence once the required deer fencing is installed in 2021

Mainstreaming and Governance

It is significant that for over 20 years Transport Scotland (or its predecessors) has promoted an approach to delivering its road-related development objectives that supports an understanding and reflection of nature.

An initial landscape policy document, suitably labelled '*Cost Effective Landscape: Learning from Nature*' (1998) encouraged designers and managers to take inspiration from the natural processes that shaped the local landscape and the elements within. This approach has been developed and further articulated within the current *Fitting Landscapes* (2014) document which, through its mandatory status and ministerial endorsement, renews and reinforces the agency's commitment to appropriate environmental custodianship.

"Local character is thus no mere accident ... it is attained only in the course of adequate grasp and treatment of the whole environment, and in active sympathy with the essential and characteristic life of the place."

Sir Patrick Geddes 1854-1932

However, even within the life of this relatively recent policy document, the global situation has shifted further and it is now clearly evident that Biodiversity is no side show but a key performance indicator and a critical element in our future social prosperity. To ensure the protection of our natural environmental resources and begin the necessary drive towards reversing the rapid decline of habitats and species requires strong leadership and a collective will across the planet.

In declaring a Climate Emergency, the Scottish Government has demonstrated a commitment to tackle these issues and it is hoped other nations will follow suit. As a government agency, Transport Scotland will play its part by building on the good foundations laid down by early policy and practice, and seeking more sustainable travel choices in tandem with improvements to the development and management of the transport infrastructure required to support this.

Transport Scotland employs a range of in-house professionals to cover all aspects of Environment and Sustainability matters, including Carbon Management, Climate Change, Air Quality, Environmental Impact Assessment, Landscape and Biodiversity etc.

In addition, the Agency also works closely with a number of industry-leading consultants and other professionals from within our supply chain to ensure emerging environmental design concepts and ideas, whether related to new schemes or the management of the existing asset, are transformed into tangible actions that can be delivered and measured across the national transport networks.

The ethos of the transport agency is to work towards biodiversity being embedded into all interventions planned for the national road and rail corridors.



Figure 17 - The Transport Scotland mandatory landscape and biodiversity policy document is called *Fitting Landscapes* and concerns both road and rail transport planning and delivery.

As highlighted in previous Biodiversity Duty Reports, the Agency's approach to the conservation and enhancement of biodiversity is captured within the landscape mandatory policy document *Fitting Landscapes*.

- **Policy vision:** 'to promote the more sustainable design, implementation, maintenance and management of the transport estate and ensure that the landscapes we create and manage are of high quality, well integrated, bio-diverse, adaptable and deliver a meaningful contribution to national sustainability targets'
- **Principles and Commitments:** to 'enhance and protect natural heritage [by delivering] effective mitigation of adverse impacts on species and ecosystems...[along with] the positive enhancement of biodiversity through the creation and management of new habitats and green networks' (Aim no. 2)
- **Project Objectives:** Objectives are required to be set at the beginning of each project development and can relate to any aspect of the intended works and outcomes, including areas of opportunity for biodiversity protection and enhancement, such as supporting native planting and/or incorporating relevant national and local biodiversity targets into schemes.

In combination with baseline habitat and species surveys, the objectives are a useful benchmark against which to measure successful delivery of the scheme and is an important consideration in the Scottish Government policy of securing positive effects for biodiversity in all development.

Recognition of the importance of support for biodiversity across the road transport sector is reflected in the recent update of the [Design Manual for Roads and Bridges \(DMRB\)](#) and the production of a new road standards for Biodiversity (LA 108 and LD 118), providing a framework for assessing, mitigating and reporting the impacts on biodiversity resources. The guidance supports the reporting of the scale and nature of potential biodiversity changes related to a new scheme or intervention on the road network through ecosystem services assessment, natural capital assessment or biodiversity metric evaluation. This represents a more robust framework for biodiversity enhancement across all schemes and further supports a policy position for Biodiversity Net Gain in future works, whether associated with new development or the management and maintenance of the trunk road network.

Network Rail's Biodiversity Action Plan, which is currently in consultation, will ensure Network Rail can deliver its intended target of No Net Loss of Biodiversity across the estate by 2024, and achieve the commitment to Biodiversity Net Gain by 2040. This, in turn, will help the 3,000 miles of track corridor in Scotland (20,000 m total in the UK) in the vitally important role of connecting areas of fragmented wildlife habitats across the countryside. When combined with the 2,000 miles of the Scottish trunk road linear estate this represents an extensive network of green infrastructure.

Monitoring

Whether related to new development or ongoing management, monitoring is an important part of accessing whether the processes in place to protect and enhance the natural environment are delivering the intended outcomes.



Figures 18 & 19 – Monitoring outcomes of transport interventions requires a detailed knowledge of the objectives and commitments as well as an onsite inspection of the completed works.

For infrastructure projects promoted and delivered by Transport Scotland there is a legal obligation to adhere to the robust requirements of the [Environmental Impact Assessment \(EIA\) Regulations](#) in order that there is a full and accurate assessment of the likely significant environmental effects arising from a proposed development.

There may already have been a Strategic Environmental Assessment prepared and the project will have been assessed against the criteria set out in the [Scottish Transport Appraisal Guidance \(STAG\)](#). In terms of biodiversity, the aim of the latter is to maintain the biodiversity within the study area (habitats and species), and to improve the status of rare and/or vulnerable species wherever possible.



Figure 20 – the Scottish Transport Appraisal Guidance (STAG) front cover

The resulting Environmental Impact Assessment (EIA) Report (or Environmental Statement, if applicable) identifies the direct and indirect significant effects of the proposed development on a number of factors, including:

- population and human health;
- biodiversity, and in particular species and habitats protected under Directive 92/43/ EEC ([the Habitats Directive](#)) and Directive 2009/147/ EC ([the Birds Directive](#));
- land, soil, water, air and climate;
- material assets, cultural heritage and the landscape.

The Report sets the context for the design development and ensures the mitigation strategy is appropriate to address the residual impacts identified. It also serves as the initial baseline against which to assess the extent to which the emerging detail design delivers the required protection and, where possible, enhancement of local biodiversity.

This baseline is provided further detail as the scheme is developed, usually including the preparation of an Ecological Impact Assessment (EclA) and possibly a Habitats Regulations Assessment (HRA), if there is a potential for impacts on a European site.

All EIAs and EclAs are prepared for Transport Scotland schemes are independently audited to ensure compliance with the regulations.



Figure 21 – Detailed inspections are undertaken onsite by qualified ecologists throughout transport scheme construction to ensure the integrated ecosystems associated with the works are protected, and opportunities to enhance local habitats are delivered effectively.

During construction the contractor is responsible for providing a suitably qualified staff to monitor and oversee the works, including an experienced Ecological Clerk of Works and a Landscape Clerk of Works. Transport Scotland will also provide a corresponding set of inspectors to work with contractor and ensure the design is delivered as specified and any unforeseen issues or opportunities are resolved appropriately, including during the usual five year contract establishment period.

