



NATURAL CAPITAL AND ENVIRONMENTAL NET GAIN

A discussion paper

NATIONAL
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The Commission

The Commission's remit

The Commission provides the government with impartial, expert advice on major long-term infrastructure challenges. Its remit covers all sectors of economic infrastructure: energy, transport, water and wastewater (drainage and sewerage), waste, flood risk management and digital communications. While the Commission considers the potential interactions between its infrastructure recommendations and housing supply, housing itself is not in its remit. Also out of the scope of the Commission are social infrastructure, such as schools, hospitals or prisons, agriculture, and land use.

The Commission's objectives are to support sustainable economic growth across all regions of the UK, improve competitiveness, and improve quality of life.

The Commission delivers the following core pieces of work:

- a *National Infrastructure Assessment* once in every Parliament, setting out the Commission's assessment of long term infrastructure needs with recommendations to the government
- specific studies on pressing infrastructure challenges as set by the government, taking into account the views of the Commission and stakeholders, including recommendations to government
- an *Annual Monitoring Report*, taking stock of the government's progress in areas where it has committed to taking forward recommendations of the Commission.

The Commission's binding fiscal remit requires it to demonstrate that all its recommendations for economic infrastructure are consistent with, and set out how they can be accommodated within, gross public investment in economic infrastructure of between 1.0 per cent and 1.2 per cent of GDP each year between 2020 and 2050. The Commission's reports must also include a transparent assessment of the impact on costs to businesses, consumers, government, public bodies and other end users of infrastructure that would arise from implementing the recommendations.

When making its recommendations, the Commission is required to take into account both the role of the economic regulators in regulating infrastructure providers, and the government's legal obligations, such as carbon reduction targets or making assessments of environmental impacts. The Commission's remit letter also states that the Commission must ensure its recommendations do not reopen decision making processes where programmes and work have been decided by the government or will be decided in the immediate future.

The Commission's remit extends to economic infrastructure within the UK government's competence and will evolve in line with devolution settlements. This means the Commission has a role in relation to non-devolved UK government infrastructure responsibilities in Scotland, Wales and Northern Ireland (and all sectors in England).

The Infrastructure and Projects Authority (IPA), a separate body, is responsible for ensuring the long term planning carried out by the Commission is translated into successful project delivery, once the plans have been endorsed by government.

The Commission's members

Sir John Armitt CBE (Chair) published an independent review on long term infrastructure planning in the UK in September 2013, which resulted in the National Infrastructure Commission. Sir John is the Chair of National Express Group and the City & Guilds Group. He also sits on the boards of the Berkeley Group and Expo 2020.

Professor Sir Tim Besley CBE is School Professor of Economics and Political Science and W. Arthur Lewis Professor of Development Economics at the LSE. He served as an external member of the Bank of England Monetary Policy Committee from 2006 to 2009.

Neale Coleman CBE is a co-founder of Blackstock Partnership. He worked at the Greater London Authority from 2000-2015 leading the Mayor's work on London's Olympic bid, the delivery of the games, and their regeneration legacy. Neale has also served as Policy Director for the Labour Party.

Professor David Fisk CB is the Director of the Laing O'Rourke Centre for Systems Engineering and Innovation Research at Imperial College London. He has served as Chief Scientist across several government departments including those for environment and transport, and as a member of the Gas and Electricity Markets Authority.

Andy Green CBE holds several Chair, Non-Executive Director and advisory roles, linked by his passion for how technology transforms business and our daily lives. He chairs Lowell, a major European credit management company and has served as Chair of the Digital Catapult, an initiative to help grow the UK's digital economy.

Julia Prescott holds several board and advisory roles. She is a co-founder and Chief Strategy Officer of Meridiam and sits on the Executive Committee of Meridiam SAS. She has been involved in long term infrastructure development and investment in the UK, Europe, North America and Africa. She is an Honorary Professor at the Bartlett School of Construction and Project Management, University College London. Since 2019 she has sat on the board of the Port of Tyne.

Bridget Rosewell CBE is a director, policy maker and economist. She served as Chief Economic Adviser to the Greater London Authority from 2002 to 2012 and worked extensively on infrastructure business cases. She has served as a Non-executive Director of Network Rail and Non-executive Chair of the Driver and Vehicle Standards Agency. She is currently Chair of the Atom Bank and the M6 Toll Road.

Professor Sadie Morgan OBE is a founding director of the Stirling Prize winning architectural practice dRMM. She is also Chair of the Independent Design Panel for High Speed Two and one of the Mayor of London's Design Advocates. She sits on the boards of the Major Projects Association and Homes England.

Executive summary

Society and the economy depend on natural capital assets and services – including the water we drink, the air we breathe and the food we eat – to function. But natural capital has declined in recent decades. Infrastructure both contributes to and is impacted by this decline but can also help reverse it.

Infrastructure developers should consider the impact of infrastructure development on natural capital assets and take the opportunities to contribute to the environment and biodiversity as part of development. Infrastructure projects should target environmental net gain, ensuring that infrastructure developers leave the environment in a measurably better state than they found it.

Infrastructure and natural capital

There is a two-way relationship between infrastructure and natural capital:

- infrastructure can have both a positive and a negative impact on natural capital assets such as fresh water and clean air
- infrastructure can deliver benefits for natural capital, for example through the provision of protected natural habitats and connecting corridors for species along linear infrastructure, and sustainable drainage systems for mitigating flood risk
- changes in the environment can increase the costs of infrastructure, for example if roads and railways need to withstand higher temperatures
- natural capital approaches can reduce the demand for infrastructure, for example natural water catchment management for flood protection.

The Commission recognises the importance of natural capital and is working on both addressing the impact of infrastructure on the environment and exploiting the opportunities to use infrastructure solutions to support and improve natural capital. One such approach is through ‘environmental net gain’, the concept of ensuring that developers leave the environment in a measurably better state compared to the pre-development baseline.

