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Appraisal of Sustainability of the National Policy Statement for Water Resources

Scoping Report Appendix B



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Amec Foster Wheeler Environment
& Infrastructure UK Limited

Proposal for

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Document revisions

No.	Details	Date
1	Draft AoS Scoping Report Appendix B	22.8.17
2	Final Draft AoS Scoping Report Appendix B	10.09.17
3	Final AoS Scoping Report Appendix B	10.10.17
4	Final AoS Scoping Report Appendix B (Published)	08.11.17

Appendix B

Detailed Appraisal including Baseline and Contextual Information

Appendix B contains the collated contextual and baseline information to inform the appraisal of the draft NPS and reasonable alternatives for the following topics:

- ▶ B1: Biodiversity and Nature Conservation;
- ▶ B2: Population, Economics and Skills;
- ▶ B3: Human Health;
- ▶ B4: Land Use, Geology and Soils;
- ▶ B5: Water Quality;
- ▶ B6: Water Quantity;
- ▶ B7: Flood Risk and Coastal Change;
- ▶ B8: Air Quality;
- ▶ B9: Noise;
- ▶ B10: Climatic Factors;
- ▶ B11: Waste and Resource Management;
- ▶ B12: Traffic and Transport;
- ▶ B13: Cultural Heritage;
- ▶ B14: Landscape and Townscape.

Each topic chapter contains:

- ▶ A definition of the topic under consideration;
- ▶ A review of plans and programmes at international, UK and national (England, Scotland and Wales) scales;
- ▶ An overview of the baseline;
- ▶ A summary of the existing problems to be taken into account in carrying out the AoS;
- ▶ A description of the evolution of the baseline;
- ▶ The objectives and guide questions used in the appraisal of the draft NPS and reasonable alternatives to the NPS alongside definitions of significance; and
- ▶ Completed matrices that record the findings of the appraisal of the draft NPS and reasonable alternatives against the AoS objectives.

For the purposes of the review of the international plans and programmes for this AoS, it is assumed that the broad objectives of extant European Union (EU) legislation will be maintained once the UK has withdrawn from the EU and that similar or equivalent environmental protections will remain in place.

Biodiversity and Nature Conservation

1. Biodiversity and Nature Conservation

1.1 Introduction

This section presents the overview of plans, programmes and baseline information for the Water Resources National Policy Statement (NPS) in respect of biodiversity and nature conservation.

Biodiversity in this context is defined by the **Convention on Biological Diversity**¹ as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.” Biodiversity is integral to the functioning of ecosystems and these, in turn, provide ‘ecosystem services’ which include food, flood management, pollination and the provision of clean air and water.

There are links between the biodiversity and nature conservation topic and other topics in the Appraisal of Sustainability (AoS), including water quality, water quantity, land use, geology and soils, climate change and landscape and townscape.

1.2 Review of Plans and Programmes

The review of policies, plans and programmes has identified that at the international/European level, a broad range of plans of programmes seek to protect biodiversity, including setting long-term goals to prevent the loss of biodiversity and various agreements to control the trade in endangered species several of which are of particular significance to the NPS for Water Resources.

The **Ramsar Convention** provides the framework for the conservation and wise use of wetlands and their resources and as such is of particular importance given the potential for wetlands to be affected by the NPS.

The **Water Framework Directive (WFD) (2000/60/EC)** also provides a key piece of international legislation, requiring countries to adopt an approach to water management focused on river basins. The WFD sets a general requirement for ecological protection and a general minimum chemical standard to cover all surface waters, referred to as “good ecological status” and “good chemical status”. These are key benchmarks for establishing the quality of the water environment.

At the national level, the majority of plans and programmes seek to protect all valuable habitats and species, rather than being focussed specifically on the inland water environment. The **Great Britain Invasive Non-native Species Strategy (2015)** sets aims and objectives to 2020 to address the increasing numbers of invasive species introduced in Great Britain, with around 80 non-native species established in Great Britain’s freshwater environment.

At both the national and international levels, the core objectives identified from the review of policies plans and programmes is the need to halt the decline in biodiversity, control invasive species and maintain and enhance the chemical and ecological quality of our aquatic ecosystems.

International/European

The UK is a signatory (along with another 167 parties) to the **Convention on Biological Diversity (CBD)**, which entered into force in 1993. The main objectives of the Convention are the conservation of biological diversity and the sustainable and equitable use of biodiversity components. The CBD called for the development and enforcement of national strategies and associated action plans to identify, conserve and protect existing biological diversity, and to enhance it wherever possible.

¹ The convention uses this definition to describe ‘biological diversity’ commonly taken to mean the same as biodiversity

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In October 2010, the Convention on Biological Diversity Conference of Parties agreed the **Strategic Plan for Biodiversity 2011-2020** at Nagoya, Japan. With its five strategic goals and 20 new global 'Aichi' targets, the Plan sets a new global vision and direction for biodiversity. The new global vision is: "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people." The parties also agreed a shorter-term ambition to "Take effective and urgent action to halt the loss of biodiversity, [so] that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication".

The **Nagoya Protocol on Access and Benefit-sharing**, which entered into force in 2014, is a supplementary agreement to the Convention on Biological Diversity which sets out to establish a fair and equitable system to enable nations to co-operate in accessing and sharing the benefits of genetic resources.

The UK is also party to the **Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)**, which was ratified in the UK in 1985 and provides strict protection for endangered migratory species, and the **Bern Convention on the Conservation of European Wildlife and Natural Habitats (1982)**, which aims to ensure the conservation and protection of species and their natural habitats. In addition, the UK is party to the **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)** which came into force in 1975. The convention aims to ensure that international trade in wild animals and plants does not threaten the survival of the species in the wild.

The European Commission adopted the **EU Biodiversity Strategy to 2020** in 2011 to help halt the loss of biodiversity in the EU. The Strategy provides a framework for action over the next decade and covers the following key areas:

- ▶ conserving and restoring nature;
- ▶ maintaining and enhancing ecosystems and their services;
- ▶ ensuring the sustainability of agriculture, forestry and fisheries;
- ▶ combating invasive alien species; and
- ▶ addressing the global biodiversity crisis.

The strategy also sets out the following 2050 vision and 2020 headline target:

- ▶ by 2050, EU biodiversity and the ecosystem services it provides - its natural capital - are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided; and
- ▶ halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restore them insofar as is feasible, while stepping up the EU contribution to averting global biodiversity loss.

The EU's **7th Environment Action Programme**, adopted in 2013, aims to accelerate the achievement of the strategy's objectives.

There are a number of EU Directives focusing on various types of wildlife and habitat that provide a framework for national action and international co-operation for conservation on land and in the sea. In particular, the **Habitats Directive (92/43/EEC)** and **Birds Directive (2009/147/EC)** include measures to maintain or restore important natural habitats and species including through the designation of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). These Directives are transposed into British law through a number of regulations and planning policy documents.

Under the **Ramsar Convention**, wetlands of international importance are designated as Ramsar sites. As a matter of policy, Ramsar sites in the UK are protected as European sites. The vast majority are also classified as SPAs and all terrestrial Ramsar sites in England are notified as Sites of Special Scientific Interest (SSSIs).

Biodiversity and Nature Conservation

The **Water Framework Directive (WFD) (2000/60/EC)** established a framework for the protection of inland surface waters, transitional waters, coastal water and groundwater and was designed to improve and integrate the way water bodies are managed, including encouraging the sustainable use of water resources. The key objectives at the European level include the general protection of the aquatic ecology and providing specific protection of unique and valuable habitats. The prevention of water deterioration is also a legally binding duty on Member States under the Directive.

The **Marine Strategy Framework Directive (2008/56/EC)** requires Member States to develop a marine strategy, including determining Good Environmental Status (GES) for their marine waters, and designing and implementing programmes of measures aimed at achieving it by 2020, using an ecosystem approach to marine management. It takes account both of socio-economic factors and the cost of taking action in relation to the scale of the risk to the marine environment.

UK

The **Wildlife and Countryside Act (1981)** is the main UK legislation relating to the protection of named animal and plant species and includes legislation relating to the UK network of nationally protected wildlife areas: Sites of Special Scientific Interest (SSSIs)². Under this Act, Natural England has responsibility for identifying and protecting the SSSIs in England. **The Countryside and Rights of Way Act 2000 (CROW Act)** strengthens the powers of Natural England to protect and manage SSSIs. The CROW Act improves the legislation for protecting and managing SSSIs so that:

- ▶ Natural England can change existing SSSIs to take account of natural changes or new information;
- ▶ all public bodies have a duty to further the conservation and enhancement of SSSIs;
- ▶ neglected or mismanaged sites can be brought into favourable management; and
- ▶ offences and heavier penalties apply to people who illegally damage SSSIs.

The **UK Biodiversity Action Plan (1994)** was the UK Government's response to signing the CBD at the 1992 Rio Earth Summit. The UK Biodiversity Action Plan was then established to conserve and enhance biodiversity in the UK through the use of Habitats and Species Action Plans to help the most threatened species and habitats to recover and to contribute to the conservation of global biodiversity.

Following the creation of the UK BAP, devolution in 1998 led the four countries of the UK (England, Northern Ireland, Scotland and Wales) to develop their own country strategies for biodiversity and the environment, allowing conservation approaches to differ according to the different environments and priorities within the countries. In 2007, however, a shared vision for UK biodiversity conservation was adopted by the devolved administrations and the UK government, and is described in 'Conserving Biodiversity – the UK Approach'. This document reflected the drivers for conservation action in the UK since the UK BAP was created, including the EU Gothenburg agreement in 2001 to halt the loss of biodiversity by 2010, and the findings of the Millennium Ecosystem Assessment (2005).

The **UK Post-2010 Biodiversity Framework**, published in July 2012 by the Joint Nature Conservation Committee (JNCC) and Defra, succeeds the UK BAP and 'Conserving Biodiversity – the UK Approach', and is the result of a change in strategic thinking following the publication of the CBD's 'Strategic Plan for Biodiversity 2011–2020', and the launch of the EU Biodiversity Strategy.

The purpose of this UK Post-2010 Biodiversity Framework³ is to set a broad enabling structure for action across the UK between now and 2020:

² As amended by the Countryside and Rights of Way Act 2000 and the Natural Environment and Rural Communities Act 2006.

³ Joint Nature Conservancy Committee and Defra (2012) *UK Post-2010 Biodiversity Framework*. Available online at: http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf

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- I. To set out a shared vision and priorities for UK-scale activities, in a framework jointly owned by the four countries, and to which their own strategies will contribute;
- II. To identify priority work at a UK level which will be needed to help deliver the Aichi targets and the EU Biodiversity Strategy;
- III. To facilitate the aggregation and collation of information on activity and outcomes across all countries of the UK, where the four countries agree this will bring benefits compared to individual country work; and
- IV. To streamline governance arrangements for UK-scale activity.

The Framework demonstrates how the work of the four countries and the UK contributes to achieving the Aichi Biodiversity Targets, and identifies the activities required to complement the country biodiversity strategies in achieving the targets.

The **Great Britain Invasive Non-native Species Strategy (2015)** sets aims and objectives to 2020 to address invasive species, including the prevention of invasive species arriving in Britain, early detection and monitoring, eradication and control.

The **Conservation of Habitats and Species Regulations 2010** (SI 2010/490) (in England and Wales), the **Conservation (Natural Habitats, &c.) Regulations 1994** (in Scotland) and the **Conservation (Natural Habitats) Regulations (Northern Ireland) 1995 (as amended)** (NISR 1995/380) (in Northern Ireland) require that sites of importance to habitats or species are to be designated and any impact on such sites or species must be considered in regards to planning permission applications.

The **Environmental Protection Act (1990)** sets out key statutory requirements for the UK regarding environmental protection (including waste and nature conservation).

The Marine Strategy Framework Directive was transposed into UK law by the **Marine Strategy Regulations 2010** (SI 2010/1627) and sets out a requirement for Member States to:

- ▶ provide an assessment of the current state of their seas by July 2012;
- ▶ provide a set of detailed characteristics of what GES means for their waters, and associated targets and indicators, by July 2012;
- ▶ establish a monitoring programme to measure progress by July 2014; and
- ▶ establish a programme of measures for achieving GES by 2016.

The UK has set targets for a healthy marine environment by 2020 under this Directive. The strategy to do this was published in stages: with the first part published in 2012, the second part containing monitoring programmes in 2014 and the third part setting out the programme of measures was published in 2015.

The **Marine and Coastal Access Act (2009)** sets out a number of measures including the establishment of Marine Conservation Zones (MCZs) and Marine Spatial Plans.

The **National Parks and Access to the Countryside Act (1949)** aims to conserve and protect countryside and National Parks through legislation.

England

The **Natural Environment and Rural Communities Act 2006** established Natural England as the main body responsible for conserving, enhancing and managing England's natural environment. It also covers biodiversity, pesticides harmful to wildlife and the protection of birds.

The **Natural Environment White Paper (Defra, 2011)** recognises that nationally, the fragmentation of natural environments is driving continuing threats to biodiversity. It sets out the Government's policy intent to:

- ▶ improve the quality of the natural environment across England;

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- ▶ move to a net gain in the value of nature;
- ▶ arrest the decline in habitats and species and the degradation of landscapes;
- ▶ protect priority habitats;
- ▶ safeguard vulnerable non-renewable resources for future generations;
- ▶ support natural systems to function more effectively in towns, in the country and at sea; and
- ▶ create an ecological network which is resilient to changing pressures.

By 2020, the Government seeks to achieve an overall improvement in the status of the UK's wildlife including no net loss of priority habitat and an increase of at least 200,000 hectares in the overall extent of priority habitats. Under the White Paper, the Government has also put in place a clear institutional framework to support nature restoration which includes Local Nature Partnerships creating new Nature Improvement Areas (NIAs).

Biodiversity 2020: A strategy for England's wildlife and ecosystem services (Defra, 2011) builds on the Natural Environment White Paper and provides a comprehensive picture of how the Government is implementing international and EU commitments. It sets out the strategic direction for biodiversity policy for the next decade on land (including rivers and lakes) and at sea. The Strategy has as its mission to halt overall biodiversity loss, support healthy, well-functioning ecosystems, and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people.

The ***National Planning Policy Framework (NPPF) (Department for Communities and Local Government (DCLG), 2012)*** includes key policies to ensure the planning system contributes to and enhances the natural and local environment by:

- ▶ protecting and enhancing valued landscapes, geological conservation interests and soils;
- ▶ recognising the wider benefits of ecosystem services;
- ▶ minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;
- ▶ preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability; and
- ▶ remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

The NPPF states that, when preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Local planning authorities are expected to set criteria based policies against which proposals for any development on or affecting protected wildlife or geodiversity or landscape areas will be judged. In doing so, they must take into account the policies in the NPPF including those which set out the circumstances where in order to conserve and enhance biodiversity planning permission should be refused.

Planning Practice Guidance for the Natural Environment (2016) explains key issues in implementing policy to protect biodiversity, including local requirements.

Scotland

The ***National Planning Framework 3 (2014)***, as part of its spatial strategy, envisions Scotland as "a natural and resilient place" and identifies where there will be opportunities for environmental enhancement.

The ***Nature Conservation (Scotland) Act 2004*** places duties on public bodies in relation to the conservation of biodiversity, increases protection for SSSI, amends legislation on Nature Conservation

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Orders, provides for Land Management Orders for SSSIs and associated land, strengthens wildlife enforcement legislation, and requires the preparation of a Scottish Fossil Code.

Scottish Planning Policy (SPP) (2014) sets out the Scottish Government's policy on land use planning. It incorporates the conservation of designated or protected sites and species, takes into account ecosystems and natural processes and seeks to establish integrated habitat networks.

Planning Advice Note 60 (PAN 60): Planning for Natural Heritage (2000) provides advice on how development and the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment and encourages developers and planning authorities to be positive and creative in addressing natural heritage issues.

Scotland's Biodiversity: It's in Your Hands - A strategy for the conservation and enhancement of biodiversity in Scotland (2004) aims to conserve biodiversity for the health, enjoyment and wellbeing of the people of Scotland now and in the future and provides a 25 year framework in order to achieve this goal.

Scotland's performance against 2010 international targets showed that good progress had been made towards meeting the UN target of a significant reduction in the loss of biodiversity. Lessons learnt from the 2010 assessment included the need to adopt a more adaptive approach, learning from experience and trying to tackle the causes of biodiversity loss. The **2020 Challenge for Scotland's Biodiversity (2013)** is a supplement to Scotland's Biodiversity: It's in Your Hands, and together, the two documents comprise the **Scottish Biodiversity Strategy**. The 2020 Challenge focusses on desired outcomes for 2020, responds to the new international Aichi targets and updates elements of the 2004 strategy.

Scotland's Biodiversity - a Route Map to 2020 (2015) sets out the short-term priority work needed to deliver the 2020 Challenge and meet the international Aichi Targets for biodiversity. Progress against the 2020 challenge for biodiversity was most recently presented to the Scottish Parliament in the **Scottish Biodiversity Strategy: Report to the Scottish Parliament 2014 – 2016⁴**.

The first land use strategy for Scotland (**Getting the best from our land - A land use strategy for Scotland (2011)**) had the objectives of: land-based businesses working with nature; responsible stewardship of Scotland's natural resources; and urban and rural communities better connected to the land. The vision, objectives and principles of the strategy were retained and built upon by the second land use strategy (published 2016) which covers the period 2016 – 2021.

Wales

Planning Policy Wales (Edition 8) (2016) sets out the land use planning policies of the Welsh Government, including objectives for the conservation and improvement of landscape and biodiversity.

Technical Advice Note 5 (TAN5): Nature Conservation and Planning (2009) sets out how the planning system should contribute to protecting and enhancing biodiversity and geological conservation.

The **Environment Strategy for Wales** was published in May 2006. It set out proposed outcomes for what the Welsh Government sought to achieve by 2026, and the actions required. The **One Wales: One Planet (2009)** sustainable development scheme also supports the strategy's outcomes and includes biodiversity indicators.

The **Well-being of Future Generations (Wales) Act 2015** sets out a framework to improve the social, economic, environmental and cultural well-being of Wales. It requires public bodies in Wales to contribute to sustainable development and in particular to implement actions that contribute to well-being goals established under the Act. One goal, "a resilient Wales" refers explicitly to biodiversity, "A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support

⁴ Scottish Government (2017) *Scottish Biodiversity Strategy: Report to the Scottish Parliament 2014 – 2016*. Available online at: <http://www.gov.scot/Resource/0052/00522533.pdf>

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social, economic and ecological resilience and the capacity to adapt to change (for example climate change)".

The **Environment (Wales) Act 2016** sets a more joined up legislative framework for regulating Wales' environment, and provides for the sustainable management of natural resources. It required Welsh Ministers to adopt a **Natural Resources Policy** (NRP) and this was done in August 2017. The focus of the NRP is the sustainable management of Wales' natural resources to maximise their contribution to achieving goals within the Well-being of Future Generations Act 2015. The policy sets out three National Priorities. These are: delivering nature-based solutions; increasing renewable energy and resource efficiency; and taking a place-based approach. The NRP links to the Wales National Marine Plan as the means of sustainably managing marine resources, reflecting the context of the ecosystem approach for Wales' marine area. The Environment (Wales) Act 2016 also requires Natural Resources Wales to publish a **State of Natural Resources Report** (SoNaRR) which will set out evidence on Wales' progress towards its environment and natural resource management goals. The Act also establishes a duty on public authorities to "maintain and enhance biodiversity in the exercise of functions in relation to Wales, and in so doing promote the resilience of ecosystems".

1.3 Overview of the Baseline

Good quality habitats are those which, for a given habitat type, have a larger range of features. For example, a habitat that has varying topography, water distribution or appropriate grazing by animals. This provides a broader variety of conditions and resources that a greater number and diversity of species can exploit. A good quality habitat needs to be large enough to support populations of species over a long period of time. Additionally, some species require large areas of consistent habitat, whilst others thrive in mosaics and therefore the best sites need to be of a size that allows both species to be accommodated.

A mixture or mosaic of habitats provide areas for a variety of species that require different conditions and resources to survive. Having multiple habitats in a locality provides opportunity for a higher number of species to utilize and occupy the area. Therefore, biodiversity is generally higher.

Habitat and habitat quality are therefore commonly used as indicators of biodiversity as good quality, diverse habitats with consistent resources and conditions generally allow for a greater diversity of species to survive and reproduce.

Given the national scope of the NPS, the baseline data presented in this section takes a comprehensive look at the overall national baseline for biodiversity. The relationship between the baseline environment and the potential effects of the plan will become increasingly clear as the appraisal progresses. Inevitably this means that in some instances the link between the baseline environment discussed here and the NPS are not directly clear; however the baseline environmental information is included to ensure that the appraisal is based on a comprehensive dataset from the outset.

UK

Special Areas of Conservation (SACs), Sites of Community Importance (SCIs), Special Protection Areas (SPAs) and Ramsar sites are important for biodiversity at the international level. In the UK there are 651 SACs/SCIs, 272 SPAs and 149 Ramsar sites⁵.

Figures 1.1, 1.2 and 1.3 illustrate the distribution of European designed sites in England, Scotland and Wales. In addition, there are almost 7,000 nationally designated sites in the UK, known as SSSIs in England, Wales and Scotland, and Areas of Special Scientific Interest (ASSIs) in Northern Ireland. There are currently 99 SACs with marine component, covering 7.6% of UK waters. 83 of these SACs are completely in

⁵ Joint Nature Conservation Committee (2017) *UK Protected Sites*. Available online at: <http://jncc.defra.gov.uk/page-4>

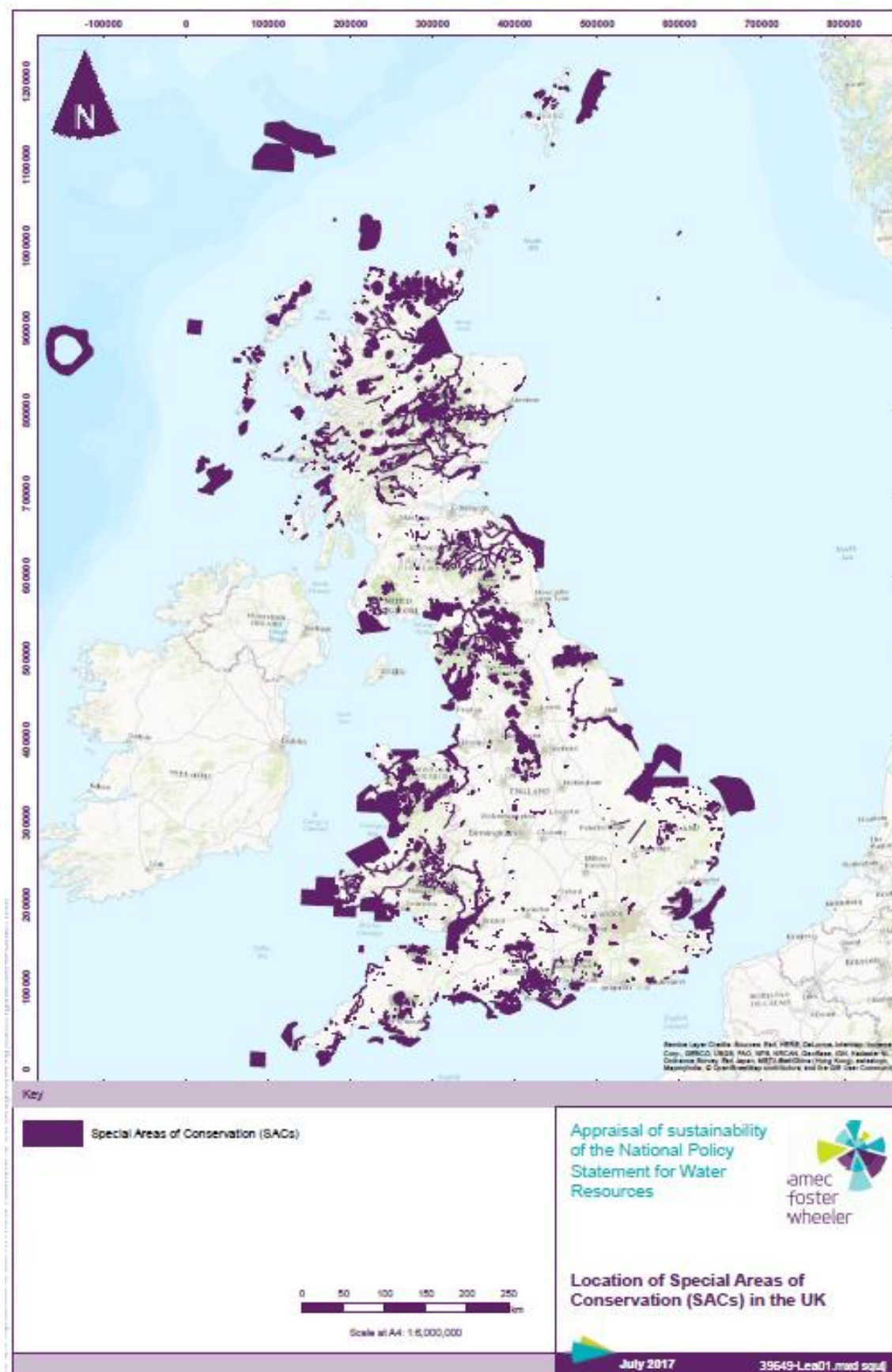
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inshore waters. There currently are 13 marine habitats and eight marine species in UK waters which are protected under Annexes I and II of the Habitats Directive⁶.

⁶ Joint Nature Conservation Committee (2017) *SACs with Marine Components*. Available online at: <http://jncc.defra.gov.uk/page-1445>

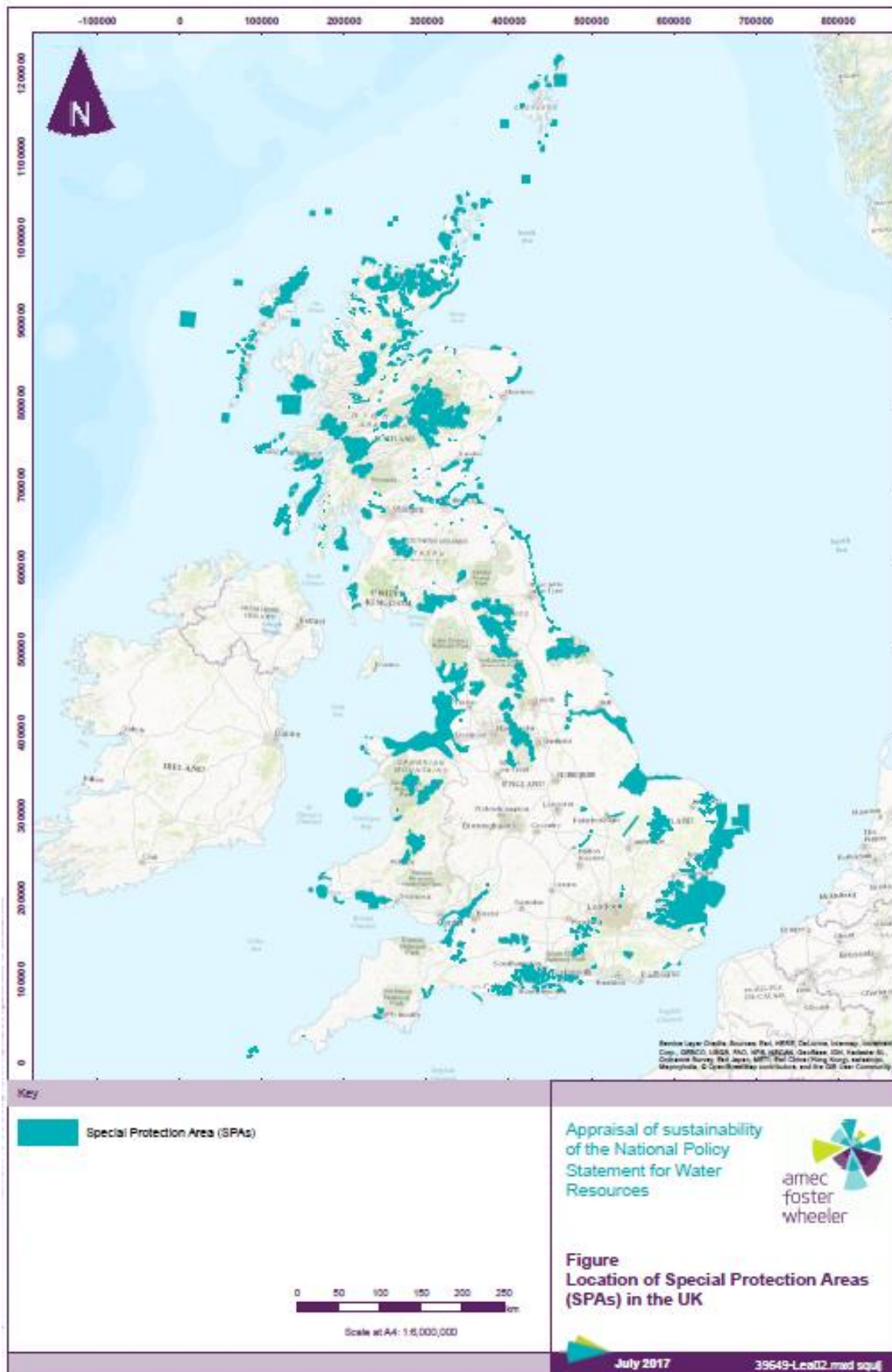
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Figure 1.1 Location of Special Areas of Conservation (SACs) in the UK



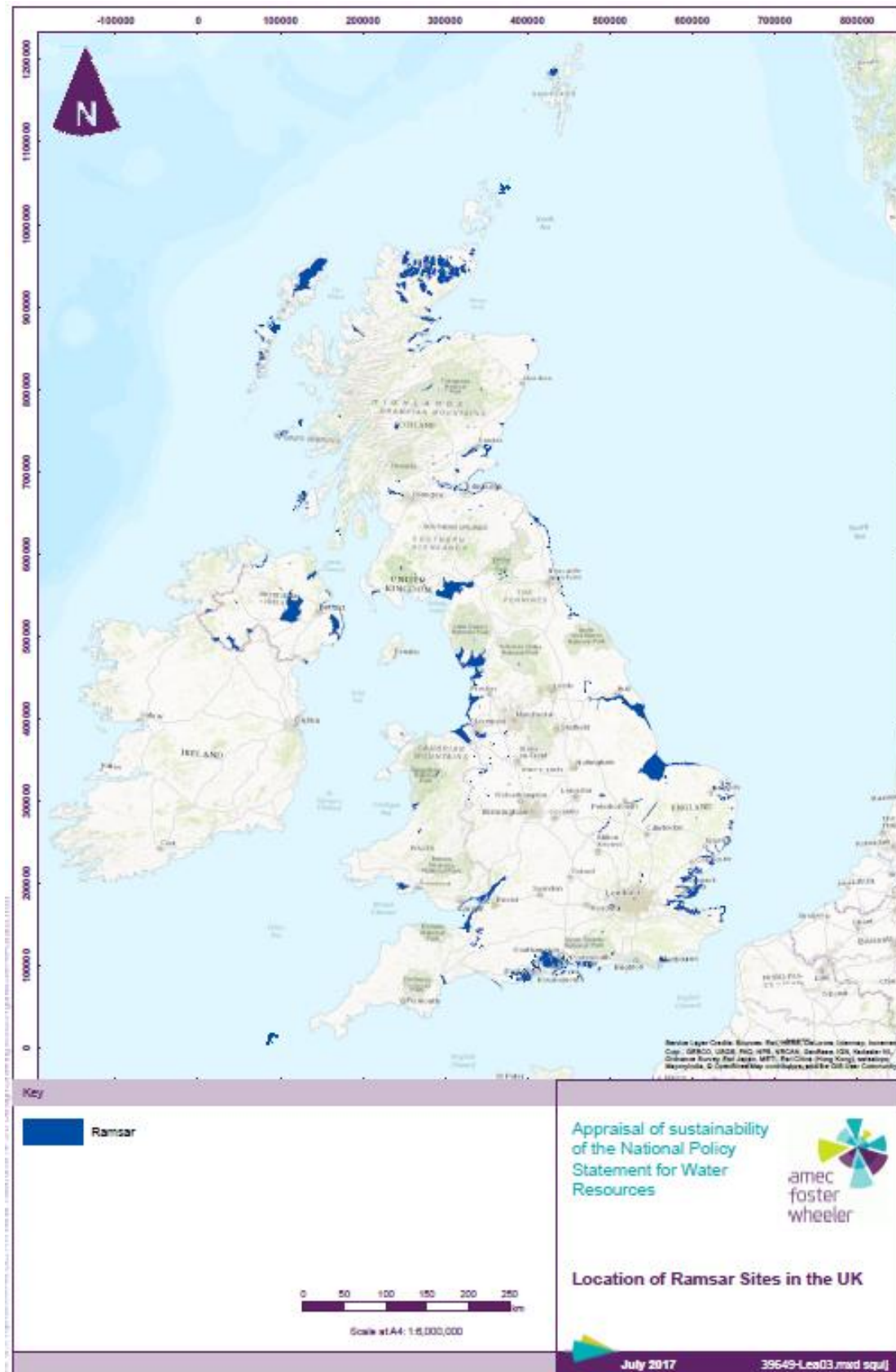
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Figure 1.2 Location of Special Protection Areas (SPAs) in the UK



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Figure 1.3 Location of Ramsar Sites in the UK

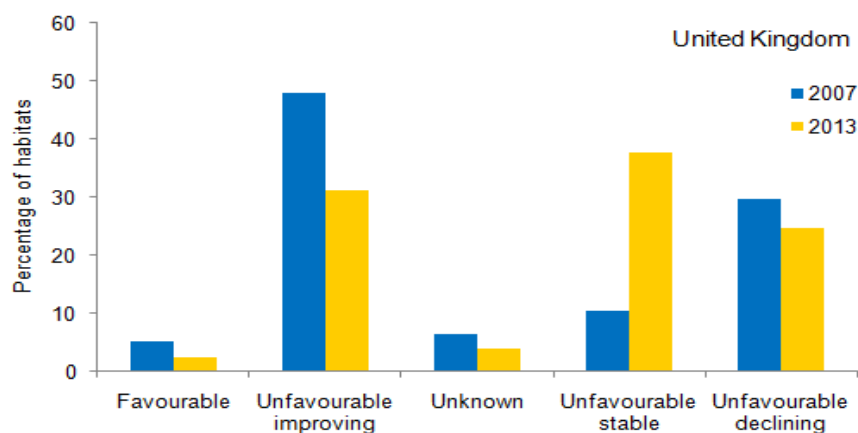


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Conservation Status of UK Habitats Listed under the Habitats Directive

In 2007 and again in 2013, the Joint Nature Conservation Committee (JNCC)⁷ published reports identifying the change in status of UK habitats of European importance. The 2007 Report identified that 5% of UK habitats listed in Annex I of the Habitats Directive were in favourable conservation status, with that number declining to 3% in the 2013 report. The conservation status of 48% of habitats was improving in 2007, while in 2013, 31% were found to be improving. The conservation status of 30% of the habitats was declining in 2007, whereas in 2013 only 25% were declining (see **Figure 1.4**).

Figure 1.4 Percentage of UK habitats of European importance in improving or declining conservation status in 2007 and 2013.



Source: UK Habitats Directive (Article 17) reports: 2nd UK Report on Implementation of the Habitats Directive (2007) and 3rd UK Habitats Directive Reporting (2013).

Notes: Graph based on 77 habitats listed on Annex I of the Habitats Directive.

The aim of the Habitats Directive is to achieve favourable conservation status for the species and habitats listed in its Annexes. An assessment of status and trends for each species and habitat is undertaken every six years. Trends in unfavourable conservation status allow identification of whether progress is being made, as it will take many years for some habitats and species to reach favourable conservation status.

⁷ UK Habitats Directive (Article 17) reports: 2nd UK Report on Implementation of the Habitats Directive (2007) and 3rd UK Habitats Directive Reporting (2013)

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Relating specifically to the condition of freshwater habitats in the UK, **Table 1.1** identifies the favourability status of SSSIs / ASSIs⁸.

Table 1.1 SSSI / ASSIs status of UK Freshwater Habitats

	Favourable	Unfavourable recovering	Unfavourable not recovering (declining or no change)	Destroyed or part destroyed
Standing water	49%	12%	38%	1%
Rivers	32%	11%	56%	1%

The favourability status of freshwater SACs is set out in **Table 1.2**.

Table 1.2 SAC Status of Freshwater SACs

	Favourable	Unfavourable recovering	Unfavourable not recovering (declining or no change)	Destroyed or part destroyed
Standing water	49%	12%	38%	1%
Rivers	32%	11%	56%	1%

Further detail on the status of SACs into EU Habitats Directive Annex 1 types is provided in **Table 1.3**.

Table 1.3 SAC Status by Annex 1 habitat types

Annex I habitat type	Favourable	Unfavourable recovering	Unfavourable not recovering
H3170 Mediterranean temporary ponds	100%	0%	0%
H3160 Natural dystrophic lakes and ponds	99%	<1%	1%
H3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea	80%	6%	14%
H3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation	61%	9%	30%
H3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. dunes along the shoreline with Ammophila arenaria ('white dunes')	38%	4%	58%
H3110 Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	22%	78%	0%
H3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	3%	0%	97%

⁸ Joint Nature Conservation Committee (2016) *Condition of UK Freshwater Habitats*. Available online at: <http://jncc.defra.gov.uk/page-6695>

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Annex I habitat type	Favourable	Unfavourable recovering	Unfavourable not recovering
H3180 Turloughs	0%	0%	100%

UK freshwater habitats and their associated species are threatened by a range of factors. **Table 1.4** provides a summary of the major threats. These are based on information in the 3rd UK Report on Implementation of the Habitats Directive and the UK Biodiversity Habitat Action Plans⁹.

Table 1.4 Threats to UK Freshwater Habitats

	Eutrophic standing waters	Mesotrophic lakes	Oligotrophic and dystrophic lakes	Aquifer-fed naturally fluctuating water bodies	Ponds	Rivers
Pollution	✓	✓	✓	✓	✓	✓
Abstraction and flow regime	✓	✓	✓	✓	✓	✓
Invasive alien species	✓	✓	✓		✓	✓
Recreation	✓	✓	✓			
Fisheries management	✓	✓		✓	✓	
Climate change	✓			✓		✓
Grazing/control of scrub & trees				✓	✓	
Morphological alterations					✓	✓

Bird Populations

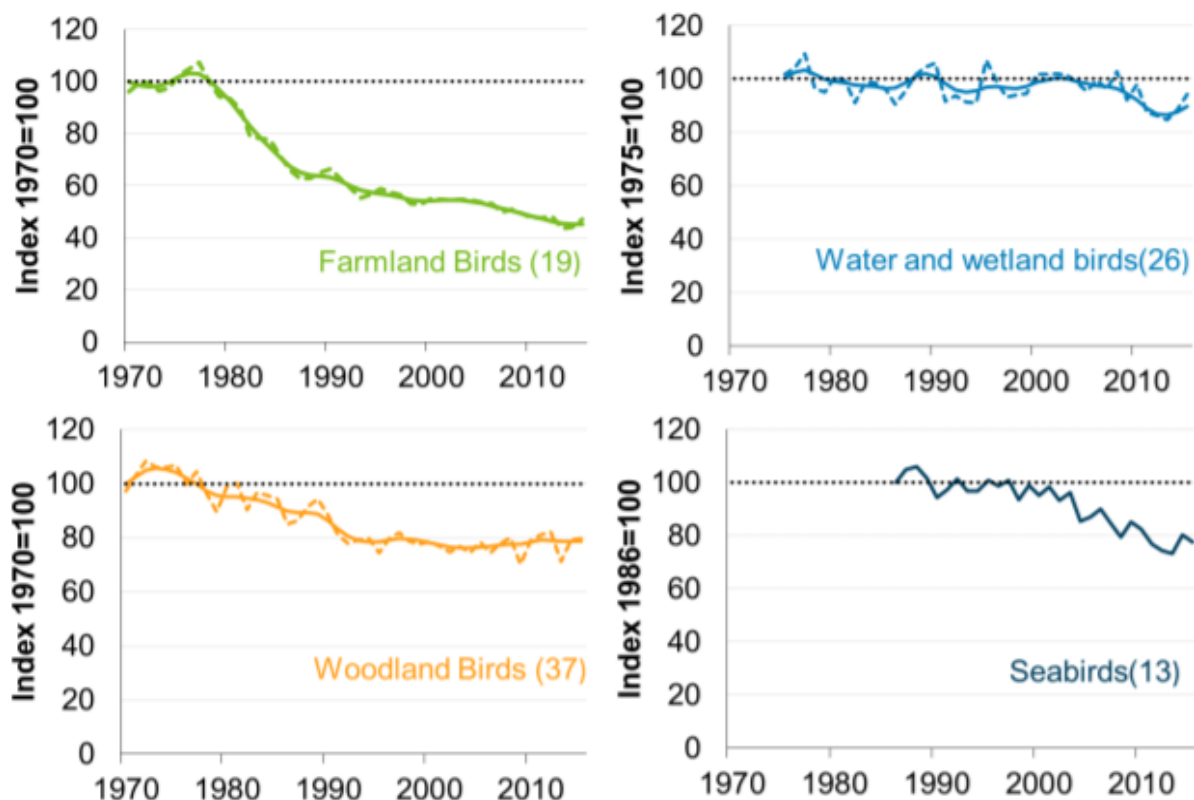
Bird populations are considered to be good indicators of the state of the environment and the countryside. Species typical of farmland, woodland and coastal areas have been used as indicators of the health of their particular habitat (see **Figure 1.5**, **Figure 1.6** and **Figure 1.7**) which provide an overview of population changes since 1970)¹⁰. The species used to calculate the indicators are set out in **Annex A**.

⁹ Joint Nature Conservation Committee (2016) *Threats to UK Freshwater Habitats*. Available online at: <http://jncc.defra.gov.uk/page-6694>

¹⁰ Defra (2017) *Wild Bird Populations in the UK, 1970-2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/614737/UK_Wild_birds_1970_2015_2.pdf

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Figure 1.5 Populations of wild birds in the UK, by habitat, 1970-2015¹¹



Source: RSPB, BTO, JNCC, Defra.

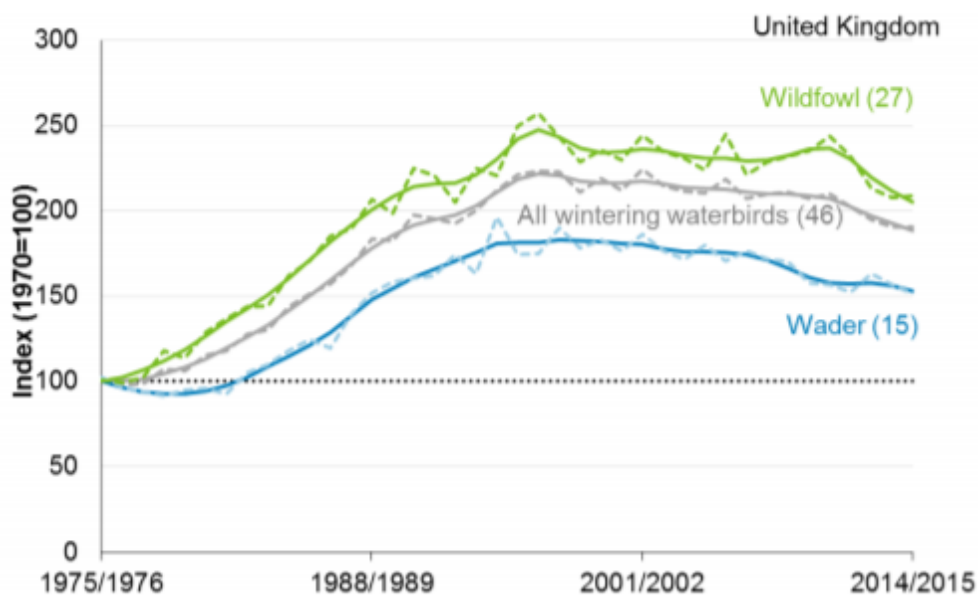
Note: Figures in brackets show the number of species. Graph shows unsmoothed trends (dashed lines) and smoothed trends (solid lines). No smoothed trend is available for seabirds as individual species population trends are based on full counts at colonies or wetland and coastal sites.

¹¹ Defra (2017) *Wild Bird Populations in the UK, 1970-2015*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/614737/UK_Wild_birds_1970_2015_2.pdf

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Figure 1.6 Populations of wintering waterbirds in the UK, 1975-76 to 2014-15¹²



Source: RSPB, BTO, JNCC, Defra.