The evaluation of trunk road projects after construction is set out in the [Scottish Trunk Road Infrastructure Project Evaluation \(STRIPE\)](#) process, which uses the baseline information, established at the scheme assessment stages, together with the approved mitigation works to determine whether the agreed biodiversity targets have been met. This process is undertaken one year post completion and again three to five years later to review any actual impacts against those forecast and determine the causes of any variances. This is important as a ‘lessons learnt’ approach for the preparation, delivery and maintenance of future schemes

The existing trunk road network is managed and maintained by Operating Companies working to term commissions of between 5 – 7 years duration. There are four main Operating Company units covering the whole of Scotland with additional specific routes resulting from private finance partnershiping (Design Build Finance and Operate DBFO) being managed separately (e.g. the M74, the M80, the Aberdeen Western Peripheral Route (AWPR) and the M8, M73, M74 schemes).

Transport Scotland has recently re-let two of the main Operating Company contracts (the SE and SW Units) under a new contract (Network Management Contract – NMC). This process, which will be repeated over the next two years for the other units, has facilitated a robust revision and updating of requirements to ensure the management processes meet the latest legislative and policy positions, whilst delivering best practice across the expansive contract remit.

Each Operating Company and DBFO Concession is required to follow the specifics of the contract requirements whilst also taking account of the Transport Scotland mandatory landscape policy, [Fitting Landscapes](#). The actions of these companies is monitored, assessed and audited by an independent company termed the Performance Audit Group (PAG). PAG employ suitable specialists to ensure the contractors deliver all their contract obligations and that all interventions are undertaken in accordance with the contract requirements. This includes all environmental matters, from grass cutting to discrete design projects. This assessment and monitoring is supported by Transport Scotland in-house staff.

Research & Development impacting Biodiversity

It is clear that in order to address the very significant challenges presented by the twin problems of the Climate Emergency and biodiversity decline we require, at the very least, a concerted effort, a joined-up approach and the embracing of new initiatives. We can learn important lessons from other countries, domestic and further afield, and we can share information across governments and operational sectors. However, there is no room for complacency and we must continually strive to assess and challenge the way we do things to ensure more appropriate options are not being missed.

As well as ensuring consideration for biodiversity protection and enhancement is an integral part of the operations undertaken for the management and development of the network, Transport Scotland is also engaged in a range of research and development works, covering all aspects of the agency's remit, including environmental custodianship.

The following examples demonstrate the range of these project.

Natural Capital Assessment for the A9

This piece of work is primarily to explore the potential benefits in adopting a shift in approach from the traditional identification and communication of significant environmental impacts (which are generally adverse) and to a system where scheme benefits, and their associated value, are highlighted.

The work proposes that statutory Environmental Impact Assessment (EIA) processes could be supported by additional methodologies (such as a natural capital approach) to better identify the value of environmental mitigation/compensation and enhancement of schemes.

To arrive at a meaningful set of data that could readily be compared with those data established through conventional means, it was determined that the research project should re-visit the baseline information gathered from an existing, live scheme – the A9 Dualling Programme, Project 4 (Pitlochry to Killiecrankie) – but apply the Natural Capital Assessment process rather than the standard EIA approach.

For the purpose of this assessment quality data was split into six categories: (Cultural Services, Water, Soil, Carbon, Air and Biodiversity).

In order to identify the presence and quantity of Scotland’s broad habitat types across the Land Made Available (LMA) boundary the European Nature Information System (EUNIS), Land Cover Scotland, data was used, with quantities defined as being within the LMA boundary alone, and with a 500 m buffer strip.

Subsequently, the asset quantity data was interrogated to understand which datasets would contribute to better understanding the sub-assets within each broad habitat type. Much of this data was also used to inform the EIA baseline

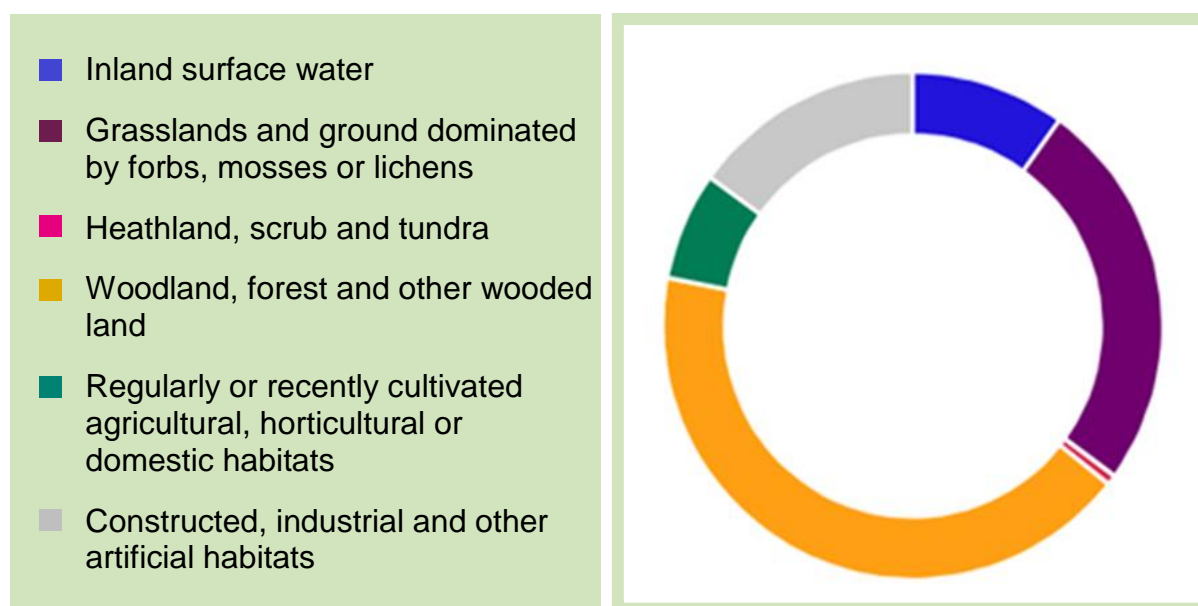


Figure 22 - The diagram illustrates those datasets used for the quantity assessment and how they contribute to the understanding of broad habitat types within the project area.

This is an ongoing piece of work which was only commenced in summer 2020, but already there is great interest in the development of the process, and the benefit this could bring for biodiversity expansion as part of future transport infrastructure planning.

Green Infrastructure for linear infrastructure assets

Transport Scotland is part of the steering group working in partnership with the Construction Industry Research and Information Association (CIRIA) on a guidance document aimed at ensuring a comprehensive understanding of how a linear asset, such as a road, railway or energy infrastructure, may be affected now or in the future by increasingly challenging short and long-term climate scenarios. The intended outcome of the research project is the development of a guidance document that can help to build for infrastructure resilience, and a better understanding of adaptive environmental design needs to be shared between clients, design teams and stakeholders.