Current approaches to natural capital

The Commission has made several recommendations relating to natural capital and environmental net gain in the past. The Commission’s design principles for national infrastructure, endorsed by government in the National Infrastructure Strategy, say that projects should make active interventions to enrich our ecosystems, seeking to deliver a net biodiversity gain, and contributing to the restoration of wildlife on a large scale while protecting irreplaceable natural assets and habitats. And the recently published *Rail Needs Assessment for the Midlands and the North* recommended adopting an ‘environmental net gain’ approach in the government’s Integrated Rail Plan.

The government has committed to embedding environmental net gain in infrastructure in its 25 year environment plan, and the government is currently legislating for biodiversity net gain through the Environment Bill. The existing planning regimes also include some requirements for consideration of the impact of development on natural capital, and the infrastructure industry has begun to adopt some approaches that support natural capital.

However, more progress is needed to fully realise infrastructure's role in supporting the delivery of the government's environmental ambitions. The National Audit Office has said that there is still a long way to go before the government can be confident that it has the right framework to deliver on its aspirations in its 25 year environment plan. And the requirement for biodiversity net gain in the Environment Bill will exempt major infrastructure projects.

Environmental net gain

While infrastructure's impact on natural capital in terms of land use are not as high as those of agriculture, for example, they still need to be considered. Delivering environmental net gain means taking steps to mitigate the high potential impact of many major infrastructure projects on natural capital.

Taking an environmental net gain approach to infrastructure has many benefits, including:

- supporting natural capital by mitigating against climate change and flood risk, improving air and water quality, and improving quality of life
- delivering benefits efficiently, for example both achieving an infrastructure goal and increasing resilience
- saving time and money by avoiding the risks of costly and lengthy appeals processes due to environmental concerns
- being a positive approach that ensures losses of high value natural capital are minimised and mitigated while also providing opportunities to enhance natural capital. This also represents a 'least regrets' option as biodiversity loss is hard to reverse.

The Commission supports an environmental net gain approach across all infrastructure projects, including major infrastructure projects. This means that:

- infrastructure developers on all infrastructure projects should leave the environment in a measurably better state compared to the pre-development baseline
- natural capital frameworks and analysis should be used in decision making for infrastructure
- infrastructure investors, developers, providers and operators should follow the mitigation hierarchy when delivering environmental net gain by:
 - avoiding impacts as far as possible
 - minimising unavoidable impacts
 - as a last resort, compensating for unavoidable losses wherever the greatest benefits can be delivered, either locally or nationally, first considering compensating for losses within the development footprint.

However, the Commission recognises that there is further work that needs to be done and there are challenges that need to be addressed in order to support infrastructure projects to achieve this.

Natural capital principles

The Commission intends to develop a set of natural capital principles for national infrastructure, similar to its *Design Principle for National Infrastructure*, to help support infrastructure developers to establish how their projects can deliver environmental net gain.

The natural capital principles will:

- promote and clarify the importance of natural capital in infrastructure
- provide support to infrastructure investors, developers, providers and operators on how to incorporate natural capital frameworks in infrastructure projects and best deliver environmental net gain, bringing together existing approaches where appropriate
- be appropriate for national infrastructure, including major infrastructure projects
- complement and expand on the existing guidance on the environment and place in the Commission's design principles.

Next steps

Following publication of this report setting out its strategic position, the Commission will:

- promote environmental net gain for all infrastructure projects
- develop thinking on natural capital and the application of environmental net gain to infrastructure
- consider natural capital where appropriate in the Commission's future work, including the second *National Infrastructure Assessment*
- develop a set of natural capital principles for infrastructure which will complement and expand on the existing design principles.

1. Natural capital and infrastructure

Natural capital refers to a range of natural assets and services that society and the economy depend on, including the water we drink, the air we breathe, the food we eat, and the wild places many of us visit to relax. Natural capital has declined in recent decades, with increasing numbers of habitats and species on the verge of extinction, and an increasing risk of invasive species. Infrastructure both contributes to and is impacted by this decline but can also help reverse it.

The Commission continues to recognise the importance of natural capital and is working on both addressing the impact of infrastructure on natural capital and exploiting the opportunities to use infrastructure solutions to support and improve natural capital. One such approach is through ‘environmental net gain’, the concept of ensuring that infrastructure developers leave the environment in a measurably better state compared to the pre-development baseline, as recently recommended in the *Rail Needs Assessment for the Midlands and the North*.¹

This section explains the concept of natural capital, covers recent trends, looks at the link between infrastructure and natural capital, explains net gain and how it is measured, and covers the recommendations the Commission has made in the past to promote natural capital and environmental net gain. The following sections highlight existing approaches to environmental net gain and natural capital in infrastructure, and the Commission’s strategic view on these issues, and next steps for the Commission’s work.

What is natural capital?

Natural capital is the term for the natural assets on which society and the economy depend.² Natural capital assets include:

- certain stocks of nature that have value to society, such as the atmosphere, forests, fisheries, rivers, biodiversity, land and minerals
- both the living and non-living aspects of ecosystems.³

Natural capital assets also provide environmental or ‘ecosystem’ services over time, including:

- **provisioning services** – tangible outputs such as food, timber and water supply
- **regulating services** – processes that regulate pollution and other adverse effects such as air filtration
- **cultural services** – environmental settings that enable cultural interaction and activity

- **abiotic flows of natural capital** – flows independent of functioning ecosystems such as solar, wind and tidal power
- **aggregated services** – a combination of services with aggregate effects, such as landscapes, water quality and biodiversity (see box).⁴

The benefits to society of natural capital assets and services include, but are not limited to:

- **freshwater:** quantity and quality of water available for human use (e.g. drinking, bathing, industrial processes etc) as well as the natural environment
- **hazard protection:** reducing the risk of flooding, drought, heatwaves or landslips
- **equable climate:** a comfortable climate that has no adverse impact on human health or wellbeing
- **clean air:** air quality that does not adversely impact on human health or wellbeing
- **recreation:** active enjoyment of the natural environment
- **health:** physical and mental health benefits e.g. from urban green spaces
- **wildlife:** wild species diversity and abundance which has aesthetic and recreational value as well as cultural and spiritual significance
- **food:** plant, animal and fungi (both wild and cultivated) consumed by people
- **fibre:** plant and animal materials (including timber) used for building, clothing etc.⁵