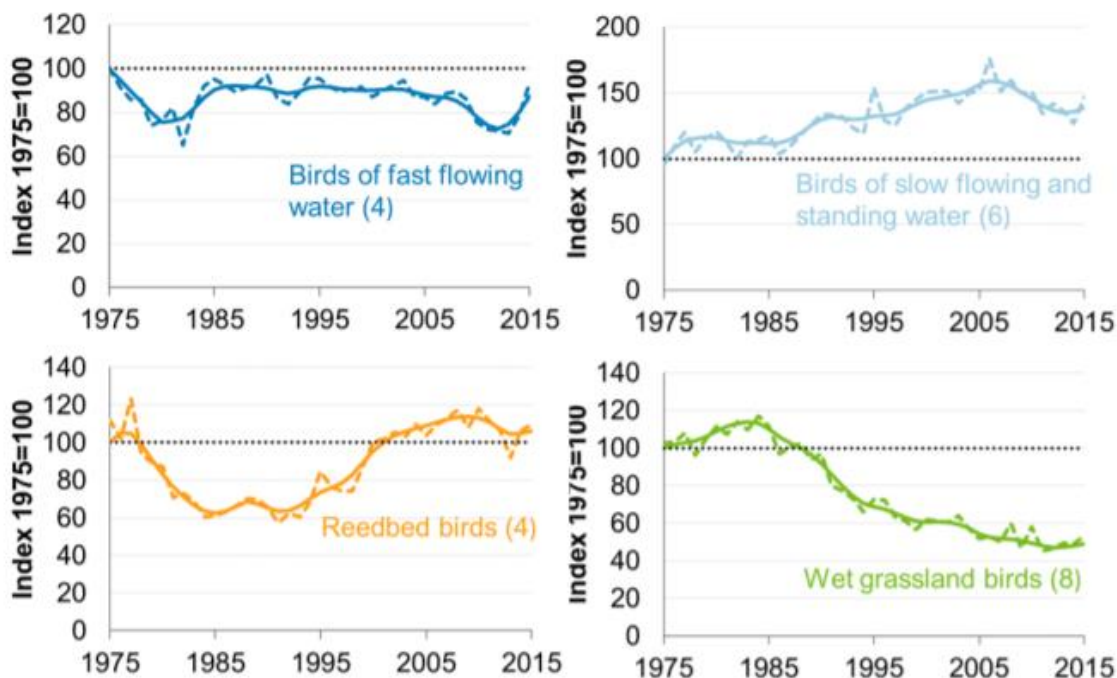
Note: Figures in brackets show the number of species. Graph shows unsmoothed trend (dashed line) and smoothed trend (solid line). Data from surveys of wintering waterbirds are based on full counts at colonies or wetland and coastal sites of markedly varying size. This means that bootstrapping methods cannot be applied and that trends for these groups are currently presented without confidence intervals.

¹² Defra (2017) *Wild Bird Populations in the UK, 1970-2015*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/614737/UK_Wild_birds_1970_2015_2.pdf

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Figure 1.7 Populations of water and wetland birds in the UK, 1975 - 2015¹³



Source: RSPB, BTO, JNCC, Defra.

Note: Figures in brackets show the number of species. Graph shows unsmoothed trend (dashed line) and smoothed trend (solid line). the number of species in each of the sub indicators do not sum to the all species indicator because four species in the main breeding wetland and waterways indicator are not included in any of the sub-indicators covering birds of reed beds, fast flowing waterways, standing and slow-flowing waterways, or wet grasslands. These are Sand Martin, Kingfisher, Grey Heron and Oystercatcher. None of these species show a strong preference for any one of those habitats, either being fairly generalist or with large proportions of their populations in other habitats such as coasts (Oystercatcher).

In 2015, the all-species index in the UK was 2% below its 1970 level, although trends vary substantially between different species and habitats. The smoothed index remained level between 2009 and 2014.

Since 1970, populations of breeding farmland birds have declined by over half, with much of this decline taking place between the late seventies and early eighties. Some of the main causes of this decline relate to land management changes and the intensification of farming, a move from spring to autumn sowing of arable crops, change in grassland management, increased pesticide and fertiliser use, and the removal of non-cropped features such as hedgerows. There is also evidence of adverse impacts from disease.

The breeding woodland bird populations have declined by 18% since 1970, with the greatest decline occurring across a 10 year period from the early eighties. The key causes of this are a lack of woodland management and increased deer browsing, which reduces the availability of nesting and foraging habitats. Long-distance migrant woodland birds may also suffer from deterioration of habitats outside the UK.

The breeding water and wetland birds experienced an overall decline of 7% from 1975 to 2015, although between the 26 species there is significant variation. Certain groups with this, such as breeding waders, have experienced historical declines due to changes in land management, intensification of grassland management and the conversion of coastal and floodplain grazing marshes to arable land. Fragmented populations are also vulnerable to predation.

¹³ Defra (2017) *Wild Bird Populations in the UK, 1970-2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/614737/UK_Wild_birds_1970_2015_2.pdf

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Populations of breeding seabirds have also declined by 22% from 1986 to 2015, with the number of seabirds declining by 6% between 2009 and 2014 alone. In 2013 numbers dipped to the lowest ever but have since increased slightly.

Wintering waterbirds are one of the few populations to show a substantial increase, with populations almost double 1975-76 levels (increase of 92%). This peaked in the late 1990s, and has since had a minor decline. These species are affected by conditions in the countries where they breed, the condition and amount of coastal and wetland habitat in the UK and changes in migratory patterns.

Bat Populations

Bat species make up a third of the UK's mammal fauna and occur in most lowland habitats across the UK. Bats are widespread throughout a variety of landscapes including urban areas, farmland, woodland, and river/lake systems. To thrive they require adequate roosting opportunities (particularly for breeding and hibernating), foraging habitat and connected landscape features, such as hedgerows and tree lines that assist them in commuting between roost sites and feeding locations. Key pressures on bats (landscape change, agricultural intensification, development, habitat fragmentation) are also relevant to many other wildlife groups. Bats are sensitive to pollution and factors affecting their insect prey (e.g. pesticides, drainage and land management change). Climatic shifts are predicted to affect bat populations through changes in their yearly hibernation cycles, breeding success and food availability.

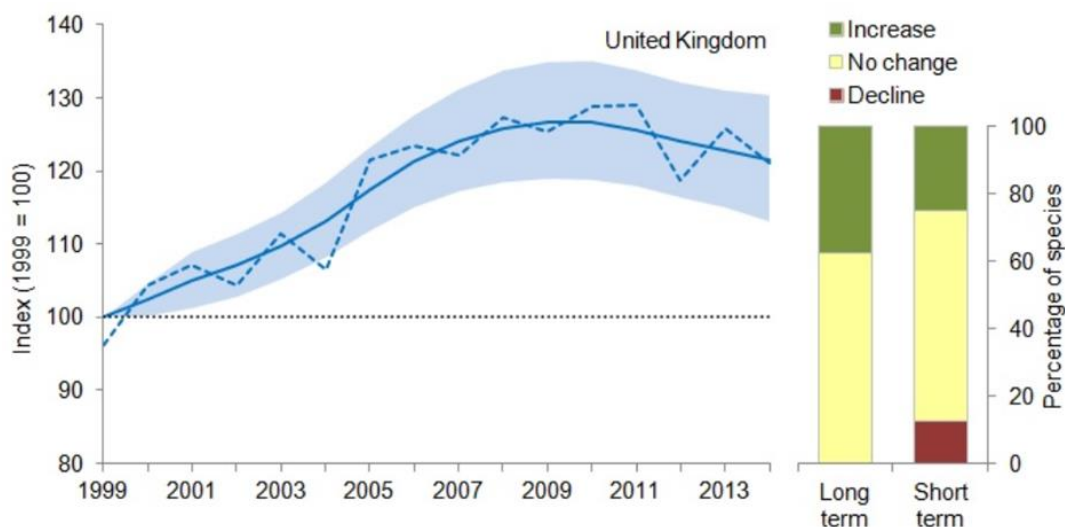
Bats have undergone severe declines historically. However, between 1999 and 2013, bat populations have increased significantly by 23% (see **Figure 1.8**)¹⁴. An assessment by the Bat Conservation Trust of the underlying smoothed trend shows this to be a statistically significant increase. In the short term, between 2008 and 2013, bat populations have shown a small, non-significant decrease of 2.5% and are therefore considered to be stable.

Three species have increased in the long term, and no species have decreased. In the short term, between 2008 and 2013, one species has shown a significant decrease, two have shown significant increases, and five of the eight species have shown no significant change in population size.

¹⁴ Joint Nature Conservation Committee (2016) *Mammals of the wide countryside (bats)*. Available online at: <http://jncc.defra.gov.uk/page-4271>

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Figure 1.8 Trends in Bat Populations, 1999-2014



Source: Bat Conservation Trust.

Notes:

- The headline measure is a composite index of eight species: serotine, Daubenton's bat, Natterer's bat, noctule, common pipistrelle, soprano pipistrelle, brown long-eared bat, and lesser horseshoe bat.
- Graph shows unsmoothed trend (dashed line) and smoothed trend (solid line) with its 95% confidence interval (shaded).
- The bar chart shows the percentage of species which, over the time period of the short-term or long-term assessment respectively, have shown a statistically significant increase or decrease.

Butterfly Populations

Butterflies respond rapidly to changes in environmental conditions and habitat management, occur in a wide range of habitats, and are representative of many other insects. Butterflies are complementary to birds and bats as an indicator because they use resources in the landscape at a much finer spatial scale than either of these groups.

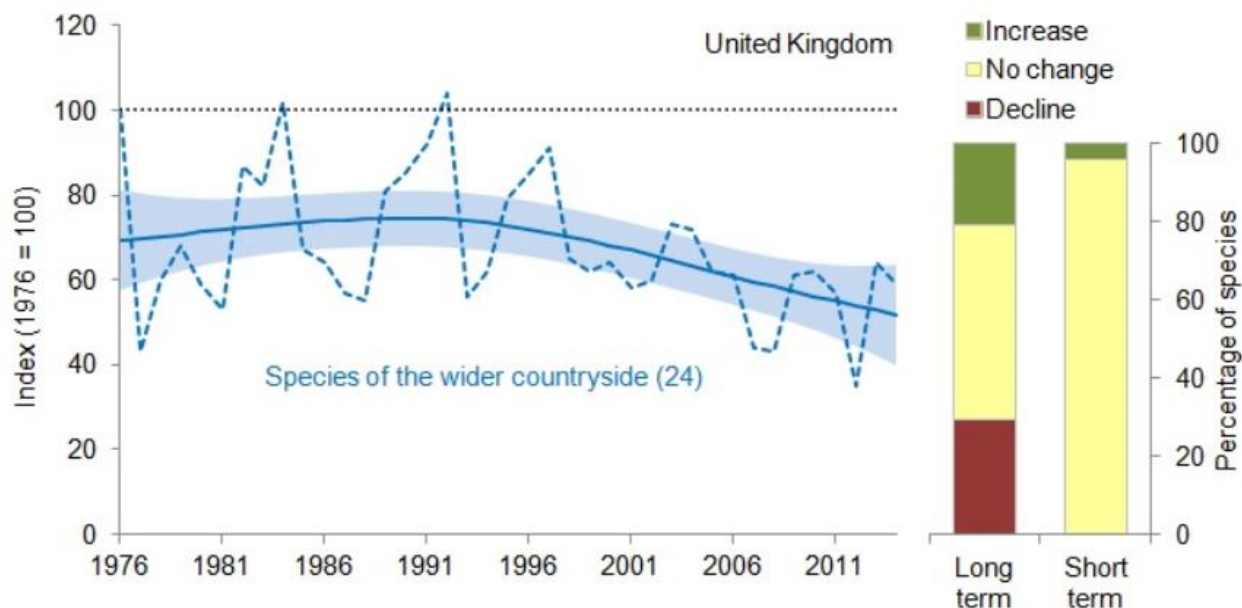
Trends are monitored in annual populations of specialist butterfly populations (those strongly associated with particular habitats, such as unimproved grassland) and generalist butterflies of the wider countryside. The data shows a high degree of annual variation^{15,16}. The assessment of change is therefore made on an analysis of the underlying trends undertaken by Butterfly Conservation and the Centre for Ecology & Hydrology. **Figure 1.9** presents monitored trends since 1976.

¹⁵ Joint Nature Conservation Committee (2016) *Insects of the wide countryside (butterflies)*. Available online at: <http://www.jncc.gov.uk/page-4236>

¹⁶ Dennis, E.B., Freeman, S.N., Brereton, T. & Roy, D.B. 2013. *Indexing butterfly abundance whilst accounting for missing counts and variability in seasonal pattern*. *Methods in Ecology and Evolution*, 4(7), 637–645

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Figure 1.9 Trends in Butterfly Populations in the UK: species of the wider countryside, 1976-2014



Source: Butterfly Conservation, Centre for Ecology & Hydrology, Defra, JNCC.

Note:

- Figure in brackets shows the number of species included in the index.
- Line graph shows unsmoothed trend (dashed line) and smoothed trend (solid line) with its 95 per cent confidence interval (shaded).
- Bar chart shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no change.
- Since 2013 an improved analysis method was applied to the measure for species of the wider countryside.

Large fluctuations in numbers between years are typical features of butterfly populations, and is often linked to weather conditions. Since 1976, the indices for butterflies associated strongly with semi-natural habitats (specialists) and for those found in the wider countryside show declines of 61% and 41% respectively. The unsmoothed data for habitat specialist butterflies shows a short-term increase between 2009 and 2014, while wider countryside species declined over this period. However, the underlying analysis of the smoothed trend shows that these changes are not significant.

In the most recent year (2014), habitat specialist butterflies increased by 7% from the previous year, whilst wider countryside species decreased by 8%.

Data from the GB Non-Native Species Report Card 2014¹⁷ identifies the following key data:

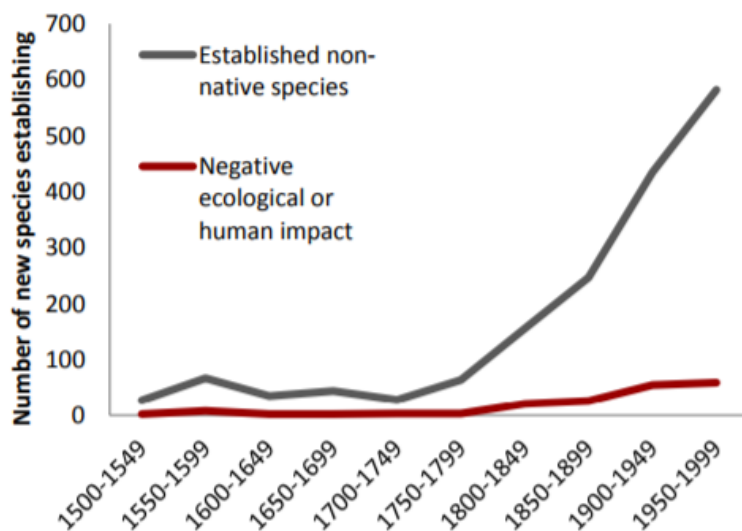
- ▶ more than 3,017 non-native species;
- ▶ 1,919 established (self-sustaining populations) non-native species comprising 1494 established nonnative plants and 420 established non-native animals and 5 other species;
- ▶ A total of 7 non-native species are known to have been eradicated from GB; and
- ▶ 234 established non-native species have been designated as having a negative ecological or human impact: 136 established non-native animals, 96 established non-native plants and 2 other species.

¹⁷ Defra, The Scottish Government and The Welsh Government (2014) *GB Non-Native Species Report Card 2014*. Available online at: <http://www.nonnativespecies.org/factsheet/index.cfm>

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The dominant pathways for non-native species in freshwater environments are both ornamental (41 species) and aquaculture (23 species). In the marine environment the arrival pathway for many non-native species is unknown but stowaways (53 species) and aquaculture (33 species) are both dominant pathways. The overall number of new species becoming established is shown in **Figure 1.10**.

Figure 1.10 Establishment of the species within the GB Non-native Species Portal



England

As of August 2017, there are approximately 4,700 sites designated for nature conservation in England, covering approximately 3.9 million hectares of land¹⁸. The designations and corresponding areas are shown in **Table 1.5**.

Table 1.5 Nature conservation designation and area

Designation	No. of Sites	Total Area (ha)
Ramsar	72	396,175
SAC	245	1,017,227
SPA	85	1,299,067
NNR	225	93,616
SSI	4,126	1,093,646

¹⁸ Natural England (2017) *Designated Sites View database*. Available online at: <https://designatedsites.naturalengland.org.uk/SearchEngland.aspx>

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The condition status of the various designations is set out in **Table 1.6**^{19, 20, 21, 22, 23}.

Table 1.6 Condition status of Sites Designated for Nature Conservation

	Favourable	Unfavourable recovering	Unfavourable - No change	Unfavourable declining	Partially destroyed	Destroyed	Not Assessed
Ramsar	58.09	36.39	2.93	2.57	0.01	0	0
SAC	35.06	60.8	2.82	1.15	0.03	0	0.14
SPA	38.28	57.56	2.31	1.78	0.04	0	0.03
NNR	53.35	39.15	5.07	1.9	0	0	0.53
SSSI	38.51	55.8	3.39	2.08	0.03	0.02	0.18

The condition status data in **Table 1.6** is shown graphically **Figure 1.11**.

¹⁹ Natural England (2017) *Designated Sites View database*. Available online at:
<https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=SAC>

²⁰ Natural England (2017) *Designated Sites View database*. Available online at:
<https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=SPA>

²¹ Natural England (2017) *Designated Sites View database*. Available online at:
<https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=RAMSAR>

²² Natural England (2017) *Designated Sites View database*. Available online at:
<https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=ALL>

²³ Natural England (2017) *Designated Sites View database*. Available online at:
<https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=NNR>

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Figure 1.11 Condition status of Sites Designated for Nature Conservation



The reasons for adverse conditions at SSSI sites are set out in **Table 1.7**. This indicates that planning permission (general) was linked to 0.37% of the area not meeting the Public Service Agreement (PSA) Target for SSSIs²⁴.

Table 1.7 Reasons for Adverse Condition Summary

Adverse Condition Reason	Num Units	Area of Units (ha)	% of unit area not meeting the PSA target
Other (the adverse condition reason doesn't fall into one of the categories below)	381	10,319.90	13.32%
Agriculture - Overgrazing	207	9,376.50	12.10%

²⁴ All Public Service Agreement targets were abolished in 2010. The PSA target was for 95% of SSSIs to be in either 'favourable' or 'unfavourable recovering' condition by 2010.

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Adverse Condition Reason	Num Units	Area of Units (ha)	% of unit area not meeting the PSA target
Freshwater Pollution - Water Pollution - Agriculture/Run Off	271	5,756.09	7.43%
Agriculture - Undergrazing	417	4,954.41	6.39%
Freshwater - Inappropriate Water Levels	180	4,672.30	6.03%
Lack of Corrective Works - Inappropriate Scrub Control	466	4,468.35	5.77%
Freshwater - Drainage	156	4,217.38	5.44%
Freshwater - Invasive Freshwater Species	118	3,369.12	4.35%
Forestry - Forestry and Woodland Management	221	2,849.15	3.68%
Fire - Moor Burning	11	2,568.68	3.32%
Freshwater Pollution - Water Pollution - Discharge	112	2,328.97	3.01%
Agriculture - Agriculture - Other	97	1,905.96	2.46%
Agriculture - Inappropriate Stock-Feeding	9	1,819.67	2.35%
Public Access/Disturbance - Public Access/Disturbance	98	1,802.61	2.33%
Coastal - Coastal Squeeze	31	1,480.56	1.91%
Lack of Corrective Works - Inappropriate Weed Control	129	1,428.78	1.84%
Freshwater - Siltation	80	1,417.93	1.83%
Lack of Corrective Works - Inappropriate Ditch Management	103	1,308.97	1.69%
Freshwater - Inappropriate Weirs Dams and Other Structures	59	1,271.32	1.64%
Freshwater - Fish Stocking	57	1,186.24	1.53%
Forestry - Deer Grazing/Browsing	76	1,177.67	1.52%
Agriculture - Inappropriate Cutting/Mowing	103	1,174.71	1.52%
Agriculture - Inappropriate Csw/Esa Prescription	28	989.27	1.28%
Agriculture - Fertiliser Use	28	752.14	0.97%
Freshwater - Water Abstraction	44	711.69	0.92%

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Adverse Condition Reason	Num Units	Area of Units (ha)	% of unit area not meeting the PSA target
Vehicles - Vehicles - Other	16	625.79	0.81%
Coastal - Inappropriate Coastal Management	32	624.08	0.81%
Fire - Fire - Other	36	517.06	0.67%
Vehicles - Vehicles - Illicit	24	406.11	0.52%
Earth Science - Earth Science Feature Obstructed	125	395.03	0.51%
Air Pollution - Air Pollution	13	371.64	0.48%
Game Management - Game Management - Other	9	297.92	0.38%
Planning Permission - Planning Permission - General	50	247.33	0.32%
Lack of Corrective Works - Inappropriate Pest Control	9	203.76	0.26%
Planning Permission - Peat Extraction	9	174.42	0.23%
Game Management - Game Management - Pheasant Rearing	11	97.61	0.13%
Planning Permission - Planning Permission - Other Mineral And Waste	14	91.13	0.12%
Coastal - Inappropriate Dredging	5	54.04	0.07%
Freshwater - Inland Flood Defence Works	9	35.29	0.05%
Earth Science - Earth Science Feature Removed	10	31.53	0.04%
Agriculture - Pesticide/Herbicide Use	1	5.02	0.01%

Source: Natural England: Designated Sites.

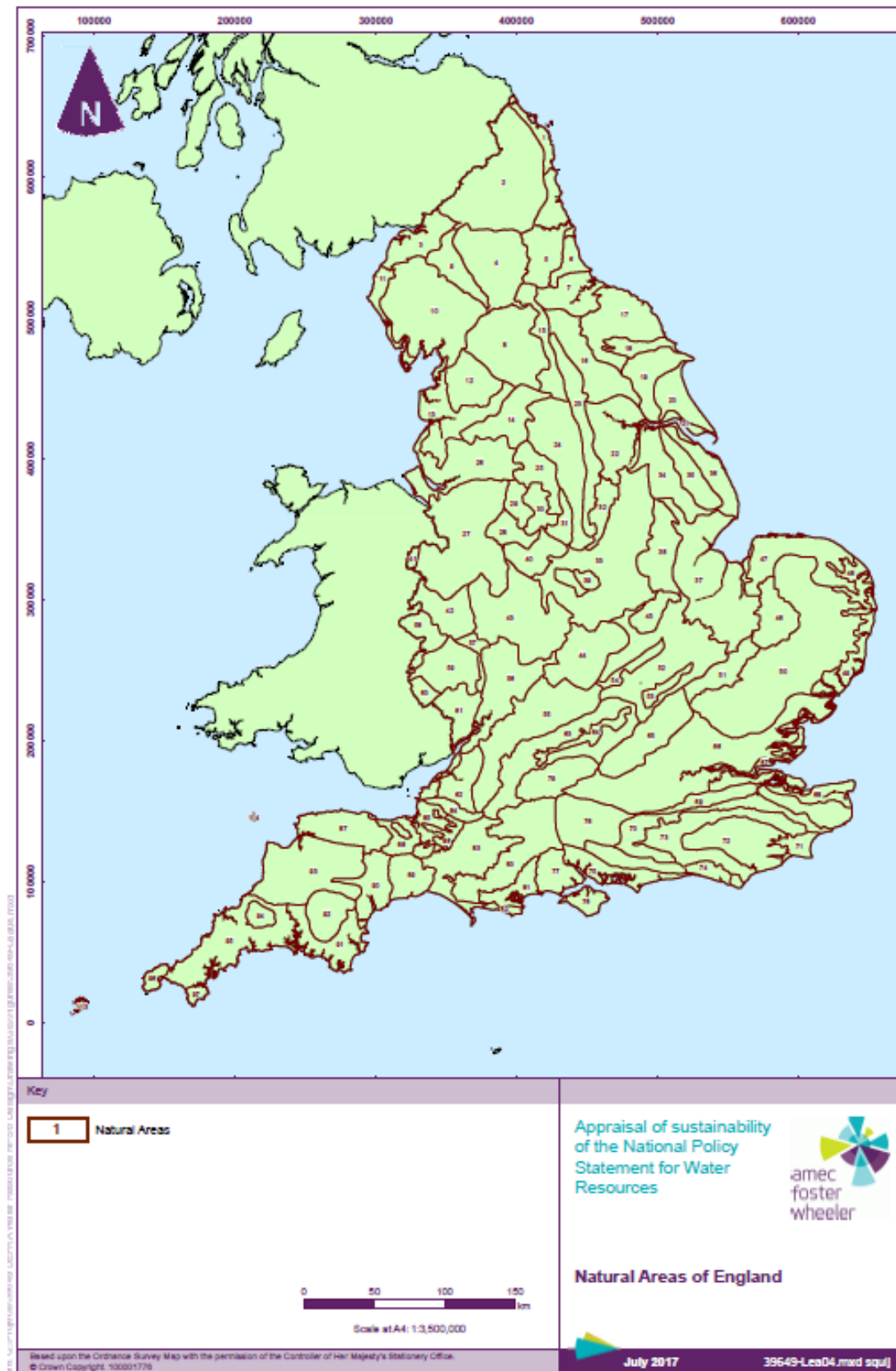
<https://designatedsites.naturalengland.org.uk/ReportUnitAdverseCondition.aspx?ReportTitle=All%20of%20England%20adverse%20conditions>

Natural Areas

Natural England has defined 120 (97 terrestrial, 23 marine) geographical areas of the English countryside, distinguished on the merit of their wildlife and other natural features, and also on historic land-use pattern. The boundaries of these zones should be considered as broad transition zones rather than hard, defined edges. The purpose of these areas is to characterise areas of England for their natural features outside, but inclusive of, the network of protected, designated sites (e.g. SPAs, SACs, SSSIs). Each Natural Area is characterised by geology and wildlife allowing a landscape scale approach to biodiversity. Natural Areas have been formally defined as “biogeographic zones which reflect the geological foundation, the natural systems and processes and the wildlife in different parts of England, and provide a framework for setting objectives for nature conservation” (UK Biodiversity Steering Group 1995). **Figure 1.12** identifies Natural Areas of England.

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Figure 1.12 Natural Areas of England



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Table 1.8 lists the Natural Areas identified in **Figure 1.12**.

Table 1.8 Natural Areas

Name	Reference	Name	Reference
North Northumberland Coastal Plain	1	East Anglian Chalk	51
Border Uplands	2	West Anglian Plain	52
Solway Basin	3	Bedfordshire Greensand Ridge	53
North Pennines	4	Yardley-Whittlewood Ridge	54
Northumbria Coal Measures	5	Cotswolds	55
Durham Magnesian Limestone Plateau	6	Severn And Avon Vales	56
Tees Lowlands	7	Malvern Hills And Teme Valley	57
Yorkshire Dales	8	Clun And North West Herefordshire Hills	58
Eden Valley	9	Central Hertfordshire	59
Cumbria Fells and Dales	10	Black Mountains and Golden Valley	60
West Cumbria Coastal Plain	11	Dean Plateau and Wye Valley	61
Forest of Bowland	12	Bristol, Avon Valleys and Ridges	62
Lancashire Plain and Valleys	13	Thames And Avon Vales	63
Southern Pennines	14	Midvale Ridge	64
Pennine Dales Fringe	15	Chilterns	65
Vale of York And Mowbray	16	London Basin	66
North York Moors and Hills	17	Greater Thames Estuary	67
Vale of Pickering	18	North Kent Plain	68
Yorkshire Wolds	19	North Downs	69
Holderness	20	Wealden Greensand	70
Humber Estuary	21	Romney Marshes	71
Humberhead Levels	22	High Weald	72
Southern Magnesian Limestone	23	Low Weald And Pevensey	73
Coal Measures	24	South Downs	74
Dark Peak	25	South Coast Plain and Hampshire Lowlands	75
Urban Mersey Basin	26	Isle of Wight	76
Mosses and Meres	27	New Forest	77
Potteries and Churnet Valley	28	Hampshire Downs	78
South West Peak	29	Berkshire And Marlborough Downs	79
White Peak	30	South Wessex Downs	80
Derbyshire Peak Fringe and Lower Derwent	31	Dorset Heaths	81
Sherwood	32	Isles Of Portland And Purbeck	82
Trent Valley and Rises	33	Wessex Vales	83
North Lincolnshire Coversands And Clay Vales	34	Mendip Hills	84
Lincolnshire Wolds	35	Somerset Levels and Moors	85
Lincolnshire Coast and Marshes	36	Mid Somerset Hills	86

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Name	Reference	Name	Reference
The Fens	37	Exmoor And the Quantocks	87
Lincolnshire And Rutland Limestone	38	Vale of Taunton And Quantock Fringes	88
Charnwood	39	Blackdowns	89
Needwood And South Derbyshire Claylands	40	Devon Redlands	90
Oswestry Uplands	41	South Devon	91
Shropshire Hills	42	Dartmoor	92
Midlands Plateau	43	The Culm	93
Midland Clay Pastures	44	Bodmin Moor	94
Rockingham Forest	45	Cornish Killas And Granites	95
Breckland	46	West Penwith	96
North Norfolk	47	The Lizard	97
The Broads	48	Isles of Scilly	113
Suffolk Coast and Heaths	49	Lundy	114
East Anglian Plain	50		

Priority species and Habitats

The Natural Environment and Rural Communities (NERC) Act came into force on 1st Oct 2006. Section 41 of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under section 40 of the Natural Environment and Rural Communities Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions. **Table 1.9** identifies in particular priority species and habitats for the freshwater environment.

Table 1.9 Freshwater priority species and habitats

Habitats	Species	
Aquifer-fed naturally fluctuating water bodies	<i>Branta bernicla</i>	Dark-bellied Brent Goose
Eutrophic standing waters	<i>Cygnus columbianus bewickii</i>	Bewick's Swan
Mesotrophic lakes	<i>Emberiza schoeniclus schoeniclus</i>	Reed Bunting
Oligotrophic and dystrophic lakes	<i>Motacilla flava</i>	Yellow Wagtail
Ponds	<i>Numenius arquata</i>	Curlew
Rivers	<i>Vanellus vanellus</i>	Lapwing
Reedbeds	<i>Arvicola terrestris</i>	Water Vole
Lowland fens	<i>Lutra lutra</i>	Otter
Coastal and floodplain grazing marsh	<i>Bufo bufo</i>	Common Toad

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Habitats	Species	
Wet woodland	<i>Natrix natrix</i>	Grass Snake
	<i>Triturus cristatus</i>	Great Crested Newt
	<i>Alosa alosa/fallax</i>	Allis/Twaite Shads
	<i>Anguilla anguilla</i>	European Eel
	<i>Lampetra fluviatilis</i>	River Lamprey
	<i>Osmerus eperlanus</i>	Smelt
	<i>Petromyzon marinus</i>	Sea Lamprey
	<i>Salmo salar</i>	Atlantic salmon
	<i>Salmo trutta</i>	Brown/Sea trout
	<i>Leersia oryzoides</i>	Cut-grass
	<i>Luronium natans</i>	Floating Water Plantain
	<i>Oenanthe fistulosa</i>	Tubular Water-dropwort
	<i>Potamogeton compressus</i>	Grass-wrack Pondweed
	<i>Pilularia globulifera</i>	Pillwort
	<i>Sium latifolium</i>	Greater Water Parsnip
	<i>Aeshna isosceles</i>	Norfolk Hawker
	<i>Austropotamobius pallipes</i>	White-clawed Crayfish
	<i>Coenagrion mercuriale</i>	Southern Damselfly
	<i>Margaritifera margaritifera</i>	Freshwater Pearl Mussel
	<i>Pisidium tenuilineatum</i>	Fine-lined Pea Mussel
	<i>Pseudanodonta complanata</i>	Depressed River Mussel
	<i>Valvata macrostoma</i>	Large-mouthed Valve Snail
	<i>Vertigo moulinsiana</i>	Desmoulin's Whorl Snail

National Character Areas

England has been divided into areas with similar landscape character, which are called National Character Areas (NCAs). A total of 159 NCAs have been identified in England²⁵. The boundaries of the NCAs are not precise and many should be considered as broad zones of transition. Natural England have rewritten and redesigned all of England's 159 NCA profiles and published the revised profiles in September 2014. The NCAs are defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and

²⁵ Natural England (2014) *National Character Area profiles: data for local decision making*. Available online at: <https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making>

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economic activity (further discussion of National Character Areas is provided in **Section 14 – Landscape and Townscape**).

Scotland

In Scotland there are:

- ▶ 152 SPAs, covering an area of 1,205,368 hectares (in addition to one site which straddles the border with England and is included under the England section above)²⁶;
- ▶ 236 SACs covering an area of 2,289,782 hectares (in addition to three sites that straddle the border with England and is included under the England section above)²⁷;
- ▶ 50 Ramsar sites covering a total area of 283,083 hectares (in addition to one site which straddles the border with England and is included under the England section above)²⁸; and
- ▶ As of February 2014, 1,425 SSSIs covering 1,020,000 hectares or 13% of Scotland²⁹.

In 2005, 71.4% of designated sites in Scotland (including SPAs, SACs, Ramsar and SSSI) were in favourable or unfavourable recovering condition. By March 2017, 80.3% of natural features on protected nature sites were assessed as being in favourable or unfavourable recovering condition³⁰. During 2016-17, the condition of 91 features improved to favourable or recovering condition. During the same period, the condition of 79 natural features deteriorated to unfavourable condition. The greatest stresses on sites were identified as invasive species and over-grazing.

Scottish Natural Heritage identified a series of Natural Heritage Zones as part of their Natural Heritage Futures initiative, and used these areas to describe a vision for sustainable use of local natural heritage. A total of 21 zones were identified³¹, each having their own identity resulting from the interaction of geology, landforms, wildlife and land use.

Wales

More than 10% of Wales' land cover is designated for nature conservation. Natural Resources Wales State of Natural Resources Report (SoNaRR)³² identifies the following key messages with regards to protected habitats and species:

²⁶ Joint Nature Conservation Committee (2017) *Classified Special Protection Areas in the UK*. Available online at: <http://jncc.defra.gov.uk/page-1399>

²⁷ Joint Nature Conservation Committee (2017) *Special Areas of Conservation (SAC)*. Available online at: <http://jncc.defra.gov.uk/page-23>

²⁸ Joint Nature Conservation Committee (2017) *UK Ramsar sites*. Available online at: <http://jncc.defra.gov.uk/page-1388>

²⁹ Scottish Natural Heritage (2016) *Where are SSSIs found?* Available online at: <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssis/sssi-location/>

³⁰ Scottish Natural Heritage (2017) *The Proportion of Scotland's Protected Sites in Favourable Condition 2016*. Available at: <http://www.snh.gov.uk/publications-data-and-research/official-statistics/official-stats/sites-favourable/>

³¹ Scottish Natural Heritage (2002) *Natural Heritage Zones: A National Assessment of Scottish Landscapes*. Available online at: <http://www.snh.org.uk/futures/Data/pdfdocs/LANDSCAPES.pdf>

³² Natural Resources Wales (2016) *State of the Natural Resources Report*. Available online at: <https://naturalresources.wales/evidence-and-data/research-and-reports/the-state-of-natural-resources-report-assessment-of-the-sustainable-management-of-natural-resources/?lang=en>

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- ▶ Wales has a wide representation of species across a broad range of taxonomic groups with estimates varying from 25,000 to 50,000 different species of animals, plants and other organisms;
- ▶ there are 20 Special Protection Areas (SPAs)³³ for internationally important populations of birds and 92 Special Areas of Conservation (SACs) for other threatened species and natural habitats;
- ▶ 562 of the total 1,016 Sites of Special Scientific Interest (SSSI) (as of 2010) have individually qualifying species and 54 have species assemblages which qualify. Many of the same species are also found on sites that qualify for their habitat; and
- ▶ the list of species and habitats of principal importance in Wales (the interim Section 7 list) includes 557 species.

Other internationally important sites to consider include the Rhinog Biogenetic Reserve in North Wales (Blaenau Ffestiniog WRZ) and the UNESCO biosphere reserve at Cors Fochno in the Dyfi estuary near Borth in Ceredigion (West Wales)³⁴. There are 76 National Nature Reserves (NNRs) in Wales, all of which are legally protected as SSSIs. Most are also designated as SACs, SPAs or Ramsar sites³⁵.

With respect to the condition of these sites, the SoNaRR report identifies that:

- ▶ the condition of SAC and SPA species features on sites in Wales, as reported in 2013, remains mostly unfavourable (55%), with the exception of birds and mammals of which 86% and 68% were in favourable condition, respectively;
- ▶ between 2002 and 2008, fewer than half of the species on the interim Section 7 list were considered to be stable or increasing; and
- ▶ Wales (along with the UK as a whole) did not meet the 2010 international and national biodiversity targets.

1.4 Summary of Existing Problems for Biodiversity and Nature Conservation Relevant to the Water Resources NPS

The SEA Directive requires consideration of any existing environmental problems which are relevant to the plan or programme, particularly those areas of environmental importance pursuant to Directives 2009/147/EC and 92/43/EC (the Birds and Habitats Directives). An analysis of the causes of unfavourable condition and threats to the range of habitats by Natural England has revealed the key pressures and risks to be:

- ▶ habitat destruction and fragmentation by development;
- ▶ agricultural intensification and changes in agricultural management practices;
- ▶ changes in woodland and forestry management;

³³ The latest data from the Joint Nature Conservancy Council identifies 21 SPAs; 18 in Wales and 3 cross border SPAs between England and Wales.

³⁴ The UNESCO Biosphere Reserve status is awarded in recognition of the way a local community lives sustainably in an area of special landscape quality with a rich wildlife. The designated area includes Aberystwyth, Llanbrynmair, Llanymawddwy, Corris Uchaf, and Aberdyfi.

³⁵ Natural Resources Wales (2016) *National Nature Reserves*. Available online at: <https://naturalresources.wales/conservation-biodiversity-and-wildlife/find-protected-areas-of-land-and-seas/national-nature-reserves/?lang=en>

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- ▶ water abstraction, drainage or inappropriate river management;
- ▶ inappropriate coastal management;
- ▶ lack of appropriate habitat management;
- ▶ atmospheric pollution (acid precipitation, nitrogen deposition);
- ▶ water pollution from both point and wider (diffuse) agricultural sources;
- ▶ climate change and sea level rise;
- ▶ sea fisheries practices;
- ▶ recreational pressure and human disturbance; and
- ▶ invasive and non-native species³⁶.

The same threats occur across the devolved administrations in the UK. For example, the Scottish Biodiversity Strategy Report to the Scottish Parliament 2014-16³⁷ identified seven key issues for biodiversity in Scotland: pollution, land use intensification/modification, invasive species/diseases, lack of recognition of the value of nature, disconnection with nature, climate change and the use of marine resources.

Table 1.10 presents an overview of the key issues for biodiversity and nature conservation relevant to the Water Resources NPS.

Table 1.10 Biodiversity and Nature Conservation Problems Relevant to the Water Resources NPS

Problem	Supporting Data	Implications
Loss of biodiversity	The status of UK priority habitats and species in 2012 indicates that the decline of biodiversity is a long-term issue. Between 2007 and 2012, populations of priority species declined by 4 per cent relative to their value in 2007. This decrease is not statistically significant. Within the index over this short-term period, 47 per cent of species showed an increase and 53 per cent showed a decline. By 2012, populations of priority species overall had declined to 33 per cent of the 1970 index value, a statistically significant decrease. Over this long-term period 25 per cent of species showed an increase and 75 per cent showed a decline.	Ensure policies do not adversely affect biodiversity.
Risks to the condition of certain habitat features	For NNRs, SSSIs, SPAs, SACs and RAMSAR sites, typically around 95% of the total site area is either in a favourable or recovering state. Whilst this is a positive testament to the efforts to improve these sites, it should be noted that those sites that are 'recovering' remain in an unfavourable state at present and gains in their status could be reversed. This is particularly important for those sites that are vulnerable to changes in the local hydrological environment. It should be noted that those sites of nature conservation importance that were least favourable were often impacted by factors which operated outside the sites on which they were designated (e.g. drainage conditions for some isolated wetlands) and which require concerted effort by many agencies (e.g. water quality affecting fish).	Ensure policies do not adversely affect the status of conservation features.
Threats to UK freshwater habitats	UK freshwater habitats and their associated species are threatened by a range of factors. These include: <ul style="list-style-type: none"> • Point and diffuse pollution; • Water abstraction for drinking water; agricultural or industrial uses; 	Ensure policies do not contribute to those factors identified as a threat to freshwater habitats and species.

³⁶ Natural England (2008) *State of the Natural Environment Report*

³⁷ Scottish Government (2017) *Scottish Biodiversity Strategy: Report to the Scottish Parliament 2014 – 2016*. Available online at: <http://www.gov.scot/Resource/0052/00522533.pdf>

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Problem	Supporting Data	Implications
	<ul style="list-style-type: none"> • Invasive alien species; • Morphological alterations; • Recreation; • Fisheries management; • Climate change; and • Grazing/control of scrub and trees. <p>It is anticipated that the NPS will have the ability to directly address a number of these affects, in particular pollution, water abstraction and addressing climate change. Consequently, these affects may be avoided, minimised or mitigated in accordance with the mitigation hierarchy.</p>	

1.5 Likely Evolution of the Baseline

UK

The general global trend in biodiversity is towards a decreased level of variability among living organisms. The European Commission states that “The loss of biodiversity has accelerated to an unprecedented level in Europe and worldwide. It has been estimated that the current global extinction rate is 1,000 to 10,000 times higher than the natural background extinction rate. In Europe some 42% of European mammals are endangered, together with 15% of birds and 45% of butterflies and reptiles”³⁸.

The global trend towards a decline in biodiversity is not mirrored in the UK. The annual review of UK Biodiversity Indicators comprises 51 measures, of which 5 are not assessed in the long term and 8 are not assessed in the short term. Of the 46 long-term measures, 22 show an improvement, compared to 13 of the measures that were deteriorating. Of the 43 short term measures, 17 show an improvement, as compared to 10 in decline. Measures that improved or deteriorated in the short term have not necessarily continued to improve or deteriorate respectively in the long term³⁹.

Measures showing an improvement in the short term include: area of land in agri-environment schemes; sustainable fisheries; pressure from pollution; total extent of protected areas: at sea; status of UK species of European importance; animal genetic resources; plant genetic resources; fish size classes in the North Sea; greenhouse gas removals by UK forests; biodiversity data for decision making; and UK expenditure on international biodiversity.

Measures which have improved in the long term include: volunteer time spent in conservation; area of land in agri-environment schemes; area of forestry land certified as sustainably managed; sustainable fisheries; pressure from pollution; protected areas; wintering waterbirds; mammals of the wider countryside (bats); animal genetic resources; plant genetic resources; greenhouse gas removals by UK forests; cumulative number of records; and expenditure on UK and international biodiversity.

Measures showing long-term deterioration include: pressure from invasive species; status of UK priority species; birds of the wider countryside and at sea; insects in the wider countryside (butterflies); animal genetic resources – horse breeds; and status of pollinating insects.

Some of these measures have continued to deteriorate in the short term, including birds of the wider countryside and at sea and the status of pollinating insects.

³⁸ European Commission (2016) *Why do we need to protect biodiversity*. Available online at: http://ec.europa.eu/environment/nature/biodiversity/intro/index_en.htm

³⁹ Defra (2016) *UK Biodiversity Indicators 2015*. Available online at: http://jncc.defra.gov.uk/pdf/UKBI_2015_v3a.pdf

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A 2016 report by the UK's non-statutory wildlife organisations⁴⁰ sets out the following headline results of their assessment of the state of the UK's biodiversity resource:

- ▶ using records of 3,816 species, some 56% of these have declined since 1970 and 44% have increased;
- ▶ of the nearly 8,000 species assessed using modern Red List criteria, 15% are extinct or threatened with extinction from Great Britain;
- ▶ an index of species' status, based on abundance and occupancy data, has fallen by 16% since 1970, and 3% from 2002. An index describing the population trends of species of special conservation concern in the UK has fallen by 67% since 1970 and 12% from 2002;
- ▶ policy-driven agricultural change was the most significant driver of declines, although climate change has also had a significant impact, which included both beneficial and detrimental effects on species. Climate change is highlighted as one of the greatest long-term threats to nature globally; and
- ▶ a new measure that assesses how intact a country's biodiversity is suggests that the UK has lost significantly more nature over the long term than the global average.