Linear assets with associated green infrastructure provide unique opportunities to deliver significant economic, social and environmental value; improving the resilience of existing or new infrastructure and responding to the current climate and ecological emergencies. Strengthened environmental legislation and policy, coupled with evidence of its multiple benefits, means that linear asset owners and operators are required to find opportunities to incorporate green infrastructure into designs and business cases.

While much adaptive design is already good practice for environmental and social responsibility, particularly in the strategic road transport planning arena, it is also embedded in legislation and policy, with the concept of green infrastructure as a core spatial concept and strategic priority at both a national and local level. It is the responsibility of the owner and design team to incorporate green infrastructure elements in linear assets projects. This is already an accepted and mandatory requirement for the Scottish Trunk Road network through the application of the DMRB and the [Fitting Landscapes](#) policy document. However, this piece of work provides the opportunity to reassess the established processes and consider the practical options for designers to enhance, incorporate and introduce green infrastructure to linear assets. All stages of a project are considered: from the strategic planning stage, through design development, implementation and finally maintenance and monitoring, providing a comprehensive model for linear asset design and improvement.

The work is in the final stages and a publication should be completed early in 2021.

Well designed & managed = asset

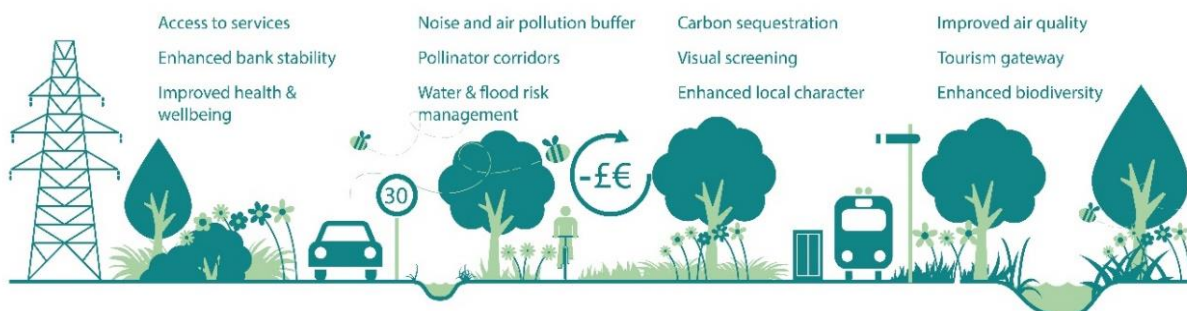


Figure 23 - Illustration of benefits from well maintained and managed GI for the performance and operation of linear assets (*Arup, LINet brochure, 2017*)

Forest Research project - Biosecurity

Transport Scotland is working in association with Forest Research (FR) on a project to review plant biosecurity. FR are considering the potential for biosecurity issues across a number of sectors but wanted to work with the agency in relation to the **Assessment of plant biosecurity risks to Scotland from large scale plantings for landscaping and infra-structure projects.**



The research considers that infrastructure projects related to transport network (as well as large-scale housing schemes) typically include extensive landscape works with related planting programmes. The concern is that the demand for plants can often put production pressure on domestic nurseries creating challenges in obtaining material from local sources which, in turn, can favour low-cost large-scale plant imports from abroad, with associated risks of pest and disease entry.

Figure 24 – the project to review biosecurity measures for planting on large scale infrastructure projects is a joint research project between the Plant Health Centre and Forest Research.

Transport Scotland has long followed a policy of using native plant material of local provenance for all its schemes and, with the assistance of some key players in the supply chain, the agency has been able to help FR with key knowledge gaps in the plant procurement processes for infrastructure projects, including the challenges related to the Government's preferred Design and Build contract procedure.



Figure 25 – Plants grown specifically for a Transport Scotland road project under a Contract Supply mechanism.

By enlisting the support of those responsible for selecting, procuring and planting plants and trees on a large-scale, the agency has been able to provide an understanding of how biosecurity features in decision-making and provide recommendations for changes required to improve future bio-secure practices. The research is due to report back to Scottish Government in 2021.

Ash Dieback Risk Group

Ash dieback, caused by the fungus *Hymenoscyphus fraxineus* (more commonly known 'Chalara'), is the most significant tree health issue affecting the UK since Dutch elm disease. Over the next ten years or so it is likely to lead to the decline and death of the majority of the 11 million mature ash trees in Scotland. This inevitably creating profound tree safety concerns as well as very significant impacts on native biodiversity.

Transport Scotland manages a significant area of land on behalf of Scottish Ministers and is in the forefront of efforts to tackle this devastating pathogen - the brunt of which is likely to be felt across transport networks as well as, utilities, buildings and areas with high public access. The agency is part of the Ash Dieback Risk Group which was formed by Scottish Forestry at the end of 2019.



Figures 26 & 27 – signs of the ash dieback disease affecting younger trees (left) and more mature specimens (right).

Through the Ash Dieback Risk Group, the agency is sharing information and working alongside other public sector organisations to ensure there is a collective, Scotland-wide effort to deal with a significant increase in damage likely to arise from ash dieback over the coming years. The aim is to develop policies on ash dieback for the Scottish Government.

A9 Central Reserve Trials

One of the central themes of the Transport Scotland landscape policy document, [Fitting Landscapes](#), is the to ensure all designs work to improve the opportunities for local habitat improvement and address the significant issues of fragmentation that are often associated with linear infrastructure.

It is also important for new roads to follow the appropriate design standards to ensure the safety road users and those with the responsibility of managing the network.

Although not mutually exclusive, these objectives can be contradictory at times, depending on road geometry and local circumstances. Central reservations can be a case in point, when the environmentalists would like to see vegetated areas to help the road sit in the landscape and reflect the adjacent habitats, whilst the engineering side is concerned about issues of visibility, lane closures for grass cutting and the safety of maintenance operatives.

However, whilst woody shrubs are not supported on anything but the widest of central reserves, not all vegetated verges need consist of tall-growing species – there are potential options for other ground cover mixes.

The purpose of this research project has been to assess options for surface treatment of the central reserves, taking cognisance of the draft A9 Dualling Aesthetic Design Guide, and identify the likely benefits and dis-benefits of each option. In addition to hard surface treatment options the project has looked at the feasibility of providing a number of seeding mixes, including:

- Mix 1- Heath/ Upland mix
- Mix 2- Lowland/ Strath mix
- Mix 3- Sedum mix
- Mix 4- Clover mix

Figure 28 – (below) initial site inspection of the early seed establishment at the southern-most trial site, near Killiecrankie.

The sites were selected to be as close to the conditions within the A9 central reservation as possible, but allowing for the safe access by the research teams.