Biodiversity

Biodiversity is defined as ‘the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part’.⁶ Biodiversity:

- is core to the ecological condition and quality of ecosystems that support the services and benefits provided to people
- underpins the resilience of ecosystems to shocks and can provide insurance value. As set out in The Dasgupta Review on the Economics of Biodiversity, a HM Treasury led review, natural capital should be actively managed and invested in like any other asset by managing the overall stock of assets and maintaining biodiversity in our portfolio of natural capital.⁷

Because of these multiple roles, the value of biodiversity can be overlooked even in natural capital assessments.⁸

Natural capital is in decline

UK and global trends show that natural capital has declined in recent decades.⁹ The UK alone has seen a 13 per cent decline in average species abundance since 1970, and 15 per cent of species assessed are threatened with extinction.¹⁰ A similar picture emerges in the latest UK Biodiversity Indicators, which show declines in the status of threatened habitats and species, biodiversity and ecosystem services, as well as increased pressure from invasive species. However, the indicators also demonstrate reduced pressures from pollution, and increased engagement with nature and conservation. Key indicators, such as habitat connectivity and adaptation to climate change, still lack suitable measures to assess short and long-term changes.¹¹

There are numerous factors responsible for the changes in natural capital. The most significant causes are:

- agricultural land management (particularly the conversion and intensification of natural habitats to farmland)
- climate change
- population growth
- exploitation of natural resources
- air pollution (especially from certain nitrogen, sulphur and phosphorous-containing compounds)
- invasive species.^{12,13}

The agriculture sector has the greatest pressure on the environment,^{14,15} as it makes up 63 per cent of land use in England.¹⁶ However, development for housing and infrastructure projects continues to put pressure on the natural environment, causing habitat loss, fragmentation and degradation.^{17,18} Transport and utilities infrastructure are the biggest contributors to this development impact, making up around four per cent of overall land use.¹⁹ The impact of the built environment has increased over several decades.²⁰

Infrastructure contributes to and is impacted by this decline

Infrastructure has a close relationship with natural capital, both contributing to and being impacted by its decline. Ahead of the first *National Infrastructure Assessment*, the Commission published a paper on the impact of the environment and climate change on future infrastructure supply and demand. This paper set out the close relationship between infrastructure, the environment and natural capital:²¹

- **Infrastructure can have a negative impact on the environment:** Some infrastructure can have a negative impact on natural capital assets and services through air quality, water quality, noise pollution, and greenhouse gas emissions. If unmanaged, infrastructure also has the potential to lock-in high greenhouse gas emissions that may put at risk the ability of the UK to meet its statutory obligations on carbon reduction.

- **Infrastructure can deliver benefits for the environment:** Properly planned infrastructure that explicitly considers natural capital impact throughout the process can have beneficial impacts for natural capital assets and services – for instance, through the provision of protected natural habitats and connecting corridors for species along linear infrastructure delivering biodiversity benefits. Sustainable drainage systems can both contribute to flood risk mitigation, capture and treat surface water runoff from roads and provide biodiversity and amenity benefits.
- **Changes in the environment can increase the costs of infrastructure:** Future changes in the environment may have an impact on the cost of infrastructure delivery, quality and reliability of service, and risks to the infrastructure. Higher temperatures may lead to more algal blooms in water supply reservoirs or damage to roads or railways. This may require costly fixes, increasing the cost of operation and maintenance of infrastructure assets.
- **The environment can reduce the demand for infrastructure:** The design of infrastructure working in concert with environmental processes has the potential to contribute positively to the delivery of infrastructure services as well as building the resilience of the infrastructure system itself, particularly in managing flood risk and improving water quality. Natural catchment management could provide protection in rural areas by helping to hold back the flow of water within the catchment or by reconnecting rivers with their floodplain. Natural capital can therefore also contribute to the Commission’s objectives, particularly supporting sustainable economic growth across all regions of the UK and improving quality of life.

The technical annex for this report contains an update to the evidence base presented in that report, providing an overview of the most significant interactions and interdependencies between infrastructure and natural capital on a sector-by-sector basis.

Net gain approaches in infrastructure can support natural capital

One way to deal with the potential negative impact of infrastructure on the environment and to help remedy historic damage is through ‘environmental net gain’.

Environmental net gain is the concept of ensuring that infrastructure developers leave the environment in a measurably better state compared to the pre-development baseline.^{22,23} Biodiversity net gain is a narrower measurement that refers only to habitats and is a requirement for achieving environmental net gain. They can be defined as follows:

- **biodiversity net gain is an approach to development that leaves biodiversity in a measurably better state than prior to development – as measured by improvements to the size, distinctiveness, condition, strategic location and connectivity of habitats, alongside other measures.²⁴**
- **environmental net gain is an approach to development that leaves both biodiversity and the environment in a measurably better state than prior to development – as measured by the biodiversity measures, alongside a broader range of measures of ecosystem services (e.g. recreation, flood protection) and environmental metrics (e.g. air quality).²⁵**

Current good practice in biodiversity and environmental net gain is to follow the ‘mitigation hierarchy’:

- do everything possible first to avoid impacts
- minimise predicted impacts on biodiversity and ecosystem services
- assess the current quantity and condition of natural assets with the development footprint and what (ecosystem) services they are providing to society
- determine whether creation of additional assets or restoration or improvement of natural assets could enhance the benefits flowing to society in the context of development
- as a last resort, compensate for losses that cannot be avoided, preferably within the development footprint.
- if this does not generate the most benefits, then these can be provided elsewhere.²⁶

The mitigation hierarchy enables infrastructure providers to take a proportionate approach to addressing natural capital, as larger projects are likely to have larger impacts. It also makes it more cost effective for projects to avoid natural capital losses, which has a lower cost than a mitigating action elsewhere – particularly as habitat loss must be replaced with the same quality and distinctiveness, and in a higher quantity, to reflect the risk losses in biodiversity and ecosystem services are being exchanged for uncertain gains. In order to secure the benefits, any habitat creation and enhancement delivered to achieve net gain need to be maintained for at least 30 years.^{27,28}

How is net gain measured?