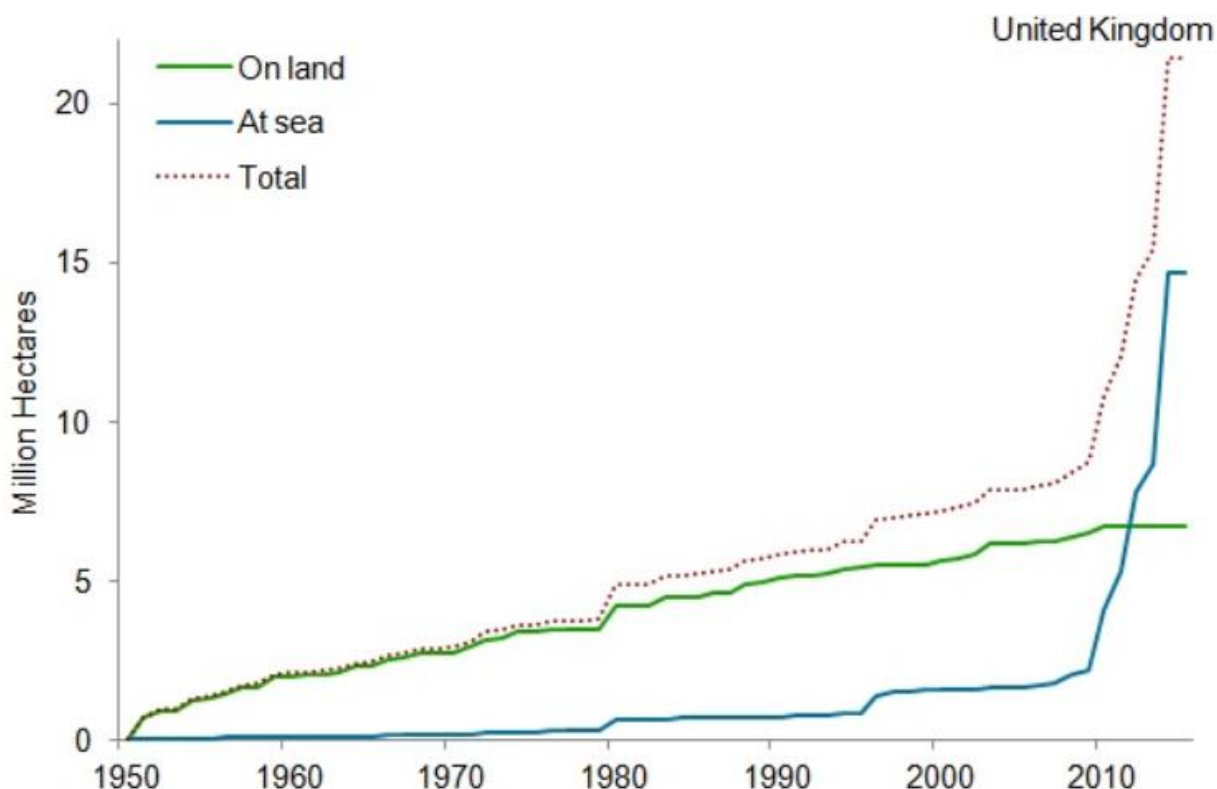
In response to these challenges and to ensure habitats and species receive protection in the UK, there has been an increase in the number of sites and areas protected for biodiversity, flora and fauna⁴¹ (see **Figure 1.13**).

⁴⁰ Hayhow DB, Burns F, Eaton MA, *et al.* (2016) *State of Nature 2016*. The State of Nature partnership. Available online at: http://www.rspb.org.uk/Images/State%20of%20Nature%20UK%20report_%2020%20Sept_tcm9-424984.pdf

⁴¹ Joint Nature Conservation Committee (2015) *Protected Areas*. Available online at: <http://jncc.defra.gov.uk/page-4241>

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Figure 1.13 Extent of UK Nationally and Internationally Important Protected Areas: (i) on-land; (ii) at-sea, 1950 to 2015



Source: Joint Nature Conservation Committee, Natural England, Natural Resources Wales, Northern Ireland Environment Agency and Scottish Natural Heritage.

Notes: The boundary between protected areas on-land and at-sea is mean high water (mean high water spring in Scotland). Coastal sites in the indicator are split between 'on-land' and 'at-sea' if they cross the mean high water mark. At-sea extent includes offshore marine protected areas out to the limit of the UK continental shelf.

Based on calendar year of site designation. For 2015, the data cut-off is 31 July.

Extent is based on the following site designations: Areas of Special Scientific Interest, Sites of Special Scientific Interest, National Nature Reserves, Marine Conservation Zones, Nature Conservation Marine Protected Areas, Ramsar Sites, Special Areas of Conservation (including candidate Special Areas of Conservation and Sites of Community Importance), Special Protection Areas, Areas of Outstanding Natural Beauty, National Scenic Areas, National Parks.

The overall total extent of land and sea protected in the UK through national and international protected areas and through wider landscape designations, has increased by 10.7 million hectares over five years, from 10.8 million hectares in December 2010 to 21.4 million hectares at the end of July 2015. This increase is almost entirely down to the designation of inshore and offshore marine sites.

The indicator also shows the condition of Areas or Sites of Special Scientific Interest (A/SSSIs) on land. A/SSSIs are surveyed periodically to assess whether they are in good condition (favourable) or, if not, they are under positive management (unfavourable-recovering). Since 2005, the percentage of features or area of A/SSSIs in favourable or recovering condition has increased from 67% to 84% in 2010 and to 94.3% in 2017. This change reflects improved management of sites, but may also be affected by a greater number of sites/features having been assessed over time. The majority of protected areas on land are A/SSSIs, so the condition indicator is not representative of marine sites.

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Aichi Goals and Targets

The Strategic Plan for Biodiversity 2011-2020, agreed at Nagoya in the Aichi Prefecture, Japan at the tenth Conference of the Parties of the CBD established five strategic goals and 20 new global 'Aichi' targets. These were then reflected in the UK Post-2010 Biodiversity Framework (2012). Those relevant to the UK and set out in the UK Post 2010 Biodiversity Framework include, among others:

- ▶ **Strategic Goal B:** Reduce the direct pressures on biodiversity and promote sustainable use.
 - ▶ **Target 5:** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
 - ▶ **Target 7:** By 2020, areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.
- ▶ **Strategic Goal C:** To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity.
 - ▶ **Target 11:** By 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.
 - ▶ **Target 12:** By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.
 - ▶ **Target 13:** By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.
- ▶ **Strategic Goal D:** Enhance the benefits to all from biodiversity and ecosystems.
 - ▶ **Target 15:** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15% of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

England

Results of the 2016 reporting of biodiversity indicators for England⁴² reveal that, of the 51 individual measures making up the indicators, 17 of the 37 measures assessed over the long term show an improvement, as do 20 of the 35 measures that are assessed over the short term. Some 11 measures (22%) show a decline in both the long term and the short term.

Those showing a deterioration over the long term are:

- ▶ change in the abundance of priority species – abundance;
- ▶ change in the abundance of priority species – distribution;
- ▶ woodland birds;

⁴² Defra (2015) *Biodiversity 2020: a strategy for England's wildlife and ecosystem services – Indicators*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/492526/England_2015_full_publication.pdf

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- ▶ butterflies of the wider countryside on woodland;
- ▶ breeding farmland birds;
- ▶ butterflies of the wider countryside on farmland;
- ▶ status of pollinating insects; and
- ▶ effective population size of native horse breeds at risk.

There has been a net decrease in the area of SSSIs in favourable condition; down from 44% in 2003 to 37% in 2015. It is evident from this that restoring species and habitats to favourable condition is difficult and to reverse previous declines in species populations or to restore the ecological functioning of habitats will take many years. However, the area of SSSIs in unfavourable recovering condition increased substantially from 13% in 2003 to 58.4% in 2015. The overall proportion of SSSIs in favourable or recovering condition remained above 95% since 2011. Looking at the condition of all sites designated for nature conservation (see **Figure 1.11**), approximately 50% of all sites are in an 'unfavourable – recovering' status as compared to 3% for 'unfavourable – declining'. This is a clear indication that the status of protected sites would be to continue to improve into the future, with an increasing number achieving favourable status.

The GB Non-native Species Strategy identifies that the number of non-native species entering GB is increasing, with 10-12 new non-native species becoming established every year and that this trend is mirrored across Europe and the rest of the world. If it is not addressed, it is expected to continue increasing for the foreseeable future⁴³.

The total extent of land and sea protected in England through national and international protected areas increased from 1.2 million to 2.1 million hectares between 1999 and 2015, an increase of 74%.

Identifying an overall trend for biodiversity in England would be to risk masking various significant trends at the species / habitat level. The interaction between trends is also highly uncertain. For example, **Figure 1.13** identifies that an increasingly large area of the UK is being protected for nature conservation. The biodiversity indicators for England identify an ongoing decline in both the abundance and distribution of priority species. It is possible that the increasing area of protected land may halt the decline in biodiversity, but there is a high degree of uncertainty.

Three of the biodiversity indicators in decline relate directly to agricultural land, however agricultural practices may be affected by the UK's withdrawal from the European Union. How agricultural practices may change, and in turn the effect on biodiversity, is uncertain.

Whilst the overall trends remain challenging to predict, as the Appraisal of Sustainability progresses it will address specific biodiversity issues as a part of appraising the NPS. A key part of this process will be to identify specific trend data relevant to the appraisal. Any trends identified that assist in understanding the likely evolution of the baseline will be detailed in the Environmental Report throughout the stages of its preparation.

Scotland

Results of the 2008 reporting round of the UK Biodiversity Action Plan indicate that in Scotland⁴⁴:

Habitats:

- ▶ 13% of priority habitats were increasing (compared to 15% in 2005);

⁴³ Defra, Scottish Government, Welsh Government (2015) *The Great Britain Invasive Non-native Species Strategy*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/455526/gb-non-native-species-strategy-pb14324.pdf

⁴⁴ Scottish Government (2016) *Key Scottish Environment Statistics 2015*. Available online at: <http://www.gov.scot/Publications/2015/09/4066/318461>

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- ▶ 21% of priority habitats were stable (compared to 20% in 2005);
- ▶ 3% of habitats were declining (continuing/accelerating) (compared to 0% in 2005);
- ▶ 26% of habitats were declining (slowing) (compared to 29% in 2005);
- ▶ 16% of habitats were fluctuating (compared to 2% in 2005);
- ▶ 3% of habitats showed no clear trend (compared to 7% in 2005); and
- ▶ the status of 21% of habitats was unknown (compared to 27% in 2005).

Species:

- ▶ 4% of species were increasing (compared to 5% in 2005);
- ▶ 23% of species were stable (compared to 24% in 2005);
- ▶ 15% of species were fluctuating (compared to 3% in 2005);
- ▶ 11% of species were declining (slowing) (compared to 9% in 2005);
- ▶ 7% of species were declining (continuing/accelerating) (compared to 5% in 2005);
- ▶ 1% of species were lost (pre BAP publication) (no change since 2005);
- ▶ 7% of species showed no clear trend (compared to 8% in 2005); and
- ▶ the status of 32% of species was unknown (compared to 42% in 2005).

By March 2016, 80.4% of natural features on protected nature sites (SPAs, SACs, Ramsar and SSSI) were assessed as being in favourable or unfavourable recovering condition.

The latest monitoring information on biodiversity in Scotland was reported in 2010⁴⁵. Based on the European BAP Framework, eight priority objectives, four supporting measures and 37 targets for action were specified for Scotland. By the end of 2010, 59% of these actions were on target (e.g. principal pollutant pressures on terrestrial and freshwater biodiversity substantially reduced by 2010), 24% had room for improvement (e.g. climate change adaptation and mitigation measures) and 16% were not on target (e.g. reducing the impact of invasive non-native species).

Wales

The SoNaRR report identified the following trends:

- ▶ the extent and population for terrestrial, freshwater and marine species vary enormously within taxonomic groups; with some species increasing and some decreasing. For instance, both increases and decreases can be seen in birds, bats and many pollinator species (e.g. bees, butterflies) whilst for many species we do not have sufficient data on which to base any conclusions;
- ▶ there has been a marked reduction in the abundance of salmon in recent years, particularly in the southern regions of the species' range which is linked to increased mortality at sea. Although stocks in many of our industrial rivers have improved in the last 30 years, most stocks in Wales are severely challenged;

⁴⁵ Mackey, E.C. and Mudge, G. (2010). *Scotland's Wildlife: An assessment of biodiversity in 2010*. Available online at: <http://www.snh.gov.uk/docs/B811968.pdf>

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- ▶ all species are directly affected by changes in habitat quantity and quality. These changes are directly related to changes in the intensity of management regimes. Fragmentation and eutrophication create particular problems for many species; and
- ▶ there are risks to species and habitats due to their inability to respond to changing climatic conditions. There may also be opportunities from new species colonisations. Conversely, native wildlife may be increasingly at risk from pests, pathogens and invasive species. There are also risks from change in the frequency and/or magnitude of extreme weather and wildfire events. Climate change is influencing the expansion or contraction of some species' ranges and populations, and the increasing frequency of extreme climatic events, predicted in many climate change scenarios, may have serious implications.

1.6 Assessing Significance

The objectives and guide questions related to biodiversity and nature conservation which have been identified for use in assessing the effects of Water Resources NPS proposals and alternatives are set out in **Table 1.11**, together with reasons for their selection.

Table 1.11 Approach to Assessing the Effects of the Water Resources NPS on Biodiversity and Nature Conservation

Objective/Guide Question	Reasoning
Objective: To protect and enhance biodiversity (habitats, species and ecosystems) working within environmental capacities and limits.	The SEA Directive (2001/42/EC) requires that the likely significant effects on biodiversity should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report. Water dependent habitats and species contribute to UK biodiversity. They can be affected by a range of factors (such as pollution, abstraction and invasive alien species) where water resources infrastructure could have positive and/or negative effects. Impacts may be direct (for example, the loss of, or damage to, habitats and species) or indirect (for example, disturbance due to noise and emissions to air associated with construction works). Water infrastructure can also contribute positively to biodiversity, introducing new features that can provide opportunities for nature and wildlife in the medium to long term. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.
Will the Water Resources NPS protect and/or enhance internationally designated nature conservation sites e.g. SACs, SPAs, Marine Protected Areas and Ramsar Sites?	The Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) include measures to maintain or restore important natural habitats and species including through the designation of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).
Will the Water Resources NPS protect and/or enhance nationally designated nature conservation sites e.g. SSSIs?	The Wildlife and Countryside Act 1981 includes measures relating to protected sites. Devolved administrations have prepared detailed action plans on protecting habitats and species e.g. Biodiversity 2020 – A Strategy for England's Wildlife and Ecosystem Services (Defra 2011), Scotland's 2020 Challenge (a supplement to the Scottish Biodiversity Strategy 2004) and Wales Natural Resources Policy Statement (2015) and emerging National Natural Resource Policy.
Will the Water Resources NPS affect animals or plants including protected species?	The Wildlife and Countryside Act 1981 includes legislation relating to protected sites. Devolved administrations are preparing detailed action plans on protecting habitats and species.
Will the Water Resources NPS lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?	The Water Framework Directive (2000/60/EC) requires all inland, coastal and groundwater to reach a 'good' chemical and ecological status. Current WFD draft classification indicate that there are still a large proportion of surface water bodies in England (and Wales) that are classified as being of Moderate Ecological Status or less. Government strategies such as the Water resources strategy for England and Wales (2009) and Water for Life (2011) include objectives to protect the quality of water. Under the Water resources Strategy, the Government aims that by 2030, at the latest, England will have improved the quality of the water environment and the ecology which it supports.

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Objective/Guide Question	Reasoning
Will the Water Resources NPS protect and/or enhance priority species and habitats?	The National Planning Policy Framework (NPPF) promotes the protection and enhancement of Species and Habitats of Principal Importance included in the England Biodiversity List published by the Secretary of State under section 41 of the Natural Environment and Rural Communities Act 2006 (known as priority species and habitats).
Will the Water Resources NPS affect the structure and function of natural systems (ecosystems)?	Biodiversity is a highly sensitive receptor. It is likely that many of the other topics considered in this report will have an effect on biodiversity. Ecosystems will be sensitive to these interconnected effects.
Will the Water Resources NPS affect public access to areas of wildlife interest?	The Countryside and Rights of Way Act addresses public rights of way and access to open land.
Will the Water Resources NPS have an impact on fisheries?	Various inland waters could be affected by the Water Resources NPS meaning that the provisions of the Water Framework Directive (WFD) (2000/60/EC) apply as they relate to the quality of freshwaters needing protection or improvement in order to support fish life.

Table 1.12 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the biodiversity and nature conservation objective.

Table 1.12 Illustrative Guidance for the Assessment of Significance for Biodiversity and Nature Conservation

Effect	Description	Illustrative Guidance
++	Significant Positive	Option would have a significant and sustained positive effect on European or national designated sites and/or protected species. (e.g. – fully supports all conservation objectives on site, long-term increase in population of designated species); Option will create new areas of wildlife interest with improved public access in areas where there is a high demand for access to these sites.
+	Positive	Option would have a minor positive effect on European or national designated sites and/or protected species (e.g. – supports one of the conservation objectives on site, short-term increase in population of designated species); Option would have a positive effect on local biodiversity (e.g. – through removal of all existing disturbance/pollutant emissions, or creation of new habitats leading to long-term improvement to ecosystem structure and function); Option would enhance existing public access to areas of wildlife interest in areas where there is some demand for these sites.
0	Neutral	Option would not have any effects on European or national designated sites and/or any species (including both designated and non-designated species); Option would not affect public rights of way or access to areas of wildlife interest.
-	Negative	Option would have negative effects on local biodiversity (e.g. – through an increase in disturbance/pollutant emissions, or some loss of habitat leading to temporary loss of ecosystem structure and function); Option would decrease public access to areas of wildlife interest in areas where there is some demand for access to these sites.
--	Significant Negative	Option would have a negative effect on European or national designated sites and/or protected species (i.e. on the interest features and integrity of the site, by preventing any of the conservation objectives from being achieved or resulting in a long-term decrease in the population of a priority species). These effects could not be reasonably mitigated.
?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.

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Annex A

Table A.1 Species Used to Calculate Wild Bird Population Indices

Woodland Birds	Waterbirds	Seabirds	Farmland Birds	Other Species
Blackbird (<i>Turdus merula</i>)	<i>Common sandpiper</i> (<i>Actitis hypoleucos</i>)	<i>Arctic skua</i> (<i>Stercorarius parasiticus</i>)	<i>Greenfinch</i> (<i>Carduelis chloris</i>)	<i>Avocet</i> (<i>Recurvirostra avosetta</i>)
Blue tit (<i>Cyanistes caeruleus</i>)	<i>Dipper</i> (<i>Cinclus cinclus</i>)	<i>Arctic tern</i> (<i>Sterna paradisaea</i>)	<i>Jackdaw</i> (<i>Corvus monedula</i>)	<i>Bearded tit</i> (<i>Panurus biarmicus</i>)
Bullfinch (<i>Pyrrhula pyrrhula</i>)	<i>Goosander</i> (<i>Mergus merganser</i>)	<i>Black Legged Kittiwake</i> (<i>Rissa tridactyla</i>)	<i>Kestrel</i> (<i>Falco tinnunculus</i>)	<i>Black-headed gull</i> (<i>Chroicocephalus ridibundus</i>)
Chaffinch (<i>Fringilla coelebs</i>)	<i>Grey wagtail</i> (<i>Motacilla cinerea</i>)	<i>Common guillemot</i> (<i>Uria aalge</i>)	<i>Reed bunting</i> (<i>Emberiza schoeniclus</i>)	<i>Buzzard</i> (<i>Buteo buteo</i>)
Duncock (<i>Prunella modularis</i>)	<i>Coot</i> (<i>Fulica atra</i>)	<i>Common tern</i> (<i>Sterna hirundo</i>)	<i>Rook</i> (<i>Corvus frugilegus</i>)	<i>Carion crow</i> (<i>Corvus corone</i>)
Great tit (<i>Parus major</i>)	<i>Great-crested grebe</i> (<i>Podiceps cristatus</i>)	<i>European shag</i> (<i>Phalacrocorax aristotelis</i>)	<i>Woodpigeon</i> (<i>Columba palumbus</i>)	<i>Girl bunting</i> (<i>Emberiza cirrus</i>)
Lesser whitethroat (<i>Sylvia curruca</i>)	<i>Little grebe</i> (<i>Tachybaptus ruficollis</i>)	<i>Great black-backed gul</i> (<i>Larus marinus</i>)	<i>Yellow wagtail</i> (<i>Motacilla flava</i>)	<i>Collared dove</i> (<i>Streptopelia decaocto</i>)
Longtailed tit (<i>Aegithalos caudatus</i>)	<i>Mallard</i> (<i>Anas platyrhynchos</i>)	<i>Great cormorant</i> (<i>Phalacrocorax carbo</i>)	<i>Corn bunting</i> (<i>Emberiza calandra</i>)	<i>Corncrake</i> (<i>Crex crex</i>)
Robin (<i>Erithacus rubecula</i>)	<i>Moorhen</i> (<i>Gallinula chloropus</i>)	<i>Herring gull</i> (<i>Larus argentatus</i>)	<i>Goldfinch</i> (<i>Carduelis carduelis</i>)	<i>Cuckoo</i> (<i>Cuculus canorus</i>)
Song thrush (<i>Turdus philomelos</i>)	<i>Cetti's warbler</i> (<i>Cettia cetti</i>)	<i>Little tern</i> (<i>Sternula albifrons</i>)	<i>Grey partridge</i> (<i>Perdix perdix</i>)	<i>Dartford warbler</i> (<i>Sylvia undata</i>)
Tawny owl (<i>Strix aluco</i>)	<i>Reed bunting</i> (<i>Emberiza schoeniclus</i>)	<i>Northern fulmar</i> (<i>Fulmarus glacialis</i>)	<i>Lapwing</i> (<i>Vanellus vanellus</i>)	<i>Firecrest</i> (<i>Regulus ignicapilla</i>)
Wren (<i>Troglodytes troglodytes</i>)	<i>Reed warbler</i> (<i>Acrocephalus Scirpaceus</i>)	<i>Razorbill</i> (<i>Alca torda</i>)	<i>Linnet</i> (<i>Carduelis cannabina</i>)	<i>Gadwall</i> (<i>Anas strepera</i>)
Blackcap (<i>Sylvia atricapilla</i>)	<i>Sedge warbler</i> (<i>Acrocephalus Schoenobaenus</i>)	<i>Sandwich tern</i> (<i>Sterna sandvicensis</i>)	<i>Skylark</i> (<i>Alauda arvensis</i>)	<i>Golden plover</i> (<i>Pluvialis apricaria</i>)
Capercaillie (<i>Tetrao urogallus</i>)	<i>Curlew</i> (<i>Numenius arquata</i>)		<i>Starling</i> (<i>Sturnus vulgaris</i>)	<i>Greylag goose</i> (<i>Anser anser</i>)
Chiffchaff (<i>Phylloscopus collybita</i>)	<i>Lapwing</i> (<i>Vanellus vanellus</i>)		<i>Stock dove</i> (<i>Columba oenas</i>)	<i>Hen harrier</i> (<i>Circus cyaneus</i>)
Coal tit (<i>Periparus ater</i>)	<i>Little egret</i> (<i>Egretta garzetta</i>)		<i>Tree sparrow</i> (<i>Passer montanus</i>)	<i>Hobby</i> (<i>Falco subbuteo</i>)
				<i>Hooded crow</i> (<i>Corvus cornix</i>)

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Woodland Birds	Waterbirds	Seabirds	Farmland Birds	Other Species
Crossbill (<i>Loxia curvirostra</i>)	Redshank (<i>Tringa totanus</i>)		Turtle dove (<i>Streptopelia turtur</i>)	House martin (<i>Delichon urbicum</i>)
Garden warbler (<i>Sylvia borin</i>)	Snipe (<i>Gallinago gallinago</i>)		Whitethroat (<i>Sylvia communis</i>)	House sparrow (<i>Passer domesticus</i>)
Goldcrest (<i>Regulus regulus</i>)	Teal (<i>Anas crecca</i>)			Magpie (<i>Pica pica</i>)
Green woodpecker (<i>Picus viridis</i>)	Yellow wagtail (<i>Motacilla flava</i>)			Meadow pipit (<i>Anthus pratensis</i>)
Jay (<i>Garrulus glandarius</i>)	Grey Heron (<i>Ardea Cinerea</i>)			Mediterranean gull (<i>Larus melanocephalus</i>)
Lesser redpoll (<i>Carduelis cabaret</i>)	Kingfisher (<i>Alcedo Atthis</i>)			Mistle thrush (<i>Turdus viscivorus</i>)
Lesser spotted woodpecker (<i>Dendrocopos minor</i>)	Oystercatcher (<i>Haematopus ostralegus</i>)			Peregrine (<i>Falco peregrinus</i>)
Marsh tit (<i>Poecile palustris</i>)	Sand Martin (<i>Riparia Riparia</i>)			Pied/white wagtail (<i>Motacilla alba</i>)
Nightingale (<i>Lusciniamegarhynchos</i>)	Tufted duck (<i>Aythya fuligula</i>)			Pochard (<i>Aythya ferina</i>)
Nuthatch (<i>Sitta europaea</i>)	Mute swan (<i>Cygnus olor</i>)			Quail (<i>Coturnix coturnix</i>)
Pied flycatcher (<i>Ficedula hypoleuca</i>)				Raven (<i>Corvus corax</i>)
Redstart (<i>Phoenicurusphoenicurus</i>)				Red-breasted merganser (<i>Mergus serrator</i>)
Siskin (<i>Carduelis spinus</i>)				Red grouse (<i>Lagopus lagopus scotica</i>)
Sparrowhawk (<i>Accipiter nisus</i>)				Red kite (<i>Milvus milvus</i>)
Spotted flycatcher (<i>Muscicapa striata</i>)				Shelduck (<i>Tadorna tadorna</i>)
Treecreeper (<i>Certhia familiaris</i>)				Shoveler (<i>Anas clypeata</i>)
Tree pipit (<i>Anthus trivialis</i>)				Stonechat (<i>Saxicola rubicola</i>)
Willow tit (<i>Poecile montana</i>)				Swallow (<i>Hirundo rustica</i>)
Willow warbler (<i>Phylloscopus trochilus</i>)				Swift (<i>Apus apus</i>)

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Woodland Birds	Waterbirds	Seabirds	Farmland Birds	Other Species
Wood warbler (Phylloscopus sibilatrix)				Whinchat (Saxicola rubetra)
				Woodlark (Lullula arborea)

Biodiversity and Nature Conservation

Table A.2 Species Used to Calculate the Wintering Waterbird Measure

Anas acuta (Pintail)	Branta bernicla hrota (Svalbard light-bellied brent goose)	Limosa limosa (Black-tailed godwit)
Anas clypeata (Shoveler)	Branta bernicla hrota (Nearctic light-bellied brent goose)	Mergus merganser (Goosander)
Anas crecca (Teal)	Branta leucopsis (Svalbard barnacle goose)	Mergus serrator (Red-breasted merganser)
Anas Penelope (Wigeon)	Branta leucopsis (Nearctic barnacle goose)	Numenius arquata (Curlew)
Anas platyrhynchos (Mallard)	Bucephala clangula (Goldeneye)	Phalacrocorax carbo (Cormorant)
Anas strepera (Gadwall)	Calidris alba (Sanderling)	Pluvialis apricaria (Golden plover)
Anser albifrons (European white-fronted goose)	Calidris alpine (Dunlin)	Pluvialis squatarola (Grey plover)
Anser albifrons flavirostris (Greenland white-fronted goose)	Calidris canuta (Knot)	Podiceps cristatus (Great crested grebe)
Anser (Greylag goose - Icelandic population)	Calidris maritime (Purple sandpiper)	Recurvirostra avosetta (Avocet)
Anser (British/Irish greylag goose)	Charadrius hiaticula (Ringed plover)	Somateria mollissima (Eider)
Anser brachyrhynchus (Pink-footed goose)	Cygnus columbianus (Bewick's swan)	Tachybaptus ruficollis (Little grebe)
Arenaria interpres (Turnstone)	Cygnus (Whooper swan)	Tadorna (Shelduck)
Aythya farina (Pochard)	Cygnus olor (Mute swan)	Tringa tetanus (Redshank)
Aythya fuligula (Tufted duck)	Fulica atra (Coot)	Vanellus (Lapwing)
Aythya marila (Scaup)	Haematopus ostralegus (Oystercatcher)	
Branta bernicla (Dark-bellied brent goose)	Limosa lapponica (Bar-tailed godwit)	

Biodiversity and Nature Conservation

Table A.3 Species Used to Calculate Butterfly Population Indices

Generalist Butterflies	Habitat Specialist Butterflies
<i>Aglaia io</i> (Peacock)	<i>Apatura iris</i> (Purple emperor)
<i>Aglaia urticae</i> (Small tortoiseshell)	<i>Argynnis adippe</i> (High brown fritillary)
<i>Anthocharis cardamines</i> (Orange-tip)	<i>Argynnis aglaja</i> (Dark green fritillary)
<i>Aphantopus hyperantus</i> (Ringlet)	<i>Argynnis paphia</i> (Silver-washed fritillary)
<i>Aricia agestis</i> (Brown argus)	<i>Aricia artaxerxes</i> (Northern brown argus)
<i>Celastrina argiolus</i> (Holly blue)	<i>Boloria euphrosyne</i> (Pearl-bordered fritillary)
<i>Coenonympha pamphilus</i> (Small heath)	<i>Boloria selene</i> (Small pearl-bordered fritillary)
<i>Erebia aethiops</i> (Scotch argus)	<i>Callophrys rubi</i> (Green hairstreak)
<i>Favonius quercus</i> (Purple hairstreak)	<i>Coenonympha tullia</i> (Large heath)
<i>Gonepteryx rhamni</i> (Brimstone)	<i>Cupido minimus</i> (Small blue)
<i>Lasiommata megera</i> (Wall)	<i>Erynnis tages</i> (Dingy skipper)
<i>Lycaena phlaeas</i> (Small copper)	<i>Euphydryas aurinia</i> (Marsh fritillary)
<i>Maniola jurtina</i> (Meadow brown)	<i>Hamearis lucina</i> (Duke of Burgundy)
<i>Melannargia galathea</i> (Marbled white)	<i>Hesperia comma</i> (Silver-spotted skipper)
<i>Ochlodes sylvanus</i> (Large skipper)	<i>Hipparchia semele</i> (Grayling)
<i>Pararge aegeria</i> (Speckled wood)	<i>Leptidea sinapis</i> (Wood white)
<i>Pieris brassicae</i> (Large white)	<i>Limenitis camilla</i> (White admiral)
<i>Pieris napi</i> (Green-veined white)	<i>Melitaea athalia</i> (Heath fritillary)
<i>Pieris rapae</i> (Small white)	<i>Papilio machaon</i> (Swallowtail)
<i>Polygonia c-album</i> (Comma)	<i>Plebeius argus</i> (Silver-studded blue)
<i>Polyommatus icarus</i> (Common blue)	<i>Polyommatus bellargus</i> (Adonis blue)
<i>Pyronia tithonus</i> (Gatekeeper)	<i>Polyommatus coridon</i> (Chalkhill blue)
<i>Satyrion w-album</i> (White-letter hairstreak)	<i>Pyrgus malvae</i> (Grizzled skipper)
<i>Thymelicus sylvestris</i> (Small skipper)	<i>Satyrion pruni</i> (Black hairstreak)
	<i>Thecla betulae</i> (Brown hairstreak)
	<i>Thymelicus acteon</i> (Lulworth skipper)

2. Population, Economics and Skills

2.1 Introduction

This section presents the overview of plans, programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources Infrastructure and reasonable alternatives in respect of population, economics and skills.

There are links between the population, economics and skills topic and a number of other topics in the Appraisal of Sustainability (AoS), in particular human health, traffic and transport, air quality and climate change.

2.2 Review of Plans and Programmes

The review identified a range of plans and programmes that seek to enhance the economy of the UK and ensure that the economy develops in accordance with the principles of sustainable development. Whilst not directly commenting on water infrastructure, they provide the context for economic growth for the country, with the associated increase in the demand for water resources from the commercial, agricultural, industrial and residential sectors.

The **National Infrastructure Delivery Programme** identifies that water and waste infrastructure are essential for health and wellbeing, environmental sustainability and economic stability. Water services are likely to come under increasing pressure because of population growth and a changing climate, whilst wastewater treatment infrastructure is essential for public health and a clean environment. Sufficient capacity is also required to safely and effectively recycle or dispose of all household and commercial waste produced.

International/European

The United Nations **World Summit on Sustainable Development (2002)** resulted in the Johannesburg Declaration on Sustainable Development, which reaffirmed the Millennium Development Goals and addresses issues such as poverty and economic development.

Europe 2020 (2010) is Europe's economic growth strategy. It aims to deliver growth that is smart, sustainable and inclusive and sets objectives on employment, innovation, education, social inclusion and climate/ energy - to be reached by 2020. **The European Employment Strategy (1997)**, also known as the Luxembourg process provides a set of common objectives and targets for employment policy. Its main aim is the creation of more and better jobs throughout the EU, as well as increasing productivity and the promotion of inclusion by addressing disparities in access to labour markets. It now constitutes part of the Europe 2020 growth strategy and it is implemented through the European semester, an annual process promoting close policy coordination among EU Member States and EU Institutions. These overarching aims are further espoused in the **Europe 2020 Integrated Guidelines (2015)**, which give guidance to Member States on implementing reforms. Key social and economic initiatives under the strategy include the '*Agenda for new skills and growth*' and the '*European platform against poverty*'. Alongside reducing poverty, these plans and programme along seek to reduce income inequality.

The **EU Sustainable Development Strategy** adopted in 2001 and reviewed in 2006 and 2009 also includes indicators relating to economic development and employment rates.

UK

Securing the Future – the UK Sustainable Development Strategy (2005) aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations. The Strategy has five guiding principles:

- ▶ living within environmental limits;

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- ▶ ensuring a strong, healthy and just society;
- ▶ achieving a sustainable economy;
- ▶ promoting good governance; and
- ▶ using sound science responsibly.

The UK Government's **Plan for Growth (2011)** announced a programme of structural reforms to remove barriers to growth for businesses and equip the UK to compete in the global race. These reforms span a range of policies including improving UK infrastructure, cutting red tape, root and branch reform of the planning system and boosting trade and inward investment, to achieve the Government's four ambitions for growth:

- ▶ creating the most competitive tax system in the G20;
- ▶ encouraging investment and exports as a route to a more balanced economy;
- ▶ making the UK the best place in Europe to start, finance and grow a business; and
- ▶ creating a more educated workforce that is the most flexible in Europe.

In 2015, the UK Government launched **Fixing the Foundations: Creating a More Prosperous Nation** which aims to increase growth through higher productivity. This approach includes long-term investment in skills and businesses as well as flexible and competitive markets.

The UK's reform plans for promoting growth and employment to meet the Europe 2020 goals are set out in **Europe 2020: UK National Reform Programme 2015 (2015)**.

In 2016, the UK Government published an updated **National Infrastructure Delivery Plan**. This sets out the Government's plan to 2021 and beyond and takes a targeted approach to infrastructure investment and delivery across different sectors. It contains major commitments to improve the UK's transport, energy, communications, waste, water, housing and science and research infrastructure as well as steps to attract new private sector investment.

England

The **Local Growth White Paper (2010)** sets out the Government's overarching goal to promote strong, sustainable and balanced growth. It restates the Government's role in providing the framework for conditions for sustainable growth by:

- ▶ creating macroeconomic stability, so that interest rates stay low and businesses have the certainty they need to plan ahead;
- ▶ helping markets work more effectively, to encourage innovation and the efficient allocation of resources;
- ▶ ensuring that it is efficient and focused in its own activities, prioritising high-value spending and reducing tax and regulatory burdens; and
- ▶ ensuring that everyone in the UK has access to opportunities that enable them to fulfil their potential.

The White Paper focuses on the approach to local growth proposing measures to shift power away from central government to local communities, citizens and independent providers. In particular, it introduced Local Enterprise Partnerships (LEPs) to provide a vision and leadership for sustainable local economic growth. The number of LEPs has increased from the 24 originally announced to 39. The Local Growth Fund gives LEPs access to central government funding, ensuring that this money is spent in line with local priorities.

The Green Paper **Building our Industrial Strategy (2017)** acts as a starting point in an ongoing consultation on the governments developing industrial strategy. It is based around 10 pillars: science,

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research and innovation; skills; infrastructure; business growth and investment; procurement; trade and investment; affordable energy; sectoral policies; driving growth across the whole country; and creating the right institutions to bring together sectors and places. Water supplies for businesses and people are identified as vital for economic growth under the infrastructure pillar.

The **National Planning Policy Framework (2012)** sets out the core land-use principles to deliver sustainable development. It notes the three dimensions to sustainable development: economic, social and environmental and highlights the importance under the economic role of planning policy in ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure.

The **Government's Strategic Priorities for Ofwat: Affordable, Resilient Water Supplies (2017)** sets out the strategic priorities and objectives for Ofwat, the independent economic regulator of the water industry. It sets a strategic objective for Ofwat to address affordability issues as well as one to challenge the water sector to plan and invest to meet the needs of current and future customers, in a way which offers best value for money over the long term.

Scotland

Scotland's **Third National Planning Framework (2014)** underlines the government's central purpose to create a more successful country for all of Scotland to flourish, through increasing sustainable economic growth. The NPF is underpinned by four interlinked visions which set out the planning strategy for Scotland. These visions are:

- ▶ A successful, sustainable place;
- ▶ A low carbon place;
- ▶ A natural, resilient place; and
- ▶ A connected place

Scotland's Economic Strategy (2015) sets out four strategic priorities which are intended to help increase competitiveness and tackle inequalities across the country. These priorities are:

- ▶ Investing in people and infrastructure in a sustainable way;
- ▶ Fostering a culture of innovation and research and development;
- ▶ Promoting inclusive growth and creating opportunity through a fair and inclusive jobs market; and
- ▶ Promoting Scotland on the international stage to boost trade and investment, influence and networks.

Scottish Planning Policy (2014) is a statement of Scottish Government policy on how nationally important land use planning matters should be addressed in Scotland. It promotes consistency in the application of policy across Scotland whilst allowing sufficient flexibility to reflect local circumstances. The seven core values of Scottish Planning Policy are:

- ▶ Focus on outcomes, maximising benefits and balancing competing interests;
- ▶ Play a key role in facilitating sustainable economic growth, particularly the creation of new jobs and the strengthening of economic capacity and resilience within communities;
- ▶ Be plan-led, with plans being up-to-date and relevant;
- ▶ Make decisions in a timely, transparent and fair way to provide a supportive business environment and engender public confidence in the system;
- ▶ Be inclusive, engaging all interests as early and effectively as possible;

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- ▶ Be proportionate, only imposing conditions and obligations where necessary; and
- ▶ Uphold the law and enforce the terms of decisions made.

The Scottish Government's ***Regeneration Strategy: Achieving A Sustainable Future (2011)*** underlines the challenges faced by some of the most disadvantaged communities and the responses required to help create a Scotland where all places are sustainable, and where people want to live, work and invest. The regeneration of Scotland's most disadvantaged areas and strengthening of local communities are key priorities.

A Plan for Scotland: The Government's Programme for Scotland 2016-17 (2016) sets the actions the Scottish Government will take 2016-17 and beyond. It focuses on an education system providing opportunities for all, an economy with more jobs and fair work, public services fit for the future and empowering people and communities.

Working for Growth: A Refresh of the Employability Framework for Scotland (2012) provides a clear framework to strengthen Scotland's focus on jobs and growth. It does so under the following themes:

- ▶ Strategy and Effective Leadership;
- ▶ Better Integration and Partnership Working;
- ▶ Towards Prevention - Tackling Inequality; and
- ▶ Improving Performance.

A report completed for the Scottish Government by the UK Commission for Employment and Skills (UKCES) entitled ***Towards Ambition 2020: skills, jobs, growth for Scotland (2009)*** found that Scotland's skills base has improved considerably but this has not translated into higher productivity and economic growth. In response to this, the Scottish Government prepared ***Skills for Scotland: Accelerating the Recovery and Increasing Sustainable Economic Growth (2010)***. This strategy focuses on the following four key themes:

- ▶ Empowering people;
- ▶ Supporting employers;
- ▶ Simplifying the skills system; and
- ▶ Strengthening partnerships.

Wales

The ***Well-being of Future Generations (Wales) Act 2015*** is focused on improving the social, economic, environmental and cultural well-being of Wales. The Act requires the public bodies listed in the Act to ensure that any action or process they carry out is done in a sustainable way, must maximise its contribution to well-being goals, and that when making decisions they take into account the impact those decisions could have on people living their lives in Wales in the future. The Act establishes seven well-being goals:

- ▶ a prosperous Wales;
- ▶ a resilient Wales;
- ▶ a healthier Wales;
- ▶ a more equal Wales;
- ▶ a Wales of cohesive communities;
- ▶ a Wales of vibrant culture and thriving Welsh language;
- ▶ a globally responsible Wales.

All relevant public bodies must take all reasonable steps (in exercising its functions) to meet those objectives.

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Economic renewal: a new direction (2010) sets out the role that devolved government, in this case Wales, can play in providing the best conditions and framework to enable the private sector to grow and flourish. It is intended that government resources will be targeted at tackling wide systematic issues within the Welsh economy – investing in infrastructure, skills and improving the conditions within which businesses operate. Economic renewal will see a fundamental shift away from direct and generic support for companies to a focus on creating the right environment for businesses to succeed.

The **Wales Infrastructure Investment Plan (2012)** is intended to drive collaboration, increase visibility and deliver the strategic capital investment decisions. It notes that, infrastructure investment is one of its highest priorities and provides a much needed stimulus, creating the conditions for sustainable growth in the medium and longer term. The Plan is designed to prioritise, scope and coordinate delivery of our major infrastructure investments, whilst improving the long-term economic, social and environmental wellbeing of people and communities in Wales.

Taking Wales Forward 2016-2021 (2016) sets out the Welsh Government's programme to drive improvement in the Welsh economy and public services, delivering a Wales which is prosperous and secure, learning and connected. It includes support for businesses, the creation of apprenticeships and employability support.

The Welsh Government's **Policy statement on skills (2014)** sets out future policy actions which will enable Wales to evolve into a highly skilled nation. It is focused on employment and skills and covers four priority areas: skills for jobs and growth; skills that respond to local needs; skills that employer's value; and skills for employment. The objective of the statement is to create the right conditions for employers across Wales to thrive and prosper.

Cymraeg 2050: A Million Welsh Speakers is the Welsh Ministers' strategy for the promotion and facilitation of the use of the Welsh language. It is based around the three themes of

1. increasing the number of Welsh speakers;
2. increasing the use of Welsh; and
3. creating favourable conditions – infrastructure and context.

The strategy aims to achieve this via several actions including making rapid progress to expand Welsh-medium early years provision by 150 nursery groups over the next decade, increasing the proportion of each school year group receiving Welsh Medium education from 22 percent to 40 percent by 2050 and reviewing the legislation that underpins the Welsh language

Planning Policy Wales (9th Edition, 2016) sets out that the planning system should support economic and employment growth alongside social and environmental considerations within the context of sustainable development. To this end, the planning system, including planning policies, aims to ensure that the growth of output and employment in Wales as a whole is not constrained by a shortage of land for economic uses. Local planning authorities should aim to facilitate the provision of sufficient land required by the market, except where there are good reasons to the contrary, and with due regard to sustainable development. Planning Policy Wales contains sections on the following topics: planning for sustainability; conserving and improving natural heritage and the coast; the historic environment; economic development; transport; housing; planning for retail and commercial development; tourism, sport and recreation; infrastructure and services; minimising and managing environmental risks and pollution; and minerals.

The **Wales Spatial Plan: Places, Futures (2008)** contains the following key themes which relate to population:

- ▶ building sustainable communities;
- ▶ promoting a sustainable economy; and
- ▶ respecting distinctiveness.

The **Vibrant and Viable Places: New Regeneration Framework (2013)** sets out the vision that everybody in Wales should live in well-connected vibrant, viable and sustainable communities with a strong local economy and good quality of life. The framework sets key priorities for regeneration investment in Wales.

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Technical Advice Note 6 – Planning for Sustainable Rural Economies (2010) (TAN6) provides practical guidance on how the planning system can support sustainable rural communities. This guidance provides advice on: sustainable rural communities and economies; rural affordable housing; rural enterprise dwellings; one planet developments; sustainable rural services; and sustainable agriculture.

Technical Advice Note 12 – Design (2016) (TAN12) sets out the Welsh Government's policies and objectives in respect of the design of new development, including; ensuring attractive, safe public spaces and ensuring ease of access for all.

Technical Advice Note 13 – Tourism (1997) (TAN13) offers advice on hotel development, holiday and touring caravans and seasonal and holiday occupancy conditions. Tourism makes a major contribution to the Welsh economy and provides employment in a wide variety of occupations and can bring benefits to local communities in urban and rural areas.

Technical Advice Note 20 – Planning and the Welsh Language (2013) (TAN20) provides advice on the consideration of the Welsh language as part of the Local Development Plan making process. The TAN covers: the role of single integrated plans; the Welsh language and sustainability appraisals; the Welsh language commissioner; and signs and advertisements.

Technical Advice Note 23 – Economic Development (2014) (TAN23) is intended to help local planning authorities and developers implement national planning policy on economic development. TAN23 provides advice on the national planning policy on economic development set out in Planning Policy Wales. It provides guidance on: developing high level economic planning objectives; assessing the economic benefits of new development; economic development and the rural economy; preparing an evidence base for a Local Development Plan; creating an economic development vision for a Local Development Plan; and determining employment land supply.

2.3 Overview of the Baseline

UK

Demographics

In mid-2016, the resident population of Great Britain was 65,640,100, representing a gain of 538,100 (0.8%) over the previous year (this growth was similar to the average annual increase seen over the last decade). A total of 63.5% of the population was of working age (aged 16 to 64)⁴⁶. The UK's population has increased by over 6 million since 2000⁴⁷.