Three separate trial sites were selected to reflect the changing characteristics of the A9 corridor, along with the varying geology, exposure and elevation. Each trial area, measuring a strip measuring 1 x 24 m in extent, was set out as near as possible to the existing A9 carriageway where the nature of the road and traffic using it would be experienced but without interfering with the operation. The trial strips were subdivided into regular 2m lengths and all four mixes were divided between these.

The trial period was set at three years to give the optimum time to prepare the trial areas, sow the mixes and ensure establishment. Each mix was managed in the same way which included a single autumn cut with any arisings uplifted. Unfortunately, in common with many other ongoing operations, the trial monitoring was affected by the Covid-19 restrictions in the final year and it has been determined to extend the trial into 2021.

So far the results are suggesting Mix 3, the Sedum mix, has performed the best over the three sites, but there are distinct variations to consider and a full set of results is eagerly awaited to see how this may influence the A9 Dualling Programme.

Managing Grassland Road Verges

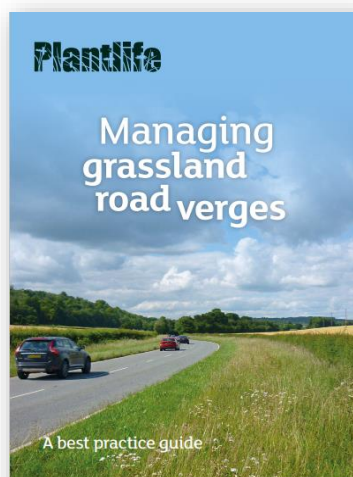


Figure 29 – PlantLife best practice document – cover

Establishing ecological networks to support the recovery of nature is a priority for all UK governments. When managed well, road verges, whether rural or urban and whether on major or minor roads, can sustain an astonishing amount of wildlife: more pollinators are found on well-managed verges than in the neighbouring countryside and nearly 45% of UK total flora is found on verges.

Traditionally, however, road verges have been designed almost entirely for road safety purposes and perceived 'ease' of maintenance. These verges are typically mown 3 – 4 times each year (and sometimes much more) and they seldom offer much in terms of appropriate habitat for wildlife, whether flora or fauna.

This guide has been developed by [PlantLife](#) in association with a steering group representing Highways England, Transport Scotland and the other Devolved Administrations, as well as road developers and nature conservation organisations. It replaces the wildflower handbook previously included in the Design Manual for Roads and Bridge.

The guide advocates a different management approach. One that reduces cutting frequency, reduces vegetation growth and the resulting management burden, improves the natural capital value – in particular the number and diversity of flowering plants – and ordinarily results in sustainable operational costs long term and a reduced carbon footprint. The publication also complements safety considerations and focuses on those areas where there are no safety constraints restricting management.



Figures 30 & 31 – Examples of species-rich grassland verges on the Scottish Trunk Road estate; A77 Haggstone (left) and M90 Inchtute (right).

Engagement, Communications & Partnerships

Engagement and communication with Stakeholders is a major part of the delivery process across the Transport Scotland business. As an agency of Scottish Ministers Transport Scotland is accountable to the Scottish public and it is incumbent on the organisation to ensure all those with an interest in the development and management of the nation's strategic transport infrastructure to have an opportunity to express their views and opinions.

At the same time Transport Scotland holds regular liaison meetings with other agencies and organisations, both public and private, including colleagues from Highways England and the other Devolved Nations. Together, we aim to respond to all environmental matters, whether of a local, regional or national scale, in the swiftest and most appropriate manner. Any mitigation will always have respect for the natural characteristics and local distinctiveness of the environment within which we operate.

We work in close partnership with colleagues in Scottish Government, Historic Environment Scotland, NatureScot, Scottish Environmental Protection Agency, the two National Park authorities, Marine Scotland, Scottish Forestry/Forest and Land Scotland/Forest Research, all 32 Scottish local authorities, and other public bodies and third sector charities. The strong working relations built across these organisations help to ensure the environmental agenda remains a primary focus in all Transport Scotland's work.



Figure 32 – It is important to ensure stakeholders have the opportunity to fully understand the developing proposals.

All new interventions affecting the trunk road network involve considerable engagement and exhibitions with all interested individuals, landowners and representative bodies. Considering the extent and linear aspect of the network, this often equates to a highly significant consultation exercise, involving a substantial resource in terms of staff and time input.

Such consultation extends from the very early project planning stages through the statutory approvals process and into the design development and construction stages. It offers a real opportunity for constructive dialogue and a sharing of views and perspectives.



Figure 33 – Community engagement underway for one of the schemes being developed for the A9 Perth to Inverness Dualling Programme

This engagement can also provide the means by which stakeholders can influence the form of the planned project. A good example of this is the very extensive consultation that the Agency has undertaken over a number of years for the planned A9 Perth to Inverness Dualling Programme and, perhaps most especially, the commitment made to engage with the local community at Dunkeld and Birnam through the Co-Creative Process.

This major engagement exercise brought together the local communities with those professionals employed to bring forward the outline route designs, and facilitated open and inclusive consultation on the potential form, alignment and all other aspects of this complex part of the A9

Biodiversity Highlights & Challenges

New Road Infrastructure

Biodiversity Offsetting on the Aberdeen Western Peripheral Route (AWPR)

The Aberdeen Western Peripheral Route (AWPR) is a 46 km dual carriageway new road that has been constructed almost entirely within a new corridor through a mixed landscape of open fields, farmland, moorland and woods, crossing a number of watercourses on the way, including the Dee and Don rivers. As part of the AWPR's consenting process under the Road Scotland Act 1984 (as amended) an Environmental Impact Assessment (EIA) was undertaken which identified the potential for significant negative residual effects on biodiversity from the project.



Figure 34 – The AWPR passes through a broad landscape of interlinked habitats and it was important that the mitigation strategy looked beyond the road corridor.

This is a familiar process for all Transport Scotland road schemes, with the extent and magnitude of the significant effects varying from scheme to scheme, depending on the project design, location and the characteristics of the receiving environment. However, in this case the nature of the scheme and the potential regional context of some adverse impacts suggested the need for larger-scale mitigation stretching beyond the confines of the scheme footprint.

A Scheme Mitigation Vision Statement was developed which provided a framework for an offset mitigation strategy to fulfil the Scheme's objectives and to augment the mitigation set out in the AWPR Environmental Statement.

The Vision Statement had specific objectives to identify:

- potential additional measures which could further ameliorate direct impacts of the scheme; or
- the opportunities that existed to enhance the environmental value of the wider area to meet the scheme objectives.