Measuring biodiversity and environmental net gain requires data and various tools to measure the habitats that support biodiversity and the environment. One tool is Natural England’s Biodiversity Metric, which provides a way of measuring and accounting for biodiversity losses and gains resulting from development or land management change.²⁹ Developers can use the metric to assess the pre-development baseline and the likely impact mitigations made by the developer.

The same metric is then used to measure net gain, which is usually expressed as a percentage. For example, ‘10 per cent net gain’ means the estimated post-development environmental value shows a 10 per cent increase on the pre-development baseline. In practice, this means that if a site is worth 50 biodiversity units before development, the site (and any offset sites and financial compensation payments) should be worth at least 55 units at the scheme’s conclusion.³⁰

Metrics also account for factors such as the time it takes for habitats to be established and the location of compensation measures. Where habitats must be created or enhanced to achieve net gain, it is preferable to do this locally to prevent the area from losing significant amounts of habitat. However, it can also be created nearby to the site or, if necessary, nationally to address national conservation priorities.^{31,32}

The Commission has supported net gain approaches in its past recommendations

The Commission has made several recommendations relating to natural capital and environmental and biodiversity net gain in the past:

- the Commission's *Design Principles for National Infrastructure*, endorsed by government in the National Infrastructure Strategy,³³ cover climate, people, places and value:
 - the 'climate' principle states that "the design of our infrastructure must help set the trajectory for the UK to achieve net zero...this means opportunities must be sought during design and construction to enable the decarbonisation of our society and mitigate and offset residual emissions.... The search for these opportunities should not be restricted to the area within the site boundary."
 - the 'places' principle includes that "Projects should make active interventions to enrich our ecosystems. They should seek to deliver a net biodiversity gain, contribution to the restoration of wildlife on a large scale while protecting irreplaceable natural assets and habitats."³⁴
 - the Commission's design principles are to be embedded in the delivery support and assurance regime, overseen by the Infrastructure and Projects Authority, for scrutiny throughout the project life cycle. The government has also said that all infrastructure projects should have board-level design champions to ensure good design is prioritised from the early stages of a project, supported by design panels where appropriate.³⁵
- The recently published *Rail Needs Assessment for the Midlands and the North* recommended that the government's Integrated Rail Plan should set out a strategic approach to mitigating impacts on the local environment and natural capital, adopting an 'environmental net gain' approach.³⁶

Annex A sets out the objectives in the government's 25 year environment plan and how the Commission's work contributes to each of them.

In addition, the Commission's recent study on resilience set out the need for a proactive approach to resilience, facing up to the possibility of different or harder challenges in the future.³⁷ In recent years, nature based solutions have emerged as a way to enhance nature and address societal challenges and provide resilience,³⁸ and the Commission recognises that there may be opportunities to both improve resilience and provide environmental net gain.

This paper sets out the current approaches to natural capital and expands more fully the Commission's position on natural capital, environmental net gain and biodiversity net gain.

2. Current approaches to natural capital

Government has committed to embedding environmental net gain in infrastructure in its 25 year environment plan. The existing planning regimes also include some requirements for consideration of the impact of development on natural capital, and the infrastructure sector has begun to adopt some net gain approaches. However, there is still a long way to go.

This section sets out a brief overview of the key commitments and progress made by government, the approach in the planning system, and some examples of actions the infrastructure sector is taking to incorporate approaches that support natural capital.

Government has committed to environmental net gain

Natural capital assets have been degraded over decades. Against this trend for decline, the government has set itself the goal of reversing this to leave the environment in better condition than now within 25 years.³⁹ A key commitment in the government's 25 year environment plan is to embed 'environmental net gain' in development, including housing and infrastructure.⁴⁰

The government is currently legislating for biodiversity net gain through the Environment Bill, including the use of Natural England's Biodiversity Metric to measure net gains.⁴¹ However, the requirement for biodiversity net gain will exempt major infrastructure projects.⁴² In addition, the Bill provides a vehicle for delivering the government's 25 year environment plan, including long term legally binding targets.⁴³ To further support the government's environmental ambitions, the Agriculture Act commits to establishing an Environmental Land Management scheme which will reward farmers and land managers for providing natural capital benefits including better air and water quality, thriving wildlife, soil health, or measures to reduce flooding and tackle the effects of climate change.^{44,45}

However, in examining the government's readiness to deliver the 25 year environment plan, the National Audit Office note that there is still a long way to go before the government can be confident that it has the right framework to deliver on its aspirations and ensure value for money from the funding it has committed to environmental projects. The National Audit Office make a number of recommendations to government, including developing a delivery plan on how the planned outcomes will be achieved, and an assessment of costs and means of financing these in the short, medium and long term.⁴⁶

The planning regime considers environmental impact

The existing planning and environmental assessment regimes incorporate net gain approaches to an extent, as well as broader efforts to incorporate sustainability and natural capital approaches. This section covers some of the relevant regimes.

The planning system for infrastructure and other development is mainly governed by the following regimes:

- **The Planning Act 2008:**^{47,48} underpins a system of development consent regime for nationally significant infrastructure projects (or ‘major infrastructure projects’) in the fields of energy, transport, water, wastewater, and waste.
- **Town and Country Planning Act 1990:**⁴⁹ regulates applications for planning permission to be determined in accordance with a local development plan, led by local planning authorities. It covers a wide range of developments (e.g. residential, commercial) and covers infrastructure projects that are not subject to the Planning Act regime.