The working age population for the period April 2017 to June 2017 for the UK was broken down as follows⁴⁸:

- ▶ 78.7% economically active, comprising:
 - ▶ 75.1%⁴⁹ in employment; and

⁴⁶ ONS (2017) *United Kingdom population mid-year estimate*. Available online at:

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/timeseries/ukpop/pop>

⁴⁷ NOMIS (2016) *Population estimates - local authority based by five-year age band*. Available online at:

<https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?opt=3&theme=&subgrp>

⁴⁸ NOMIS (2016) *Labour Market Profile*. Available online at:

<https://www.nomisweb.co.uk/reports/lmp/gor/contents.aspx>

⁴⁹ % are for those aged 16-64

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- ▶ 4.4%⁵⁰ unemployed.
- ▶ 21.3% economically inactive.

Since January to March 2016, there was a 0.6% increase with regard to those in the working age population who were economically active, a 1.5% increase in employment and 1.1% reduction in those who are unemployed.

Education and Skills

The breakdown of qualifications of the working age population in 2016 was as follows:

- ▶ 38 % had NVQ4⁵¹;
- ▶ 17.1 % had NVQ3⁵²;
- ▶ 3.1% had trade apprenticeships;
- ▶ 15.9 % had NVQ2⁵³;
- ▶ 10.9 % had NVQ1⁵⁴;
- ▶ 6.6 % had other qualifications; and
- ▶ 8.3 % have no qualifications.

In 2015/2016, the UK had a total of 32,142 schools, comprising:

- ▶ 3,007 nursery;
- ▶ 20,954 primary;
- ▶ 7 middle;
- ▶ 4,169 secondary;
- ▶ 2,391 non-maintained mainstream;
- ▶ 1,261 special; and
- ▶ 353 pupil referral units⁵⁵.

⁵⁰ % is a proportion of economically active

⁵¹ HND, Degree and Higher Degree level qualifications or equivalent

⁵² 2 or more A levels, advanced GNVQ, NVQ 3, 2 or more higher or advanced higher national qualifications (Scotland) or equivalent

⁵³ 5 or more GCSEs at grades A-C, intermediate GNVQ, NVQ 2, intermediate 2 national qualification (Scotland) or equivalent

⁵⁴ Fewer than 5 GCSEs at grades A-C, foundation GNVQ, NVQ 1, intermediate 1 national qualification (Scotland) or equivalent.

⁵⁵ Department for Education (2016) *Education and Training Statistics for the United Kingdom: 2016*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567215/SR54_2016_Text.pdf

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Economic Baseline

In 2015, UK per capita Gross Value Added (GVA) was £25,601⁵⁶. The 2015 headline estimates show that both total GVA and GVA per head at current basic prices have increased in all UK regions since 2014. In 2014, London had the highest GVA per head at £43,629 while Wales had the lowest at £18,002.

In April 2016, median gross weekly earnings for full-time employees were £539, up 2.2% from £527 in 2015. The 2.2% growth seen this year is the joint highest growth in earnings seen since the economic downturn in 2008 (matching that seen in 2013)⁵⁷.

In the period April to June 2017, the UK had a total of 32,073,000 people in employment aged 16 and over, 125,000 more than for January to March 2017 and 338,000 more than for a year earlier⁵⁸. The number of people employed in the private sector increased across the year by 391,000 to reach 26.53 million, while the number of people employed in the public sector fell by 20,000 to 5.42 million.

Employment in the mining, energy and water supply sector stood at 538,000 in April-June 2016, an increase of 20,000 from the same period the year previously and an increase of 74,000 since 2007⁵⁹.

Relating specifically to the water industry alone, which is made up of the regulated water utility companies, non-regulated subsidiary water companies (e.g. involved in construction, engineering, consultancy, laboratory services, etc) and the associated supply chain, there were considered to be 166,500 people employed in the industry in 2006. This included 37,000 employed by regulated water companies utilities. A further 65,000 were employed by support services including contractors and consultants and 6,500 self-employed people⁶⁰.

UK gross domestic product (GDP) is estimated to have increased by 0.66% in the first quarter of 2017, with GDP 2% higher compared with the same quarter a year ago. Construction industries fell by 0.4% and agriculture by 1.0%, whilst the output of the service industries rose by 0.5% and production by 2.1%⁶¹.

⁵⁶ Office for National Statistics. *Regional Gross Value Added (income approach): December 2016*. Available online at: <https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2016>

⁵⁷ ONS (2016) *Annual Survey of Hours and Earnings: 2016 provisional results*. Available online at: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2016provisionalresults>

⁵⁸ ONS (2016) *UK Labour Market: August 2017*. Available online at: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/august2017>

⁵⁹ Nomis (2017) *EMP13: Employment by industry*. Available online: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/employmentbyindustryemp13>

⁶⁰ *Energy & Utility Skills Sector Skills Agreement: The Water Industry 2006*. Available online at: <https://www2.warwick.ac.uk/fac/soc/ier/ngrf/lmifuturetrends/sectorscovered/energy/sectorinfo/subsectors/>

⁶¹ ONS (2017) *Gross domestic product*. Available online at: <http://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/grossdomesticproductpreliminaryestimate/aprtojune2016>

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England

Demographics

In mid-2016, England had a resident population of 55,268,100 (49.4% males and 50.6% females) and 63.1% of the population was of working age (aged 16 to 64)⁶². The total resident population accounts for 84% of the UK's population. The population of England increased by 481,800 (0.9%). England's population grew quicker than any other UK country during the year.

In the period, April to June 2017, the working age population breakdown was as follows⁶³:

- ▶ 79.1% were economically active, comprising:
 - ▶ 75.5%⁶⁴ of working age population in employment; and
 - ▶ 4.4%⁶⁵ of working age population unemployed.
- ▶ 20.9% were economically inactive.

In England, the regional water industry workforce in March 2015 was as follows (change from March 2014 – March 2014 indicated in brackets)⁶⁶:

- ▶ North East: 8,000 (+14.3%)
- ▶ North West: 24,000 (+9.1%)
- ▶ Yorkshire and the Humber: 16,000 (No change)
- ▶ East Midlands: 18,000 (+5.9%)
- ▶ West Midlands: 18,000 (+5.9%)
- ▶ East of England: 17,000 (-5.6%)
- ▶ London: 17,000 (-15.0%)
- ▶ South East: 28,000 (+3.7%)
- ▶ South West: 16,000 (-5.9%)

Education and Skills

The working age population in 2016 had the following qualifications:

- ▶ 37.9% had NVQ4;

⁶² ONS (2016) *Population Estimates for UK, England and Wales, Scotland and Northern Ireland: mid-2016*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2015#main-points>

⁶³ NOMIS (2017) *Labour Market Profile*. Available online at: <https://www.nomisweb.co.uk/reports/lmp/gor/contents.aspx>

⁶⁴ % are for those aged 16-64

⁶⁵ % is a proportion of economically active

⁶⁶ Hope Spring (2015) *UK household water consumption 2015: facts and figures*. Available online at: <https://www.hopespring.org.uk/uk-household-water-consumption-2015-facts-figures/>

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- ▶ 17.4% had NVQ3;
- ▶ 16% had NVQ2;
- ▶ 11.6% had NVQ1;
- ▶ 6.7% had other qualifications;
- ▶ 3% had trade apprenticeships; and
- ▶ 7.8% had no qualifications.

In January 2017, England had 24,281 schools, comprising:

- ▶ 402 nursery;
- ▶ 16,786 primary;
- ▶ 3,408 secondary;
- ▶ 2,297 independent;
- ▶ 1,037 special; and
- ▶ 351 pupil referral units.

As of January 2017, there was total of 8.67 million pupils enrolled in schools in England. The total number of pupils has grown each year since 2009, and there are now over half a million more pupils in schools than at that point. Just over 3 million of the school pupils attend academies and free schools⁶⁷.

Economic Baseline

In 2015, England's per capita GVA was £26,159, which represents a 3% increase on 2014. England accounts for 86% of the UK's total GVA⁶⁸.

In 2016, the median full-time gross hourly pay in England was £13.73 (male median being £14.35 and the female median being £12.89).

In April to June 2017, England had an unemployment rate of 4.4% (people aged 16 and over). This compares to same period in the previous year when the unemployment rate stood at 4.9%⁶⁹.

Deprivation

In England, 61% of local authority districts contain at least one of the most deprived neighbourhoods in England, according to the 2015 Index of Multiple Deprivation. Middlesbrough, Knowsley, Kingston upon Hull, Liverpool and Manchester are the local authorities with the highest proportions of neighbourhoods among the most deprived in England. On average, 37% of the population in the most deprived areas were

⁶⁷ Department for Education (2017) *Schools, pupils and their characteristics: January 2017*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/623124/SFR28_2017_Main_Text.pdf

⁶⁸ ONS (2016) *Regional gross value added (income approach), UK: 1997 to 2015*. Available online at: <https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2016>

⁶⁹ NOMIS (2017) *Labour market profile – England*. Available online at: <https://www.nomisweb.co.uk/reports/lmp/gor/2092957699/report.aspx>

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income deprived. 83% of neighbourhoods that are the most deprived in 2015 were also the most deprived in 2010⁷⁰.

Research by the Consumer Council for Water in 2015 revealed that 12% of customers said they were struggling to pay their water bills, disproportionately affecting those on low incomes. This is evidenced by the fact that total unpaid bills have increased from £1.9 billion to £2.2 billion in the four years between 2010-11 and 2014-15 (2014-15 prices). 23% of households in England spend more than 3% of their income on water and 11% of households spend more than 5% of their income on water. To address this, water companies have put a range of practices in place including⁷¹:

- ▶ promoting assistance schemes;
- ▶ establishing social tariffs;
- ▶ engaging with local communities and debt advice charities;
- ▶ reviewing their communications methods;
- ▶ managing debt; and
- ▶ training their staff.

Scotland

Demographics

In mid-2016, Scotland had a resident population of 5,404,700 (48.6% male and 51.4% female) and 64.6% of the population was of working age (aged 16 to 64). The population grew by 31,700 since mid-2015 (increase of 0.6%), and accounts for 8.2% of the UK's population⁷².

In the period, April to June 2017, the working age population breakdown was as follows⁷³:

- ▶ 78.2% were economically active, comprising:
 - ▶ 75.2%⁷⁴ of working age population were in employment; and
 - ▶ 3.9%⁷⁵ of working age population were unemployed.
- ▶ 21.8% were economically inactive.

⁷⁰ DCLG (2015) *The English Indices of Deprivation 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/465791/English_Indices_of_Deprivation_2015_-_Statistical_Release.pdf

⁷¹ Ofwat (2015) *Affordability and debt 2014-15*. Available online at: www.ofwat.gov.uk/publication/affordability-and-debt-2014-15

⁷² ONS (2017) *Population Estimates for UK, England and Wales, Scotland and Northern Ireland: mid-2016* <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland>

⁷³ NOMIS (2017) *Labour Market Profile - Scotland*. Available online at: <https://www.nomisweb.co.uk/reports/lmp/gor/contents.aspx>

⁷⁴ % are for those aged 16-64

⁷⁵ % is a proportion of economically active

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Education and Skills

The working age population in 2016 had the following qualifications:

- ▶ 43.7% had NVQ4;
- ▶ 14.1% had NVQ3;
- ▶ 13.4% had NVQ2;
- ▶ 8.6% had NVQ1;
- ▶ 6.1% had other qualifications;
- ▶ 4.3% had trade apprenticeships; and
- ▶ 9.9% had no qualifications.

In April 2016, Scotland had 2,528 local authority schools⁷⁶, comprising:

- ▶ 2,034 primary;
- ▶ 359 secondary; and
- ▶ 135 special.

Economic Baseline

In 2015, Scotland's per capita GVA was £23,685. This represents a 2.3% increase on 2014. Scotland accounts for 7.6% of the UK's total GVA⁷⁷.

In 2016, the median full-time gross hourly pay in Scotland was £13.50 (male median being £13.85 and the female median being £13.00). This compares to £13.39 in 2015.

In March to May 2017 Scotland had an unemployment rate of 3.8% (people aged 16 and over). This compares to the same period in the previous year when the unemployment rate stood at 4.6%⁷⁸.

Deprivation

The Scottish Index of Multiple Deprivation (SIMD) 2016 shows that the pattern of multiple deprivation in Scotland has changed over time, with 11 council areas having a larger share of the 20% most deprived data zones in Scotland compared with SIMD 2012, while ten council areas had a smaller share. There are, however, deep-rooted areas of deprivation, most notably in Glasgow City, which have been consistently among the 5% most deprived in Scotland since SIMD 2004. Glasgow City also has the highest proportion of the most deprived data zones within its area, with almost half of its data zones being in the 20% most deprived. This is followed by Inverclyde, West Dunbartonshire, North Ayrshire and Dundee City⁷⁹.

⁷⁶ Scottish Government (2016) *School Estates 2016 Supplementary Dataset*. Available online at: <http://www.gov.scot/Topics/Statistics/Browse/School-Education/schoolestatestats/schestate2016>

⁷⁷ ONS (2016) *Regional gross value added (income approach), UK: 1997 to 2015*. Available online at: <https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2016>

⁷⁸ NOMIS (2017) *Labour Market Profile - Scotland*. Available online at: <https://www.nomisweb.co.uk/reports/lmp/lor/2013265931/report.aspx>

⁷⁹ Scottish Government (2016) *The Scottish Index of Multiple Deprivation*. Available online at: <http://www.gov.scot/Topics/Statistics/SIMD>

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Wales

Demographics

In mid-2016, the resident population of Wales was 3,113,200 (49.3% males and 50.7% females) and 61.7% of the population were of working age⁸⁰. The population grew by 14,100 (an increase of 0.45%) from mid-2015, an account for 5% of the UK's population⁴⁶.

In the period, April to June 2017, the working age population was broken down as follows⁸¹:

- ▶ 76.2% economically active, comprising:
 - ▶ 72.7%⁸² in employment; and
 - ▶ 4.5%⁸³ unemployed.
- ▶ 23.8% were economically inactive.

Education and Skills

The working age population in 2015 had the following qualifications:

- ▶ 35.1% NVQ4;
- ▶ 17.6% NVQ3;
- ▶ 17.6% NVQ2;
- ▶ 10.9% NVQ1;
- ▶ 6.1% other qualifications;
- ▶ 3.2% trade apprenticeships; and
- ▶ 9.6% no qualifications.

In January 2017, Wales had 1,617 schools⁸⁴ comprising:

- ▶ 11 nursery;
- ▶ 1,2870 primary;
- ▶ 10 middle;
- ▶ 200 secondary;

⁸⁰ ONS (2017) *Population Estimates for UK, England and Wales, Scotland and Northern Ireland: mid-2016*

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland>

⁸¹ NOMIS (2017) *Labour Market Profile - Wales*. Available online at:

<https://www.nomisweb.co.uk/reports/lmp/qr/2013265930/report.aspx>

⁸² % are for those aged 16-64

⁸³ % is a proportion of economically active

⁸⁴ Welsh Government (2016) *Schools' Census Results*. Available online at:

<http://gov.wales/statistics-and-research/schools-census/?lang=en>

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- ▶ 39 special; and
- ▶ 70 independent.

Economic Baseline

In 2015, Wales' per capita GVA was £18,002, an increase of 3% compared to 2014. Wales accounts for 3.3% of the UK's total GVA⁸⁵.

In 2016, the median full-time gross hourly pay in Wales was £12.66 (the male median being £13.04 and the female median being £12.01). This compares to £12.00 in 2015.

In the period, April to June 2017, Wales had an unemployment rate of 4.5% (people aged 16 and over). This shows an increase from the previous year when it had an unemployment rate of 4.3%⁸⁶.

Deprivation

In the Welsh Index of Multiple Deprivation (WIMD) 2014 (revised in 2015), there were pockets of high relative deprivation in the South Wales valleys and large cities, and in some North Wales coastal and border towns. The overall picture is similar to that of WIMD 2011, with six of the ten most deprived areas from WIMD 2011 remaining in the ten most deprived areas in WIMD 2014. The local authority with the highest proportion of areas in the most deprived 10 per cent in Wales in WIMD 2014 was Blaenau Gwent (23.4%), while Monmouthshire had no areas in the most deprived 10 per cent⁸⁷.

2.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for the population, economics and skills topic have been identified:

- ▶ There is a broad level of consistency with regard to the qualifications of the working age population in England, Scotland and Wales, with approximately 38% having a NVQ4 or equivalent qualification and above. Scotland has the greatest proportion of the population with this level of qualification (43.7%), while Wales has the lowest (35.1%). In addition, 8.8% have no qualifications and this should be addressed.
- ▶ Many people struggle to pay their water bills, with up to 12% of customers reporting that they struggle to pay. This has a disproportionately large effect on vulnerable groups and those on a low income.
- ▶ The respective indicators and areas of multiple deprivation in England, Scotland and Wales are similar in that there continues to be deep rooted deprivation in specific areas year after year. That said, there is also some broader variation to the areas of deprivation across the rest of the country. This suggests that the affordability of water bills will remain an issue for certain communities in the UK.

⁸⁵ ONS (2016) *Regional gross value added (income approach), UK: 1997 to 2015*. Available online at: <https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2016>

⁸⁶ NOMIS (2017) *Official Labour Market Profile - Wales*. Available online at: <https://www.nomisweb.co.uk/reports/lmp/lor/2013265930/report.aspx>

⁸⁷ Welsh Government (2015) *Welsh Index of Multiple Deprivation*. Available online at: <http://gov.wales/statistics-and-research/welsh-index-multiple-deprivation/?lang=en>

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2.5 Likely Evolution of the Baseline

UK

Demographics

The current UK population is generally increasing and is projected to reach 74.3 million by 2039, a rise of 9.7 million people. Assumed net migration accounts for 51% of the projected increase, with natural increase (more births than deaths) accounting for the remaining 49% of growth.

The age structure of the UK population is moving towards an ageing population, with the average (median) age rising from 40.0 years in 2014 to 42.9 by mid-2039. The number of people of State Pension Age and over is projected to increase by 32.7% to 16.5 million by mid-2039, despite increases to State Pension Age. By mid-2039 more than 1 in 12 of the population is projected to be aged 80 or over.

Those aged under 14 is projected to increase from 11.4 million in 2014 to 12.3 million in 2024 and stay at approximately this level for the next 15 years. There are no formal targets for population growth in the UK⁸⁸.

The increase in population is anticipated to increase demand for water resources, particularly in London and the south east where not only is the population expected to increase most rapidly, these areas also experience the highest levels of water stress.

Economics

There are current uncertainties over market conditions, and the outlook for growth in the short to medium term has weakened following the UK's vote to leave the European Union. With a fall in the exchange rate and likely rises in inflation, the Bank of England highlights that whilst financial conditions are currently stable, there are a number of possible exit scenarios from the European Union that could test the resilience of the financial system⁸⁹. The Bank of England also notes that if the economy follows a path broadly consistent with the May 2017 central projection, then monetary policy could need to be tightened by a greater extent over the forecast period than is currently expected⁹⁰.

Jobs in the water and energy industries have declined since the 1970s as a result of factors including the decommissioning of coal fired power stations and the privatisation of utilities. However, it is anticipated that jobs in these sectors are estimated to increase by 0.8% between the years 2015 and 2025⁹¹.

⁸⁸ ONS (2015) *National Population Projections: 2014-based Statistical Bulletin*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29>

⁸⁹ Bank of England (2017) *Financial Stability Report: Executive summary July 2017*. Available online at: <http://www.bankofengland.co.uk/publications/Documents/fsr/2017/fsrjun17sum.pdf>

⁹⁰ Bank of England (2017) *Inflation Report May 2017*. Available online at: <http://www.bankofengland.co.uk/publications/Documents/inflationreport/2017/may.pdf>

⁹¹ Price Waterhouse Coopers (2016) *UK Economic Outlook*. Available online at: <https://www.pwc.co.uk/assets/pdf/ukeyo/ukeyo-sectoral-employment-march-2016.pdf>

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England

Demographics

Between 2014 and 2039, the population of England is projected to increase from 54.3 million to 63.3 million, an increase of 16.3%⁹².

Economics

England's total GVA growth in 2015 was up 3% from 2014. GVA has risen year on year since 2009, so it could be expected that it will continue to increase in the future, although the rate may slow given the UK outlook⁹³. Given the UK trend data for employment in the water sector is currently increasing year-on-year, it is assumed that jobs in the water industry in England are also showing an annual rise.

Scotland

Demographic

Between 2014 and 2039, the population of Scotland is projected to increase from 5.3 to 5.7 million, an increase of 6.6%⁹⁴.

Scotland has a population target of matching the average European (EU15) population growth over the period from 2007 to 2017. In 2014/15, population growth for was higher than that of the EU15 countries. The average annual population growth rates since 2007 for Scotland and the EU15 were 0.5% and 0.4%, respectively⁹⁵.

Economics

Scottish GDP grew 0.8% during the first quarter of 2017. The services sector grew by 0.3% and the Production sector by 3.1%. The construction sector contracted by 0.7%. On an annual basis, comparing the latest quarter to the same period in the previous year, Scottish GDP grew by 0.7%.⁹⁶

⁹² ONS (2015) *National Population Projections: 2014-based Statistical Bulletin*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29>

⁹³ ONS (2016) *Regional gross value added (income approach), UK: 1997 to 2015*. Available online at: <https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2016>

⁹⁴ ONS (2015) *National Population Projections: 2014-based Statistical Bulletin*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29>

⁹⁵ Scottish Government (2017) *Purpose Target: Population*. Available online at: <http://www.gov.scot/About/Performance/scotPerforms/purposetargets/population>.

⁹⁶ Scottish Government (2017) *Scotland's gross domestic product: 1st quarter 2017*. Available online at: <http://www.gov.scot/Topics/Statistics/Browse/Economy/PubGDP/GDP2016Q2>

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Wales

Demographic

The population of Wales is projected to increase to 3.3 million by 2039 (a 6.1% increase compared to 3.1 million in 2014)⁹⁷.

Economics

When comparing the year ending December 2016 to the year ending December 2015, the Index of Production increased for both Wales (2.9 per cent) and the UK (1.2 per cent). The increase in Wales was largely accounted for by an increase in output in 'Other Manufacturing and Repair' and 'Rubber and Plastics' and 'other Non-metallic Minerals', whilst the increase in the UK was largely accounted for by Electricity, Gas and Water Supply. When comparing the current quarter with the previous quarter, output increased in both Wales and the UK (by 8.8 per cent and 0.4 per cent respectively). The longer term trend for the Index of Construction for Wales shows a 8% increase when comparing the latest four quarters to the previous four quarters⁹⁸.

Welsh total GVA rose by 2.4% from 2013 to 2014, and has risen year on year since 2008⁹⁹. It could be expected that it will continue to increase in the future, although the rate may slow given the weakened growth expectations for the UK.

2.6 Assessing Significance

The objectives and guide questions related to population which have been identified for use in the appraisal of the effects of Water Resources NPS proposals and alternatives are set out in **Table 2.1**, together with reasons for their selection.

Table 2.1 Approach to Assessing the Effects of the Water Resources NPS Proposals on Population, Economics and Skills

Objective/Guide Question	Reasoning
Objective: To support a strong, diverse and stable economy through the provision of nationally significant water resources infrastructure with opportunities to improve skills and employment, minimise disturbance to local communities and maximise positive social impacts.	<p>The SEA Directive (2001/42/EC) requires that the likely significant effects on population should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>Growth in the economy would be expected to lead to an increase in demand for water for commercial and industrial purposes and the provision of sustainable water supplies will be essential for this growth. The construction of large scale water resources infrastructure in particular can represent a significant capital investment with the potential to create employment opportunities, deliver supply chain benefits and contribute to skills development in the working population. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>

⁹⁷ ONS (2015) *National Population Projections: 2014-based Statistical Bulletin*. Available online at:

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29>

⁹⁸ Welsh Government (2017) *Index of Production for Wales and Index of Construction for Wales: 2016 Quarter 4*. Available online at:

<http://gov.wales/docs/statistics/2017/170427-index-production-construction-quarter-4-2016-en.pdf>

⁹⁹ StatsWales (2016) *Gross Value Added by component, Welsh NUTS2 areas*. Available online at:

<https://stats.wales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/Regional-Accounts/Gross-Value-Added-GDP/gva-by-component-welshnuts2areas-year>

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Objective/Guide Question	Reasoning
Will the Water Resources NPS help to ensure that sufficient water resources infrastructure is in place to meet increased demand associated with population growth and to support economic development?	The Environment Agency's 2011 'Case for Change' considered the implications of climate change for water supplies regionally and nationally and concluded that while demand management will have an important role, significant new water resources will be needed to meet the needs of people, businesses and the environment. Water UK's 2016 'Water resources long term planning framework (2015-2065)' noted the importance of strategic schemes. The Government confirmed in its 'Consultation on the Government's Strategic Priorities for Ofwat: Affordable, Resilient Water Supplies' (2017) that a strategic objective for Ofwat is to further a reduction in the long-term risk to water supply resilience from drought and other factors, through a range of measures including new supply solutions.
Will the Water Resources NPS ensure that an affordable supply of water is maintained and vulnerable customers protected?	The Consultation on the Government's Strategic Priorities for Ofwat: Affordable, Resilient Water Supplies (2017) sets out the strategic priorities and objectives for Ofwat and which included a strategic objective for Ofwat to address affordability issues. Research by the Consumer Council for Water in 2015 revealed that 12% of customers said they were struggling to pay their water bills and which disproportionately affects those on low incomes. This is evidenced by the fact that total value of unpaid bills has increased between 2010-11 and 2014-15.
Will the Water Resources NPS promote economically efficient solutions that deliver best value for money?	Ofwat's regulatory duties include promoting economy and efficiency by water companies in their work.
Will the Water Resources NPS affect opportunities for investment in education and skills development?	Investment in education and skills development are vital for economic growth.
Will the Water Resources NPS reduce the effect of water restrictions resulting from droughts on the economy?	Water restrictions have the capacity to affect the productivity of the commercial and industrial sectors, adversely affecting the economy.
Will the Water Resources NPS affect existing abstractors?	The construction of new water resource infrastructure could lead to changes in catchment flows which could affect existing licensed users of water resources.
Will the Water Resources NPS affect the number or types of jobs available in local economies?	Affecting the number or type of jobs will have influences on the local economy and productivity. It is anticipated that a number of jobs may be created during the construction and maintenance phases of any infrastructure built.
Will the Water Resources NPS affect the social infrastructure and amenities available to local communities?	The Water Resources NPS may result in short or medium term changes to population demographics arising from the projects receiving development consent (for example, through migration of workers skilled to work in the industry, depending on the scale and location of the proposed infrastructure). Changes to local population demographics and employment have the potential to impact on the local economy and demand for community facilities such as healthcare, education and recreation. The potential to impact on the local social infrastructure and amenities which could affect the quality of life of individuals in local communities.

Table 2.2 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the population objective.

Table 2.2 Illustrative Guidance for the Assessment of Significance for Population, Economics and Skills

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would help ensure sufficient water resources infrastructure is in place to meet increased future long term regional demand for water and support economic development; Option would ensure a significant additional regional affordable supply of water is maintained and vulnerable customers protected;

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Effect	Description	Illustrative Guidance
		<ul style="list-style-type: none"> Option would incorporate the provision of social infrastructure and amenities; Option would provide educational services/facilities and offer long-term opportunities for skills development including, for example, apprenticeship schemes; Option would generate in the order of 800 or more direct full time equivalent (FTE) employment opportunities per annum¹, a large proportion of which would benefit the local community; Option would generate significant investment in local supply chains fostering economic growth, generating indirect employment opportunities and enhancing the robustness of the local economy (e.g. through the procurement of local contractors to undertake construction activities); Option would significantly enhance the attractiveness of an area to existing and prospective residents and businesses (e.g. through the generation of employment opportunities).
+	Positive	<ul style="list-style-type: none"> Option would help ensure water resources infrastructure is in place to contribute towards meeting increased future long term sub-regional demand for water and support economic development; Option would ensure an additional affordable supply of water is maintained and vulnerable customers protected; Option would stimulate some limited investment in existing services and amenities (e.g. associated with any increase in the work place population); Option would provide some educational opportunities and skills development including, for example, apprenticeship schemes; Option would generate some direct full time equivalent (FTE) employment opportunities per annum (below 800) which may benefit the local community; Option would generate some limited investment in local supply chains (e.g. through the procurement of local contractors to undertake construction activities); Option would enhance the attractiveness of an area to existing and prospective residents and businesses (e.g. through the generation of employment opportunities and provision of infrastructure).
0	Neutral	<ul style="list-style-type: none"> Option would not affect the provision of water resources infrastructure. Option would not affect affordable supplies of water; Option would not affect social infrastructure and amenities available to local communities; Option would not affect the provision of educational services/facilities or offer opportunities for skills development; Option would not affect any local employment opportunities/increase local unemployment rates; Option would have no effect on wider economic benefits/undermine the growth and diversity of the local economy; Option would not affect the attractiveness of an area to existing and prospective residents and businesses.
-	Negative	<ul style="list-style-type: none"> Option would reduce/restrict the provision of water resources infrastructure; Option would adversely affect additional affordable supplies of water; Option would cause some disruption to existing services and amenities available to local communities which is likely to be felt in the short term; Option would lead to a loss of some direct FTE jobs (below 800 per annum) (e.g. due to the cessation of some activities or rationalisation of activities on sites); Option would reduce the resilience and diversity of the local economy (e.g. through loss of local supply chain opportunities); Option would reduce local investment in an area and affect growth of local economy; Option would undermine the attractiveness of an area to existing and prospective residents and businesses (e.g. due to impacts arising from construction activities or concerns regarding operational impacts); Option would undermine the quality of life of the local population (e.g. due to noise and vibration associated with HGV movements during construction or operation) such that

Population, Economics and Skills

Effect	Description	Illustrative Guidance
		some complaints could be expected.
--	Significant Negative	<ul style="list-style-type: none"> Option would reduce/restrict the provision of nationally significant water resources infrastructure; Option would adversely affect additional affordable regional supplies of water; Option would result in the loss of existing services and amenities available to local communities (e.g. where development is proposed on a site in community use); Option would lead to a significant loss of direct FTE jobs (a minimum of 800 per annum) (e.g. due to the closure of local employment sites); Option would significantly reduce the resilience and diversity of the local economy (e.g. through significant loss of local contracts and supply chain opportunities); Option would lead to a significant reduction in investment in an area that would affect the growth of local economy; Option would significantly undermine the attractiveness of an area to existing and prospective residents and businesses (e.g. due to impacts arising from construction activities or concerns regarding operational impacts); Option would seriously undermine the quality of life of the local population (e.g. due to noise and vibration associated with HGV movements during the construction or operation of facilities) such that the project and local authority would be likely to experience a considerable number of complaints.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

¹ The proposed threshold of significance represents around 0.5% of the estimated 166,500 jobs supported by the water sector in the UK (<https://www2.warwick.ac.uk/fac/soc/ier/ngrf/lmifuturetrends/sectorscovered/energy/sectorinfo/subsectors/>).

Human Health

3. Human Health

3.1 Introduction

This section presents the overview of plans, programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources Infrastructure and reasonable alternatives in respect of human health.

There are links between the human health topic and other topics in the Appraisal of Sustainability (AoS), including population, economics and skills, air quality, noise and water quality.

3.2 Review of Plans and Programmes

Clearly, there is a strong link between human health and the availability of potable drinking water. The review of plans and programmes identifies the broad range of plans that seek to promote health and healthy lifestyles. Between them, they identify various factors that contribute to health including the availability of green space and the influence of poor air quality and noise. There is also a recognised need to manage the water environment to ensure that it doesn't pose a health risk.

International/European

The **Canadian Lalonde Report (1974)** identified four health fields independently responsible for individual health: environment, human biology, lifestyle and health care organisation.

Health 2020 (2012) is the WHO's health policy framework for Europe. It aims to support action across government and society to: significantly improve the health and well-being of populations, reduce health inequalities, strengthen public health and ensure people-centred health systems that are universal, equitable, sustainable and of high quality.

The WHO **Children's Environment and Health Action Plan for Europe (CEHAPE) (2004)** was launched at the Fourth Ministerial Conference on Environment and Health in June 2004 and signed by all 53 Member States of the WHO European Region, including the UK. The aim of the CEHAPE is to protect the health of children and young people from environmental hazards. The **Fifth Ministerial Conference on Environment and Health 2010, Parma**, resulted in strengthened commitments to act on children's health and protection from the effects of climate change.

In 2007 the European Commission adopted an overarching Health Strategy **Together for Health - A Strategic Approach for the EU 2008-2013**. The Health Strategy has three strategic objectives: fostering good health in an ageing Europe, protecting citizens from health threats, and supporting dynamic health systems and new technologies. As part of the EU Health Strategy there is a focus on health as a precondition for economic prosperity and the need for smarter investments in health. The Strategy also supports the principle of 'health in all policies', which involves strengthening the integration of health concerns into all policies at Community, Member State and regional levels. An evaluation by the European Commission in 2011 determined that the strategy will remain valid for the next decade and will support the broader Europe 2020 strategy. Europe 2020 aims to turn the EU into a smart, sustainable and inclusive economy promoting growth for all – one prerequisite of which is a population in good health.

The **Third EU Health Programme 2014-2020** is in place to implement the Health Strategy, with objectives to: promote health, prevent diseases, and foster supportive environments for healthy lifestyles; protect citizens from serious cross-border health threats; contribute to innovative, efficient and sustainable health systems; and facilitate access to better and safer healthcare for Union citizens.

The Commission published **Towards Social Investment for Growth and Cohesion 2014-2020 (2013)**, supported by the Commission staff working document **Investing in Health (2013)**, to show how investing in health contributes towards the Europe 2020 objective of smart, sustainable and inclusive growth.

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The **SEA Directive (2001/42/EC)** adopted in 2001 specifically requires the consideration of: “the likely significant effects on the environment, including on issues such as ... human health”. The **SEA Protocol** (United Nations Economic Commission for Europe, 2003), which came into force in 2010, implements the political commitments made at the Third European Conference on Environment and Health and uses the term ‘environment and health’ throughout. It indicates that health authorities should be consulted at the different stages of the process and so goes further than the SEA Directive.

The WHO publication ***Health and Strategic Environmental Assessment (2009)*** provides advice from SEA and health experts on the further involvement of the health sector in SEA and strategic planning processes, in light of the stronger health requirements of SEA set out in the SEA Protocol and the 2004 Fourth Ministerial Conference on Environment and Health.

In the UK, all drinking water, whether from public supplies or other sources, has to meet standards laid down in the **EU Drinking Water Directive (98/83/EC)**. It is the duty of each EU member state government to translate the requirements of the directive into local laws, which must as a minimum meet the requirements of EU legislation. The EU standards are in turn based on advice from the World Health Organization – through the ***WHO Guidelines for Drinking Water Quality***, which are regularly updated to take account of new knowledge. The EU Drinking Water Directive also requires the European Commission to review the standards at least every five years in order to take account of changes in the WHO guidelines and current knowledge

UK

Many of the national level policies and strategies regarding health are aimed at understanding the trends and nature of health issues within the country, understanding the links between health issues and other related factors (such as economic status, etc.), and, primarily, at reducing the inequalities in health outlooks that are evident between different parts of the country and different sections of the population. Whilst some applicable policies/strategies are contained within adopted strategies, many of the Government’s objectives and intended actions are contained within White Papers and guidance papers.

The Health Protection Agency (now part of Public Health England) published ***A Children’s Environment and Health Strategy for the United Kingdom (2009)*** to meet the UK commitments to the WHO’s CEHAPE, and provides recommendations to the UK Government as to how it best can meet its commitment to the CEHAPE.

The ***Water Industry Act 1991*** sets out the main powers and duties of the water and sewerage companies, and defined the powers of the then Director General of Water Services (now the Water Services Regulation Authority (Ofwat)).

The Water Industry Act 1999 made several important amendments to the Water Industry Act 1991. These included:

- ▶ removing a company’s right to disconnect domestic customers for non-payment of bills;
- ▶ limiting the circumstances in which companies can start charging domestic customers on a metered basis; and
- ▶ securing that companies could continue to charge customers on the basis of rateable value.

The ***Water Act 2003*** amended the framework for abstraction licensing, made changes to the corporate structure of economic regulation, and extended the scope for competition in the industry to large users.

The ***Water Act 2014*** enabled greater competition for non-household customers (expected to be limited to customers of English water companies) and gave Ofwat new powers to make rules about charges and charges schemes, as well as making provisions for flood insurance and drainage boards.

The ***Water Supply (Water Quality) Regulations 2016*** consolidate legislation concerning the quality of water supplies for human consumption in England. The regulations also apply to supplies in Wales where the water undertaker or licensee is primarily based in England.

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The **Water Quality and Supply (Fees) Order 2016** sets out the fees that the Chief Inspector of Drinking Water may charge relevant water suppliers for the exercise of functions performed by an inspector. These functions include checking water sampling and analysis and water supply management arrangements and investigating events, incidents, emergencies or other matters arising from the quality or quantity of water.

England

In England, the Department of Health is the government department responsible for public health issues. Its work includes setting national standards, shaping the direction of health and social care services and promoting healthier living.

The Government's White Paper **Healthy Lives, Healthy People: Our strategy for public health in England (2010)** recognises that the quality of the environment, including the availability of green space and the influence of poor air quality and noise, affects people's health and wellbeing. It detailed plans for a shift of power to local communities, including new duties and powers for local authorities to improve the health of local people.

In April 2013 (enacted by changes to the **National Health Service Act 2006** made by the **Health and Social Care Act 2012**), unitary and upper tier local authorities took over a range of public health activity and as part of this reform the post of Director of Public Health (DoPH) was created. The role of the DoPH is to influence local services, for example joining up activity and services to improve public health.

Public Health England's **From Evidence into Action: Opportunities to Protect and Improve the Nation's Health (2014)** sets out seven health priorities for England for the next five years, namely tackling obesity; reducing smoking; reducing harmful drinking; ensuring every child has the best start in life; reducing dementia risk; tackling antimicrobial resistance; and reducing tuberculosis.

The NHS **Five Year Forward View (2014)** sets out the vision for an improved NHS to address changing health needs and demographics. This includes action on prevention of avoidable illnesses, empowering patients and engaging communities.

The **National Planning Policy Framework (DCLG, 2012)** sets out the core land use planning principles that should underpin both plan-making and decision taking. It includes a focus on developing healthy communities and states that the planning system can "play a role in creating healthy, inclusive communities and facilitating social interaction". The **Planning Practice Guidance (DCLG, 2014)** relating to health and wellbeing requires local planning authorities to "ensure that health and wellbeing, and health infrastructure are considered in local and neighbourhood plans and in decision making."

Scotland

The **Public Health etc. (Scotland) Act 2008** provides legislation for public health enabling Scottish Ministers, health boards and local authorities to better protect public health in Scotland. The Act defines "protecting public health" to mean protecting the community or any part of it from (i) infectious diseases, (ii) contamination, or (iii) other such hazards which constitute a danger to human health. Guidance has been produced to support the implementation of the Act including in respect of statutory nuisances.

Scottish Government's **2020 Vision (2011)** sets out its strategic vision for achieving sustainable quality in the delivery of healthcare services across Scotland, in the face of the significant challenges of Scotland's public health record, its changing demography and the economic environment. The **Healthcare Quality Strategy for NHS Scotland (2010)** aims to support "everyone in Scotland to live longer healthier lives and to participate more productively both economically and socially".

The Scottish Government's **Scottish Planning Policy (2014)** sets out how the planning system can help deliver more vibrant, successful and sustainable places, of which the choice to "live more active, engaged, independent and healthy lifestyles" is a key deliverable. The document also aims to tackle health and social problems and improve the health and well-being of people.

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The **National Planning Framework (NPF 3, 2014)** for Scotland, as part of its vision, aims to enhance the health and well-being of people through promotion of sustainable transport and strengthening environmental and landscape quality.

Wales

The White Paper **Sustainable Social Services for Wales: A Framework for Action (2011)** highlighted a number of challenges faced by public services in Wales including demographic changes, increased expectations from those who access care and support as well as continuing hard economic realities. The **Social Services and Well-being (Wales) Act 2014** provides the legal framework for improving the well-being of people who need care and support, and carers who need support and to transform social services in Wales. It is based on the principles of well-being, people, partnership and prevention.

The **Well-being of Future Generations (Wales) Act 2015** includes 'a healthier Wales' as one of the seven well-being goals. This is supported by the National Indicators for Wales **How to Measure a Nation's Progress? (2016)** which specifies indicators relating to birth weight, healthy life expectancy, and healthy lifestyle behaviours for adults and children. **Together for Health (2011)** is a five-year vision for NHS Wales, based around community services and placing prevention, quality and transparency at the heart of healthcare. **Working Differently – Working Together (2012)** sets out key objectives, including to develop a workforce aligned and committed to the Together for Health vision and to create a sustainable and skilled workforce that focuses on helping the people of Wales.

Public Health Wales's Strategic Plan for 2015-18, **Creating a Healthier, Happier and Fairer Wales for Everyone**, sets priority areas for Wales including children's start in life, making healthy choices, and health threats such as infections and air pollution.

Planning Policy Wales (PPW Edition 9) (2016) states the planning policies and proposals should contribute towards the protection and, where possible, the improvement of people's health and well-being. One of the main outcomes of the PPW is to ensure a strong, healthy and just society linked to the contribution of the well-being goals.

3.3 Overview of the Baseline

UK

In the UK, life expectancy at birth during the period 2013-2015 was 79.1 years for males and 82.8 years for females¹⁰⁰.

In England and Wales, cancer accounted for 28.5% of all deaths registered in 2016 and remained the most common broad cause of death for both men and women (30.8% of all male deaths and 26.2% of all female deaths registered in 2016). There have been fairly steady decreases in age-standardised mortality rates for the three main broad disease groups (cancer, respiratory and circulatory diseases) over the last decade. The overall rates for cancer decreased by 0.5% compared to 2015, however for females they increased by 0.1%. Death rates from respiratory diseases (including influenza, pneumonia, chronic lower respiratory disease, bronchitis, emphysema and other chronic obstructive pulmonary diseases and asthma) are higher in the UK at 138.3 per 100,000 population than in any other EU Member State. In the UK, in 2016, there were 161.9 deaths per 100,000 males and 114.7 deaths per 100,000 females from respiratory diseases, compared to an

¹⁰⁰ ONS (2016) *National life tables, UK: 2013–2015*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/nationallifetablesunitedkingdom/20132015>

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EU average of 117.3 deaths per 100,000 males and 63.0 deaths per 100,000 females^{101,102}. Circulatory diseases, such as heart disease and stroke remained the second most common broad cause of death, accounting for just over a quarter (25.5%) of all deaths registered in 2016. Mortality rates for circulatory diseases decreased compared to 2015 and are now lower than in 2014 for both males and females¹⁰³.

In 2013, more than one in three adults in Great Britain reported having a long-standing illness or disability, this increased slightly compared with 2012 but was in line with the levels seen between 2005 and 2012. One in five reported having a limiting long-standing illness or disability¹⁰⁴.

There are high levels of hypertension and overweight/obesity in the UK¹⁰⁵. Public health trends often correlate with deprivation and these figures for illness are invariably far less favourable in deprived areas¹⁰⁶.

The quality standards for the UK's public water supply are laid down in national regulations derived from the EU Drinking Water Directive (as noted above). These standards are based on advice from the World Health Organization (WHO) and are regularly reviewed. Water quality is also checked and regulated by independent drinking water inspectorates in England and Wales, Scotland and Northern Ireland, who report each year. The latest figures for drinking water quality compliance are:

- ▶ England and Wales 99.96% (reported July 2017);
- ▶ Scotland 99.91% (reported August 2017); and
- ▶ Northern Ireland 99.83% (reported November 2016).

Water in rivers can be carriers or vectors of disease. The most commonly incurred water borne diseases in the UK include:

- ▶ Leptospirosis;
- ▶ Cryptosporidiosis;
- ▶ E coli;
- ▶ Hepatitis A / C; and
- ▶ Botulism.

¹⁰¹ Eurostat (2016) *Causes of Death Statistics*. Available online at:
http://ec.europa.eu/eurostat/statistics-explained/index.php/Causes_of_death_statistics

¹⁰² ONS (2017) *Deaths registered in England and Wales 2016*. Available online at:
<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsregistrationsummarytables/2016>

¹⁰³ ONS (2017) *Deaths registered in England and Wales 2016*. Available online at:
<http://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsregisteredinenglandandwales/seriesdr/2015-11-09>

¹⁰⁴ ONS (2015) *Adult Health in GB, 2013*. Available online at:
<http://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/compendium/opinionsandlifestyle/survey/2015-03-19/adulthealthinenglandandwales2013>

¹⁰⁵ Health and Social Care Information Centre (2015) *Health Survey for England 2014: Trend Tables Commentary*. Available online at:
<http://content.digital.nhs.uk/catalogue/PUB19297/HSE2014-Trend-commentary.pdf>

¹⁰⁶ ONS (2013) *General Health in England and Wales: 2011 and comparison with 2001*. Available online at:
<https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandwellbeing/articles/generalhealthinenglandandwales/2013-01-30>

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England

In England, life expectancy at birth during the period 2013-2015 was 79.4 years for males and 83.1 years for females.