The initiative also acknowledged and addressed the wider-area impacts for which a more strategic 'offset' mitigation approach would be particularly effective. A range of potential projects was investigated and evaluated following which eight projects were selected as being most suitable in providing meaningful off-set mitigation. Four of the projects related directly to biodiversity enhancement:

- Water vole (loss of habitat and connectivity)
- Red squirrel (loss of habitat and connectivity)
- Broad, non-species specific habitat loss and fragmentation
- Watercourses (particularly the loss of geomorphological diversity)

AWPR Green Bridges

A further example of the how the environmental impact assessment procedures for the AWPR influenced the scheme development and the need to maintain species connectivity in and around the new road corridor, is in the inclusion of a number of green bridges in the design.

Habitat fragmentation was a key issue in the development of the AWPR and the final route selection. Whilst every attempt was made to avoid fragmentation, it was inevitable that such a long section of linear infrastructure would have a residual impact on surrounding habitats. In order to provide essential mitigation and reduce the effects of severance of habitat for species such as otter, badger, bats, deer and red squirrel, a strategy was developed to create as permeable a road as possible by utilising every opportunity to create multi-functional crossing points.



The approach was to use the habitat assessment results to determine the priority areas for these species and make best use of culverts designed to channel watercourses under the route. In addition to this, a number of green bridges were designed to allow wildlife to cross the road. Such structures have been used fairly extensively in mainland Europe but there are limited examples in the UK. The AWPR scheme has included a large, bespoke wildlife bridge at Kirkhill and two shared green bridges (light traffic use with a wide green verge) also near Kirkhill and at Cleanhill Wood.

Figure 35 & 36 – The AWPR included a number of enlarged underpasses as well as wildlife overpasses – two of these shared with access tracks and one a bespoke crossing for wildlife only, linking to important habitats at Cleanhill.

A monitoring programme is in place using wildlife cameras mounted on nearby trees, and sand traps to capture footprints. This is aimed at determining the frequency with which these structures are being used and the range of species involved.



Figure 37 & 38 – the Cleanhill wildlife bridge soon after the road opening, and images of deer using the structure captured by the onsite wildlife monitoring cameras.

A9 Woodland Connectivity Assessments

The objective of this work was to understand the habitat network connectivity effects of potential woodland losses resulting from the A9 Dualling Programme using the Least Cost Modelling (LCM) GIS toolset developed by NatureScot (formerly SNH).

The analysis was undertaken on a proof of concept basis with a 'semi-natural woodland generalist' species and ancient woodland and broadleaf woodland tested as source habitat for the purposes of the assessment.

The analysis considered species dispersal range scenarios of 500m and 2km, with outputs aimed to inform identification of possible compensatory planting sites to limit connectivity effects within a 10km study buffer zone either side of the A9 between Perth and Inverness.

Key assessment outcomes:

- Validated baseline ancient woodland dataset;
- Habitat connectivity models for the A9 between Perth and Inverness at species dispersal ranges of 500m and 2km;
- Demonstration of good north/south connectivity and limited east/ west connectivity impact given existing road, rail, hydrological and urban barriers;
- Identification of potential compensatory planting areas to inform EIA mitigation proposals; and
- Development of a hierarchy approach to compensatory site selection.

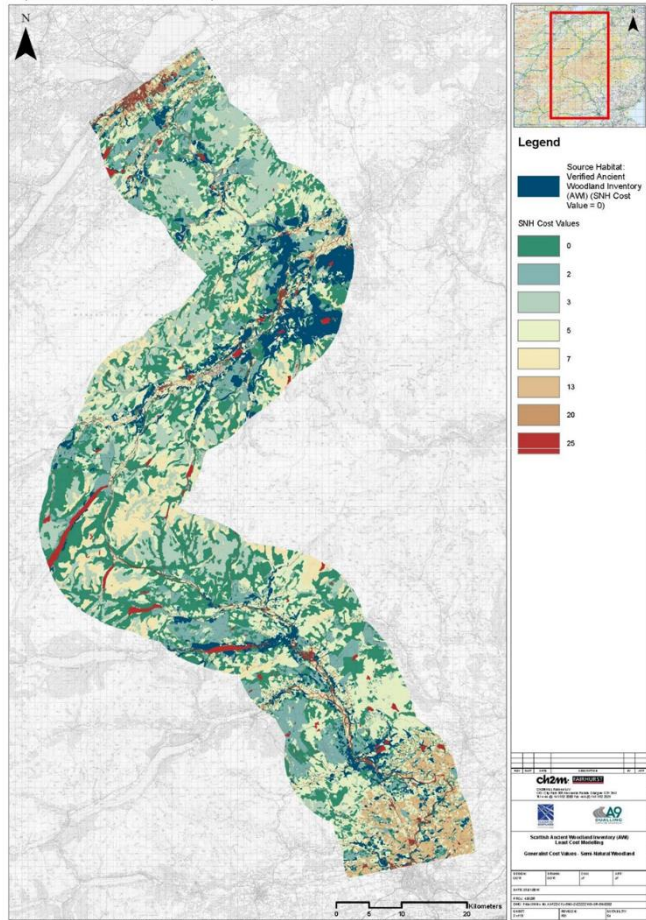


Figure 39 – Baseline land cover mosaic from the Scottish Ancient Woodland Inventory (AWI) and Dispersal Cost Values at a distance of 500 m.

Compensatory woodland planting areas, identified during the subsequent project level EIA processes, have been incorporated into required mitigation proposals and are currently intended to be secured via the required Road Orders and Compulsory Purchase Orders (CPO), as areas required for essential scheme mitigation.

Once secured via CPO, each A9 Dualling project contract will include specific landscape and ecological mitigation measures, including woodland planting and habitat restoration, to comply with the Project level Environmental Statements.

Following construction completion and the landscape maintenance period, the planted woodlands will form part of the wider Transport Scotland trunk road network soft estate, which is managed and maintained with Trunk Road Network Operating Contracts.

Sustainable Drainage System development

The Construction Industry Research and Information Association (CIRIA) has previously published the Sustainable Drainage System (SuDS) Manual (2015) which sets out the four pillars of good SuDS design, namely:



The guidance promotes the early consideration of the criteria in the design process to obtain the best multi-functional outcome. However, research from the Chartered Institution of Water and Environmental Management (CIWEM) and the Wildfowl and Wetlands Trust (WWT) has suggested that SuDS designs often miss opportunities to provide multiple benefits, including local biodiversity enhancements, beyond the basic function of control, treatment and attenuation of surface water.

To combat this, the Environmental Statements for the developing A9 Dualling schemes have included a commitment to the improved environmental design of SuDS structures including the following ecological objectives:

- Maximise multi-functionality.
- Support and protect natural local habitats and species.
- Contribute to habitat connectivity and to the delivery of local biodiversity objectives.
- Create diverse, self-sustaining and resilient eco-systems.
- Mitigate adverse visual impacts on landscape and visual receptors by using natural characteristics in design and sensitive methods to mitigate adverse visual and environmental impacts.
- The form of drainage features should relate to the meanders of water courses.
- Plant with native marginal and emergent aquatic species and native terrestrial vegetation suitable to local context to provide wildlife habitat and visual interest.