There are also overlapping regimes including ‘hybrid bills’ which apply to works of national importance but in a specific area of the UK such as Crossrail and High Speed 2,⁵⁰ and Transport and Works Act orders which authorise new railway or tramway schemes in England and Wales that are not nationally significant.⁵¹

For certain large or environmentally complex projects carried out by the public and/or private sector, there is a requirement to carry out an Environmental Impact Assessment, prepared by qualified experts, as part of the planning application process.^{52,53} Investors seeking to invest in infrastructure will also require that such assessments are carried out. The aim is to ensure that when a local planning authority (or other consenting authority) decides whether to grant planning permission for a project likely to have significant effects on the environment, it does so in the full knowledge of the environmental impacts, and takes this into account in the decision making process.⁵⁴

Where it is decided that an assessment is required, the applicant must prepare and submit an Environmental Statement. The Environmental Statement must include at least the information reasonably required to assess the likely significant environmental effects of the development,⁵⁵ including but not limited to:

- a description of the location of the development
- a description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases
- a description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used
- an estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during the construction and operation phases
- a description of the reasonable alternatives studied by the developer, and an indication of the main reasons for the option chosen.⁵⁶

Major infrastructure projects are within scope, and other infrastructure developments can be included, subject to various criteria and thresholds.^{57,58} The more environmentally sensitive the location of the development, the more likely it is that the effects on the environment will be significant and will require an Environmental Impact Assessment.⁵⁹

For other developments, the National Planning Policy Framework provides protections for important sites and wildlife and makes provisions for the delivery of biodiversity net gain.⁶⁰ Biodiversity net gain is not yet mandatory (although it is being legislated for as part of the Environment Bill)⁶¹ so is currently subject to negotiation between developers and local authorities, which means it competes with other needs such as affordable housing delivery.⁶²

The infrastructure sector is beginning to adopt some approaches that support natural capital

Some infrastructure operators and developers have already adopted net gain or 'no net loss' commitments, as well as broader strategies around environment and nature:

- Highways England's Biodiversity Plan adopts targets of no net loss in biodiversity by 2020, and biodiversity net gain by 2040 across its estate.⁶³ As part of this they have also undertaken actions to improve water quality and biodiversity across 30,000 ha of green estate they manage across 4,500 miles of roads.⁶⁴
- several of Network Rail's major projects such as the Thameslink Programme and East West Rail have adopted biodiversity net gain approaches.⁶⁵ As part of their Environmental and Sustainability Strategy, Network Rail have targeted no net biodiversity loss by 2024 and biodiversity net gain by 2035, and annual natural capital reporting against a defined baseline by 2024.⁶⁶
- recent revisions to the water resources planning guidelines states water companies should use natural capital in decision making and provide environmental net gain through their Water Resource Management Plans.⁶⁷ Similar revisions have been made to Drainage and Wastewater Management Plans.⁶⁸
- in 2018, 44 per cent of the UK Green Building Council's 'gold leaf' (i.e. top tier) members, who make up around 10 per cent of their membership overall, have a nature and biodiversity strategy in place – however, only 22 per cent have adopted a commitment to biodiversity net gain, although this was up from 9 per cent in 2017.⁶⁹

Natural capital approaches are increasingly being seen in a variety of different ways across infrastructure sectors and activities. For example:

- the Oxford to Cambridge Arc is developing a local natural capital plan to ensure the delivery of improved connectivity, productivity and place making, whilst ensuring pioneering environmental standards and enhancements are delivered⁷⁰
- Greater Manchester Combined Authority has developed a partial valuation of its natural capital assets and launched an ecosystem services opportunity mapping tool^{71,72}
- a £10 million flood scheme in Salford, Manchester, incorporates wetland and habitat creation to reduce flood risk for around 1,900 homes and businesses and bring wider benefits to people and wildlife⁷³
- recent funding announcements to enhance flood protection in England included £200m for sustainable drainage systems and nature based solutions which also benefit wildlife, doubling the number of these projects that are government funded⁷⁴

- schemes such as EnTrade are providing a mechanism for water companies and other organisations to pay farmers and land managers to undertake sustainable land management measures, thereby addressing water quality issues upstream^{75,76}
- there has been progress in innovative designs in the construction process that use minimal energy and water, produce minimal waste, prevent pollution and preserve and enhance local biodiversity⁷⁷
- techniques are being developed to reduce the biodiversity impact of transport networks, including the potential restoration of functional habitat connectivity.⁷⁸

In recent years, ‘nature based solutions’ have emerged as a way to both enhance nature and address infrastructure challenges.⁷⁹ In this report, nature based solutions refer to nature based solutions to infrastructure challenges, that provide infrastructure services, for example wetland that provides flood risk management services. These are predominantly in flood risk management and water. As well as contributing to the provision of infrastructure services, nature based solutions can offer important well-being outcomes, directly contributing to people’s health and quality of life.⁸⁰

One way of supporting the use of nature based solutions might be one similar to that being developed by the Green Alliance and the National Trust, which proposes developing a market for such solutions to infrastructure services. Those looking to make interventions to improve water quality or reduce flood risk would be able to buy ecosystem services from farmers and landowners.⁸¹



Pegwell Bay, Kent

3. Environmental net gain

The Commission supports an environmental net gain approach across all infrastructure projects, including major infrastructure projects, which are currently exempt from the proposed requirement for biodiversity net gain in the Environment Bill. While infrastructure's impact in terms of land use are relatively low, they still need to be considered given its broader impact on natural capital. Delivering environmental net gain means taking steps to mitigate the high potential impact of many major infrastructure projects on natural capital.

Taking an environmental net gain approach to infrastructure has many benefits, including:

- supporting natural capital by mitigating against climate change and flood risk, improving air and water quality, and improving quality of life
- delivering benefits efficiently, for example both achieving an infrastructure goal and increasing resilience
- saving time and money by avoiding the risks of costly and lengthy appeals processes due to environmental concerns
- being a positive approach that ensures losses in high value natural capital are minimised and mitigated while also providing opportunities to enhance natural capital, given that biodiversity loss is hard to reverse.

However, the Commission recognises that there is further work that needs to be done and challenges that need to be addressed in order to support infrastructure projects to achieve this.