In 2011, 47.2% of the population in England rated their health as very good; 34.2% as good, 13.1% as fair, 4.2% as bad and 1.2% as very bad¹⁰⁷.

The 2014 Health Survey for England, published in 2015, sets out the following key findings¹⁰⁸:

- ▶ Overall, 11% of men and 13% of women aged 65 and over received help over the last month with at least one of the Activities of Daily Living (ADL) such as having a bath or shower, dressing or undressing and taking medicine.
- ▶ Mean BMI for both men and women was 27.2 kg/m², in the overweight range. Around a quarter of adults were obese (24% of men and 27% of women), and 41% of men and 31% of women were overweight.
- ▶ 22% of men and 16% of women drank more alcohol than the level considered to be at lower risk of alcohol-related harm.
- ▶ 26% of adults reported having ever been diagnosed with at least one mental illness.

Scotland

In Scotland, life expectancy at birth during the period 2013-2015 was 77.1 years for males and 81.1 years for females¹⁰⁰.

The 2015 Scottish Health Survey, published in 2016, sets out the following key findings¹⁰⁹:

- ▶ 74% of adults aged 16 and over described their health as 'good' or 'very good'.
- ▶ 29% of adults were obese, while 65% were overweight including obese.
- ▶ 15% of adults reported ever having been diagnosed with cardiovascular disease (CVD).
- ▶ 6% of adults had doctor diagnosed diabetes.
- ▶ 29% of adults aged 16 and over had hypertension.

Wales

In Wales, life expectancy at birth for the period 2013-2015 was 78.4 years for males and 82.3 years for females.

In 2011, 46.6% of the population in Wales rated their health as very good; 31.1% as good, 14.6% as fair, 5.8% as bad and 1.8% as very bad.

¹⁰⁷ ONS (2013) *General Health in England and Wales: 2011 and comparison with 2001*. Available online at:

<https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandwellbeing/articles/generalhealthinenglandandwales/2013-01-30>

¹⁰⁸ Health and Social Care Information Centre (2015) *Health Survey for England 2014: Trend Tables Commentary*. Available online at:

<http://content.digital.nhs.uk/catalogue/PUB19297/HSE2014-Trend-commentary.pdf>

¹⁰⁹ Scottish Government (2016) *Scottish Health Survey 2015*. Available online at:

<http://www.gov.scot/Resource/0050/00505745.pdf>

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The 2015 Welsh Health Survey, published in 2016, includes the following key findings¹¹⁰.

- ▶ 59% of adults were classified as overweight or obese, including 24% obese.
- ▶ 51% of adults reported currently being treated for an illness, 20% of adults currently being treated for high blood pressure, 14% for a respiratory illness, 12% for arthritis, 13% for a mental illness, 8% for a heart condition and 7% for diabetes.
- ▶ 33% of adults reported that their day-to-day activities were limited because of a health problem/disability, including 15% who were limited a lot.

3.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for health have been identified:

- ▶ Health inequalities exist in many communities. This is due a number of factors (and the interplay between them) including housing quality, economic wellbeing, employment, lifestyle, heredity factors, cultural and environmental factors.
- ▶ At present, respiratory illness places a significant burden on the health service. Sustained exposure to elevated air pollution levels (including exposure to elevated concentrations of particulate matter, oxides of nitrogen and sulphur) contributes to this problem. According to WHO estimates, nearly 500,000 deaths in Europe in 2012 were linked to exposure to outdoor air pollution (WHO 2014)¹¹¹. There is the potential for significant level of dust and other emissions to arise during the construction phase to arise during the construction phase that are related to respiratory illnesses.
- ▶ Whilst relatively uncommon, the freshwater environment poses a number of health risks that can be easily exacerbated if the environment is poorly managed.

3.5 Likely Evolution of the Baseline

UK

Life expectancy¹¹² at birth in the UK has reached its highest level on record for both males and females. From 1982 to 2015, life expectancy at birth has increased from 70.8 to 79.1 years for males and 76.8 to 82.8 years for females¹⁰⁰.

Period life expectancy¹¹³ at birth is projected to rise by eight years for males and seven years for females across the 50-year projection period 2014 – 2064. **Figure 3.1** shows period life expectancy at birth for males and females 1981-2014 and then for each of the variant life expectancy projections to 2064. Under the principal projection, a baby boy born in 2064 is projected to live to 87.2 years and a baby girl to 89.8 years. In the high life expectancy variant, period life expectancy at birth is projected to reach age 92.2 and age 94.4

¹¹⁰ Welsh Government (2016) *Welsh Health Survey 2015*. Available online at: <http://gov.wales/statistics-and-research/welsh-health-survey/?lang=en>

¹¹¹ WHO (2014) *Burden of disease from ambient air pollution for 2012*. Available online at: www.who.int/phe/health_topics/outdoorair/databases/AAP_BoD_results_March2014.pdf?ua=1

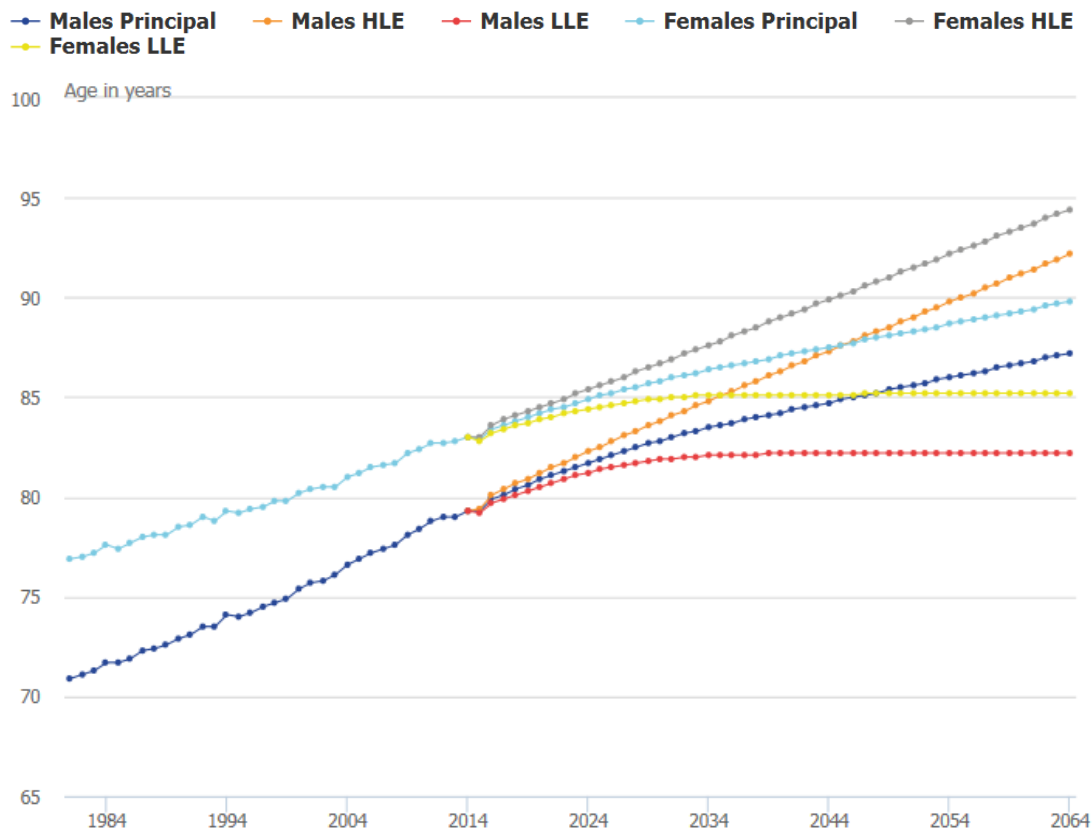
¹¹² The average period that a person may expect to live.

¹¹³ Period life expectancy at a given age for an area is the average number of years a person would live, if he or she experienced the particular area's age-specific mortality rates for that time period throughout his or her life.

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for males and females respectively in 2064, but the low life expectancy variant projects period life expectancy as low as 82.2 and 85.2 respectively¹¹⁴.

Figure 3.1 Period life expectancy at birth for males and females, UK, 1981-2064



Source: Office for National Statistics.

England

Life expectancy at birth for males in England has increased from 71.1 years in 1980-82 to 79.4 years in 2013-15, an increase of 8.3 years. For females, life expectancy increased by 6.0 years from 77.0 to 83.0 years over the same period. As a result, the gap in life expectancy between genders over this time has decreased from 6 years to 3.7 years.

Between 1993 and 2014, the proportion of the population in England reporting very good and good general health has fluctuated between 74% and 78% among men and between 73% and 76% among women, with no clear pattern of variation. The prevalence of very bad or bad general health has ranged from 4% to 8% across both sexes over the same period.

The current general trend in human health is generally towards greater life expectancy and healthier lifestyles, including reductions in smoking prevalence and excessive alcohol consumption, and increases in

¹¹⁴ ONS (2015) *Past and projected data from the period and cohort life tables: 2014-based, UK, 1981 to 2064*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/pastandprojecteddatafromtheperiodandcohortlifetables/2014baseduk1981to2064>

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fruit and vegetable consumption and physical exercise over the last 10 years. However, levels of obesity and the prevalence of certain conditions such as diabetes have increased across this period¹¹⁵.

Scotland

Male life expectancy has improved across Scotland as a whole over the last 30 years (from 69.1 years in 1980-82 to 77.1 years in 2013-2015). Female life expectancy has also improved across Scotland, from 75.3 years in 1980-82 to 81.1 years in 2013-15. As a result, the gap in life expectancy between genders over this time has decreased from 6.2 years to 4.1 years. Overall life expectancy in Scotland still lags behind the rest of the UK and most Western European nations.

All-cause mortality rates for young working-age adults (people aged 15-44) have declined in the last ten years from 119 in 2002-04 to 105 per 100,000 population in 2011-13. However, these rates remain relatively high compared to other Western European countries¹¹⁶. Alcohol related hospital admissions have been declining since 2007/08, while self-assessment of 'good' or 'very good' general health has stayed relatively stable between 74% and 77% over this period¹¹⁷.

Wales

Life expectancy for males in Wales has increased from 70.4 years in 1980-82 to 78.4 years in 2013-15, an increase of 8 years. For females, life expectancy increased by 5.9 years from 76.4 to 82.3 years over the same period. As a result, the gap in life expectancy between genders over this time has decreased from 6 years to 4 years.

There has been a decrease in smoking rates in Wales since 2003/04, while obesity levels have increased during this time. There has also been a slight increase in adults reporting being treated for diabetes and mental illness, and levels of high blood pressure are higher than in 2003/04. By contrast, levels of heart conditions and arthritis have decreased. There has also been a slight decrease in reporting of 'fair' or 'poor' general health during this time.

Key strategic aims for NHS Wales in the Together for Health 5 year vision include:

- ▶ reduce health inequality;
- ▶ reduce obesity, smoking, drug and alcohol abuse;
- ▶ making access to primary services easier;
- ▶ increasing the range of local services reducing the need for travel;
- ▶ guarantee respect and dignity to patients; and
- ▶ systems for assuring high quality care will match the best in the world¹¹⁸.

¹¹⁵ HSCIC (2014) *Health Survey for England 2014: Trend Tables Commentary*. Available online at: <http://content.digital.nhs.uk/catalogue/PUB19297/HSE2014-Trend-commentary.pdf>

¹¹⁶ NHS Scotland (2015) *Health and Wellbeing Profiles 2015, Scotland Overview Report*. Available online at: <http://www.scotpho.org.uk/opt/Reports/ScotPHO-Health-Wellbeing-Report-2015-150731-web.pdf>

¹¹⁷ Scottish Government. *National Indicators: Reduce alcohol related hospital admissions; Improve self-assessed general health*. Available online at: <http://www.gov.scot/About/Performance/scotPerforms/indicator>

¹¹⁸ Welsh Government (2011) *Together for Health*. Available online at: <http://wales.gov.uk/docs/dhss/publications/111101togethernen.pdf>

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3.6 Assessing Significance

The objectives and guide questions related to health which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 3.1**, together with reasons for their selection.

Table 3.1 Approach to Assessing the Effects of the Water Resources NPS on Human Health

Objective/Guide Question	Reasoning
Objective: To ensure the protection and enhancement of human health and wellbeing.	<p>The SEA Directive (2001/42/EC) requires that likely significant effects on human health be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>A reliable source of clean water is required to ensure human health. The increase in the severity of drought, particularly in the south and east of England could also pose a risk to health. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>
Will the Water Resources NPS adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	Nuisance, disturbance and disruption from the construction of water resource infrastructure (in common with many major projects) could occur from the effects of noise, vibration and changes in air quality. The impacts of noise pollution and from vibration on specific localities will need careful consideration in all phases of any project associated with the development of new water infrastructure. Emissions to air may create dust or odours that have the potential to affect air quality or to be classed as a statutory nuisance (as under Environmental Protection Act 1990).
Will the Water Resources NPS disproportionately affect communities already identified as vulnerable / at risk?	There is a duty to protect the health of the local communities, including more vulnerable members of the population, such as children as set out in CEHAPE (2004) and UK CEHAPE strategy (2007).
Will the Water Resources NPS ensure the continuity of a safe and secure drinking water supply?	The Water Supply (Water Quality) Regulations 2016 establish the quality standards of water supplies for human consumption. The developer of the water infrastructure covered by the NPS will be responsible for ensuring water quality meets the regulatory requirements for health.
Will the Water Resources NPS affect opportunities for recreation and physical activity?	Water infrastructure (such as reservoirs) provide significant recreational opportunities e.g. Kielder, Thirlmere, Derwent and Abberton.
Will the Water Resources NPS maintain surface water and bathing water quality within statutory standards	The Water Framework Directive (2000/60/EC) requires all inland, coastal and groundwater to reach a 'good' chemical and ecological status whilst the Bathing Waters Directive (2006/7/EC) sets standards for the quality of bathing waters

Table 3.2 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the health objective.

Table 3.2 Illustrative Guidance for the Assessment of Significance for Human Health

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would have a significant positive effect on the likely determinants of good health (including employment opportunities, level of deprivation, physical activity, access to open space and recreational activities, environmental quality and community safety); Option would have a strong and sustained positive effect on health and well-being and acknowledges the health needs of specific groups in society (e.g. children, mums to be and the elderly); Option supports the provision of healthcare facilities.

Human Health

Effect	Description	Illustrative Guidance
+	Positive	<ul style="list-style-type: none"> Option would have a positive effect on the likely determinants of good health (including employment opportunities, level of deprivation, physical activity, access to open space and recreational activities, environmental quality and community safety); Option would have a positive effect on health and well-being and acknowledges the health needs of specific groups in society (e.g. children, mums to be and the elderly); Option would support the provision of healthcare facilities (i.e. as a result of an increase in the local population linked with employment provision).
0	Neutral	<ul style="list-style-type: none"> Option would have no observable effects (short, medium and long-term) on the health and well-being of individuals, specific groups in society (e.g. children, mums to be and the elderly) and communities.
-	Negative	<ul style="list-style-type: none"> Option would have a negative effect on the likely determinants of good health (including employment opportunities, level of deprivation, physical activity, access to open space and recreational activities, improvements to environmental quality and community safety); Option would have a negative effect on the health and well-being of individuals, specific groups in society (e.g. children, mums to be and the elderly) and communities; Option would result in some nuisance and/or disruption to communities, such that some complaints could be expected.
--	Significant Negative	<ul style="list-style-type: none"> Option would have a significant negative effect on the likely determinants of good health (including employment opportunities, level of deprivation, physical activity, access to open space and recreational activities, improvements to environmental quality and community safety); Option would have a significant negative effect on the health and well-being of individuals, specific groups in society (e.g. children, mums to be and the elderly) and communities; Option would cause statutory nuisance or a sustained and significant nuisance and/or disruption to communities.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

4. Land Use, Geology and Soils

4.1 Introduction

This section presents the overview of plans, programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources in respect of land use, geology and soils.

Land use in this context is concerned with the effective use of land, i.e. by encouraging the reuse of land that has been previously developed (brownfield land) as well promoting sustainable patterns of land use, e.g. in relation to the protection of open spaces and green infrastructure. Geology and soils is concerned with important geological sites, the contamination of soils and high quality agricultural land.

There are links between the land use, geology and soil topic and other topics in the Appraisal of Sustainability (AoS), including biodiversity and nature conservation, human health, climate change, waste and resources and landscape and townscape.

4.2 Review of Plans and Programmes

The government's stated aim for soils in ***Safeguarding our Soils, A Strategy for England*** is that all soils are managed sustainably by 2030 and degradation threats are tackled quickly. Planning policy also provides the context both for the prevention and remediation of contaminated land. The NPPF and supporting Planning Practice Guidance encourage the effective use of land by reusing land that has been previously developed, provided that it is not of high environmental value. Through promoting the sustainable use of soils and the remediation of contaminated land, the plans and programmes provide a framework for the protection of soil and water resources.

International/European

The first ***World Soil Charter*** was adopted in 1981 by members of the Food and Agriculture Organization of the United Nations (FAO), which highlighted key principles and guidelines related to soil conservation. In 2015, member countries endorsed an updated World Soil Charter to promote sustainable soil management at all levels.

The ***European Thematic Strategy on Soil Protection (2006)*** sets out the European Commission's strategy on soils. The overall objective of the Strategy is the protection and sustainable use of soil, based on the following guiding principles:

- ▶ preventing further soil degradation and preserving its functions;
- ▶ when soil is used and its functions are exploited, action has to be taken on soil use and management patterns;
- ▶ when soil acts as a sink/receptor of the effects of human activities or environmental phenomena, action has to be taken at source; and
- ▶ restoring degraded soils to a level of functionality consistent at least with current and intended use, thus also considering the cost implications of the restoration of soil.

The Strategy also included a proposal for a Soils Directive. However, the proposal for a Directive has since been withdrawn (May 2014) with the Commission stating that it "*remains committed to the objective of the protection of soil*". The commitment to sustainable soil use is in line with the **Seventh Environment Action Programme**, (7th EAP) which provides that by 2020 "*land is managed sustainably in the Union, soil is adequately protected and the remediation of contaminated sites is well underway*" and commits the EU and its Member States to "*increasing efforts to reduce soil erosion and increase organic matter, to remediate contaminated sites and to enhance the integration of land use aspects into coordinated decision-making involving all relevant levels of government, supported by the adoption of targets on soil and on land as a*

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resource, and land planning objectives". It commits the EU and its Member States to increasing efforts to reduce soil erosion, increase soil organic matter and to remediate contaminated sites. This reiterates a number of soil and land use commitments in the **2011 Road Map for Resource-Efficient Europe** (part of Europe 2020). The EAP builds on the commitments of the **2012 United Nations Conference on Sustainable Development (Rio+20)** which recognises the economic and social significance of good land management, and calls for a 'land degradation neutral world'.

The **Industrial Emissions Directive (IED) (2010/75/EU)** combines seven previous directives, including the Large Combustion Plant Directive and the Integrated Pollution Prevention and Control (IPPC) Directive. It applies an integrated environmental approach to the regulation of certain industrial activities, which means that emissions to air, water and land must be considered together. Regulators must set permit conditions so as to achieve a high level of protection for the environment as a whole, based on the use of the best available techniques (BAT), which balances the costs to the operator against the benefits to the environment. The Directive specifies that permit conditions must be included to ensure the protection of soil quality.

A number of other European Directives contribute indirectly to soil protection including the **Habitats Directive (92/43/EEC)**, **Ambient Air Quality and Cleaner Air for Europe Directive (2008/50/EC)**, **Water Framework Directive (WFD) (2000/60/EC)**, **Nitrates Directive (91/676/EEC)** and **Sewage Sludge Directive (86/278/EEC)**.

UK

The **Environmental Protection Act 1990** defines within England, Scotland and Wales the legal framework for duty of care for waste, contaminated land and statutory nuisance.

The **Environment Act 1995** seeks to protect and preserve the environment and guard against pollution to air, land or water. The Act adopts an integrated approach to environmental protection and outlines where authorisation is required from relevant authorities to carry out certain procedures as well as outlining the responsibilities of the relevant authorities. The Act also amends the Environmental Protection Act 1990 with regard compulsory remediation of contaminated land.

The **Wildlife and Countryside Act 1981** allows the designation of Sites of Special Scientific Interest (SSSI) for sites with geological importance.

The **Environmental Permitting (England and Wales) Regulations 2010** (SI 2010/675) consolidates a range of previous permits required for processes which might cause pollution. It covers water discharges, groundwater activities, radioactive substances, waste, mining and installations. It requires operators to obtain permits for some facilities, to register others as exempt and provides for ongoing supervision by regulators. The aim of the regime is to:

- ▶ protect the environment so that statutory and Government policy, environmental targets and outcomes are achieved;
- ▶ deliver permitting and compliance with permits and certain environmental targets effectively and efficiently in a way that provides increased clarity and minimises the administrative burden on both the regulator and the operators;
- ▶ encourage regulators to promote best practice in the operation of facilities; and
- ▶ continue to fully implement European legislation.

The Forestry Commission's **National Forest Inventory** takes place every 10-15 years, with the most recent beginning in 2009. It provides a record of key information about the Great Britain's forests and woodlands. This information is useful to many people and organisations involved in forestry and land management, as well as in the wider world of planning, policy development and business.

Land Use, Geology and Soils

The ***Ancient Woodland Inventory***¹¹⁹ identifies woodlands that have had a continuous woodland cover for centuries. Studies show that these woodlands are typically more ecologically diverse, and of higher nature conservation value, than those that have developed recently or those where woodland cover on the site has been intermittent. They may also be culturally important.

England

In 2009, Defra published ***Safeguarding our Soils, A Strategy for England***. The vision in this Strategy is that by 2030, all of England's soils will be managed sustainably and degradation threats will be tackled successfully. The overall aspiration is that this will improve the quality of England's soils and safeguard their ability to provide essential services for future generations. In June 2011, the Government reiterated its vision and 2030 target for England's soils in the ***Natural Environment White Paper (Defra, 2011)***. As part of this vision, the Government committed to undertaking further research to explore how soil degradation can affect the soil's ability to support vital ecosystem services; and how best to manage lowland peatlands in a way that supports efforts to tackle climate change. This will inform future policies and the direction of future action towards 2030.

The ***Contaminated Land (England) Regulations 2006*** (SI 2006/1380) sets out provisions relating to the identification and remediation of contaminated land. The ***Environmental Damage (Prevention and Remediation) (England) Regulations 2015*** (SI 2015/810) require action in response to the most significant cases of environmental damage including in respect of risks to human health from contamination of land.

The ***National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2012)*** sets out the Government's planning policy for the use of land in England. With specific regard to geology and soils, it states that "the planning system should contribute to, and enhance, the natural and local environment by protecting and enhancing valued landscapes, geological conservation interests and soils; preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil pollution or land instability; and remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate" (paragraph 109). The NPPF states that planning policies should encourage the effective use of land by reusing land that has been previously developed, provided that it is not of high environmental value (paragraph 111). Planning authorities should also take into account the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality (paragraph 112).

In 2014, the Department for Communities and Local Government (DCLG) published online Planning Practice Guidance. Sections of specific relevance include *Land Affected by Contamination (2014)* in addition to *Brownfield Land, Soils and Agricultural Land (2014)* and *Green Infrastructure (2016)* under the 'Natural Environment' guidance.

Scotland

The main aim of the ***Scottish Soil Framework (2009)*** is to promote the sustainable management and protection of soils consistent with the economic, social and environmental needs of Scotland. The Framework identifies a wide range of activities that will contribute to 13 soil outcomes, including factors such as maintaining soil structure, reducing soil erosion and where possible remediating, maintaining and enhancing soil's productive capacity.

Scottish Planning Policy (2014) sets out the Scottish Government's policy on land use planning. The SPP states that the planning system should seek to protect soils from damage such as erosion or compaction and limits development on prime agricultural land.

¹¹⁹ Actively maintained by Natural England, Natural Resources Wales, Scottish Natural Heritage and the Woodland Trust in Northern Ireland

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The third **National Planning Framework (NPF3)** was published in June 2014 and sets the spatial expression of the Scottish Government's Economic Strategy, and of plans for development and investment in infrastructure. The NPF identifies national developments and other strategically important development opportunities in Scotland.

Planning Advice Note 33: Development of Contaminated Land (PAN33) (Revised October 2000) provides advice on implications of the development of contaminated land and the approach to contaminated land in development plans.

Scotland's second land use strategy, **Getting the Best from Our Land: A land use strategy for Scotland 2016-2021**, was published in 2016. It retains the long-term vision; three Objectives relating to the economy, environment and communities; and the Principles for Sustainable Land Use from the first land use strategy. It takes a strategic approach to the challenges facing land use in Scotland and sets out the following vision: "A Scotland where we fully recognise, understand and value the importance of our land resources, and where our plans and decisions about land use deliver improved and enduring benefits, enhancing the wellbeing of our nation." This vision is underpinned by the following objectives:

- ▶ land based businesses working with nature to contribute more to Scotland's prosperity;
- ▶ responsible stewardship of Scotland's natural resources delivering more benefits to Scotland's people; and
- ▶ urban and rural communities better connected to the land, with more people enjoying the land and positively influencing land use.

A scheme for remedying contaminated land is introduced in the **Contaminated Land (Scotland) Regulations 2000** (SSI 2000/178) and **Contaminated Land (Scotland) Regulations 2005** (SSI 2005/658). This scheme identifies special sites' enforced by Scottish Environment Protection Agency (SEPA), remediation notices and their contents, and sets out the information to be held on a contaminated land register maintained by local councils. The **Pollution Prevention and Control (Scotland) Regulations 2012** (SSI 2012/360) permit and regulate many industrial activities that may pollute our environment. The **Environmental Liability (Scotland) Regulations 2009** (SSI 2009/266) oblige operators of certain activities to take preventative measures where there is an imminent threat of environmental damage, and to remediate any environmental damage caused by their activities.

The **Scottish Forestry Strategy (2006)** also includes objectives relating to sustainable soil management and protection.

Wales

The **Well-being of Future Generations (Wales) Act 2015** strengthens existing governance arrangements for improving the well-being of Wales to ensure that present needs are met without compromising the ability of future generations to meet their own needs. The act identifies goals to improve the well-being of Wales, introduces national indicators that will measure the difference being made to the well-being of Wales, and simplifies requirements for integrated community planning. The 2016 national indicators include the 'concentration of carbon and organic matter in soil'. This is supported by the **Environment (Wales) Act 2016**, which puts legislation in place to plan and manage Wales' natural resources in a more proactive, sustainable and joined-up way, and includes provisions relating to land management.

One Wales: One Planet (2009) sets out proposals to promote sustainable development, how the Welsh Government will make sustainable development a reality for people in Wales, and the benefits that people will see from this, particularly in less well-off communities. With specific regard to land-based resources, the strategy's aim is to "meet the needs of current and future generations without depleting the resources provided by land upon which we all depend". The Welsh Government's **Natural Resources Policy Statement (2015)** also illustrates key priorities including soil, green infrastructure, woodlands and peat management.

The **Wales Spatial Plan (2008)** provides the context and direction of travel for local development plans and the work of local service boards. The 2008 update brings the Wales Spatial Plan into line with One Wales,

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and gives status to the area work which has developed since 2006. The key themes of the update (and the Wales Spatial Plan before it) are set out below:

- ▶ Building Sustainable Communities;
- ▶ Promoting a Sustainable Economy;
- ▶ Valuing our Environment;
- ▶ Achieving Sustainable Accessibility; and
- ▶ Respecting Distinctiveness.

The **Planning (Wales) Act 2015** sets out a series of legislative changes to deliver reform of the planning system in Wales. This includes the requirement for a National Development Framework which will set out the Welsh Government's land use priorities and Strategic Development Plans for areas with matters of greater than local significance.

Planning Policy Wales (Edition 9) (2016) contains current land use planning policy for Wales. It promotes a preference for the reuse of brownfield land and conservation of the best and most versatile agricultural land and geological assets. Chapter 13 deals with minimising and managing environmental risks and pollution including contaminated and unstable land and seeks to maximise environmental protection for people, natural and cultural resources, property and infrastructure and prevent or manage pollution and promote good environmental practice. Chapter 14 addresses mineral extraction and related development in Wales, which includes all minerals and substances in, on or under land extracted either by underground or surface working.

Technical Advice Note 5: Nature Conservation and Planning (2009) includes guidance relating to conservation of geological features such as rocks and soils. **Technical Advice Note 6: Planning for Sustainable Rural Communities (2010)** provides guidance on how the planning system can contribute to: sustainable and rural communities; sustainable rural housing; sustainable rural services; and sustainable agriculture.

Local Development Plans (LDPs) set out local planning authority proposals and policies for future development and use of land in Wales. As of May 2016, 18 authorities had an adopted LDP with the remainder relying on extant adopted and emerging Unitary Development Plans.

The **Contaminated Land (Wales) Regulations 2006** (WSI 2006/2989) sets out provisions relating to the identification and remediation of contaminated land. The **Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009** (WSI 2009/995) require action in response to the most significant cases of environmental damage including in respect of risks to human health from contamination of land.

Woodlands for Wales (2009) is the Welsh Government's strategy for woodlands and trees, which is supported by Policy Position statements including **Water and Soils (2010)** which has the following objectives:

- ▶ Woodland management achieves high standards of environmental stewardship where water quality, water resources, soil resources, soil carbon and soil function are safeguarded and enhanced;
- ▶ More existing woodland is brought into appropriate and sustainable management and delivers high quality ecosystem services, particularly in catchments at risk of failing good ecological and chemical status; and
- ▶ Woodland and trees are better integrated into wider land management practices (especially agriculture) where new woodland and trees support improved environmental, water and soil services and functions (including urban areas).

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4.3 Overview of the Baseline

UK

Geology

The geology of the UK is diverse and has almost 700 soil types in England and Wales alone¹²⁰. As a broad overview the following rock types exist in a progression from North West to South East (predominant rock types): Tertiary Volcanic Rocks; Crystalline Rock of Pre-Cambrian and later age; Lower Carboniferous to Cambrian; Triassic and Permian; Early Precambrian and Devonian; Jurassic; Cretaceous; Tertiary and Marine Pleistocene; and finally a return to Cretaceous¹²¹.

The UK has a diversity of mountain ranges and flood plains. In England, the southern part of the country is predominantly lowland, with mountainous terrain north-west of the Tees-Exe line (the Lowland-Upland divide across England), which includes the Cumbrian Mountains of the Lake District, the Pennines and limestone hills of the Peak District, Exmoor and Dartmoor¹²².

The Geological Conservation Review (GCR) was launched in 1977 in order to identify and describe the most important (nationally and internationally) geological sites in Britain, and to create a suite of descriptions which collectively catalogue and display the full range of the UK's earth heritage features. The full geological chronology from the Cambrian period to the Quaternary is covered in 3,000 sites spanning 100 categories (or 'blocks').

There are over 2,000 geological Sites of Special Scientific Interest (SSSIs) in the UK. Across the UK there are also a number of non-statutory geological and geomorphological sites designated at a local level, i.e. often known as Local Geological Sites (formerly Regionally Important Geological and Geomorphological Sites (RIGS)).

Land Use and Soils

The UK covers an area of 24,853,200 hectares (248,532 km²). England comprises the largest land area in the UK, covering an area of 13,293,800 hectares (132,938 km²). The smallest land area in the UK is Northern Ireland, which covers an area of 1,413,000 hectares (14,130 km²)¹²³.

Average population density of the UK in 2017 is 263 people per square kilometre¹²⁴.

¹²⁰ Natural England (2008) *State of the Natural Environment 2008*. Available online at: <http://publications.naturalengland.org.uk/publication/31043?category=118044>

¹²¹ Natural England. *England's geology*. Available online at: <http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/englands/default.aspx>

¹²² Natural England (2008) *State of the Natural Environment 2008*. Available online at: <http://publications.naturalengland.org.uk/publication/31043>

¹²³ ONS. *The Countries of the UK*. Available online at: <http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/administrative/the-countries-of-the-uk/index.html>

¹²⁴ ONS (2017) *Overview of the UK population: March 2017*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/overviewoftheukpopulation/mar2017>

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Table 4.1 shows land cover in the UK as it stood in 2007 and highlights that arable and horticulture and improved grassland are the most common land cover types, constituting 25.5% and 25.3% of total land area in the UK respectively¹²⁵.

Table 4.1 Estimated Areas of Broad Habitats in the UK in 2007

Land Type	'000 Hectares	% Land Area
Broadleaved, mixed and yew woodland	1,373.3	5.6
Coniferous woodland	1,505.7	6.1
Arable and horticulture	6,300.5	25.5
Improved grassland	6,237.7	25.3
Neutral grassland	1,589	6.4
Calcareous grassland	37.2	0.2
Acid grassland	1,647.1	6.7
Dwarf shrub heath	2,111.8	8.5
Fen, Marsh, Swamp	10.1	0.1
Bog	1,097.2	4.3
Freshwater	324.8	1.3
Montane	488.6	2.0
Inland Rock	131.4	0.5
Built-up Areas and Gardens	1,464.8	6.0
Other land	363.3	1.5
Total	24,682.5	100%

Source: Countryside Survey, LCM2007.

According to the 2011 UK National Ecosystem Assessment, 6.8% of the UK's land area is classified as urban, the urban landscape accounts for 10.6% of England, 1.9% of Scotland, 3.6% of Northern Ireland and 4.1% of Wales (and encompass some agricultural land). The remainder of the population live in smaller towns and villages, with a very small proportion scattered through the countryside¹²⁶.

Within the rural areas, land use varies greatly on a very local basis, but there are clear regional trends. There is a much higher proportion of arable farming in the east than in the west, with most of East Anglia and the area around the Wash almost entirely arable or devoted to other forms of intensive agriculture. To the west, there is much more grassland, although a high proportion of it is improved grassland, particularly in lowland areas; this is often cultivated for fodder or silage as much as for grazing. Upland areas, particularly in the north, the west and Wales, tend to have a high proportion of unimproved land used for extensive rather than intensive grazing, mainly for sheep, and large areas of forestry.

¹²⁵ Countryside Survey (2011) *Final Report for LCM2007*. Available online at: http://nora.nerc.ac.uk/14854/1/LCM2007_Final_Report_-_vCS_Web.pdf

¹²⁶ UNEP (2011) *UK National Ecosystem Assessment, Synthesis of Key Findings 2011*. Available online at: <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx>

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National Forest Inventory Woodland Area Statistics for Great Britain highlight that the area of woodland in Great Britain at 31 March 2010 is estimated to be 2,982 thousand hectares, around 13.0% of the total land area in Great Britain¹²⁷.

The quality of land across the UK varies, with the best and most versatile agricultural land generally situated in the lowland and valley areas of England. Due to the topography and terrain, much of Scotland and Wales is classified as lower grade land. An estimated 21% of all farmland in England is classified as Grade 1 ('Excellent') and 2 ('Very Good') land, with a similar percentage graded as Subgrade 3a ('Good') land. These grades are the best and most versatile land grades as classified under the Agricultural Land Classification System (ALC)¹²⁸.

There is estimated to be around 400,000 hectares of contaminated land in the UK (around 1.6% of the total land area)¹²⁹. The UK has a substantial legacy of chemical contaminants in soil. Some contaminants may be present naturally, but more often they occur as a result of human industrial and domestic pollution. Such contamination is typically found in brownfield sites on former industrial land. The majority of such sites are in urban contexts, but a large number are not, particularly those associated with mining or other extractive industries, primary processing of bulk raw materials and power generation.

England

Geology

England's landscape is closely associated with its underlying geology. The topography of England is very varied. Lowland areas are generally found in the East of England. The North West is the most mountainous area with other rugged areas found in the South West and central northern regions. There are a number of upland areas across England, such as the South Downs, Cotswolds, Peak District and North York Moors.

In 2008 Natural England reported that there were 1,214 SSSIs designated for their geodiversity features covering 1,704 Geological Conservation Review (GCR) sites (which identified nationally important features of geological interest). Many SSSIs have more than one GCR feature and some GCR features extend over more than one SSSI, giving a total of 1,735 SSSI-GCR combinations, or 'geo-features'. The proportion of GCRs in favourable/recovering status varied between 76-94% depending on its category of GCR (each category is reported separately)¹³⁰.

There are no formal international designations for geodiversity sites equivalent to the SPA and SAC designations for biological features, although the geodiversity of the Dorset and East Devon Coast is recognised through designation as a World Heritage Site.

England contains two Global Geoparks: the English Riviera in Devon and the North Pennines AONB. These are areas considered by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) to be of international importance for geological heritage that should be safeguarded and sustainably managed

¹²⁷ Forestry Commission (2011) *National Forest Inventory Statistics for Great Britain*. Available online at: [https://www.forestry.gov.uk/pdf/NFI_GB_woodland_area_stats_2010_FINAL.pdf/\\$FILE/NFI_GB_woodland_area_stats_2010_FINAL.pdf](https://www.forestry.gov.uk/pdf/NFI_GB_woodland_area_stats_2010_FINAL.pdf/$FILE/NFI_GB_woodland_area_stats_2010_FINAL.pdf)

¹²⁸ Natural England (2012) *Agricultural Land Classification: protecting the best and most versatile agricultural land*, TIN049. Available online at: <http://publications.naturalengland.org.uk/file/4424325>

¹²⁹ Department for International Trade (2015) *Land remediation: Bringing brownfield sites back to use*. Available online at: <https://www.gov.uk/government/publications/land-remediation-bringing-brownfield-sites-back-to-use/land-remediation-bringing-brownfield-sites-back-to-use>

¹³⁰ Natural England (2008) *State of the Natural Environment, Chapter 2: Landscapes*. Available online at: <http://publications.naturalengland.org.uk/publication/31043>

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and include strong local involvement. Two further areas in England (Abberley and Malvern Hills and the Cotswold Hills) identify themselves as national Geoparks¹³¹.

Land Use and Soils

As of 2016, the average population density of England was estimated to be 417 people per square kilometre.

Table 4.2 shows land cover in England as it stood in 2007 and highlights arable and horticulture and improved grassland as the most common land use covers (covering 40.5% and 27.1% of total land in England respectively)¹³².

Table 4.2 Land Cover in England in 2007

England Land Cover 2007	'000 ha	% Area
Broadleaved, Mixed and Yew Woodland	930	7.1
Coniferous Woodland	303.3	2.3
Arable and Horticulture	5,332.9	40.5
Improved Grassland	3,568.4	27.1
Neutral Grassland	611	4.6
Calcareous Grassland	35.9	0.3
Acid Grassland & Bracken	317.1	2.4
Dwarf Shrub Heath	361.0	2.6
Fen, Marsh and Swamp	6.8	0.1
Bog	196.5	1.5
Freshwater	79.8	0.6
Montane	36.6	0.3
Inland rock	42.3	0.3
Built-up Areas and Gardens	1,169	8.9
Supra-littoral rock	1.0	-
Supra-littoral sediment	18.4	0.1
Littoral rock	11.2	0.1
Littoral sediment	161.7	1.2
TOTAL	13,182.9	100

Source: Countryside Survey, LCM2007.

The majority of land in England (around 70%) is in agricultural use. A further 9% is used for woodland and forestry. Whilst urban areas account for around 10% of the total area, only a very small proportion of the land (1.1%) is occupied by domestic buildings (e.g. houses), with domestic gardens accounting for almost

¹³¹ UNESCO (2017) *Properties inscribed on the World Heritage List for the United Kingdom*. Available online at: <http://whc.unesco.org/en/statesparties/gb>

¹³² Countryside Survey (2011) *Final Report for LCM2007*. Available online at: http://nora.nerc.ac.uk/14854/1/LCM2007_Final_Report_-_vCS_Web.pdf

Land Use, Geology and Soils

half of the 'developed area' (over 4% of the national land area). Marshland, bogs and freshwater areas account for a combined 2.4% of the land area¹³³. Of the agricultural land, approximately 42% is classed as best and most versatile land grades ('good' or better).

A total of 511 sites had been reported to the Environment Agency as 'contaminated land' at April 2016, however this is likely to be an underestimate due to a low response rate from local councils. Less than 2% of the land area of England is estimated to have been affected by industrial activities of a type that could have caused contamination¹³⁴.

Scotland

Geology

As a broad overview, the following rock types exist in a progression from north east to south west Scotland (predominant rock types): Pre-Cambrian (the Highlands); Carboniferous (Midland Valley area); and Ordovician and Silurian (Southern Uplands). Topographically, Scotland is divided into three main areas; the Highland region in the north, which includes the Cairngorm and Grampian mountain ranges; the Central Lowlands, which includes the major cities of Edinburgh and Glasgow; and the Southern Uplands, a pastoral upland area north of the English border.

As of 2012 there were 895 GCR sites in Scotland, of which 77% were protected by SSSI status¹³⁵. Scotland has two Global Geoparks: North West Highlands Geopark and Shetland Geopark, in addition to Lochaber Geopark (which is currently being considered by UNESCO for global status). These three Geoparks cover approximately 10% of Scotland's land area¹³⁶.

Land Use and Soils

The average population density of Scotland is 69 people per square kilometre. **Table 4.3** shows land cover in Scotland as it stood in 2007 and highlights Dwarf Shrub Heath as the most common land use cover (covering 19.6% of total land in Scotland).

Table 4.3 Land Cover in Scotland in 2007

Scotland Land Cover 2007	'000 ha	% Area
Broadleaved, Mixed and Yew Woodland	264.2	3.3
Coniferous Woodland	993.8	12.5
Arable and Horticulture	704.1	8.8
Improved Grassland	1,117.8	14.0
Neutral Grassland	575.8	7.20

¹³³ UNEP (2011) *UK National Ecosystem Assessment, Chapters 10 (Urban) and 17 (England)*. Available online at: <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx>

¹³⁴ Environment Agency (2016) *Dealing with contaminated land in England*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/513158/State_of_contaminated_land_report.pdf

¹³⁵ Scottish Natural Heritage (2012) *Geological conservation review (GCR) sites*. Available online at: <http://www.snh.gov.uk/protecting-scotlands-nature/safeguarding-geodiversity/protecting/geological-conservation/>

¹³⁶ Scottish Natural Heritage (2016) *Protecting Scotland's nature: Geopark*. Available online at: <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/geoparks/>

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Scotland Land Cover 2007	'000 ha	% Area
Calcareous Grassland	1.2	0.03
Acid Grassland & Bracken	1,024.0	12.80
Dwarf Shrub Heath	1,566.0	19.60
Fen, Marsh and Swamp	2.6	0.07
Bog	768.9	9.60
Freshwater	170.3	2.10
Montane	452.0	5.70
Inland Rock	70.5	0.90
Built-up Areas and Gardens	142.1	1.80
Supra-littoral rock	6.0	0.10
Supra-littoral sediment	22.0	0.30
Littoral rock	35.1	0.40
Littoral sediment	60.4	0.80
TOTAL	7,976.8	100

Source: Countryside Survey 2007.

Agricultural uses of land in Scotland cover 75% of the land area, and only 2.4% of the land is urban¹³⁷.

Scotland has a large variety of soils reflecting its geological and climatic diversity. Scotland's soil is predominantly carbon rich, with podzols, peat soils and gleys accounting for more than two-thirds. These soils are found throughout Scotland with the exception of the Central Valley, which is dominated by mineral soils. Soils in the north and west are more acidic on the whole and rich in organic matter. Scotland contains a much higher proportion of organic soils than the rest of the UK¹³⁸.

The quality of land is highly variable with much of Scotland classified as Less Favoured Areas (suited only for improved grassland and rough grazing). Prime agricultural land (suitable for a wide range of crops) make up 8% of the total land area according to the Land Capability for Agriculture Classification Scheme, which is distributed predominantly along the eastern coasts, and the Firths of Forth and Tay¹³⁹.

In 2005, there was estimated to be around 82,034 hectares of land affected by industrial activity in Scotland that may be contaminated. A total of 13 sites (equivalent to 53 hectares) had been determined as 'contaminated land' under the Environmental Protection Act by the end of 2008¹⁴⁰.

¹³⁷ UNEP (2011) *UK National Ecosystem Assessment, Chapter 19 (Scotland)*. Available online at: <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx>

¹³⁸ The Scottish Government (2009) *Scottish Soil Framework*. Available online at: <http://www.gov.scot/Resource/Doc/273170/0081576.pdf>

¹³⁹ The James Hutton Institute (2011) *Land Capability for Agriculture in Scotland*. Available online at: http://www.hutton.ac.uk/sites/default/files/files/soils/lca_leaflet_hutton.pdf

¹⁴⁰ SEPA (2009) *Dealing with land contamination in Scotland: A review of progress 2000-2008*. Available online at: <https://www.sepa.org.uk/media/28314/dealing-with-land-contamination-in-scotland.pdf>

Land Use, Geology and Soils

Wales

Geology

The bedrock geology of Wales is extremely varied and comprises sandstone, limestone and igneous rock. As a broad overview, the following rock types exist in a progression from North West to South East (predominant rock types): Ordovician; Silurian; Devonian; and Carboniferous Peat (covers 3 per cent to 4 per cent of Wales and is predominantly acid blanket peat). There are small areas of raised bog and fen peat scattered in lowland areas¹⁴¹. The Permo-Triassic sandstone forms an important groundwater resource in North Wales, whilst peat, sand and gravel deposits along river valleys support strategic local water supplies.