Figures 40 & 41 – examples of information drawings developed for the A9 Dualling Programme to be included as commitments in the schemes to be constructed on site. The emphasis is on ensuring all four SuDS objectives are met.

These design principles, along with others relating more particularly to landscape integration will be adopted as part of the detailed design and construction of the proposed schemes.



Figure 42 – an example of an appropriately formed and ecologically-rich SuDS design constructed within the A1 trunk road corridor at Houndwood. East Lothian.

Scottish Wildcat Mitigation

The wildcat is a European Protected Species (EPS) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Although two recent studies (RZSS and NatureScot) have suggested Scottish wildcats are on the brink of extinction in Scotland the A9 Tomatin – Moy scheme project team is working with the NatureScot, the Cairngorms National Park Authority and the Royal Zoological Society of Scotland to incorporate suitable mitigation proposals to support a reintroduction programme in priority areas of captive-bred wildcats.



Figure 43 – a detailed site assessment has been undertaken to determine the most likely locations for wildcat in close proximity to the proposed A9 route alignment, based on viable priority habitat identification.

The main approach has been to identify likely locations where the wildcat may come into close proximity with the new road and to identify suitable design options for the mitigation fencing. A significant amount of work has also been undertaken consulting with colleagues at the Infra Eco Network Europe (IENE) and looking at fencing designs used in Germany leading to a trial being arranged within a wildcat enclosure in a Highland Wildlife Park to test two favourable designs.

The fences were monitored over a four-month period using motion activated cameras and infra-red cameras and food was used to attract wildcats to the fence to test their ability to climb over it. The monitoring found that wildcat were unable to climb either fence, although attempts were made to excavate below the fences.

Based on the researched fencing designs, it is recommended that a 1.8 m high with an 18 cm mesh overhang at a 45 degree angle, with vertical wires (5 mm diameter) with separation of 5 cm) is used for the A9. Work is now underway to determine how these mitigation proposals can best be incorporated into the relevant scheme requirements.

Trunk Road Network Management

A78 Otter protection

Following reports of otter roadkill incidents along the A78 trunk road carriageway between Routenburn and Skelmorlie, within North Ayrshire the Operating Company, Scotland TranServ, undertook an ecological investigation. Initial reports suggested a significant number of this internationally protected species had been found along a small stretch of the A78 over a relatively short period of time. The investigation determined that the incidents coincided with significant rainfall events and high water levels, likely causing inundation to the normal otter commuting routes under the road.

The team used wildlife cameras to gain a better understanding of main routes used by the otters and the factors that might be at play resulting in the deaths. Unfortunately, the cameras were stolen before the full term of the study and therefore the results were less conclusive than they might have been.

However, evidence gathered from site surveys and camera footage demonstrated significant otter activity at Skelmorlie water. As a result, an otter ledge is being designed for the culvert at this location to provide safe passage during high water levels when the velocity of flow acts as a deterrent to otters, potentially providing them with the incentive to cross the road.



Figure 44 – infrared camera footage of an otter reaching the coast after crossing the A78

A76 Glaisnock Water – fish passage improvements

The Glaisnock Water in East Ayrshire supports a variety of fish and other wildlife and is important to local residents. For around 30 years the dual culverts have been impassable to migratory fish and did not provide dry passage for foraging mammals. This had prevented trout, salmon and eels from migrating upstream to utilise the locally favourable habitats.



Figure 45 – retrofitting facilities like the artificial pools and weirs to ‘hard engineered’ culverts can introduce greatly improved habitat and species connectivity where barriers previously existed.

Scotland TranServ Design Team, working with the Ayrshire Rivers Trust, carefully designed a considerate solution to benefit fish, mammals and address the scour concerns threatening the structure. Pools were introduced at the mouth of the culvert to assist fish in climbing up from the existing river bed to the culvert floor. In-stream ledges were placed upstream to direct the flow of water to one culvert when flow is low.

This provided the sufficient depth to enable fish to swim upstream. Upstanding “baffle” structures were introduced at intervals along the 50 m length of the culvert helping to dissipate the power of the water to ease the swim upstream.

By directing the water to one culvert, the second culvert remains dry during most of the year. This provides dry passage to mammals and is favoured by species such as badger and otter.

M8 Fossorial Water Voles

Water voles are one of Scotland's most threatened native mammals and a nationally significant population (adapted to grassland habitat) has established a strong population on the verges of the M8 motorway in Glasgow. It was understood how important it is to protect these voles from harm during normal verge maintenance operations on the M8.

The The Operating Company has taken an active role in water vole conservation on the M8 motorway verges for a number of years, including being a main contributor to an annual knowledge exchange workshop. The workshop combines local stakeholders and academic researchers (including the Glasgow Water Vole Ambassador, Seven Lochs Wetland Park and NatureScot) to develop a collective understanding of this unique population and support water vole habitat connectivity in the Glasgow area.

The project investigating water vole disturbance from road maintenance activities was recognised this year, receiving a highly commended award from the Chartered Institute of Ecology and Environmental Management in their annual award ceremony.



Figures 46 & 47 – images of the water voles trapped and relocated in suitable habitat, under licence from NatureScot, to allow for maintenance and management works on the M8 motorway verges.

Findings from this study were used to develop a protection plan and develop mitigation for the species ahead of key safety improvements on the M8 in 2019. To protect water voles during improvement works, Scotland TranServ's Ecologists gently trapped them, under licence, to allow the water voles to be relocated away from danger and to safer areas of suitable grassland.

A828 Appin Scour scheme

During some standard scour protection works required in the NW Unit to prevent undercutting of the A828 near Appin House, Argyll & Bute, the Operating Company, BEAR Scotland, determined that there was an opportunity to improve the existing culvert for the benefit of salmonids and other migrating fish. Low-level river crossings can have negative impacts on freshwater ecosystems, including blocking upstream fish passage.

Following discussion with the Argyll District Salmon Fisheries Board, Argyll Fisheries Trust, and SEPA, a scheme was devised that re-profiled the apron to the culvert to improve the water distribution over the apron and across the weir during low flow conditions. Baffles and fish tiles were also designed and retrofitted to the apron and within the culvert, respectively, to improve access for fish.

Finally, the watercourse, itself, has been deepened in front of the weir to add to a set of features that help to ameliorate fish passage through the culvert to the watercourse upstream for spawning. There is ongoing work in liaison with the fisheries board to install eel brushes to further improve access for European eels (*Anguilla anguilla*).



Figure 48 & 49 – the driver for works at this location was for scour protection but opportunity was taken to improve the culvert for fish (and eel) passage by installing fish tiles on the new culvert apron and baffles within the structure.