Delivering environmental net gain across all infrastructure projects can bring multiple benefits

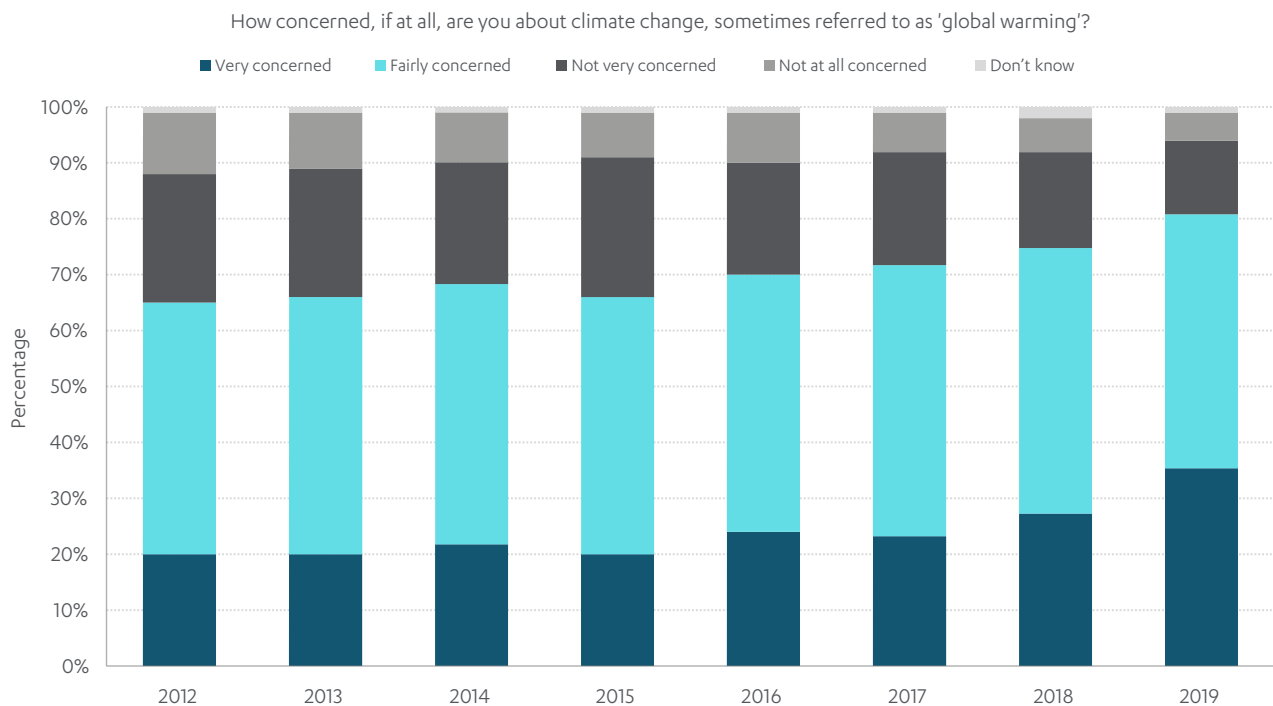
As set out earlier in this report, society and the economy depend on natural capital assets such as freshwater, clean air, food and an equitable climate. However, UK and global trends show that natural capital has declined in recent decades.⁸²

As set out in chapter 1, infrastructure both contributes to and is impacted by the decline in natural capital. Infrastructure projects can have a significant impact on the natural environment, changing land use in areas with high natural capital. While infrastructure's impact on natural capital in terms of land use is not as high as that of agriculture, for example, it still needs to be considered. Delivering environmental net gain means taking steps to mitigate the high potential impact of many major infrastructure projects on natural capital.

Alongside the obvious benefits to natural capital and the environment, such as mitigating climate change and flood risk, improving air and water quality and improving quality of life, there are other benefits to taking an environmental net gain approach for all infrastructure projects:

- **it can deliver benefits efficiently** – exploiting the two way relationship between infrastructure and natural capital can enable multiple benefits to be delivered simultaneously.^{83,84} Focusing on a single or narrow range of benefits overlooks how combining actions and funding for different natural capital benefits can produce an outcome greater than the sum of its parts.⁸⁵ Recent research for the Climate Change Committee found a well managed environment could provide resilience given the number of risks its affected by and knock-on effects to infrastructure and built environment (e.g. reduced water quality in the natural environment leading to water supply disruptions).⁸⁶
- **it can save time and money** – ensuring infrastructure projects contribute to environmental net gain is important for the sake of the environment but will also avoid the risks of plans being delayed at a later stage due to controversy around the potential environment impact - the public is increasingly conscious of the environment and averse to projects that will further damage it.⁸⁷ See figure 3.1 for research carried out by the Department for Business, Energy & Industrial Strategy.
- **it is a positive approach to natural capital** – biodiversity loss is hard to reverse, and it can take several decades for restored or replacement habitat to have the same biodiversity and ecosystem functioning as what was lost.⁸⁸ Environmental net gain is a positive approach that ensures losses of high value natural capital are minimised and mitigated, while also providing opportunities to enhance natural capital. In some ways this represents a 'least regrets' option.

Figure 3.1: Public environmental concern is high⁸⁹



The Commission has already recommended environmental and biodiversity net gain approaches both in its design principles and in the recent *Rail Needs Assessment for the Midlands and the North*.⁹⁰

This is in line with the government's commitment in its 25 year environment plan to embed 'environmental net gain' in development, including housing and infrastructure.⁹¹ As set out in the previous chapter, the trend in industry is towards increasing consideration of natural capital, and considering net gain approaches.

The Commission supports an environmental net gain approach

The Commission supports an environmental net gain approach across all infrastructure projects, including major infrastructure projects, in order to deliver benefits to natural capital, mutual benefits to infrastructure, avoid the risk of lengthy appeals processes, and prevent irreversible biodiversity loss. In supporting environmental net gain, the Commission is advocating for:

- all infrastructure projects to leave the environment in a measurably better state compared to the pre-development baseline
- natural capital frameworks and analysis to be used in decision making for infrastructure such as businesses cases and investment appraisal
- infrastructure investors, developers, providers and operators follow the mitigation hierarchy when delivering environmental net gain by:
 - avoiding impacts as far as possible
 - minimising unavoidable impacts
 - as a last resort, compensating for unavoidable losses wherever the greatest benefits can be delivered, either locally or nationally, first considering compensating for losses within the development footprint.

In the first instance, infrastructure investors, developers, providers and operators should work to determine their impact on natural assets and take the appropriate steps to avoid, mitigate or compensate against any negative impact by restoring and enhancing the condition of surrounding natural capital assets. Mitigating or compensating actions should adhere to the Lawton principles: 'more, bigger, better and joined'.⁹²

The Commission understands that although there has been progress in natural capital approaches and delivering environmental net gain (see chapter 2), there remain barriers to progress (covered later in this chapter). The Commission intends to do more work to provide guidance and leadership to the infrastructure sectors in its remit, including developing natural capital principles, see below.