Coal and metal mining has been very important to Wales historically. The South Wales Coalfield stretches across a large part of South Wales and is still mined to some extent, although less than previously (and from opencast or drift mines rather than deep mines). Lead and silver were once produced from mines in mid-Wales, from a series of mines inland from Aberystwyth. Copper, meanwhile, was mined in Snowdonia and at Parys Mountain on Anglesey, whilst gold was exploited around Dolgellau and Pumpsaint. A number of other metals were produced including zinc, arsenic, antimony and manganese. The geodiversity of Wales has led to the forming of landscapes and environmental settings that have strong cultural service value. For example, the mountains of Snowdonia attract tourists to Wales whilst coal mining has helped to define the cultural identity of the South Wales Valleys.

Within Wales, there are approximately 450 SSSIs designated for geology and earth science features. The Joint Nature Conservation Committee (JNCC) has reported the first six years of Common Standards Monitoring for Geological SSSIs in the UK but limited information is available for SSSIs in Wales in this respect. There are also 443 Geological Conservation Review (GCR)¹⁴² and there are two Global Geoparks located in Wales (Fforest Fawr and Ynys Môn)¹⁴³.

Land Use and Soils

The average population density of Wales is 149 people per square kilometre.

Table 4.4 shows land cover in Wales as it stood in 2007 and highlights improved grassland as the most common land use cover (covering 40.0% of total land in Wales).

¹⁴¹ CCW (2005). *Strategic Environmental Assessment Guidance for Practitioners*. Available online at: www.ccg.gov.uk/landscape--wildlife/managing-land-and-sea/environmental-assessment/strategic-environmental-assess.aspx

¹⁴² JNCC. *Geological Conservation Review*. Available online at: <http://jncc.defra.gov.uk/page-2947>

¹⁴³ UNESCO (2017) *Global Geoparks*. Available online at: <http://www.unesco.org.uk/designation/geoparks/>

Land Use, Geology and Soils

Table 4.4 Land Cover in Wales in 2007

Wales Land Cover 2007	'000 ha	% Area
Broadleaved, Mixed and Yew Woodland	125.1	5.90
Coniferous Woodland	143.1	6.80
Arable and Horticulture	176.9	8.40
Improved Grassland	842.2	40.00
Neutral Grassland	227.1	10.80
Calcareous Grassland	0.0	0.00
Acid Grassland & Bracken	284.5	13.50
Dwarf Shrub Heath	112.2	5.30
Fen, Marsh and Swamp	6.0	0.05
Bog	41.5	2.00
Freshwater	11.4	0.50
Montane	1.7	0.10
Inland Rock	8.8	0.40
Built-up Areas and Gardens	89.3	4.30
Supra-littoral rock	0.8	0.04
Supra-littoral sediment	6.3	0.40
Littoral rock	3.0	0.10
Littoral sediment	30.2	1.40
TOTAL	2,110.1	100.00

Source: Countryside Survey, LCM2007.

Land use in Wales is dominated by farmland and grasslands, urban land accounts for 5% of the land area, and woodlands 14%. These characteristics reflect the climate, relief and soil type of Wales¹⁴⁴.

The area designated as 'Best and Most Versatile' agricultural land accounts for approximately 7% of total land in Wales, which includes land of 'good to moderate' quality and above¹⁴⁵.

A total of 10,130 potentially contaminated sites had been brought to the attention of local authorities in Wales, with 175 determined as 'contaminated land' in Wales by the end of 2013. The most common contaminants were Benzo(a)pyrene, lead and arsenic, all of which were identified at over 60% of determined contaminated land sites¹⁴⁶.

¹⁴⁴ UNEP (2011) *UK National Ecosystem Assessment, Synthesis of Key Findings 2011*. Available online at: <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx>

¹⁴⁵ Welsh Government (2016) *Agricultural Land Classification*. Available online at: <http://gov.wales/topics/environmentcountryside/farmingandcountryside/agricultural-land-classification/?lang=en>

¹⁴⁶ Natural Resources Wales (2016) *The State of Contaminated Land in Wales*. Available online at: https://naturalresources.wales/media/677708/nrw26759-contaminated-land-in-wales-pdf_english-1.pdf

Land Use, Geology and Soils

4.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for land use, geology and soils have been identified.

- ▶ there is a need to protect, maintain and enhance geomorphological functions and services;
- ▶ some 1.6% of land in the UK is contaminated from industrial activity, although this is progressively being cleaned up as sites are redeveloped. Whilst contamination is remediated during redevelopment, the process can be expensive;
- ▶ disturbance of contaminated sites carries the risk of pollution pathways being created or re-opened for any existing ground contamination;
- ▶ there is currently increasing pressure on rural and agricultural land from developers as urban areas expand. Future population growth leading to an increase in the need for housing and related urban development infrastructure will put more pressure on protected land including important geological sites;
- ▶ soils in England, Scotland and Wales continue to be degraded by human actions including intensive agriculture, historic levels of industrial pollution and urban development, making them vulnerable to erosion (by wind and water), compaction and loss of organic matter¹⁴⁷. Effects include:
 - ▶ loss of organic matter – soil organic matter underpins many soil functions. It is particularly important as a carbon store and thus has implications for climate change. The most recent evidence suggests relatively low rates of change in topsoil soil organic matter concentration; however, there is still uncertainty about the status and change in the soil organic matter stock;
 - ▶ sealing – there is no systematic data collection to capture the extent and the quality of land being sealed. It is essential that the value of soil functions is taken into account during development planning;
 - ▶ contamination – data on the extent and nature of soil contamination is limited. There is some evidence that some contaminant inputs and their impacts are reducing, for example from atmospheric acid deposition. However, many other potential soil contaminants such as organic chemicals are not routinely measured; change in soil biodiversity – soil biodiversity is essential to most ecosystem services. However, relatively little is known about the state and trend of Scotland's soil biodiversity except for a few protected soil-dwelling species; this is a major gap in our understanding of the contribution of soils to ecosystem services;
 - ▶ erosion and landslides – soil erosion is one of the more visible of the threats to soil. Impacts include loss of soil carbon, loss of fertility and off-site effects such as impacts on the water environment. Landslides, although potentially life threatening, remain rare in Scotland;
 - ▶ compaction – the processes associated with soil compaction are broadly understood, but there is no systematic assessment of the extent and wider implications of soil compaction in Scotland; and
 - ▶ emerging issues – it is difficult to evaluate the potential impacts of emerging issues as there is little evidence currently available.
- ▶ as the climate (including temperature and rainfall patterns) changes in the future, it is likely that soils have the potential to be further degraded, as a result of increased seasonal aridity and

¹⁴⁷ Natural Scotland (2011) *The State of Scotland's Soil*. Available online at:
<https://www.sepa.org.uk/media/138741/state-of-soil-report-final.pdf>

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wetness and variations in temperature¹⁴⁸. Climate change and changes in land use are the most significant threats to Scottish soils¹⁴⁹. The effect of industry, agricultural practices, forestry and climate change upon soils, particularly carbon rich peat soils, is also a key issue. Key pollutants include chemicals, oil or waste. Organic waste, including sewage sludge, is one of the main sources of heavy metal contamination of soils from humans;

4.5 Likely Evolution of the Baseline

UK

Geology

As part of the JNCC Common Standards Monitoring for designated sites, the features for which certain sites are designated were assessed to determine site condition. For geological sites, the principal designations are GCRs and SSSIs, many of which occupy the same or part of the same area of land. Site attribute condition was compared with its target value, the outcome of which resulted in a site being classified as favourable, unfavourable, unfavourable-recovering, or destroyed (in whole or in part).

The increase in public and policy awareness regarding geological SSSI sites and Geoparks may lead to an increase in the number of sites protected and managed. As quarries come to the end of their working lives there is potential for their identification and conservation as geologically important sites.

Land Use and Soils

The estimated broad habitat type in the UK (Great Britain) and how it has changed from 1984 to 2007 was calculated by the Office of National Statistics¹⁵⁰ and is shown in **Table 4.5**. It shows that the area of land cover under arable and horticulture has decreased by 9.1% between 1998 and 2007. The area of grassland land cover has generally increased with improved grassland increasing by 5.7%. Built-up areas and gardens have increased by 3.4% between 1998 and 2007.

Table 4.5 Estimated Area ('000 ha) of Broad Habitats in the UK (Great Britain) in 1984, 1990, 1998 and 2007

Land Type	1984	1990	1998	2007	% Change between 1998 and 2007
Broadleaved, mixed and yew woodland	1317	1343	1328	1406	5.9
Coniferous woodland	1243	1239	1386	1319	-4.8
Linear features	491	581	511	496	-2.9
Arable and horticulture	5283	5024	5067	4608	-9.1
Improved grassland	5903	4619	4251	4494	5.7
Neutral grassland	467	1669	2007	2176	8.4

¹⁴⁸ UK Committee on Climate Change (2017) *UK Climate Change Risk Assessment*. Available online at: http://www.gis.naturalengland.org.uk/pubs/gis/tech_aw.htm

¹⁵⁰ ONS (2011) *Land cover account, Great Britain*. Available online at: <http://www.ons.gov.uk/ons/rel/environmental/environmental-accounts/2011/rftlandcover.xls>

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Land Type	1984	1990	1998	2007	% Change between 1998 and 2007
Calcareous grassland	75	78	61	57	-6.6
Acid grassland	1476	1821	1503	1589	5.7
Bracken	439	272	315	260	-17.5
Dwarf shrub heath	1388	1436	1299	1343	3.4
Fen, Marsh, Swamp	428	427	426	392	-8.0
Bog	2303	2050	2222	2232	0.5
Standing open waters	284	200	196	204	4.1
Rivers and streams	70	70	65	58	-10.8
Montane	41	n/a	41	42	2.4
Inland rock	38	76	111	84	-24.3
Built-up areas and gardens	1268	1266	1279	1323	3.4
Other land	n/a	57	107	113	n/a
Unsurveyed land	n/a	522	522	522	n/a
Total	22,514	22,632	22,601	22,627	

Source: Countryside Survey 2007. Note: Standing open waters and rivers and streams broad habitats are calculated using a different statistical model to the other broad habitats. The land in urban areas from within Great Britain was excluded from the estimation of broad habitats. The totals are therefore not equal to the sum of the column.

It is not known whether the decrease in arable and increase in improved grassland is likely to continue at the same rate in the future although it does seem likely that the extent of built up areas will continue to increase as some development will inevitably take place on greenfield land.

The total area of agricultural land across the UK has declined slightly over the last 30 years from 18,753 thousand hectares in 1984 to 18,428 thousand hectares in 2015 (a reduction of 1.7%)¹⁵¹. This area includes arable and horticultural crops, uncropped arable land, common rough grazing, temporary and permanent grassland and land used for outdoor pigs.

The clearest trend in land use change in the UK over the past quarter of a century has been the conversion of land from agriculture to forestry and woodland. Forestry Commission estimates of the area of forest and woodland cover in the UK imply an average annual net increase of 28,000 hectares from 1980 to 2016, equivalent to 0.11% increase in total UK land cover per year. This follows on from a slower but steady increase in woodland cover from the early 1900s onwards, and there has overall been a doubling of the area of UK woodland since World War II to reach 3.16 million hectares in 2016¹⁵².

New planting has predominantly responded to subsidy and has involved the expansion of small broadleaved woodlands within agricultural holdings. The average annual increase in woodland on farms (14,500 hectares

¹⁵¹ Defra (2016) *Agriculture in the UK: Datasets, Chapter 2*. Available online at: <https://www.gov.uk/government/statistical-data-sets/agriculture-in-the-united-kingdom>

¹⁵² Forestry Commission (2016) *Forestry Statistics 2016: Chapter 1*. Available online at: [http://www.forestry.gov.uk/pdf/Ch1_Woodland_FS2016.pdf/\\$FILE/Ch1_Woodland_FS2016.pdf](http://www.forestry.gov.uk/pdf/Ch1_Woodland_FS2016.pdf/$FILE/Ch1_Woodland_FS2016.pdf)

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per annum) accounts for more than half of the net increase in the wooded area as a whole. The area of woodland within agricultural holdings has thus more than doubled since the early 1980s¹⁵³.

A number of threats to the UK soil resource have been recognised in England, Scotland and Wales including:

- ▶ loss of soil organic matter and erosion;
- ▶ climate change;
- ▶ loss of soil biodiversity;
- ▶ structural degradation and compaction;
- ▶ contamination;
- ▶ loss of soil to development (e.g. soil sealing), including urbanisation and agriculture; and
- ▶ threat to soil as a cultural resource (e.g. archaeological protection and UK environmental records).

UK soils store around 10 billion tonnes of carbon¹⁵⁴. A study by the National Soil Inventory (NSI) found that between 1978 and 2003 there was a loss in soil organic carbon of 0.6% per year for all soil types, though with higher losses (2% per year) in those which are particularly organic rich¹⁵⁵. However, between 1990 and 2014, the UK has gone from being a net source of Land Use, Land Use Change and Forestry (LULUCF) emissions to a net sink driven by land converted to cropland and forest land, with an increasing uptake of CO₂ by trees as they reach maturity, in line with the historical planting pattern¹⁵⁶.

Future projections of LULUCF GHG emissions and removals do not include a climate component because of fundamental uncertainties, even with regard to present-day conditions. Enhanced storage of carbon due to a longer growing season and CO₂ fertilisation¹⁵⁷ is likely to be countered by a loss of carbon from enhanced soil respiration due to higher temperatures. At present, it is difficult to evaluate which will be the dominant process and it will also depend on changes in soil water regimes. Nevertheless, in currently vulnerable areas (e.g. unvegetated or degraded peat), higher temperatures and the likelihood of drier summers, particularly in the eastern side of the UK, would be likely to substantially increase the loss of carbon stocks. Hence, the role of land management in enhancing soil resilience, by maintaining peat-forming vegetation cover for example, or limiting tillage during cultivation, will be important for both climate adaptation and mitigation objectives¹⁵⁸.

Compaction may result from a number of activities including intensive mechanised agriculture, poor timing of cultivation, over-stocking and overworking of land. The result is a reduced plant yield, habitat loss for larger fauna, NO₂ losses, reduced water holding and soil infiltration capacity and an increased risk of flooding and

¹⁵³ Bibby, P. (2009) *Land Use Change in Britain*. *Land Use Policy*, 26S, S2–S13.

¹⁵⁴ Defra (2009) *Safeguarding our Soils – A Strategy for England*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69261/pb13297-soil-strategy-090910.pdf

¹⁵⁵ Bellamy PH, Loveland PJ, Bradley RI, Lark RM and Kirk GJD (2005) *Carbon Losses from all Soils across England and Wales 1978-2003*. *Nature* 437: 245-248. Available online at: <http://core.ac.uk/download/pdf/141023.pdf>

¹⁵⁶ DECC (2016) *2014 UK Greenhouse Gas Emissions, Final Figures*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496942/2014_Final_Emissions_Statistics_Release.pdf

¹⁵⁷ The CO₂ fertilisation effect is the principle that the increase of carbon dioxide in the atmosphere increases the rate of photosynthesis in plants.

¹⁵⁸ UK Committee on Climate Change (2017) *UK Climate Change Risk Assessment*. Available online at: http://www.gis.naturalengland.org.uk/pubs/gis/tech_aw.htm

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erosion. The principal causes of accelerated erosion (i.e. that which exceeds background levels) in England, Wales and Scotland are:

- ▶ intensive cultivation - particularly where compacted by machinery and left open to rain;
- ▶ trampling by animals;
- ▶ poor forestry practice (e.g. during road construction and harvesting); and
- ▶ run-off from urban land surfaces.

Other causes include wind erosion, tillage losses and soil co-extracted with root vegetables¹⁵⁹. The rate of soil erosion due to agriculture is thought to have remained relatively stable across the period 1969 to 2010¹⁶⁰.

Soil chemical and biological processes are controlled by a complex set of factors, but most importantly by the balance between soil temperature and soil moisture. Temperature is a key factor that can control many terrestrial biogeochemical processes. Soils processes, properties and functions are therefore all sensitive to changes in climatic conditions.

Future changes in temperature and precipitation could potentially have considerable impacts on soils and their biodiversity. Rising atmospheric concentrations of CO₂, are also likely to influence soils indirectly, via changes in plant growth. There is a high degree of uncertainty about how climate change will affect soils in the UK due to limitations on the current evidence and the difficulties of distinguishing the role of climate from other factors. Nevertheless, the majority of climate projections imply a trend towards reductions in soil moisture, most notably in the eastern districts of the UK, due to an increased frequency of warmer, drier summers. The consequent changes in soil water regimes will be highly dependent on soil type and, in combination with elevated temperatures and CO₂ levels, will have an impact on rates of soil physical, biological and chemical processes, and hence on soil function and ecosystem services¹⁶¹.

Land use including agriculture and building work have the potential to disturb archaeological contexts, which if not appropriately studied, could be damaged. Since the middle of the last century in England, 23,500 ancient monuments have been destroyed, with a total 10% destroyed and 30% damaged by agricultural practices. Around 3,000 Scheduled Monuments are actively ploughed, and a third of all sites are on ploughed land, with 2% at high risk. In Wales, 15% of Scheduled Monuments have deteriorated due to natural, agricultural and other causes¹⁶². In Scotland, there is a lack of monitoring with regard to issues relating to the preservation of archaeological features, and indeed the extent and distribution of cultural soils. In addition, there is a general lack of data on changes in soil condition which may influence preservation conditions.

¹⁵⁹ Quine TA Van Oost K, Walling DE and Owens PN (2006) *Development and Application of GIS-Based Models to Estimate National Rates of Soil Erosion by Tillage, Wind and Root Crop Harvest*. University of Exeter Report to Defra, Project SP08007, University of Exeter, UK, 59pp. Available online at:

http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CCIQFjAA&url=http%3A%2F%2Frandd.defra.gov.uk%2FDocument.aspx%3FDocument%3DSP08007_6584_FRA.pdf&ei=mBdnVdaOC4X2UvaVgPgK&usg=AFQjCNEcGiVqzMhyX0jjAa1ghaPkRmpA-Q&bvm=bv.93990622,d.d24

¹⁶⁰ Cranfield University (2015) *Research to develop the evidence base on soil erosion and water use in agriculture: Final Technical Report*. Available online at:

<https://www.theccc.org.uk/wp-content/uploads/2015/06/Cranfield-University-for-the-ASC.pdf>

¹⁶¹ UK Committee on Climate Change (2017) *UK Climate Change Risk Assessment*. Available online at:

http://www.gis.naturalengland.org.uk/pubs/gis/tech_aw.htm

¹⁶² Environment Agency (2004) *The state of soils in England and Wales*. Available online at:

http://www.adlib.ac.uk/resources/000/030/045/stateofsoils_775492.pdf

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As there are now more stringent statutory controls on land contamination and remediation, increased areas of historic contamination are being remediated and fewer areas are being left in a contaminated state following decommissioning of commercial and industrial sites.

There are a number of European directives that are being implemented that may influence the way in which land contamination is managed in the future (i.e. the Environmental Liabilities, Water, Groundwater and the Waste Framework Directives). The implementation of these regimes into UK legislation is likely to affect how contaminated land is dealt with.

England

Geology

Natural England¹⁶³ has identified the following key threats to geology (which are also equally applicable to Scotland and Wales):

- ▶ inappropriate development;
- ▶ natural degradation;
- ▶ irresponsible specimen collecting; and
- ▶ irresponsible recreational activities.

Land Use and Soils

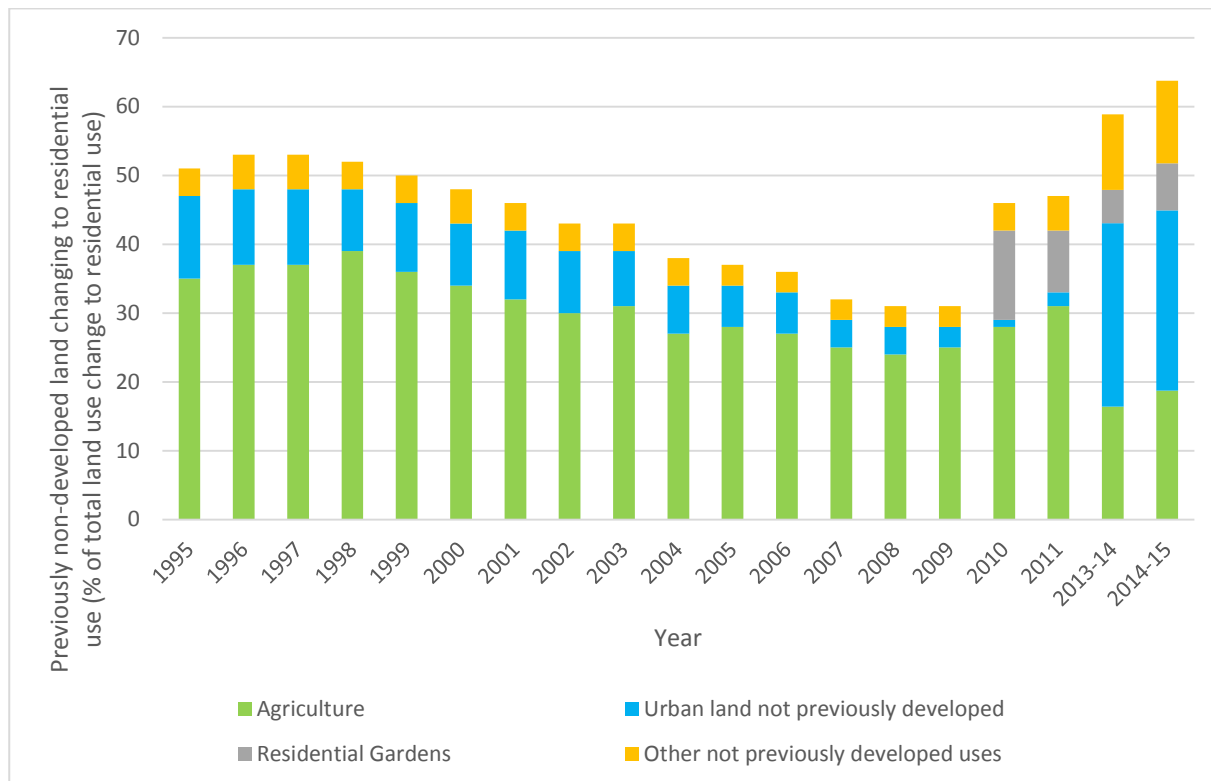
Figure 4.1 shows the origin and proportion of non-previously developed land lost to residential development for each year from 1995 to 2014/15 for England. In 2013/14 and 2014/15, there was a notable rise in the proportion of undeveloped land being converted to residential use, with a corresponding decrease in previously developed land being used for residential development. Overall, the amount of soil lost to residential development (including previously developed land) gradually decreased from nearly 5,800 hectares in 1995 to 2,200 hectares in 2009, and has since risen substantially to 4,800 hectares in 2014/15.

¹⁶³ Natural England. *What are the threats to geology?* Available online at:

<http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/threats/default.aspx>

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Figure 4.1 Soils Lost to Residential Development (England)



Source: DCLG. Live tables on land use change statistics: Land use change statistics - live tables 2014 to 2015. Note data gap from 2011 to 2013/14.

In 2010, there was an estimated 68,910 hectares of previously developed land in England, up 11% from 61,920 hectares in 2009¹⁶⁴. The conversion of previously undeveloped land to developed land decreased from 7,530 hectares in 2000 to 2,180 hectares in 2011, before rising sharply to 21,446 hectares in 2014/15 and reducing to 15,405 in 2015/16. In 2015/16, 7% of the land changing to residential use was in Flood Zone 3. It is not known what proportion of the land was within Flood Zone 3a and what was within Flood Zone 3b¹⁶⁵.

There have also been changes to land use related to broad habitat types. Between 1998 and 2007 in England there was a significant increase in the area of Broadleaved Woodland (5.8%), Neutral Grassland (12.6%), Dwarf Shrub Heath (15.1%) and Standing Open Water and Canals (5.3%).

The increase in the area of Dwarf Shrub Heath between 1998 and 2007 followed a decrease in area between 1990 and 1998. The increase in the area of Standing Open Water and Canals recorded in England between 1998 and 2007 continued the increases recorded by Countryside Survey since 1990. On the other hand, there was a significant decrease in the area of Arable and Horticulture Broad Habitat (8.8%) in England across the same period.

¹⁶⁴ Defra (2013) *National Land Use Database PDL – Results and Analysis*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/366838/NLUD_2010_Summary_Headline_Report.doc

¹⁶⁵ DCLG (2017) *Live tables on land use change statistics: Land use change statistics - live tables 2015 to 2016*. Available online at: <https://www.gov.uk/government/statistical-data-sets/live-tables-on-land-use-change-statistics>

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No statistical change in extent was detected in the Coniferous Woodland, Improved Grassland, Bracken, Bog, Fen, Marsh and Swamp and Calcareous Grassland Broad Habitats in England between 1998 and 2007¹⁶⁶.

The loss of organic matter from soils influences its structure and is linked to erosion and soil compaction, reduced agricultural productivity and soil biodiversity. Since 1980 there has been an estimated average loss in organic matter in England and Wales of:

- ▶ 15% in arable soils and rotational grass soils;
- ▶ 16% in soils under permanently managed grassland; and
- ▶ 23% in agriculturally managed soils and semi-natural land¹⁶⁷.

17% of soils in England and Wales show signs of erosion which leads to a reduction in water retention and filtering, and the mobilisation of sediment (which may contain pesticides, nutrients and metals) to watercourses or floodplains¹⁶⁸.

In the 2012 Farm Practices Survey for England¹⁶⁹, 20% of farmers stated that they had experienced soil compaction throughout the soil profile. For the 12 months leading up to August 2012, the Farm Practices Survey 2012 indicated that the most common actions taken to reduce compaction were removing compaction from headlands after harvest, enhancing drainage, using low pressure set-ups and crop rotation.

Key objectives and targets within the Soil Strategy for England (Safeguarding Our Soils) include:

- ▶ to undertake further research in areas including best practices to protect and enhance levels of soil organic matter, contribution of soil management to flood mitigation and best practices to prevent and remediate soil degradation;
- ▶ to significantly reduce the rate of loss of stored soil carbon by 2020;
- ▶ to halt the decline of soil organic matter caused by agricultural practices in vulnerable soils by 2025; and
- ▶ to introduce a reviewed Soil Protection Review to make it a more effective tool for soil management.

The Natural Environment White Paper (2011) established an ambition that by 2030 all of England's soils will be managed sustainably and degradation threats tackled successfully, in order to improve the quality of soils and to safeguard their ability to provide essential ecosystem services and functions for future generations.

¹⁶⁶ Countryside Survey (2007) *England Results from 2007*. Available online at: <http://www.countrysidesurvey.org.uk/content/england-results-2007>

¹⁶⁷ Defra (2006) *Sustainable Farming and Food Strategy – Indicator Data Sheet. Headline Indicator H5: Soil Quality – Soil Organic Matter*. Available online at: http://webarchive.nationalarchives.gov.uk/20080726153624/https://statistics.defra.gov.uk/esg/indicators/h5_data.htm

¹⁶⁸ Environment Agency (2004) *The state of soils in England and Wales*. Available online at: http://www.adlib.ac.uk/resources/000/030/045/stateofsoils_775492.pdf

¹⁶⁹ Defra (2012) *Farm Practices Survey Autumn 2012 - England*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/181719/defra-stats-foodfarm-environ-fps-statsrelease-autumn2012edition-130328.pdf

Land Use, Geology and Soils

Scotland

Geology

No further information has been identified beyond those issues identified for the UK.

Land Use and Soils

Scotland's land cover has been studied in both the Countryside Survey and by the National Countryside Monitoring Scheme (NCMS). The latter study is arguably outdated, being based on aerial photography interpretation with the last dataset dating to 1988. The principal findings with regard to this section include, since the 1940s¹⁷⁰:

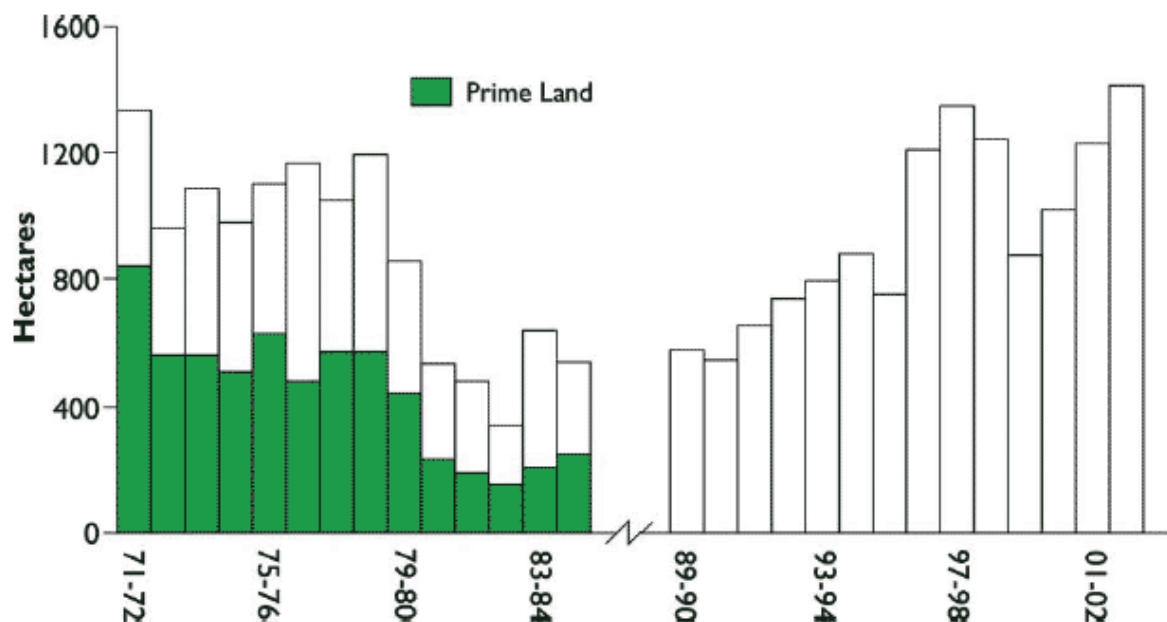
- ▶ Built land increased by 46% mainly on grassland and farmland;
- ▶ Recreational land increased by 138%;
- ▶ Bare ground increased four-fold due to peat extraction and urban road development;
- ▶ Transport corridors increased by 22%; and
- ▶ Upland surfaced tracks increased by 29%.

Figure 4.2 indicates the area of agricultural land in Scotland lost to development over the last 30 years, which has been recently increasing.

¹⁷⁰ Scottish Natural Heritage. *Land Cover Change in Scotland*. Available online at:
<http://www.snh.org.uk/publications/on-line/education/advances5/5-land-cover-change.asp>

Land Use, Geology and Soils

Figure 4.2 Conversion of Agricultural Land (Scotland)



Source: Scottish Government

The total amount of derelict and urban vacant land has decreased in each year between 2010 and 2016 (annual decreases ranging from 0.2% to 3%), except for 2014 when there was an increase of 2,090 hectares (19%) compared to 2013, largely due to over 2,200 hectares of former surface coal mine sites in East Ayrshire that had become derelict following the liquidation of Scottish Coal and ATH Resources in 2013. The total amount of derelict and urban vacant land in Scotland has decreased by 253 hectares (2%) in the latest year, from 12,688 hectares in 2015 to 12,435 hectares in 2016¹⁷¹.

The 2007 Countryside Survey identified that the area of Broadleaved Woodland, Improved Grassland and Acid Grassland Broad Habitats increased by 9.5% in Scotland between 1998 and 2007. There was a corresponding decrease of 7.1% in the area of Coniferous Woodland. The area of the Arable and Horticulture Broad Habitat decreased by 13.6% between 1998 and 2007. There was a corresponding increase of 9.1% in the area of Improved Grassland, but no significant increase in the area of Neutral Grassland across Scotland as a whole. The changes in the areas of Broad Habitats in Scotland reflect short-term influences, such as agricultural economics, and medium-term influences, such as woodland planting and harvesting¹⁷².

Scotland's Land Use Strategy for 2016-2021 takes a strategic approach to the challenges facing land use in Scotland and sets out the following vision: "A Scotland where we fully recognise, understand and value the importance of our land resources, and where our plans and decisions about land use deliver improved and enduring benefits, enhancing the wellbeing of our nation." Overall, the Scottish Government concludes that in the future, the challenges facing Scotland's soil will be to understand and deal with a number of issues including:

¹⁷¹The Scottish Government (2017) *Scottish Vacant and Derelict Land Survey 2016*. Available online at: <http://www.gov.scot/Resource/0051/00516905.pdf>

¹⁷² Countryside Survey (2007) *Scotland Results from 2007*. Available online at: <http://www.countrysidesurvey.org.uk/content/scotland-results-2007>

Land Use, Geology and Soils

- ▶ the need for policy integration: understanding the role of soil in existing policy and developing recommendations for future soil policy to ensure soil is sufficiently protected;
- ▶ tackling the lack of systematic Scottish soil data: understanding what information is already available, identifying gaps and making recommendations for future soil monitoring; and
- ▶ understanding soil management and providing recommendations for targeting practical management options to minimise soil degradation and its consequences¹⁷³.

Wales

Geology

No further information has been identified beyond those issues identified for the UK.

Land Use and Soils

In Wales, between 1998 and 2007 the area of built land has increased by 12.5%. Most Broad Habitats did not change significantly in area between 1998 and 2007 when averaged across Wales as a whole. However, a number of statistically significant changes in area have been noted between 1998 and 2007. In the lowland zone of Wales Broadleaved, Mixed and Yew Woodland increased, and in the upland zone, Arable and Horticultural Land increased, Neutral Grassland decreased and Acid Grassland increased. The possible drivers of these changes are unknown and require further research¹⁷⁴.

No baseline data has been identified in relation to previously developed land in Wales and therefore trends could not be established. However, similar to recent trends in England, the trend in land use may be generally towards increased development on land that has not previously been developed.

4.6 Assessing Significance

The objectives and guide questions related to land use, geology and soils which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 4.6**, together with reasons for their selection.

Table 4.6 Approach to Assessing the Effects of the Water Resources NPS on Land Use, Geology and Soils

Objective/Guide Question	Reasoning
Objective: To conserve and enhance soil and geology and contribute to the sustainable use of land.	<p>The SEA Directive (2001/42/EC) requires that likely significant effects on soil and resources be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>The construction of water resources infrastructure can affect land use and soil. Impacts may be direct (for example, the loss of, or damage to, land and soil from new development) or indirect (for example, location of new infrastructure affecting adjacent land uses). The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>
Will the Water Resources NPS have an effect on	Loss of soil quality, variety, extent or an increase in soil compaction will lead to

¹⁷³ Scottish Government (2017) *Soils*. Available online at: <http://www.environment.scotland.gov.uk/get-informed/land/soils/>

¹⁷⁴ Countryside Survey (2007) *Wales Results from 2007*. Available online at: <http://www.countrysidesurvey.org.uk/content/wales-results-2007>

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Objective/Guide Question	Reasoning
soil quality/function, variety, extent and/or compaction levels?	degradation of soil. The European Thematic Strategy on Soil Protection seeks the protection and sustainable use of soil, preventing soil degradation and ensuring restoration of degraded soils.
Will the Water Resources NPS increase the risk of significant land contamination?	Environment Act 1995 seeks to protect and preserve environment against pollution to land. The Soil Strategy for England (2009) and Scottish Soil Framework (2009) include objectives on reducing/preventing soil pollution and contamination.
Will the Water Resources NPS have an effect on any known and existing contamination?	Significant areas of the UK carry a burden of contamination from industrial activity. Disturbance of contaminated sites carry the risk of pollution pathways being created or re-opened for existing ground contamination.
Will the Water Resources NPS protect and/or enhance Geological Conservation Sites, important geological features and geophysical processes and functions?	National planning policy in England, Scotland and Wales seeks to protect and enhance geological conservation interests.
Will the Water Resources NPS change patterns of land use including or affect best and most versatile agricultural land?	National and local planning policies set out that planning should use of previously developed land where possible, and avoid using best and most versatile land.

Table 4.7 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the land use, geology and soils objective.

Land Use, Geology and Soils

Table 4.7 Illustrative Guidance for the Assessment of Significance for Land Use, Geology and Soils

Effect	Description	Illustrative Guidance
++	Significant positive	<ul style="list-style-type: none"> Option would restore and significantly improve soil quality and land stability to conditions beyond current levels and remove all soil contamination so that soil functions and processes would be significantly improved in the long term; Option would minimise the use of, and protect from irreversible damage, high quality agricultural land; Option would have a significant and sustained positive impact on national designated geological sites; Option would seek to minimise the use of any undeveloped land, and look to preferentially reclaim and redevelop significant areas of previously developed or derelict land.
+	Positive	<ul style="list-style-type: none"> Option would generate minor improvements in soil quality and land stability and would remove some soil contamination so that soil functions and processes would be improved in the long term; Option would reduce any potential damage to high quality agricultural land; Option would reduce any potential hazard associated with existing soil contamination; Option would have a minor and temporary positive impact on a national designated geological site; Option would seek to preferentially make use of previously developed land.
0	Neutral	<ul style="list-style-type: none"> Option would not significantly affect potential hazards associated with any existing contamination; Option would not cause damage or loss to soil such that soil function and processes would not be affected; Option would not affect land stability; Option would not involve significant loss of any undeveloped or developed land.
-	Negative	<ul style="list-style-type: none"> Option would lead to an increase in pollutant discharges to soil; however, these would be less than permitted limits, such that there would be minor short-term increases in land contamination; Option would cause minor increases in potential hazards associated with existing soil contamination; Option would cause minor increases in potential hazards associated with land stability; Option would cause a temporary loss of soil so that soil function and processes would be negatively affected in the short/medium term; Option would cause minor short-term negative effects on geological conservation sites/important geological features or soils of high importance; Option would lead to the majority of development using undeveloped land or land that has reverted to a 'wild' state.
--	Significant negative	<ul style="list-style-type: none"> Option would lead to a statutory limit being reached or exceeded in relation to land contamination, such that there would be a major and sustained increase in land contamination; Option would cause major and sustained increases in potential hazards associated with existing soil contamination; Option would cause major increases in potential hazards associated with land stability; Option would cause considerable loss of soil quality, such that soil function and processes would be irreversibly and significantly affected; Option would cause a substantial and permanent loss of, or damage to, soil of high importance (such as best and most versatile agricultural land) and/or designated geological conservation sites/important geological features; Option would not develop derelict or previously developed land, but would lead to development of significant areas of undeveloped land/ land that has reverted to a 'wild' state.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

Water Quality

5. Water Quality

5.1 Introduction

This section presents the overview of the plans, programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources in respect of water quality.

Water quality within this context is defined as inland surface freshwater, groundwater, estuarine, coastal and marine water quality.

There are links between water quality/resources and a number of other Appraisal of Sustainability (AoS) topics, in particular the effects and interactions of water quality on biodiversity and human health and flood risk.

It should be noted that for the purposes of this Scoping Report, water quality and water quantity have been discussed as two separate topics. The two topics are very closely related and in the majority of cases, both the plans and programmes and the baseline data discussed under one topic could also be discussed under the other. Therefore, to avoid unnecessary duplication, in the majority of instances a given issue is only discussed under the topic to which it is most directly relevant.

5.2 Review of Plans and Programmes

The *Water Framework Directive (WFD) (2000/60/EC)* provides the basis for the protection of water resources, with further EU directives providing legislation to ensure water quality. The water resources plans and policies also seek to ensure that a suitable volume of potable water is available in light of the increasing demand for water. Together, the EU directives and domestic legislation aim ensure that water quality is maintained throughout the water cycle, including appropriate treatment of wastewater, safe standards for drinking water and the maintenance of inland and coastal water quality.

Plans such as the *Great Britain Invasive Non-native Species Strategy (2015)* recognise the two-way relationship between water quality and invasive non-native species. Invasive species can have significant effects on water quality and aquatic ecosystem health and in turn aquatic ecosystems with poor water quality can provide an opportunity for the proliferation of non-native species.

International/European

The ***Water Framework Directive (WFD) (2000/60/EC)*** is the most substantial piece of EC water legislation to date and replaced a number of existing Directives including the Surface Water Abstraction Directive. It establishes a framework for the protection of inland surface waters, transitional waters, coastal water and groundwater and is designed to improve and integrate the way water bodies are managed, including encouraging the sustainable use of water resources. The key objectives at the European level are general protection of the aquatic ecology, specific protection of unique and valuable habitats, protection of drinking water resources and protection of bathing water.

Article 4(1) of the WFD sets out that the objectives for surface water, groundwater, transitional and coastal water bodies are to:

- ▶ prevent deterioration;
- ▶ reduce pollution;
- ▶ protect, enhance and restore condition;
- ▶ achieve 'good status' by 2015, or an alternative objective where allowed; and
- ▶ comply with requirements for protected areas.

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Article 7.3 of the Directive notes that Member States shall ensure the necessary protection for the bodies of water identified (for the purposes of providing human consumption for 50 persons or more, or providing more than 10m³ a day as an average and those bodies of water intended for such future use) with the aim of avoiding deterioration in their quality in order to reduce the level of purification treatment required in the production of drinking water. In addition, Member States may establish safeguard zones for those bodies of water.

The WFD adopted the 'polluter pays principle' in seeking to ensure that the costs and benefits of discharging pollutants to the water environment are appropriately valued, and that implementation of the Directive is achieved in a fair and proportionate way across all sectors.

The **Groundwater Directive (2006/118/EC)** established a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The Directive established quality criteria that takes account local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge. It is intended to complement the requirements of the WFD.

The **Drinking Water Directive (DWD) (98/83/EC)** concerns the quality of water intended for human consumption. The objective of the DWD is to protect the health of the consumers in the EU and to make sure the water is wholesome and clean. To do this, the DWD sets standards for 48 (microbiological and chemical) parameters that can be found in drinking water. The parameters must be monitored and tested regularly. Member States have to monitor the quality of the drinking water supplied to their citizens and of the water used in the food production industry. Member States report at three yearly intervals the monitoring results to the European Commission.

The **Urban Waste Water Treatment Directive (91/271/EEC)** has the objective of protecting the environment from the adverse effects of untreated 'urban waste water' ('sewage'). The Directive established minimum requirements for the treatment of significant sewage discharges. An important aspect of the Directive is the protection of the water environment from nutrients (specifically compounds of nitrogen and phosphorus) and/or nitrates present in waste water where these substances have adverse impacts on the ecology of the water environment or abstraction source waters. It was transposed into English law through the **Urban Waste Water Treatment (England and Wales) Regulations 1994 (as amended) (SI 1994/2841)**.

The **Urban Waste Water Directive (98/15/EC)** amended the **Urban Waste Water Treatment Directive 91/271/EEC** to clarify the requirements of the Directive in relation to discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication.

With specific regard to coastal water quality, the **Bathing Waters Directive (2006/7/EC)** sets standards for the quality of bathing waters in terms of:

- ▶ the physical, chemical and microbiological parameters;
- ▶ the mandatory limit values and indicative values for such parameters; and
- ▶ the minimum sampling frequency and method of analysis or inspection of such water.

The **Marine Strategy Framework Directive (2008/56/EC)** requires Member States to take the necessary measures to achieve or maintain good environmental status in the marine environment by 2020 at the latest through the development and implementation of marine strategies.

The OSPAR is the mechanism by which fifteen Governments of the western coasts and catchments of Europe, together with the European Community, cooperate to protect the marine environment of the North-East Atlantic. A key publication is **The North-East Atlantic Environment Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2010–2020** which sets out the OSPAR Commission's vision is a clean, healthy and biologically diverse North-East Atlantic ocean, used sustainably.

In addition, the following European Directives have relevance to the protection of the water environment and resources:

- ▶ Directive on Priority Substances 2008/105/EC;

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- ▶ Waste Framework Directive 2008/98/EC;
- ▶ Industrial Emissions Directive 2010/75/EU; and

UK

The **Flood and Water Management Act 2010** makes provisions for water, including water resources, including:

- ▶ to widen the list of uses of water that water companies can control during periods of water shortage, and enable Government to add to and remove uses from the list;
- ▶ to encourage the uptake of sustainable drainage systems (SUDS) by removing the automatic right to connect to sewers and providing for unitary and county councils to adopt SUDS for new developments and redevelopments;
- ▶ to reduce 'bad debt' in the water industry by amending the Water Industry Act 1991 to provide a named customer and clarify who is responsible for paying the water bill; and
- ▶ to make it easier for water and sewerage companies to develop and implement social tariffs where companies consider there is a good cause to do so, and in light of guidance that will be issued by the Secretary of State following a full public consultation.

Shoreline Management Plans (SMPs), currently under revision by Coastal Groups and the Environment Agency, assess the risks to people, development and the natural and historic environment from coastal processes. These plans (SMPs) will provide a route map for local authorities for the time period of the next 20 years, and leading up to the next 50-100 years. They will include an action plan of what is required to manage coastal processes and where, and will form the basis of decision making for such works.