A9 Killiecrankie viaduct

Killiecrankie Bridge is a major structure on the A9 that lies close to steep, craggy rock slopes and is surrounded largely by woodland – the area presents ideal conditions for bats.



Figure 50 – the elegant structure at Killiecrankie has a high potential for bat roosts.

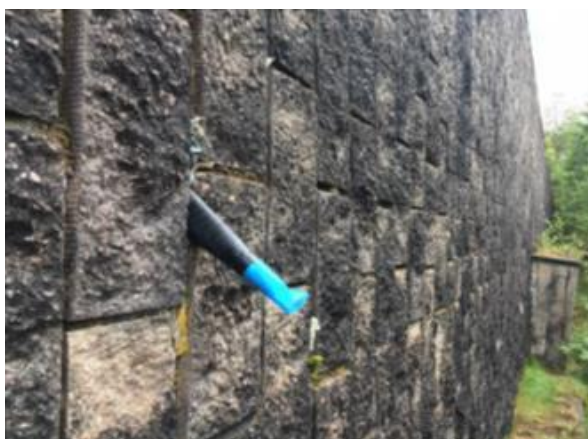
Significant maintenance works were required recently that included the repair and replacement of anchors, installation of drainage outlets and masonry repairs to the retaining walls. Due to the location and nature of intrusive works, an extensive bat survey was carried out which involved close-up endoscope surveys by licensed bat surveyors using rope access to undertake surveys of the retaining walls.



Figure 51 – Above the viaduct on the A9 lies a significant retaining wall that supports the rocky slopes of the Pass of Killiecrankie.

All suitable cracks and crevices in the retaining wall and trees within 30 m of the works were inspected. The wall was found to have some potential for bats during both the summer and winter periods and the presence of a small numbers of roosting bats.

It was important that any potential for bats to roost in the retaining wall was dealt with prior to the works commencing. As a simple but effective means of temporary exclusion, rags were used to prevent any bats entering any crevices and cracks. However, where particularly deep cavities extended into the wall and where any potential roosts were beyond the reach of the endoscope a small exclusion device was fitted, under the precautionary principle, and left in place for a minimum of three nights before being permanently blocked.



Figures 52 & 53 – great care was taken to exclude the potential bat roosts within the cracks and crevices on the retaining wall, and to provide bat boxes on nearby trees as replacement roosts.

The exclusion devices are made out of damp-proof course membrane rolled into a tube approximately 10-15 cm long, with plastic sheeting attached to the end to stop bats gripping and being able to re-enter. The tubes are simply pushed into the gap, making sure that bats are able to gain access out.

To compensate for any long-term loss of any roosts or potential habitat on the retaining wall face, bat boxes were mounted on nearby trees to provide winter hibernation and summer roosts

A95 Cromdale Footbridge

Cromdale Footbridge (80 F) sits adjacent to the A95 masonry road bridge and both span Cromdale Burn (SEPA ID: 23101), which forms part of the River Spey Special Area of Conservation (SAC; NatureScot Site Code 8365). This area is also located within Cairngorms National Park.



Figures 54 & 55 – retained riparian habitat and sediment management in place during construction,

The footbridge required to be replaced and the Operating Company, BEAR Scotland NE Unit, prepared designs for a new footbridge, including new access paths and ramps. To protect the water environment and ecology, the following mitigation was implemented:

- No works were carried out during Atlantic salmon (*Salmo salar*) spawning season (November-May).
- Sediment management systems were created at critical locations to prevent silt runoff entering the Burn of Cromdale.
- Except for four nights (maximum), no night-time working was undertaken to avoid disturbance to residents, otters (*Lutra lutra*) and the mainly nocturnal movement of migratory fish.
- The existing footbridge was wrapped in geotextile to limit the potential for contamination of the Burn of Cromdale during removal by crane.
- Footbridge design retains terrestrial strips along the Burn of Cromdale banksides to allow safe passage by otters and other fauna and prevent adverse impacts to the bankside or in-channel burn habitat.
- The existing footbridge pier located within the Burn of Cromdale was removed to restore the natural river pattern and ensure that debris does not snag.

A96 Forres Road, Nairn – verge management

In recognition of local interest, and reflecting the guidance Transport Scotland has helped PlantLife to deliver in the road verges management document, BEAR Scotland have developed a project to explore the means of establishing a species-rich grass sward on selected verges within the area of Nairn on the A96 Forres Road.

This initiative makes the most of the impacts of the Covid-19 restrictions which meant the Operating Company was forced to delay the normal high amenity grass cutting operations in Nairn until summer 2020 which allowed the grass to grow longer than usual. This attracted residents' attention and BEAR suggested that this presented an opportunity to enhance the local biodiversity through the establishment of an ecological trial.

An agreed area was identified on the eastern side of the town where it was considered safe to allow a longer growing sward (without compromising safety or operational efficiencies) and an ecological survey was commissioned to determine the habitat and species baseline. A final late autumn cut was undertaken and the arisings were collected and composted off-site.

The area normally receives 14 cuts each year but with the trial area this will now be limited to two cuts at spring and autumn 2021. Additional ecological surveys will be undertaken in spring, mid-summer and autumn 2021 to assess whether there has been any development of flora and/or fauna during the trial period.



Figure 56 & 57 – the uncut verge along Forres Road early in 2020 and an example from near Fort William where a similar approach has allowed a rich wild flower sward to develop.

A report detailing the findings will be submitted to Transport Scotland after the 12-month period (October 2021). There is potential for this trial to be extended if more data is required and/or if it is determined that a longer assessment period would deliver more robust results.

Appendix A

Consideration of biodiversity impacts and opportunities takes place at all stages of our development work as well as the decisions taken daily on the management of the national transport networks. Transport Scotland's internal procedures ensure this occurs at the following times:

During Appraisal

All interventions proposed for Scotland's transport networks require robust assessment and appraisal at the outset to determine whether the proposals could have significant effects on the environment. Decision-makers need to be able to understand any such effects and any potential alternative approaches that could minimise or avoid them.

In this context, the assessment and appraisal process can cover statutory Environmental Impact Assessment (EIA), non-statutory environmental impact assessment, and Assessment of Implications on European Sites. At a wider level, there may also be a requirement for Strategic Environmental Assessment (SEA) and Transport Appraisal which are then linked to project based environmental impact assessments. These processes are valid whether the proposals concerned are related to new schemes or management and maintenance interventions. In terms of conservation and enhancement of biodiversity, the appraisal process allows the assessment team the opportunity to consider whether the proposal will have a likely impact on the diversity and character of the local environment, including its wildlife communities and assemblages (flora and fauna) and to arrive at a balanced report.

During Design

The results of the assessment and appraisal process will directly influence the scope and content of the project design stage. Transport Scotland promotes the ethos that consideration of biodiversity should be built into the early planning and development of all works proposed for relevant transport networks, irrespective of the nature of the works.