The Commission will also continue to consider natural capital where appropriate in its studies and the next *National Infrastructure Assessment*.

Next steps

The Commission will:

- promote environmental net gain for all infrastructure projects
- develop thinking on natural capital and the application of environmental net gain to infrastructure
- consider natural capital where appropriate in the Commission's future work, including the second *National Infrastructure Assessment*.

Existing natural capital tools and resources

There are many frameworks, tools and other resources to support decision makers to consider natural capital, as reflected in the Department for Environment, Food & Rural Affairs recently published guidance on 'enabling a natural capital approach.'⁹³ Those listed below are not exhaustive, but show the large variety of resources available.

- **Department for Environment, Food & Rural Affairs (Defra) guidance on 'enabling a natural capital approach':** The guidance sets out the wealth of frameworks, tools, data and other resources to help support decision makers apply a natural capital approach.⁹⁴ Defra is also working with the Office for National Statistics to develop natural capital accounts.⁹⁵
- **HM Treasury's Green Book appraisal guidance:** The Green Book underpins the strategic and economic case for businesses cases and impact assessments, now includes guidance on assessing and valuing effects on the natural environment.⁹⁶ The revised guidance improves appraisal of a range of natural capital impacts alongside traditional 'environmental externalities' such as air pollution, noise, waste and greenhouse gases.
- **Natural Environment Valuation Online:**⁹⁷ a tool which the Commission has used to partially quantify and monetise the natural capital impacts of various rail packages as part of the *Rail Needs Assessment for the Midlands and the North*.⁹⁸
- The forthcoming '**Net Gain Planning Tool**': which will enable the assessment and measurement of the extent to which new spatial plans or development achieve net gains across a range of ecosystem services.⁹⁹
- **Natural England's 'Natural Capital Atlas':** maps the quantity, quality and location of natural capital throughout England.¹⁰⁰
- **Natural England's Biodiversity Metric:** provides a way of measuring and accounting for biodiversity losses and gains resulting from development or land management change, by considering changes to the size, distinctiveness, condition, strategic location and connectivity of habitats. Developers can use the metric to assess the pre-development baseline and the likely impact of mitigations made.¹⁰¹ Natural England is also developing the Eco-metric to measure environmental net gain by considering wider natural capital benefits (e.g. flood protection, recreation), although achieving biodiversity net gain is still a pre-requisite under the tool.¹⁰² Both tools can support decision making but must

be combined with expert advice and detailed assessments of biodiversity and ecosystem services.¹⁰³

- **UN Sustainable Development Goals (SDGs):**¹⁰⁴ there are a range of targets and indicators underpinning goal 9 of the SDGs which is to ‘build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation’

In the long term, the government is also piloting a new **Natural Capital and Ecosystem Assessment, the aim of which is to improve the baseline understanding of habitats and species abundance at different spatial scales (e.g. local, national) to help improve decision making and to ensure new developments can deliver net gains for nature and society.**¹⁰⁵

Challenges and barriers

Despite the continued progress set out in chapter 2 and the many frameworks, tools and resources available, there are some challenges that must continue to be addressed:

- valuing the benefits of natural capital approaches continues to be difficult, because there is a lack of data on the benefits of natural capital approaches,¹⁰⁶ partly because restoring or replacing lost habitats can take several decades¹⁰⁷
- future changes to climate will affect habitat creation and management, meaning the effectiveness and timescale of habitat restoration can often be uncertain¹⁰⁸
- planning policy and practice take a project by project approach to considering environmental impacts, meaning that interactions and interdependencies are often not considered, cumulative impacts of multiple developments may not be understood, and opportunities to deliver integrated solutions can be missed^{109,110,111}
- local planning authorities, which require a high level of ecological competence to discharge statutory obligations and implement national planning policy requirements, tend to lack natural capital expertise^{112,113}
- the reliance on benefit-cost ratios for option selection in appraisal can come at the expense of clearly defined strategic direction, meaning projects’ contribution to the delivery of government’s strategic goals, such as environmental net gain or net zero, is not considered.¹¹⁴

Natural capital principles

To address the last of the challenges set out above, HM Treasury’s Green Book appraisal guidance now requires projects to establish clear and measurable objectives, that support the delivery of the government’s overall strategic ambitions – which should include environmental net gain – with benefit-cost ratios estimated for options that have a strong strategic case.¹¹⁵

The Commission intends to develop a set of natural capital principles, similar to its *Design Principles for National Infrastructure* (see chapter 1), to help support infrastructure developers to establish how their projects can deliver environmental net gain.

While the design principles reference both the environment and biodiversity, expanding on these points with complementary natural capital principles will help further support the infrastructure sector to consider natural capital from the beginning of projects and during their operation, and give guidance on how best to deliver environmental net gain.

The natural capital principles will:

- promote and clarify the importance of natural capital in infrastructure
- provide support to infrastructure investors, developers, providers and operators on how to incorporate natural capital frameworks in infrastructure projects and best deliver environmental net gain, bringing together existing approaches where appropriate
- be appropriate for national infrastructure, including major infrastructure projects
- complement and expand on the existing guidance on the environment and place in the Commission's design principles.

Next step

The Commission will develop a set of natural capital principles for infrastructure which will complement and expand on the existing design principles.

Next steps

The Commission will seek to ensure that the impact of infrastructure on natural capital is understood, considered and addressed, where appropriate, in its future work. The next *National Infrastructure Assessment* will consider natural capital as part of its work on the key themes of net zero and climate resilience.

Following publication of this report setting out its strategic position, the Commission will take the following steps:

- promote environmental net gain for all infrastructure projects
- develop thinking on natural capital and the application of environmental net gain to infrastructure
- consider natural capital where appropriate in the Commission's future work, including the second *National Infrastructure Assessment*
- develop a set of natural capital principles for infrastructure which will complement and expand on the existing *Design Principles for National Infrastructure*.