The Marine Strategy Framework Directive has been transposed into UK law through the **Marine Strategy Regulations 2010** (SI 2010/1627). It aims to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend.

The **Marine and Coastal Access Act 2009** sets out a number of measures including the establishment of Marine Conservation Zones (MCZs) and Marine Spatial Plans. The main objectives of the **Marine Policy Statement (2011)** are to enable an appropriate and consistent approach to marine planning across UK waters, and to ensure the sustainable use of marine resources and strategic management of marine activities from renewable energy to nature conservation, fishing, recreation and tourism.

The **Water Quality and Supply (Fees) Order 2016** sets out the fees that the Chief Inspector of Drinking Water may charge relevant water suppliers for the exercise of functions performed by an inspector. These functions include checking water sampling and analysis and water supply management arrangements and investigating events, incidents, emergencies or other matters arising from the quality or quantity of water.

The **Great Britain Invasive Non-native Species Strategy (2015)** sets aims and objectives to 2020 to address the increasing numbers of invasive species introduced in Great Britain, with around 80 non-native species established in Great Britain's freshwater environment.

England and Wales

In England, the implementation work related to the WFD is undertaken by the Environment Agency, working with key partners. Natural Resources Wales undertakes the same duties for WFD implementation in Wales. There are 11 River Basin Districts in England and Wales which each require (under the WFD) a **River Basin Management Plan (RBMP)** including objectives for surface water, groundwater, transitional and coastal water bodies. The Western Wales River Basin District, is contained and managed wholly in Wales. The two other River Basin Districts in Wales are cross-border with England: the Severn River Basin District and the Dee River Basin District. The Environment Agency leads on the development of the Severn River Basin Management Plan, whilst Natural Resources Wales leads on the development of the Dee River Basin

Water Quality

Management Plan. For this reason, the majority of data and programmes regarding water quality and resources cover both administrations and therefore England and Wales are considered collectively in this context.

Updated RBMPs were published in February 2016 for 8 river basin districts.

The 2011 White Paper, *Water for Life*, sets out the Government's vision for future water management in which the water sector is resilient and water is valued as a precious resource. The key reforms set out in the White Paper are:

- ▶ the introduction of a reformed water abstraction regime, as signalled in the Natural Environment White Paper changes, to deal with the legacy of over-abstraction of our rivers;
- ▶ a new catchment approach to dealing with water quality and wider environmental issues;
- ▶ with the Environment Agency and Ofwat, provide clearer guidance to water companies on planning for the long term, and keeping demand down;
- ▶ consultation on the introduction of national standards and a new planning approval system for sustainable drainage; and
- ▶ collaboration with water companies, regulators and customers to raise awareness of the connection between how we use water and the quality of our rivers.

Water for people and the environment - Water resources strategy for England and Wales (2009) published by Environment Agency, includes the following objectives:

- ▶ enable habitats and species to adapt better to climate change;
- ▶ allow protection for the water environment to adjust flexibly to a changing climate;
- ▶ reduce pressure on the environment caused by water taken for human use;
- ▶ encourage options resilient to climate change to be chosen in the face of uncertainty;
- ▶ better protect vital water supply infrastructure;
- ▶ reduce greenhouse gas emissions from people using water, considering the whole life-cycle of use; and
- ▶ improve understanding of the risks and uncertainties of climate change.

Other relevant strategies include the Environment Agency's ***Catchment Abstraction Management Strategies*** (CAMS) which have identified a number of catchments in England and Wales that are designated as 'over-licensed' or 'over-abstracted'. That is, where the current level of licensed abstraction could result in an unacceptable stress on the catchment's ecology (designated over-licensed) or possibly is resulting in an unacceptable effect (designated over-abstracted).

The ***Water Supply (Water Quality) Regulations 2016*** consolidate legislation concerning the quality of water supplies for human consumption in England. The regulations also apply to supplies in Wales where the water undertaker or licensee is primarily based in England.

England

The ***Groundwater (Water Framework Directive) (England) Direction 2016*** sets out instructions to the Environment Agency on obligations to protect groundwater (water found below the surface). It updates requirements including:

- ▶ the monitoring and setting of thresholds for pollutants in groundwater;
- ▶ adding new pollutants to the list of pollutants to be monitored; and
- ▶ changing the information to be reported to the European Commission.

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The Groundwater (Water Framework Directive) (England) Direction 2016 revoked and replaced the Groundwater (Water Framework Directive) (England) Direction 2014, which applied to England. Similar Directions have been issued by the Welsh Ministers to Natural Resources Wales.

The **Nitrate Pollution Prevention Regulations 2015** provides for, among other issues, the designation of land as nitrate vulnerable zones.

The Marine Management Organisation (MMO) is responsible for preparing marine plans in England. The East Inshore and East Offshore marine plan areas were the first two to be selected in England. The East Inshore Marine Plan area covers 6,000 square kilometres of sea. It stretches from mean high water springs to 12 nautical miles offshore off the coastline between Flamborough Head and Felixstowe. The East Offshore Marine Plan area extends from the outer boundary of the East Inshore area to England's borders with the Netherlands, Belgium and France. This is a total of about 49,000 square kilometres of sea. The South Inshore and South Offshore areas are the third and fourth areas in England to be selected for marine planning.

The **National Policy Statement for Waste Water (2012)** sets out Government policy for the provision of major waste water infrastructure in England. It will be used by the decision maker as the primary basis for deciding development consent applications for waste water developments that fall within the definition of Nationally Significant Infrastructure Projects (NSIP) set out in the Planning Act 2008.

The **National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2012)** expects the planning system to contribute to conserving and enhancing the natural environment and reducing pollution. In particular, the planning system is expected to prevent new development from contributing to unacceptable levels of water pollution.

Local planning authorities are expected to set out the strategic priorities for their area in the Local Plan including strategic policies to deliver the provision of infrastructure for water supply and wastewater. In preparing the evidence base for their Local Plans, they are expected to work with other authorities and providers to assess the quality and capacity of the existing infrastructure and its ability to meet forecast demands. Public bodies have a duty to co-operate on planning issues that cross administrative boundaries particularly those which relate to strategic priorities.

Planning Practice Guidance relating to water supply, wastewater and water quality provides advice on how planning can ensure water quality and the delivery of adequate water and wastewater infrastructure, which is needed to support sustainable development. It promotes a catchment based approach as set out by Defra in **Catchment Based Approach: Improving the Quality of our Water Environment** (2013), which provided the initial framework to bridge the gap between local actions and River Basin Management Plans. It identifies the following key issues for plan-making to consider with regards to infrastructure:

- ▶ Identifying suitable sites for new or enhanced infrastructure. In identifying sites it will be important to recognise that water and wastewater infrastructure sometimes has particular locational needs (and often consists of engineering works rather than new buildings) which mean otherwise protected areas may exceptionally have to be considered where consistent with their designation. Plan-making will also need to take into account existing and proposed development in the vicinity of a location under consideration for water and wastewater infrastructure. In 2-tier areas there will need to be close working between the district and county councils.
- ▶ Considering whether new development is appropriate near to sites used (or proposed) for water and wastewater infrastructure (for example, odour may be a concern).
- ▶ Phasing new development so that water and wastewater infrastructure will be in place when needed.

It also identifies the following issues with regards to water quality:

- ▶ How to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage. For example, can the plan steer potentially polluting development away from the most sensitive

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areas, particularly those in the vicinity of potable water supplies (designated source protection zones or near surface water drinking water abstractions)?

- ▶ The type or location of new development where an assessment of the potential impacts on water bodies may be required.
- ▶ Where particular types of sustainable drainage systems may not be practicable.

The National Environment Programme published by the Environment Agency outlines improvements required to meet European Directives. It includes actions to improve the quality of water that is discharged from sewage treatment to either rivers or the sea, prevent chemicals from entering groundwater and ensure that abstraction of water does not adversely impact on habitats which are protected by law.

Scotland

The ***Water Environment and Water Services (Scotland) Act 2003 (as amended)*** makes provisions for the protection of the Scottish water environment, including a timetable for implementation of requirements of the WFD up until 2015.

The ***Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)*** (SSI 2011/209) sets out the process by which activities that have the potential to affect Scotland's water environment are regulated. Authorisation under the Controlled Activities Regulations (CAR) is required for discharging to waters, disposal of pollutants to land, abstractions, impoundments and engineering works affecting water bodies.

Scotland's ***National Marine Plan (NMP) (2015)*** is a single framework, enabling the sustainable development of Scotland's marine area in a way which will protect and enhance the marine environment whilst ensuring the sustainable growth of both existing and emerging marine industries.

The ***River Basin Management Plans for the Solway Tweed River Basin District and Scotland River Basin District (2015)*** seek to ensure that the water environment is protected, and where necessary and possible improved to good ecological condition in a pragmatic, and sensible way which balances human benefit with ecological impact.

Other relevant strategies include the Scottish Government's ***Bathing Water Strategy for Scotland (2006)*** which sets out a framework for meeting the challenges associated with implementing the revised Bathing Water Directive. This revision requires stricter bacteriological standards to be met in the future and sets new requirements for the provision of information on water quality to the public, as well as for engaging public participation in matters relating to bathing waters.

The Scottish Government's ***A Strategy for Scotland's Coast and Inshore Waters (2004)*** has goals that include (inter alia): delivering integrated management for the whole Scottish coast; establishing an integrated system of spatial planning for Scotland's inshore marine area which combines with the terrestrial planning system; strategic and adequately resourced leadership for the management and sustainable use of coastal resources; safeguard the resources of Scotland's coast and inshore waters and to promote awareness; and to achieve effective stakeholder participation at the appropriate geographical and administrative levels.

Policies aimed to provide a sustainable future for Scotland's groundwater resources by protecting legitimate uses of groundwater are included within the ***Groundwater Protection Policy for Scotland (2009)***.

Scottish Planning Policy (2014) places a duty on the planning system to protect and improve the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way. ***Scotland's Third National Planning Framework (2014)*** sets out the importance of managing the water environment in a sustainable manner and the relevance of water within planning and the decision making process.

The Scottish Government provides advice in the form of Planning Advice Notes (PAN) on water and drainage including PAN 61: Planning and sustainable urban drainage systems and PAN 79: Water and drainage.

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Wales

The **Water Strategy for Wales (2015)** sets out the strategic direction for water policy in Wales over the next 20 years and beyond. Water is one of the greatest natural assets and an integral part of Wales' culture, heritage and national identity. The Strategy highlights the Welsh Government's vision to ensure that Wales continues to have a thriving water environment which is sustainably managed to support healthy communities, flourishing businesses and the environment. The strategy will contribute to wider Welsh Government priorities and principles, including tackling poverty.

The Welsh National Marine Plan (WNMP), which covers Welsh inshore and offshore waters, is currently being developed. The Welsh Government is responsible for marine planning in Wales and marine planning will help to manage marine activities sustainably. The WNMP will have a 20 year outlook and provide important information and guidance to those who wish to use or undertake development in the marine area.

Within the **Environment Strategy for Wales (2006)** there are a number of water related objectives; including:

- ▶ to manage water resources sustainably without causing environmental damage;
- ▶ to increase water efficiency and maintain water quality;
- ▶ to maintain and enhance the quality of water sources; understand and manage diffuse pollution sources; and
- ▶ to minimise the risk posed by exposure to chemicals.

Planning Policy Wales (Edition 9) (2016) sets out the land use planning policies of the Welsh Government. Regarding water resources, Planning Policy Wales seeks to protect and improve water resources through increased efficiency and demand management of water, particularly in those areas where additional water resources may not be available, and ensure that appropriate sewerage facilities are provided to convey, treat and dispose of waste water in accordance with appropriate legislation and sustainability principles.

The **Well-being of Future Generations (Wales) Act 2015** became law in Wales on 29th April 2015 and strengthens existing governance arrangements for improving the well-being of Wales to ensure that present needs are met without compromising the ability of future generations to meet their own needs. This act is supported by the **Planning (Wales) Act (2015)** and **Environment (Wales) Act 2016**.

The **Environment (Wales) Act 2016** recognises that natural resources, such as water, are amongst the most important assets. The Act includes features that will ensure that managing these natural resources sustainably will be a core consideration in decision-making including providing for targets for reducing emissions of greenhouse gases. It also established the Flood and Coastal Erosion Committee and made minor changes to the law about land drainage.

5.3 Overview of the Baseline

UK

The UK has a diversity of inland and coastal waters (such as reservoirs, lakes, rivers, canals, estuaries, transitional waters and coastal waters). Protected water features include: waters designated for human consumption (including those abstracted from groundwater); areas designated for the protection of economically significant aquatic species (e.g. shellfish or freshwater fish); bathing waters (under the Bathing Waters Directive); nutrient-sensitive areas; and areas with waters important to protected habitats or species under the Habitats Directive or the Birds Directive.

Water Quality

There are 189 protected areas in UK inshore waters with a marine element, which includes 102 Special Protection Areas (SPAs) with marine habitats for birds¹⁷⁵, 105 Special Areas of Conservation (SACs) with marine habitats or species¹⁷⁶ 56 Marine Conservation Zones, 30 Nature Conservation Marine Protected Areas¹⁷⁷ and three Marine Nature Reserves. In total, the area coverage of these sites exceeds 1.5 million hectares, or 1.8% of UK waters.

The principal aquifers of the UK are located in the lowlands of England. The most important are the Chalk, Permo-Triassic sandstones, the Jurassic limestones and the Lower Greensand¹⁷⁸.

England

Water Quality

There are 8 river basin management areas in England:

- ▶ Anglian river basin;
- ▶ Humber river basin;
- ▶ Northumbria river basin;
- ▶ North West river basin;
- ▶ Severn river basin;
- ▶ South East river basin;
- ▶ South West river basin;
- ▶ Thames river basin.

A river basin district covers an entire river system, including river, lake, groundwater, estuarine and coastal water bodies. The River Basin Management Plans are designed to protect and improve the quality of our water environment. Good quality water is essential for wildlife, agriculture and business to thrive

Figure 5.1 shows the status classification of all UK surface water bodies under the Water Framework Directive.

¹⁷⁵ Joint Nature Conservation Committee (2017). *SPAs with marine components*. Available online at: <http://jncc.defra.gov.uk/page-4559>

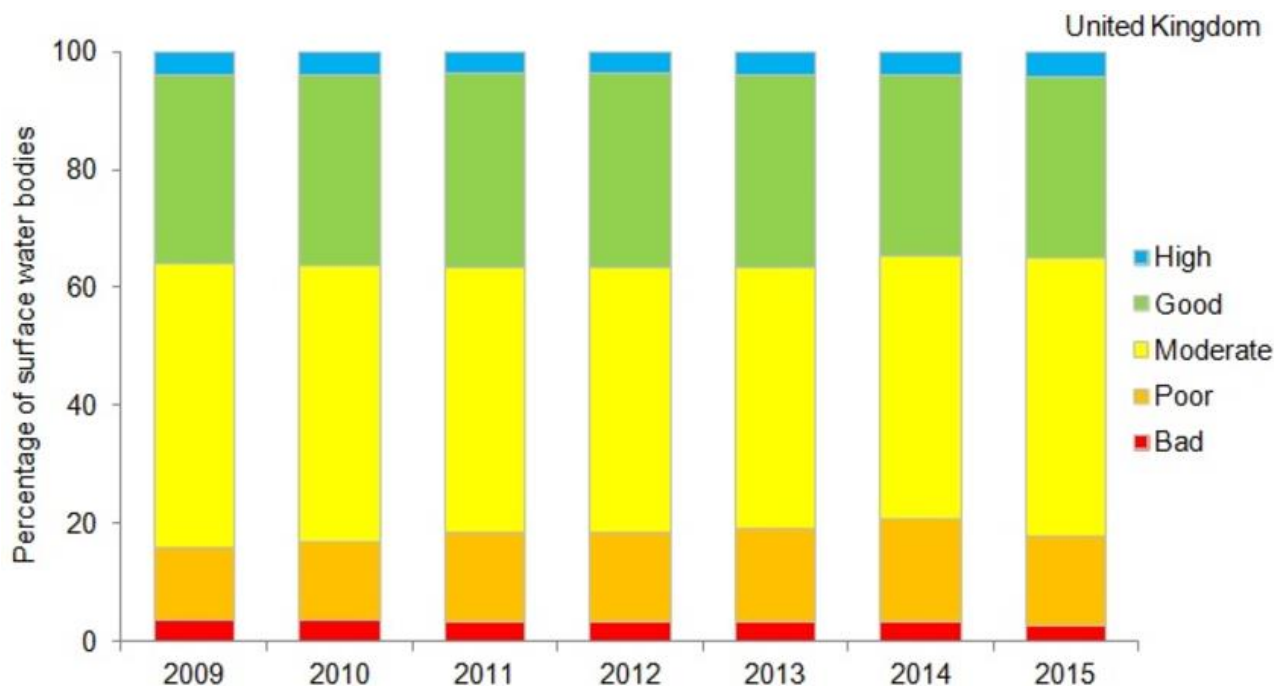
¹⁷⁶ Joint Nature Conservation Committee (2017). *SACs with marine components*. Available online at: <http://jncc.defra.gov.uk/page-1445>

¹⁷⁷ Joint Nature Conservation Committee (2017) *Contributing to a marine protected area network*. Available online at: <http://jncc.defra.gov.uk/page-4549>

¹⁷⁸ Natural Environment Research Council. *The Aquifers of the UK*. Available online at: http://www.groundwateruk.org/downloads/the_aquifers_of_the_uk.pdf

Water Quality

Figure 5.1 Status classification of UK surface water bodies under the Water Framework Directive, 2009 to 2015



Source: Joint Nature Conservancy Council

River water quality in England has in general been steadily increasing since 1990. The proportion of rivers at good or high biological quality did not change significantly between 2009 and 2012 but decreased slightly in 2013 and 2014¹⁷⁹.

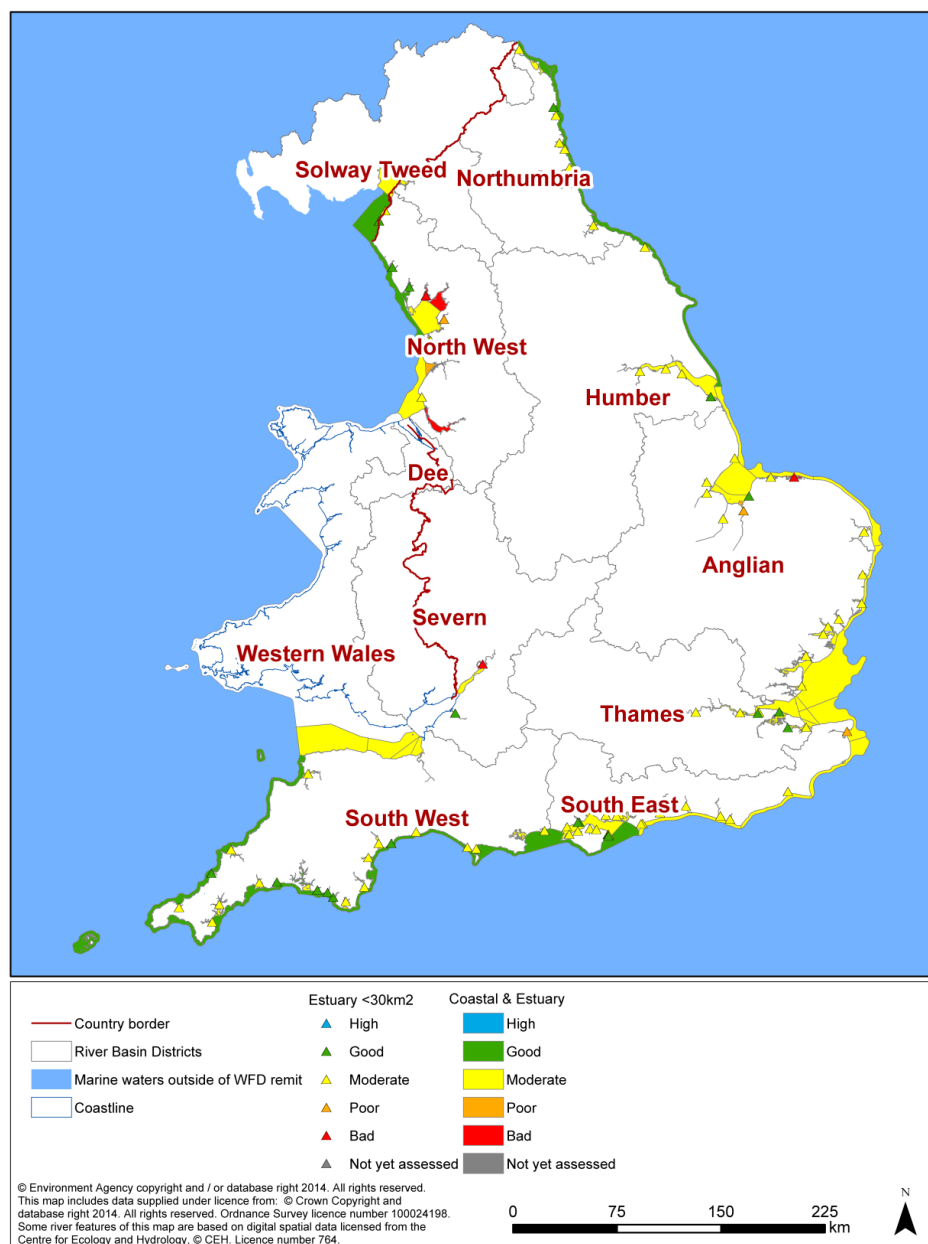
Coastal water quality has improved over the last two decades, however current WFD draft classification results and maps produced by the Environment Agency indicate that there are still a large proportion of coastal waters in England (and Wales) that are classified as being of Moderate Ecological Status (see **Figure 5.2**), i.e. are failing to meet 'Good Ecological Status' (GES) on the basis of a number of physio-chemical and biological standards and are therefore in need of measures to achieve GES.

¹⁷⁹ Office for National Statistics. Sustainable Development Indicators. 2015.

<http://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/sustainabledevelopmentindicators/2015-07-13>

Water Quality

Figure 5.2 Ecological Status or Potential for Estuaries and Coastal Water Bodies in England and Wales



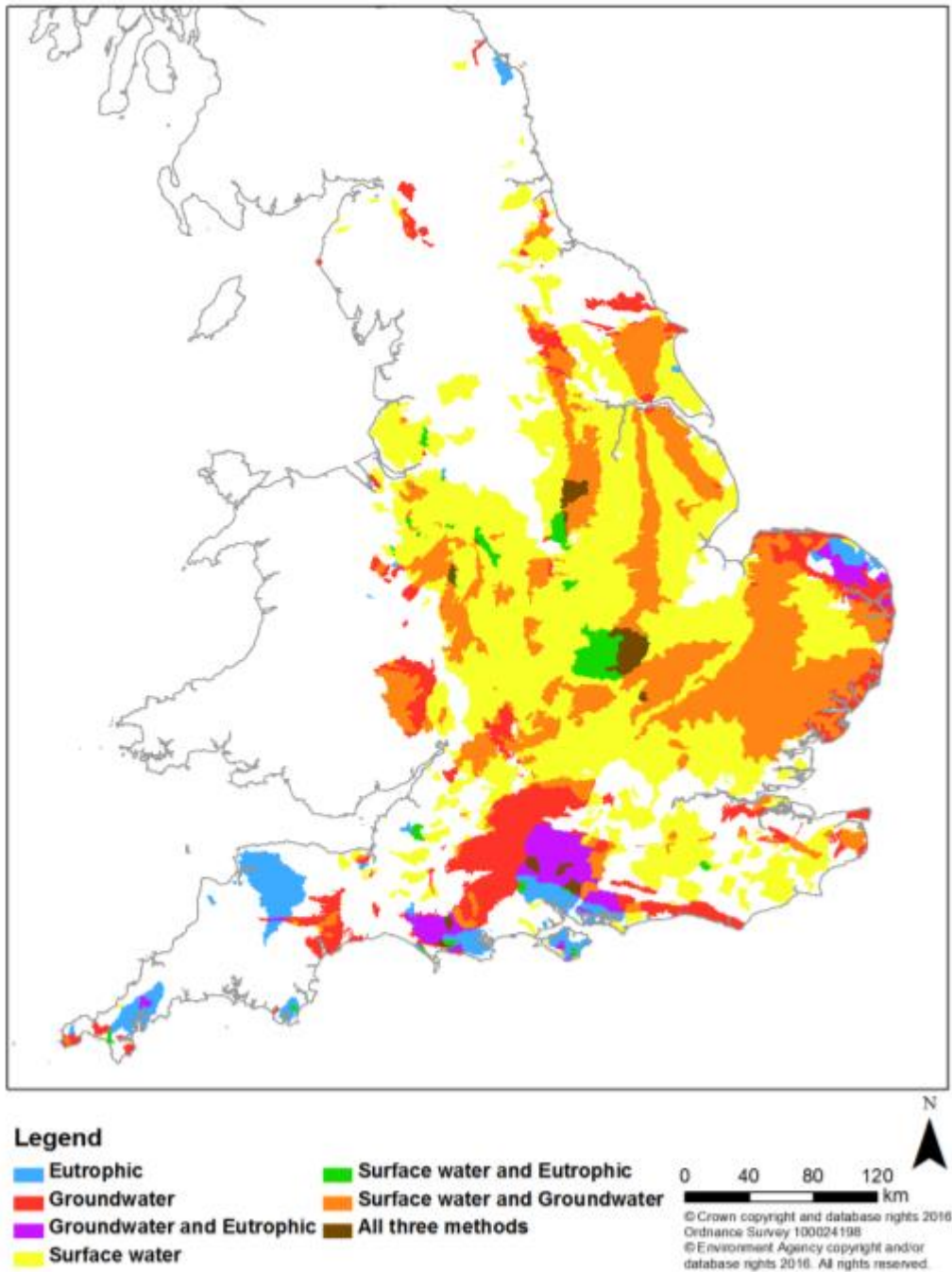
Source: Estuarine and coastal waters national engagement summary. Environment Agency. 2014. http://auneconservation.org.uk/wp-content/uploads/2014/12/Estuarine_and_coastal_waters.pdf

A Nitrate Vulnerable Zone (NVZ) is an area of land that drains into polluted waters and contributes to the pollution of those waters. Polluted waters are waters that are affected by nitrate pollution or could be if the Regulations are not applied in the area concerned. The Nitrate Pollution Prevention Regulations 2015 require the review of NVZs at least every 4 years. The latest review¹⁸⁰ identifies both existing areas at risk alongside new area and the methods that designate each area as shown in **Figure 5.3**.

¹⁸⁰ Environment Agency (2017) *Review of Nitrate Vulnerable Zone designations for implementation in 2017*. Available online at: http://apps.environment-agency.gov.uk/static/documents/nvz/NVZ2017_Recommendation_Report_Final_HOEV151604_R_1611115.pdf

Water Quality

Figure 5.3 Proposed 2017 NVZs and the methods that designate each area



Source: Environment Agency

Groundwater provides a third of drinking water in England, and up to 80% in some areas of southern England. The Environment Agency has defined Source Protection Zones (SPZs) for 2,000 groundwater sources. These zones show the risk of contamination from any activities that might cause pollution in the area. The Environment Agency use the zones in conjunction with their Groundwater Protection Policy to set up pollution prevention measures in areas which are at a higher risk and to monitor the activities of potential polluters nearby.

Groundwater Source Protection Zones are classified as either 'Inner Zone' (Zone 1), 'Outer Zone' (Zone 2), 'Total Catchment/Source Catchment' (Zone 3) or 'Special Interest' (Zone 4). The shape and size of a zone depends on the condition of the ground, how the groundwater is removed, and other environmental factors.

Water Quality

A map that shows the contours of these zones for England and Wales can be viewed on the Environment Agency's website at:

<http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&txonly=off&lang=e&topic=groundwater>.

Bathing Water

In 2016, 98.5% of bathing waters met the minimum standard of the Bathing Water Directive, with 69.5% reaching the excellent standard. A total of 6 bathing waters, representing 1.5% of the total, did not meet the minimum requirement. Due to a change in recording methodology, bathing water quality statistics can only be compared to statistics from the year 2015 onwards, which at the time of writing provides only two years' worth of comparable datasets. Nonetheless, the data for 2016 showed an improvement on the data from 2015 as a result of recent improvements to infrastructure and more favourable weather conditions¹⁸¹.

Scotland

Water Quality

Overall, Scotland's water environment is in a good condition but a wide range of problems exist at local levels. In most cases, the risks to water quality are declining, the exception being groundwater.

Scotland has two river basin districts: the Scotland river basin district which covers most of Scotland and the Solway Tweed river basin district in the south of the country. The Scotland river basin district has been sub-divided into eight Management Plan Areas which are administrated by eight regional 'Area Advisory Groups' (AAGs). These are: Argyll; Clyde; Forth; North East Scotland; North Highland; Orkney and Shetland; Tay and West Highland.

Table 5.1 displays the percentage of water bodies in each class in Scotland for 2014¹⁸².

Table 5.1 WFD Classification Results for Water Bodies in Scotland: Percentage of Water Bodies in each Class 2014

Status	High	Good	Moderate	Poor	Bad
Category					
Rivers	6.9	47.1	24.1	14.6	5.3
Lochs	30.8	35.6	17.7	14.4	1.5
Estuaries	30.6	55.1	14.3	0.0	0.0
Coastal Waters	32.2	64.5	3.1	0.2	-
Groundwater	-	77.7	-	22.3	-

Source: <http://www.environment.scotland.gov.uk/get-interactive/data/water-body-classification/> and <http://www.environment.scotland.gov.uk/get-interactive/data/groundwater/>.

¹⁸¹ Defra (2016) *Statistics on English coastal and inland bathing waters: a summary of compliance with the 2006 Bathing Water Directive*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/565710/STATS_bathing-water-release-2016v1.pdf

¹⁸² Scottish Environment Protection Agency. *Water Body Classification* <http://www.environment.scotland.gov.uk/get-interactive/data/water-body-classification/> and <http://www.environment.scotland.gov.uk/get-interactive/data/groundwater/>

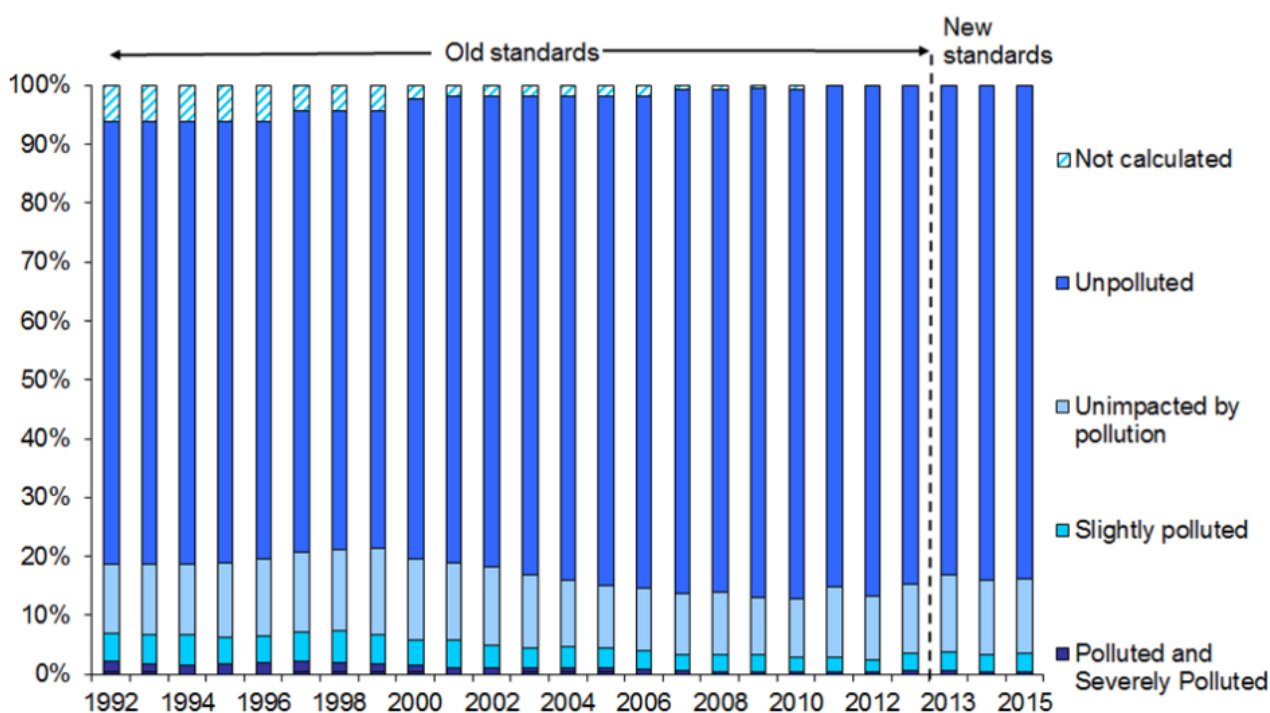
Water Quality

The Scottish Environment Protection Agency (SEPA) has established an indicator of river water quality based on a network of sites covering 253 water bodies (rivers, or sections of rivers), which account for approximately 10% of all water bodies. The indicator is based on a consistent set of five water quality parameters which are sensitive to organic pollution, nutrients and toxic substances and provide a measure of species diversity. Each of the parameters is assessed over a rolling 3 year period and the results weighted by river length.

The assessment is against the standards provided for each parameter in the Water Framework Directive classification. Two of the Water Framework Directive standards, invertebrates and phosphorus, used to calculate the indicator were changed in 2013; SEPA is looking into back calculating the indicator values potentially as far back as 2007 using the new standards to provide a consistent time series

The proportion of river length that was classed as slightly polluted, polluted or severely polluted in Scotland rose from 6.8% in 1992, to 7.4% in 1998, before falling to 3.4% in 2013, using the old standards. Using the new standards, this proportion fell from 3.7% in 2013 to 3.5% in 2015. The proportion of river length classed as unpolluted fell from 86.5% in 2010 to 84.8% in 2013. Using the new standards, the proportion of river length classed as unpolluted rose from 83.3% in 2013 to 84.0% in 2015. In 2015, the proportion of river length classed as unimpacted by pollution was 12.5%. **Figure 5.4** shows the historic data for river quality.

Figure 5.4 River water quality 1992-2015



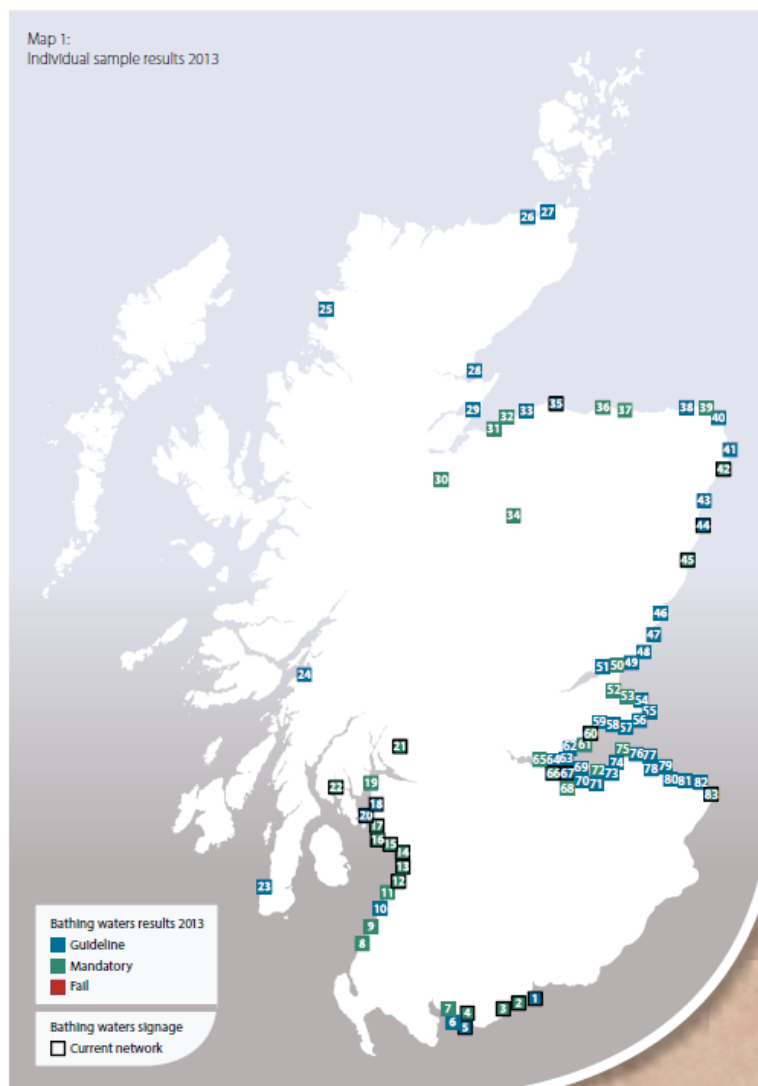
Bathing Water

Despite an exceptionally wet summer in 2014, all of Scotland's 83 bathing waters achieved the mandatory standard for bathing water quality and 57% managed to achieve the more stringent guideline standard¹⁸³. **Figure 5.5** shows compliance with the Bathing Water Directive across Scotland for the period 2013 to 2014.

¹⁸³ Scottish Environmental Protection Agency (2014) *Scottish Bathing Waters 2013-14*. Available online at: <http://www.sepa.org.uk/media/39125/scottish-bathing-waters-report-2013-2014.pdf>

Water Quality

Figure 5.5 Map of Bathing Water Results 2013 in Scotland



Source: SEPA. Scottish Bathing Waters 2013-14. 2014. <http://www.sepa.org.uk/media/39125/scottish-bathing-waters-report-2013-2014.pdf>

Wales

Water Quality

The Welsh Government reported on the River Basin Planning progress in 2015 and **Table 5.2** shows the percentage of water bodies in each River Basin District achieving poor, moderate or good status, both in 2009 and 2015.

Water Quality

Table 5.2 Overall status of water bodies as a percentage between 2009 and 2015¹⁸⁴.

River Basin District	2009			2015		
	Poor	Moderate	Good	Poor	Moderate	Good
Dee	11	58	30	5	63	31
Western Wales	7	63	30	5	57	38
Welsh part of the Severn River	12	50	37	8	47	43

In 2009, 10% of all water bodies were in poor condition, 57% were in moderate condition and 33% were in good condition. Since then, many improvements have been made both in monitoring and data collection and assessment. The 2015 classification shows that the percentage of water bodies achieving good or better status has increased to 38%. The number of water bodies at poor status, meanwhile, has reduced to 6% with a resulting increase in the number of water bodies at moderate status.

In 2009 31% of surface water bodies in Wales achieved good or better ecological status. The 2015 classification results indicate that 39% of surface water bodies achieved good or better status. Improvement in status is limited by the current understanding of pressures on the water environment, their sources, and the action required to tackle them.

All 38 groundwater bodies in Wales achieved good quantitative status in 2015. For chemical status in 2009 26 groundwater bodies met good chemical status Wales. In 2015 22 are in good chemical status. This increase in the number of groundwater bodies at poor status, which is considered to be due to discharges of contaminated minewaters and the discharge of nutrient rich groundwaters into groundwater dependent terrestrial ecosystems¹⁸⁵.

Monitoring for chemicals is based on those that are discharged in significant quantities and at locations which are considered to be at risk of failing objectives. Over twice the number of water bodies have been reported in 2015 to that in 2009, however the proportion of water bodies failing has remained broadly similar. The main reasons for water body failure in Wales are pollution from abandoned mines and contaminated land, agricultural pollution, barriers to fish migration and impoundments. Sewage discharges, acidification, forestry, flood protection and land drainage, surface water drainage from urban and transport development, abstraction and industrial discharges are also factors.

The 'Wales' Marine Evidence Report' (2015)¹⁸⁶ highlights that no transitional or coastal water bodies in Wales fail the assessment of chemical status, based on priority hazardous substances defined in the WFD. However, in numerous instances, ecological status /potential has not been reported as good.

All 102 bathing waters complied with the requirements of the Bathing Water Directive (2006/7/EC) in 2015. Of the 102 designated bathing waters, 82 were of an excellent standard (three more than projected in 2014), 16 achieved a good standard and four were classified sufficient standard.

¹⁸⁴ Welsh Government. River Basin Planning Progress Report for Wales 2009-2015. Updated December 2015. Available online at: <http://naturalresources.wales/media/676155/progress-report-for-wales-2009-2015-english.pdf>

¹⁸⁵ Natural Resources Wales (2015) *River basin planning progress report for Wales 2009 – 2015*. Available online at: <http://naturalresourceswales.gov.uk/media/676155/progress-report-for-wales-2009-2015-english.pdf>

¹⁸⁶ Welsh Government (2015) Wales' Marine Evidence Report <http://gov.wales/topics/environmentcountryside/marineandfisheries/marine-planning/other-supporting-evidence/wales-marine-evidence-report/?lang=en>

Water Quality

NVZ's account for 2.4 per cent of land area in Wales¹⁸⁷ and the most recent review of NVZ's in Wales was undertaken by the Environment Agency Wales in 2012.

Across England and Wales new drinking water standards came into force in 2016, The Water Supply (Water Quality) (Amendment) Regulations 2016. Welsh Waters performance against the water quality tests (known as Overall Mean Zonal Compliance) for 2015 is 99.96 percent, the same as the UK average. This is an increase from 2014 (99.94 per cent) but a slight decrease from 2013 (99.97 per cent)¹⁸⁸.

5.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for water quality have been identified:

- ▶ There is considerable pressure on water resources in many parts of the UK, which can in turn affect water quality.
- ▶ There is a legacy of groundwater pollution in the UK from historical mining and other industrial activities.
- ▶ Climate change is expected to have significant impacts on the water environment. Areas where the underlying geology is generally impermeable are expected to be particularly affected as river flows would be likely to fall to low levels in drier periods and quickly react to rainfall episodes.
- ▶ Many waterbodies are subject to pressure from multiple sources including rural diffuse pollution, waste water discharges, acidification and urban diffuse pollution.

5.5 Likely Evolution of the Baseline

UK

The UK Climate Change Risk Assessment¹⁸⁹ identifies that at present, a clear climate-related trend in risk at a national scale cannot be distinguished for freshwater ecosystems and their services. This is due to the dominating role of large year-to-year climate variability and the influence of other factors (notably land use).

Future projections for an increased incidence of warmer, drier summers are very likely to increase the risk of low flows and reduced water levels. In combination with higher water temperatures, this increases the risk of ecosystem disruption from reduced oxygen supply, thermal stress to species, reduced dilution of harmful pollutants and increased incidence of algal blooms in water bodies. Climate change would therefore provide further stress for water bodies that do not have good ecological status and may introduce new risks for water bodies that do have good status, depending on the magnitude of change.

Impacts would be exacerbated during periods of drought, although currently evidence for increased incidence of drought remains limited. The increased likelihood of more frequent periods of heavy rainfall could cause further raw water quality problems due to increased runoff/discharge of pollutants, effluents and sediments into water bodies, including elevated levels of dissolved organic carbon. In addition to environmental impacts, these problems would incur greater treatment costs for drinking water.

¹⁸⁷ NRW (2017). *Nitrate Vulnerable Zones*. Available online at:
<https://naturalresources.wales/water/quality/nitrate-vulnerable-zones/?lang=en>

¹⁸⁸ Discover Water. *Water quality results for all water companies*. Available online at:
<http://www.discoverwater.co.uk/quality>

¹⁸⁹ UK CCC ASC. *UK Climate Change Risk Assessment 2017: CCRA2 Evidence Report*. 2016.
<https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/>

Water Quality

Risks may be further exacerbated in some catchments due to shifts towards more intensive land use, contributing greater pollution loads from diffuse sources. Depending on the rate of sea-level rise, existing freshwater aquifers may be at an increased risk of saline intrusion, with implications for drinking water supplies.

Ecosystems, particularly wetlands and woodlands, regulate and filter the flow of water through vegetation and soils (interception, evapotranspiration, infiltration, drainage, conductivity). Climate related and human-related changes to ecosystems will therefore modify their role in buffering against extreme high flows (flood risk) and low flows, in addition to their role in water circulation and purification. Increasing evidence is available for these relationships but remains incomplete¹⁹⁰.

In the UK, 96.8% of bathing waters met the mandatory water quality in 2016. Between 2015 and 2016, 16 UK sites improved from poor to sufficient¹⁹¹. It is anticipated that the overall quality of bathing waters is likely to increase as water quality is improved to meet the requirements of the Bathing Water Directive.

England

The objectives of the RBMPs, required by the WFD and referenced earlier in this section, are:

- ▶ to prevent deterioration of the status of surface waters and groundwater;
- ▶ to achieve objectives and standards for protected areas;
- ▶ to aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status;
- ▶ to reverse any significant and sustained upward trends in pollutant concentrations in groundwater;
- ▶ the cessation of discharges, emissions and losses of priority hazardous substances into surface waters; and
- ▶ progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants.