In this way, an understanding of biodiversity and the potential application of appropriate measures is a key component, whether the works are primarily developed for nature conservation/enhancement or even if they are considered unrelated to environmental management – such as carriageway resurfacing etc. In this way, implications on wildlife and natural habitats, whether direct or indirect, can be explored at a stage where it should be relatively straightforward to make any necessary allowances to the emerging design. This includes avoidance and mitigation of any negative impacts as well as consideration of opportunities for biodiversity enhancement.

Transport Scotland has long championed the use of native species of local provenance for all new works within the Scottish trunk road network. This has since become a common policy in other delivery authorities and is now enshrined in legislation through the Wildlife and Natural Habitats (Scotland) Act 2011 which reinforced the provisions of the Wildlife and Countryside Act 1981 in this respect.

During Procurement

Our procurement process takes account of biodiversity through clear statements of instructions to our supply chain. For example, with respect to road maintenance works, the Fourth Generation term maintenance contracts provide instructions to our Operating Companies within Schedule 7 Part 4 Landscape Development. Extracts from this contract are shown below:

'When developing the Landscape Development Plan, the Operating Company shall take account of Transport Scotland's commitment to the protection and enhancement of biodiversity through all relevant legislation and documents including (i) the Trunk Roads Biodiversity Action Plan, and (ii) the Scottish Government's biodiversity strategy Scotland's Biodiversity – It's in your hands. The Landscape Development Plan shall include (i) recommendations in accordance with the landscape strategy; (ii) recommendations resulting from the annual landscape management report, and (iii) recommendations resulting from the Operating Company's landscape opportunities inspections referred to in this Part. The annual landscape management report shall record details of the Operations undertaken in support of enhancing biodiversity and nature conservation, including works associated with creating, repairing or improving any wildlife mitigation measures within the Unit.'

A number of appendices on landscaping and ecology in the 4G contract provide specific instructions for specific elements, with extracts such as:

- The Operating Company shall give at least 48 hours' notice to the Overseeing Organisation of the intention to commence any of the Operations at...Special Areas of Conservation including candidate sites...or Sites of Interest for Nature Conservation.
The Operating Company shall also ensure that the appropriate advisory body (for example Scottish Natural Heritage, Scottish Environmental Protection Agency and Historic Scotland) shall also be advised of the intended Operations prior to the Operations commencing on Site
- The Operating Company's programme of weed control shall ensure there shall be a significant reduction in the occurrences and extent of these species each successive year for the duration of this Contract wherever they occur. Within wildflower areas or areas of nature conservation value the Operating Company shall eliminate any injurious weeds that cannot be effectively controlled by chemical means without causing damage to other vegetation by hand pulling
- The Operating Company shall carry out rabbit, hare and deer control in all areas of new planting or seeding undertaken under this Contract. Areas of brambles and herbage that interfere with the control of rabbit or deer shall be cut
- The Operating Company shall maintain all the grass and wildflower grass areas within the Unit in accordance with the Landscape Inventory categories.

No grass cutting shall be carried out within 250 mm of unprotected trees and shrubs

- Wildflower seeding shall be undertaken typically in early Spring or early Autumn and following best horticultural practice appropriate to the species involved

Our major road schemes also take account of biodiversity. For example, extracts from the A737 Dalry Bypass Employer Requirements from May 2016 state that:

'Notwithstanding any other provision of the Contract the Chartered Landscape Architect shall inspect the Site monthly throughout the Period of Establishment Maintenance and report accordingly. Not more than two weeks after each visit the Contractor's Chartered Landscape Architect shall make written recommendations to the Contractor regarding deficiencies and opportunities for improving the landscape maintenance and exploiting environmental opportunities that become apparent during the Period of Establishment Maintenance to enhance biodiversity and reduce pesticide application.'

A copy of the Chartered Landscape Architect's written recommendations shall be provided simultaneously to the Engineer. The Contractor's Chartered Landscape Architect shall confirm, without limitation, the requirements for plant replacement, establishment of woodland, shrub and hedgerow planting and all seeded grassland and wildflower areas and remedial Works associated with the landscape Design. The recommendations of the Contractor's Chartered Landscape Architect shall be carried out by the Contractor.'

During Construction

It is fundamental to the success of all schemes that implementation of biodiversity actions are carefully monitored by appropriately qualified individuals to ensure that the aims and objectives embedded in the design are realised. This includes the delivery of all committed mitigation. At the same time, and despite the most carefully prepared design documentation, it is in the nature of projects involving excavations and other ground works that unexpected issues can often arise. Such issues can present significant problems for the Design Teams to overcome and it can sometimes be challenging to find appropriate solutions to protect against increased environmental impact.

However, the discovery of unexpected issues and overcoming practical problems during implementation can also be used as an opportunity to maximise scheme benefits through the development of alternative solutions, whether in relation to landscape integration and/or enhancement of the natural heritage. Contractual and regulatory obligations will still be required to be satisfied but the potential for the delivery of alternative, creative solutions is encouraged.

Safeguarding the natural resource, delivery of the agreed proposals and the exploitation of onsite opportunities requires regular monitoring of implementation by suitably qualified and experienced staff.

Transport Scotland ensures that this is clearly detailed in the relevant contract documentation (whether as part of the Management and Maintenance Term Contracts or for new scheme requirements). This is helped by ensuring a clear understanding of the project objectives across the other project professionals involved and supported by good communication.

During Maintenance

A common issue with the development of schemes within the public realm, however well delivered initially, is the commitment to a long term maintenance regime. All major scheme interventions will ordinarily include a 5-year project maintenance period post completion. This is a contract requirement and covers the defects liability on built elements and the establishment period for any new planting and seeding works. The requirement allows for the employment of suitably qualified individuals to undertake regular inspections of the works throughout each year of the maintenance period to check that the scheme is performing as required. This also provides a chance for an assessment of how the site is developing in general and in relation to the local characteristics of the adjacent landscape. This, in turn, gives rise to the possible introduction of small amendments to the maintenance regime if there is an opportunity to improve biodiversity integration – for example, the minor adjustment of a wildlife fence alignment following evidence of conflict with migrating mammals or changes to a mowing regime to encourage a more diverse sward development.

Transport Scotland have recently re-let two of the four network maintenance contracts (NMC) for the two trunk road units in the south of the country. These contracts build on and develop many of the good practices laid down through the 4G contracts. On the environment side, this includes the requirement for the Operating Companies to prepare comprehensive tree management strategies and tree management plans, taking full account of the condition and value of the trees and woodland throughout each unit and ensuring this vital ecological and landscape resource is managed effectively for the multiple benefits they encompass.

Appendix B

Acknowledgements

Transport Scotland would like to thank all its staff and supply chain who are involved in delivering projects and maintaining the nation's strategic transport networks. It is through collective understanding and collaborative working that the greatest differences can be made for the benefit of Scotland's natural environment.

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