The Commission will also continue to consider how it can better understand the relationship between infrastructure and natural capital in its future work and seek to further understand the opportunities and cost implications of addressing impacts.



Floodplain, Wollaston

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List of organisations:

Blue Green Cities Project	UK Collaboratorium for Research on Infrastructure and Cities
Chartered Institute of Ecology and Environmental Management	University of Exeter
Climate Change Committee	University of Oxford
Department for Environment, Food and Rural Affairs	Wildlife and Countryside Link
Environmental Systems	Woodland Trust
Environment Agency	World Wide Fund for Nature
Frazer-Nash Consultancy	
Friends of the Earth	
Green Alliance	
Greenpeace	
Highways England	
HM Treasury	
Ministry of Housing, Communities and Local Government	
Natural Capital Committee	
Natural England	
Northumbria University	
Renewable Energy Association	
The National Trust	
Town and Country Planning Association (including Green Infrastructure Partnership Sounding Board)	

Annex A: Objectives in the 25 year environment plan and the Commission's work¹¹⁶

25 year environment plan objective	Commission recommendations and work
1. Clean air: reduction in harmful pollutants and greenhouse gasses	<ul style="list-style-type: none"> ● National Infrastructure Assessment recommendations to enable 100 per cent new vehicle sales being electric by 2030 ● National Infrastructure Assessment recommendations to enable move to highly renewable power system ● National Infrastructure Assessment recommendations to support the transition to zero carbon heating ● Freight Study recommendations to enable zero carbon freight by 2050 ● Emissions from other sectors sit outside the Commission's remit.
2. Clean and plentiful water: improving at least 25 per cent of waters to close to their natural state by: <ul style="list-style-type: none"> ● reducing the damaging abstraction of water from rivers and ground water ● reaching or exceeding targets for rivers, lakes, and coastal or ground water that is specially protected ● supporting OFWAT's ambition on leakage ● minimising by 2030 the harmful bacteria in designated bathing waters. 	<ul style="list-style-type: none"> ● National Infrastructure Assessment recommendations on drought resilience through increasing supply and reducing demand for water

<p>3. Thriving plants and wildlife: to achieve a growing and resilient network of land, water and sea that is richer in plants and wildlife including by:</p> <ul style="list-style-type: none"> ● reversing the loss of marine biodiversity ● restoring 75 per cent of the UK's one million hectares of terrestrial and freshwater protected sites ● creating or restoring 500,000 hectares of wildlife-rich habitat outside of protected site network ● increasing woodland in England in line with a target of 12 per cent cover by 2060. 	<ul style="list-style-type: none"> ● Design Group's Design Principles for National Infrastructure: Under 'places' principle they argue infrastructure projects should: make interventions to enrich our ecosystems; seek to deliver biodiversity net gain; contribute to the restoration of wildlife on a large scale; protect irreplaceable habitats ● Rail Needs Assessment for the Midlands and the North: recommended that the Integrated Rail Plan should set out a strategic approach to mitigating impacts on the local environment and natural capital, adopting an 'environmental net gain' approach.
<p>4. Reducing the risks of harm from environmental hazards: Reducing individuals' risks from natural hazards including flooding, drought and coastal erosion</p>	<ul style="list-style-type: none"> ● National Infrastructure Assessment recommendations on flood resilience: including a national standard for flood resilience by 2050, reducing the annual risk of flooding to 0.5 per cent and 0.1 per cent for densely populated areas
<p>5. Using resources from nature more sustainably and efficiently: Ensuring that resources from nature, such as food, fish and timber, are used more sustainably and efficiently</p>	<ul style="list-style-type: none"> ● Design principles: include consideration for using resources for construction of infrastructure more sustainably and efficiently ● Soil, food, and timber not relevant to the Commission's remit.
<p>6. Enhancing beauty, heritage and engagement with the natural environment by:</p> <ul style="list-style-type: none"> ● safeguarding and enhancing the beauty of natural scenery ● making sure there are high quality, accessible, natural spaces close to where people live and work. 	<ul style="list-style-type: none"> ● Design principles: 'people' principle says national infrastructure should seek opportunities to improve the quality of life for people who live and work nearby. The 'places' principle says infrastructure design should be sensitive to heritage

7. Mitigating and adapting to climate change	<ul style="list-style-type: none"> ● National Infrastructure Assessment recommendations: produced for 80 per cent emissions reduction target but consistent with net zero. Recommendations supporting net zero include those on electric vehicles, energy, heat and waste. Water and floods recommendations addressed mitigating the impact of climate change ● Freight Study: recommended a pathway to zero emissions freight sector by 2050.
8. Minimising waste by: <ul style="list-style-type: none"> ● ambition for zero avoidable waste by 2050 ● target of eliminating avoidable plastic waste by 2042 ● meeting existing waste targets ● eliminating waste crime ● significantly reducing and where possible preventing all kinds of marine plastic pollution. 	<ul style="list-style-type: none"> ● National Infrastructure Assessment recommendations: municipal waste recycling target of 65 per cent by 2030, including a plastic packaging recycling target of 75 per cent by 2030. The Assessment also recommended incentivising recyclable packaging and product design, restricting hard-to-recycle plastics, and a consistent collections standard for municipal waste
9. Managing exposure to chemicals by: <ul style="list-style-type: none"> ● eliminating the use of polychlorinated biphenyls by 2025 ● reducing land-based emissions of mercury to air and water by 50 per cent by 2030 ● substantially increasing the amount of persistent organic pollutants material being destroyed or irreversibly transformed by 2030. 	<ul style="list-style-type: none"> ● This is not relevant to the Commission's remit
10. Enhancing biosecurity by: <ul style="list-style-type: none"> ● managing and reducing the impact of existing plant and animal diseases and tackling invasive non-native species ● reaching goals set out in 2018 Tree Health Resilience Plan ● ensuring strong biosecurity at UK border ● working with industry to reduce the impact of endemic disease. 	<ul style="list-style-type: none"> ● This is not relevant to the Commission's remit, with the exception of linear transport infrastructure which can act as a vector for the spread of invasive species

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