Since a new assessment framework was introduced in 2009, there has been no real change the in quality of rivers within England; between 2009 and 2012 the percentage of rivers of good biological quality in England dropped from 26% to 25%. Over the same time period the percentage of rivers that passed the chemical status criteria rose from 78% to 80%.

Defra aims that by 2030, at the latest, England will have improved the quality of our water environment and the ecology which it supports, and continue to provide high levels of drinking water quality from its taps; sustainably manage risks from flooding and coastal erosion, with greater understanding and more effective management of surface water; ensure a sustainable use of water resources, and implement fair, affordable and cost reflective water charges; cut greenhouse gas emissions; and embed continuous adaptation to climate change and other pressures across the water industry and water users.

Scotland

Table 5.3 demonstrates that the overall percentage of water bodies in Scotland which were at good or high status in 2007 and 2014 was broadly similar for all water categories. In most cases the risks to water quality are steady or declining, the exception being estuaries.

¹⁹⁰ UK Committee on Climate Change (2017) UK Climate Change Risk Assessment 2017. Available online at: <https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/ccra-chapters/natural-environment-and-natural-assets/>

¹⁹¹ European Environment Agency (2016). *State of Bathing Water*. Available online at: <https://www.eea.europa.eu/themes/water/status-and-monitoring/state-of-bathing-water>

Water Quality

Table 5.3 WFD Classification Results for Water Bodies in Scotland; Percentage of Water Bodies in each Class for 2007 and 2014

Status	High	Good	Moderate	Poor	Bad
Category					
Rivers (2007 Classification)	8	40	31	16	5
Rivers (2014 Classification)	7	47	24	15	5
Lochs (2007 Classification)	26	35	15	22	2
Lochs (2014 Classification)	31	36	18	14	2
Estuaries (2007 Classification)	28	16	44	4	8
Estuaries (2014 Classification)	31	55	14	0	0
Coastal Waters (2007 Classification)	57	34	9	0	0
Coastal Waters (2014 Classification)	32	65	3	0.2	0
Groundwater (2007 Classification)	-	76	-	24	0
Groundwater (2014 Classification)	-	78	-	22	0

Another important trend is the sources of effects. In general, environmental effects from industry are declining, whereas effects from urban development and intensification are increasing¹⁹².

The Scotland river basin district objective is to improve water quality such that 88% of water bodies will be of good or better condition by 2027¹⁹³. By 2027, the objective for the Solway Tweed river basin district is for 90% of water bodies to be of good or better quality¹⁹⁴.

As illustrated in **Figure 5.6**, the quality of bathing water has been improving since 1988. However, the results from recent years suggest that there are still challenges to ensure full compliance with the standards set out in the Bathing Waters Directive. Higher rainfall in summer and more intensive rainfall, as expected in most climate change projections, would be likely to pose significant hurdles to achieve full compliance with the standards.

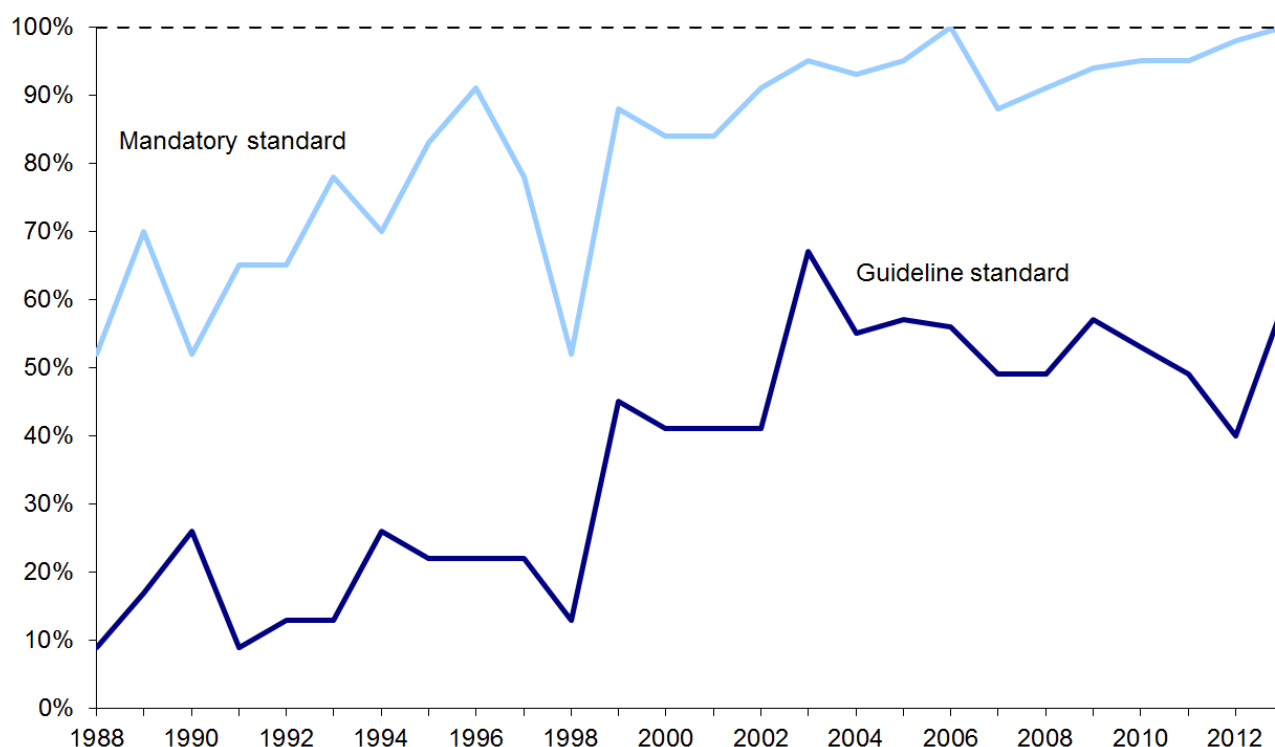
¹⁹² Scottish Environmental Protection Agency (2013) *State of the environment and trends – Scotland – Water*. Available online at: <http://www.seaguidance.org.uk/11/State-of-the-Environment.aspx>

¹⁹³ Scottish Government (2015) *The river basin management plan for the Scotland river basin district 2015–2027*. Available online at: <https://www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf>

¹⁹⁴ Scottish Government and Environment Agency (2015) *The river basin management plan for the Solway Tweed river basin district: 2015 update*. https://www.sepa.org.uk/media/218890/rbmp_solway_tweed_2015.pdf

Water Quality

Figure 5.6 Percentage Compliance of Coastal Waters with the EC Bathing Water Directive 1988- 2013



Source: Scottish Government (2014) *Key Environmental Statistics 2014*. Available online at: <http://www.gov.scot/Resource/0045/00458333.pdf>

Wales

Wales records some of the highest rainfall levels in the UK, and relies on this rainfall which is collected in the rivers, lakes and reservoirs as sources of water supply. However, in significant parts of Wales, there are no further reliable supplies of water available for new abstractions. Whilst population increase estimates are lower for Wales than for many other parts of the UK, growth will place further pressure on water resources. Climate change is also expected to have significant effects on river flows in Wales, with most major watercourses experiencing a 10-15% increase in mean monthly winter flows and 50-80% decreases in summer flows. These predictions are generally more pronounced than in England, primarily due to the lack of groundwater storage capacity in Wales.

Under the WFD, rivers in England and Wales were required to have achieved 'good ecological status' by 2015. Where this was not possible and subject to criteria set out in the Directive, the aim is to achieve good status by 2021 or 2027. The second River Basin Management Plan cycle, 2015 – 2021 recognises the large degree of uncertainty about achieving such significant increases to achieve good status or better by 2021. NRW propose in Wales to improve compliance with good status by delivering measures locally in an integrated way to achieve improvements. This will involve targeting 21 water bodies in the Western Wales River Basin District¹⁹⁵ and seven in the Dee River Basin District¹⁹⁶.

¹⁹⁵ Western Wales River Basin Management Plan 2015 – 2021 Summary December 2015. Available online at: <https://naturalresources.wales/media/676165/wwrbdsummary.pdf>

¹⁹⁶ Dee River Basin Management Plan 2015 – 2021 Summary Updated December 2015
<https://www.naturalresourceswales.gov.uk/media/676146/deerbdsummary.pdf>

Water Quality

The State of Natural Resources Report (SoNaRR)¹⁹⁷ highlights that climate change may affect groundwater recharge in Wales and that by 2025, it is likely that groundwater recharge will decrease, resulting in decreased dry weather river flows and a general lowering of groundwater levels. This may have impacts on base-flow to rivers and wetlands in dry periods and affect small domestic and agricultural water supplies.

5.6 Assessing Significance

The objectives and guide questions related to water quality and resources which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 5.4**, together with reasons for their selection.

Table 5.4 Approach to Assessing the Effects of the Water Resources NPS Proposals on Water Quality

Objective/Guide Question	Reasoning
Objective: To protect and enhance water quality and help achieve the objectives of the Water Framework Directive.	The SEA Directive (2001/42/EC) requires that likely significant effects on water be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report. The construction of water resources infrastructure can have adverse impacts on water quality due to, for example, pollution. The operation of water resources infrastructure can have both positive and negative impacts on water quality associated with, in particular, changes to water levels as a result of abstraction or discharge. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.
Will the Water Resources NPS protect and improve surface, ground, estuarine and coastal water quality?	The Water Framework Directive (2000/60/EC) requires all inland, coastal and groundwater to reach a 'good' chemical and ecological status. Current WFD draft classification indicate that there are still a large proportion of surface water bodies in England (and Wales) that are classified as being of Moderate Ecological Status or less. Government strategies such as the Water resources strategy for England and Wales (2009) and Water for Life (2011) include objectives to protect the quality of water. Under the Water resources Strategy, the Government aims that by 2030, at the latest, England will have improved the quality of the water environment and the ecology which it supports.
Will the Water Resources NPS prevent the deterioration of Water Framework Directive waterbody status (or potential)?	
Will the Water Resources NPS ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	
Will the Water Resources NPS support the achievement of protected area objectives such as groundwater source protection zones and nitrate vulnerable zones?	Drinking water protected areas are bodies of surface water or groundwater: (i) used, or planned to be used, for the abstraction of water intended for human consumption; and (ii) providing, or planned to provide, a total of more than 10 cubic metres of water per day on average, or serving, or planned to serve, more than 50 people.
Will the Water Resources NPS support the achievement of environmental objectives set out in River Basin Management Plans?	There are 11 River Basin Districts which each require (under the WFD) a River Basin Management Plan (RBMP) including objectives for surface water, groundwater, transitional and coastal water bodies.

Table 5.5 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the population objective.

¹⁹⁷ Natural Resources Wales (2016) *The State of Natural Resources Report (SoNaRR)*. Available online at: <https://naturalresources.wales/our-evidence-and-reports/the-state-of-natural-resources-report-assessment-of-the-sustainable-management-of-natural-resources/?lang=en>

Water Quality

Table 5.5 Illustrative Guidance for the Assessment of Significance for Water Quality

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would significantly decrease the amount of waste water, surface run-off and pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking water receptors) would be significantly improved and sustained and water targets (including those relevant to chemical and ecological condition) reached and exceeded; Option would significantly improve surface, ground, estuarine and coastal water quality; Option would significantly improve Water Framework Directive waterbody status (or potential).
+	Positive	<ul style="list-style-type: none"> Option would lead to minor decreases in the amount of waste water, surface run-off and/or pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking water receptors) may be improved to some level temporarily and some water targets (including those relevant to chemical and ecological condition) would be reached/exceeded; Option would improve surface, ground, estuarine and coastal water quality; Option would improve Water Framework Directive waterbody status (or potential).
0	Neutral	<ul style="list-style-type: none"> Option would not change the amount of waste water, surface run-off and/or pollutant discharges such that the quality of water receptors would not be affected; Option would not affect Water Framework Directive waterbody status (or potential).
-	Negative	<ul style="list-style-type: none"> Option would lead to minor increases in the amount of waste water, surface run-off and/or pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking water receptors) may be decreased to some level temporarily and it may prevent some water targets (including those relevant to chemical and ecological condition) from being achieved; Option would decrease (directly or indirectly) surface, ground, estuarine and coastal water quality; Option would lead to a decrease in Water Framework Directive waterbody status (or potential).
--	Significant Negative	<ul style="list-style-type: none"> Option would lead to major increases in the amount of waste water, surface run-off and/or pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking water receptors) would be considerably increased and some or all water targets (including those relevant to chemical and ecological condition) would not be achieved; Option would significantly decrease (directly or indirectly) surface, ground, estuarine and coastal water quality; Option would significantly decrease Water Framework Directive waterbody status (or potential).
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

Water Quantity

6. Water Quantity

This section presents the overview of the plans, programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources in respect of water quantity.

Water quantity within this context is defined as inland surface freshwater and groundwater resources.

There are links between water quality/resources and a number of other Appraisal of Sustainability (AoS) topics, in particular the effects and interactions of water quantity on biodiversity, human health, flood risk and climatic factors.

It should be noted that for the purposes of this Scoping Report, water quality and water quantity have been discussed as two separate topics. However, the two topics are very closely related and in the majority of cases the both the plans and programmes and the baseline data discussed under one topic could also be discussed under the other. Therefore, to avoid unnecessary duplication in the majority of instances a given item or issue is only discussed under the topic to which it is most directly relevant.

6.1 Review of Plans and Programmes

Levels of rainfall vary substantially across Britain, with Wales, Scotland and the north of England experiencing higher levels of rainfall than the south and east of England. The south and east also have some of the highest demand for potable water. As such, long term plans and policies have been produced by and between governments, water companies and other key stakeholders to ensure that suitable supplies can be maintained to cope with drought conditions and in a future of increased demand and a changing climate.

International/European

The aspects of the **Water Framework Directive (WFD) (2000/60/EC)** relating directly to water quality are discussed under Section 5 – Water Quality of this report. The Directive aims at maintaining and improving the aquatic environment in the Community. Whilst the Directive is primarily concerned with the quality of the waters concerned, the control of quantity is recognised as an ancillary element in securing good water quality and therefore measures on quantity, serving the objective of ensuring good quality, are established.

In addition, the Directive recognises that the quantitative status of a body of groundwater may have an impact on the ecological quality of surface waters and terrestrial ecosystems associated with that groundwater body. There is only a certain amount of recharge into a groundwater each year, and of this recharge, some is needed to support connected ecosystems (whether they be surface water bodies, or terrestrial systems such as wetlands). For good management, only that portion of the overall recharge not needed by the ecology can be abstracted - this is the sustainable resource, and the Directive limits abstraction to that quantity.

One of the innovations of the Directive is that it provided a framework for integrated management of groundwater and surface water for the first time at European level. River Basin Management Plans are required to provide a detailed account of how the objectives set for the river basin including ecological status, quantitative status, chemical status and protected area objectives are to be reached within the timescale required.

UK

In 2016, the UK Government published an updated **National Infrastructure Delivery Plan**. This sets out the Government's plan to 2021 and beyond and takes a targeted approach to infrastructure investment and delivery across different sectors. It contains major commitments to improve the UK's transport, energy, communications, waste, water, housing and science and research infrastructure as well as steps to attract new private sector investment. With regards to water infrastructure, the plan identifies the Thames Tideway Tunnel as the key priority to 2021. This is the second project to address the 39 million tonnes of sewage that

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has been released into the Thames in recent years, the first project being the Lee Tunnel, which was completed in early 2016.

The **Water resources long term planning framework (2015-2065)** seeks to develop a high-level strategy and framework for the long term planning of water resources for Public Water Supply in England and Wales. In turn, it provides an assessment of the key challenges facing public water supplies in England and Wales up to 50 years in future, in terms of the current planning process (water resource management plans and drought plans) and approaches used, and in particular, in terms of the levels of drought resilience that are planned, and how these differ across the country. Key recommendations include the need for further work in a number of areas to better understand future scenarios. These include the further development of datasets and models, requirements for improved climatic scenarios and better water demand and drought forecasting

England

The **Water Industry Act 1991 (as amended by the Water Act 2003)** requires water undertaker to prepare and maintain Drought Plans under Section 39B and 39C of the Water Industry Act 1991. A drought plan is a plan for how the water undertaker will continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water. Such plans include the definitions used to define a drought, how water will be managed during a drought and how drought management will be improved in the future.

The Act also requires water undertakers to prepare and maintain a water resources management plan (WRMP). Fundamentally, WRMPs show how a water company will be able to provide a secure supply of water to customers over a 25-year period at an affordable price and without damaging the environment. WRMPs must take into account anticipated population growth, future housing, economic growth and climate change.

The **National Planning Policy Framework (2012)** sets out the core land use planning principles that should underpin both plan-making and decision taking. Local planning authorities are expected to set out the strategic priorities for their area in the Local Plan including strategic policies to deliver the provision of infrastructure for water supply.

The **UK Government response to consultation on reforming the Water Abstraction Management System (2016)** sets out Defra's proposed plans for reforming the abstraction management system in England following extensive consultation. Key aspects of the reformed abstraction system include:

- ▶ Abstraction permits that reflect current business use, with unused abstraction volumes removed subject to appeal.
- ▶ Water storage will be permitted at any time flows are sufficiently high
- ▶ All abstractors directly affecting surface water will have conditions on their permits that enable flow based controls to protect the environment; and
- ▶ A more efficient permit trading systems to allow abstractors to deal with low flows.

In response to the above proposals for revising the water abstraction system, the Environment Agency published **Managing Water Abstraction (2016)**, which sets out how the Environment Agency will manage water resources in England. It explains the technical, legal and policy requirements behind the abstraction licensing strategies. It also discusses the relationship between drought management plans, WRMPs and abstraction management, noting that the Environment Agency publishes its own drought plan; **Drought response: our framework for England (2017)**. The Environment Agency's drought plan explains how drought affects England and how the Environment Agency works with government, water companies and others to manage the effects on people, business and the environment. It aims to ensure consistency in the way the Environment Agency coordinates drought management across England. The Environment Agency sets out its approach to balancing abstraction demands against the need to maintain desired ecology, particularly of surface water, through its **Catchment Abstraction Management Strategies (CAMS)**.

Defra's **Creating a great place for living: Enabling resilience in the water sector (2016)** set out the Government's approach to enhancing the policy framework for the water sector to secure the long-term resilience of the sector, helping to deliver a cleaner, healthier environment, benefiting people and the

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economy. This is supported and informed by the Environment Agency's advice to Defra ***Water supply and resilience and infrastructure (2015)***.

The ***Government's Strategic Priorities for Ofwat: Affordable, Resilient Water Supplies (2017)*** sets out the strategic priorities and objectives for Ofwat, the independent economic regulator of the water industry. It sets a strategic objective for Ofwat to further a reduction in the long-term risk to water supply resilience from drought and other factors, including through new supply solutions, demand management and increased water trading.

Scotland

Scotland's ***National Water Scarcity Plan*** sets out how water resources will be managed prior to and during periods of prolonged dry weather. This is to ensure the correct balance is struck between protecting the environment and providing resource for human and economic activity.

Wales

The ***Water Strategy for Wales (2015)*** sets out the strategic direction for water policy in Wales over the next 20 years and beyond. The aim is to ensure Wales has a more integrated and sustainable approach to managing water and associated services in Wales. The Strategy aims there are sufficient, reliable water resources and waste water services available in Wales and that these are sustainable and resilient to future changes. The Strategy will contribute to the implementation of the natural resource management policy.

6.2 Overview of the Baseline

UK

Over the past five years, there has been a downward trend in the amount of water that households are using each day, although fluctuations can be seen throughout the years. However, in 2015- 16, there was a slight increase in the amount of water that customers use each day, averaging 139.5 litres per person per day. Unmetered households use more water (around 30 litres per person per day more) than metered households. In Scotland, domestic water use accounts for 841.64 Ml/d or 150 litres per person per day (2013-14). A declining trend has been observed since (2008/09). Average water use in Northern Ireland is 145 litres per person per day¹⁹⁸.

England and Wales

Abstraction

The abstraction of water from non-tidal surface water and groundwater in England and Wales had fallen steadily from the peak of an estimated 11.6 billion cubic metres in 2001 to 8.2 billion cubic metres in 2011. However, since 2011, total abstraction has increased by 14% to 9.4 billion cubic metres, driven mostly by abstraction for electricity generation, which increased from 1.4 billion cubic metres in 2011 to 2.5 billion cubic metres in 2015. This is in contrast to the statistics for 2016 which showed that abstraction was decreasing due to a large reduction in hydropower abstracted in Wales. The abstractions for public water supply, which makes up 50% of total abstraction, decreased slightly by 1% over the same period to 5.1 billion cubic metres in 2015¹⁹⁹.

¹⁹⁸ Waterwise (2017) Water efficiency strategy for the UK. Available online at:

<http://www.waterwise.org.uk/data/resources/67/Waterwise-UK-Water-Efficiency-Strategy-full-report.pdf>

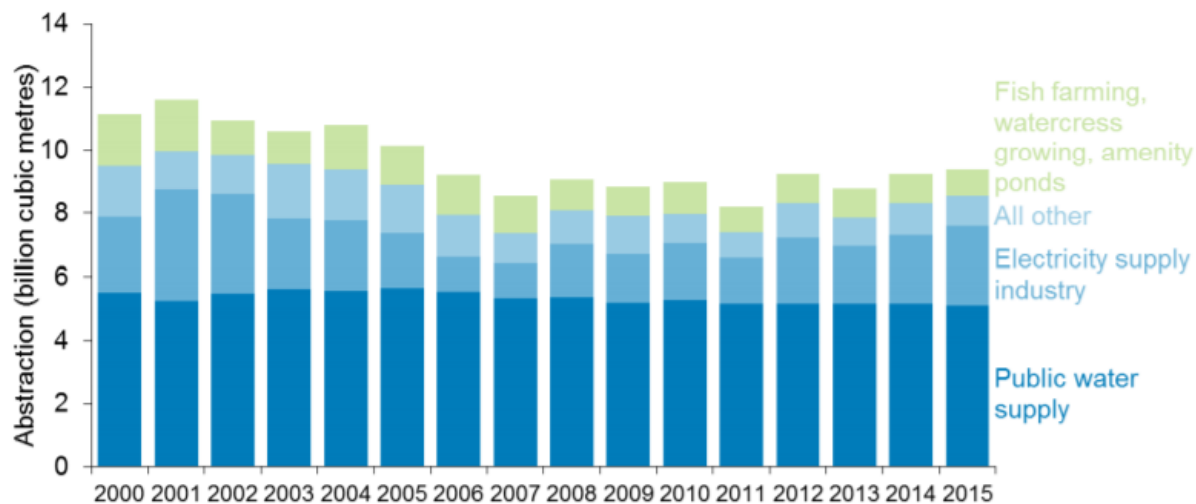
¹⁹⁹ Defra (2017) *Water abstraction statistics, England 2000-2015*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/422246/Water_Abstractions_release_V1.pdf

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Figure 6.1 shows abstraction by type for the years 2000-2015.

Figure 6.1 Estimated abstractions from non-tidal surface water and groundwater in England, 2000 to 2015.



Source: Environment Agency

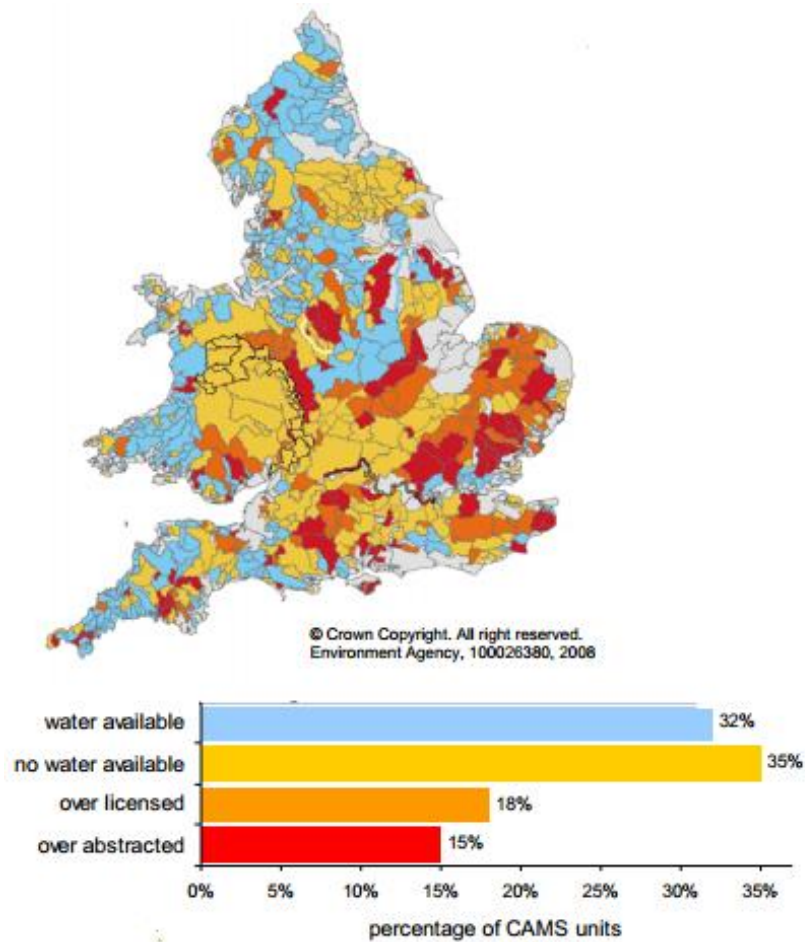
The results from the first cycle of Catchment Abstraction Management Strategies in 2008 showed that there is considerable pressure on water resources throughout England and Wales but in particular in the South East and East of England, with less pressure in the north west of England and the west of Wales as shown in Figure 6.2²⁰⁰.

²⁰⁰ Defra. Environmental Statistics – Key facts. 2013.

<http://data.defra.gov.uk/env/doc/Environmental%20Statistics%20key%20facts%202012.pdf>

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Figure 6.2 Map of Water Available for Abstraction (surface water combined with groundwater)



Source: Environment Agency. Water resources in England and Wales – current state and future pressures. 2008.
<http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/geho1208bpas-e-e.pdf>

Leakage

Table 6.1 identifies the leakage data for water companies in England and Wales.

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Table 6.1 Leakage per property served per day (litres per day)

Company	2011-12	2012-13	2013-14	2014-15	2015-16
Water and Sewerage Companies					
Anglian	93.83	89.14	91.11	89.77	84.47
Dwr Cymru	115.15	127.10	130.89	127.18	126.93
Northumbrian	109.82	114.88	113.22	114.90	113.80
Severn Trent	133.24	126.64	126.64	127.00	122.98
South West	101.31	105.06	105.06	104.31	103.59
Southern	75.63	74.71	78.40	75.21	76.53
Thames	172.26	174.70	174.16	175.60	170.94
United Utilities	139.98	141.21	139.67	139.55	138.01
Wessex	115.48	115.48	115.48	114.57	112.51
Yorkshire	121.64	117.64	125.19	127.15	125.22
Water only companies					
Affinity	116.42	129.93	123.93	125.22	122.64
Bournemouth	106.42	102.35	102.55	101.94	95.44
Bristol	82.67	80.75	84.59	85.99	83.83
Cambridge	91.82	91.60	94.20	98.87	95.86
Dee Valley	68.30	74.39	81.36	77.68	78.24
Essex and Suffolk	74.91	68.37	74.03	76.60	74.54
Hartlepool	94.98	89.06	87.01	91.66	98.97
Portsmouth	119.53	109.84	96.91	92.22	89.03
South East	105.02	102.76	102.10	94.40	89.97
South Staffs	117.70	112.70	115.46	118.23	119.08
Sutton and East Surrey	83.17	83.52	84.33	84.75	84.19

On an industry wide basis, the trend is towards a reduction in leakage, however this masks some notable variation between the companies. For example, Portsmouth has reduced leakage by 30 litres per property served per day, compared to an increase of 12 litres for Dwr Cymru.

Household Water Use

Table 6.2 shows the level of water consumption for water companies in England and Wales. As can be seen, the overall industry trend is downwards, with some significant variation between water companies.

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Table 6.2 Average water use (litres per person per day)

	2011-12	2012-13	2013-14	2014-15	2015-16	Trend
Industry Average	145.8	140.1	141.5	138.6	139.6	
Water and Sewerage Companies						
Anglian*	144.8	136.2	135.1	133.4	135.4	
Dŵr Cymru	152.1	144.4	144.6	141.5	138.5	
Northumbrian	146.2	140.5	141.2	141.9	144.7	
Severn Trent	125.0	120.9	129.3	126.4	130.4	
South West	134.5	136.7	136.9	134.6	136.6	
Southern	156.7	143.4	140.8	134.8	132.0	
Thames	160.6	154.7	156.2	150.9	149.3	
United Utilities	132.0	128.0	129.1	130.0	130.0	
Wessex	139.8	136.3	138.4	138.8	138.1	
Yorkshire	136.0	133.4	136.2	133.0	133.1	
Water only companies						
Affinity	157.6	148.5	154.7	148.3	152.2	
Bournemouth	146.4	142.4	144.1	138.4	133.6	
Bristol	142.0	141.0	144.0	143.0	141.1	
Cambridge	140.7	133.1	130.1	130.5	132.9	
Dee Valley	138.3	135.5	132.9	130.4	134.9	
Essex & Suffolk	153.0	147.4	151.9	151.0	150.7	
Hartlepool	123.7	123.1	124.7	119.9	127.5	
Portsmouth	160.0	149.0	148.0	145.5	143.3	
South East	167.2	159.4	155.6	148.2	161.2	
South Staffs	135.6	127.6	131.0	129.0	128.9	
Sutton & East Surrey	168.6	161.5	166.5	161.1	157.9	
* Anglian includes Hartlepool						

Over the past five years, there has been a downward trend in the amount of water that households are using each day, although fluctuations can be seen throughout the years. However, in 2015-16, there was a slight increase in the amount of water that customers use each day. Only four companies have met the UK Government's aspirational target of 130 litres per person, per day.

Scotland

In Scotland, before 2006 there were limited forms of control on abstraction and impoundment. Ministers were able to make Water Orders to give powers to water authorities to abstract water for public water supply. Since April 2006, the Water Environment (Controlled Activities) (Scotland) Regulations have taken effect and abstractions and impoundments for water supply now require authorisation by SEPA. It is a condition of authorisation that water should be used efficiently.

Between 2002 and 2009, estimated raw water abstractions by Scottish Water decreased by 13% to 2,165 MI/d. Between 2010 and 2015, using improved data and methodology, the volume of raw water abstracted decreased by 12.6% to 1,831 MI/d. Operational use increased by 53 MI/d between 2002/03 and 2007/08 to a peak of 71 MI/d. It has since decreased by 14 MI/d to 57 MI/d in 2015/16. Reported domestic water consumption has increased by 13 % between 2002/03 and 2015/16, though it should be noted improved data and methodologies have been used in later years. Non-domestic water consumption has decreased by

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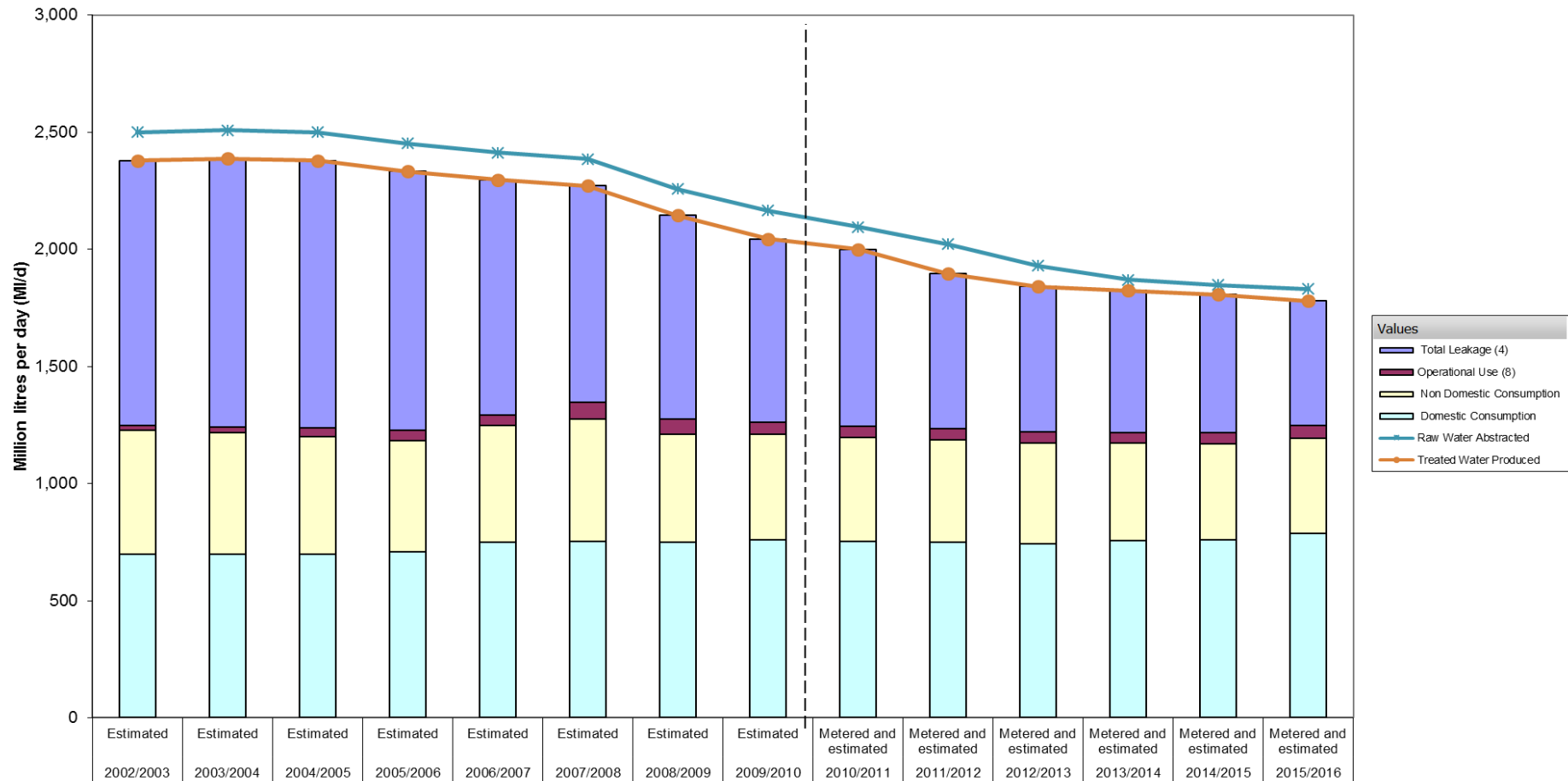
24% over the same period. When looking at all water consumption combined (operational use, domestic and non-domestic consumption), between 2002/03 and 2015/16 it has remained almost constant.²⁰¹

Water usage statistics for Scotland from 2002/03 to 2015/16 are set out in **Figure 6.3**. Most noticeable is the 53% decline in total leakage in this period. Raw water abstracted, treated water produced and nondomestic consumption have all also declined in the long term. Domestic water consumption has increased by 13% over that time, with 4% of that increase between 2014/15 and 2015/16.

²⁰¹ Scottish Government (2016) *Public Water Supplies – Water abstracted and supplied*. Available online at: <http://www.gov.scot/seso/Datasets.aspx?TID=5>

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Figure 6.3 Public Water Supplies – Water abstracted and supplied (Ml/d): 2002/03 to 2015/16



Source: Scottish Water

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Wales

Wales has relatively high rainfall compared to the rest of the UK, receiving on average 1400mm per year. However, this hides the geographical differences across the Welsh Water supply area. Across Anglesey, the borders of Wales and Herefordshire, rainfall is around 700 mm per year²⁰², whilst the mountainous areas of the Brecon Beacons and Snowdonia receive substantially more rainfall, with the latter typically receiving more than 3,000mm of rainfall per year²⁰³.

Rainfall patterns combined with sources of demand drive the nature of the water resource system operated by Welsh Water. Only 3 per cent of the rainfall in Wales is used for public water supply, which is very different to the rest of the UK where up to 50 per cent of rainfall is used to supply.

The number and type of water bodies in Wales is shown in **Table 6.3**.

Table 6.3 Number and Type of Water Bodies in Wales²⁰⁴

Water body category	Natural	Artificial	Heavily modified	Total
River*	863	28	110	1001
Lake	29	3	90	122
Coastal	18	n/a	6	24
Estuarine	17	n/a	14	31
Groundwater	38	n/a	n/a	38
Total	965	31	220	1216

* River water bodies includes canals and surface water transfers.

The availability of water in wales is shown in **Figure 6.4**.

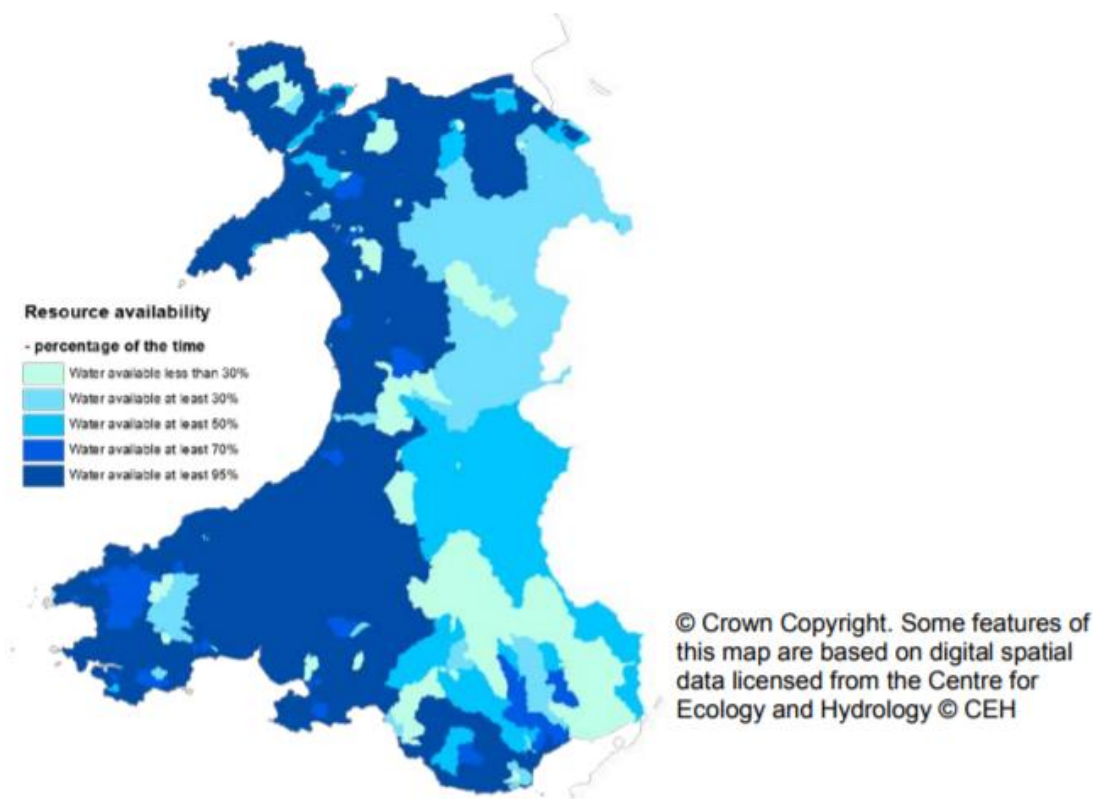
²⁰² Welsh Water. Final Water Resources Management Plan. Technical Report. April 2014. Available from: <http://www.welshwater.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx>

²⁰³ <http://www.metoffice.gov.uk/climate/uk/regional-climates/wl>

²⁰⁴ NRW (2015) River Basin Planning Progress Report for Wales 2009 – 2015. Available at <https://naturalresources.wales/media/674595/progress-report-for-wales-2009-2015-final.pdf>

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Figure 6.4 Water resource availability in Wales in 2014 (percentage of time)



Source: Natural Resources Wales

Water is abstracted from water bodies for many purposes, including public water supply in Wales and England, agriculture, industry and electricity generation. In Wales, most of the water licensed for abstraction is from surface water rather than groundwater, with electricity generation being the sector abstracting the most (82 per cent), followed by public water supply (13 per cent), other industry (0.03 per cent), fish farming and amenity ponds (0.01 per cent). Spray irrigation, other agriculture and private water supplies account for a very low percentage of the total water abstracted²⁰⁵. About 60 per cent of water bodies in Wales can provide a reliable source of water for new abstractions for at least 95 per cent of the time. Approximately 10 per cent of water bodies in Wales can only provide water for new abstractions 30 per cent or less of the time (less than 100 days a year)²⁰⁶.

Welsh Water manages its water supplies and demands across 24 water resource zones (WRZs). Welsh Water delivers some 850 million litres of drinking water per day to more than 3 million people living in Wales and some adjoining parts of England²⁰⁷. Approximately 98 per cent of the water Welsh Water abstracts is

²⁰⁵ Environment Agency (2011) *Case for change – current and future water availability*. Available online at <http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/research/planning/135501.aspx>

²⁰⁶ Environment Agency & NRW (2013) *Current and future water availability – addendum: A refresh of the Case for Change analysis, December 2013*. Available at: <http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/research/planning/135501.aspx>

²⁰⁷ Welsh Water. *Final Water Resources Management Plan. Technical Report. April 2014*. Available online at: <http://www.welshwater.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx>

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taken from rivers and reservoirs, the majority of which is drawn from a total 65 impounding reservoirs. In response to weather, water supply and environmental needs 20 of these reservoirs feed water into five major rivers

- ▶ Rivers Wye and Usk in South East Wales;
- ▶ Rivers Tywi and Eastern Cleddau in South West Wales; and
- ▶ the River Dee in North Wales²⁰⁸

River abstractions are most prevalent in Tywyn Aberdyfi, Llyswen, Hereford CU, Whitbourne, Ross on Wye, and Monmouth zones. Reservoir supplies dominate the rest of Welsh Water's company area. The remaining 2 per cent of water is drawn from the ground through springs, wells and boreholes. There are groundwater sources in the Pilleth, Brecon/Portis, Clwyd Coastal, and Vowchurch zones.

Some of the water used to supply densely populated areas is taken from water bodies in statutory designated protected areas. Changes to hydraulic conditions are identified as having an impact or likely to have an impact on 45 of 112 (40%) Natura 2000 protected sites. Reduced flows caused by abstraction present risks to migratory fish and wider biodiversity. Water Framework Directive (WFD) investigations have identified 29 (3%) water bodies that have failed to meet objectives because of changes to flows and water levels²⁰⁹.

6.3 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for water quality have been identified:

- ▶ There is considerable existing pressure on water resources in many parts of the UK.
- ▶ Demand for water is expected to increase from an increasing population alongside industrial, agricultural and commercial pressures.
- ▶ Climate change is expected to have significant impacts on the water environment. Areas where the underlying geology is generally impermeable are expected to be particularly affected as river flows would be likely to fall to low levels in drier periods and quickly react to rainfall episodes.
- ▶ There are legislative requirements to reduce abstraction.
- ▶ There is a need to ensure that there is sufficient water infrastructure in place to accommodate future growth in the UK.

²⁰⁸ Welsh Water. Final Water Resources Management Plan. Technical Report. April 2014. Available online at: <http://www.welshwater.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx>

²⁰⁹ Natural Resources Wales (2016) *The State of Natural Resources Report (SoNaRR): Assessment of the Sustainable Management of Natural Resources*. Available online at: <https://naturalresources.wales/media/681127/chapter-3-state-and-trends-final-for-publication.pdf>

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6.4 Likely Evolution of the Baseline

UK

The UK Climate Change Risk Assessment²¹⁰ indicates that rainfall patterns will become increasingly seasonal, with lower amounts of flow in the summer. This will lead to lower summer river flows, especially in those catchments with a low groundwater component. This could lead to increased abstraction pressure and increased stress on sensitive hydrological systems. Population pressures are predicted to increase in certain parts of Great Britain, for example in the South East²¹¹. Increased population density will result in an increased pressure on natural resources and could exacerbate current problems or cause new ones. Economic growth could also lead to increased commercial, industrial and agricultural pressure on water resources²¹².

It is anticipated that climate change will affect river flows, and in turn the availability of water, in the following ways:

- ▶ increases in average winter flows;
- ▶ reduced summer flows;
- ▶ reduced spring flows;
- ▶ no clear pattern in autumn flows; and
- ▶ increases in the magnitude of flood events.

These projected changes imply that both high and low flows are likely to be significantly modified throughout the UK. In particular, the reduced summer flows along with an increased demand for water, including water for agriculture, is expected to lead to reduced water availability over the summer months. It is also considered that the UK will experience longer, more acute droughts with areas such as the south and east of England expected to face droughts more severe than those previously experienced²¹³.

²¹⁰ UK CCC ASC. UK Climate Change Risk Assessment 2017: CCRA2 Evidence Report. 2016.
<https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/>

²¹¹ ONS (2016) Subnational Population Projections for Local Authorities in England: Table 2.
<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/localauthoritiesinenglandtable2>

²¹² Anglian Water, United Utilities and Yorkshire Water. *Water 2020 – Long term challenges and uncertainties for the water sector of the future*. Available online at:
http://www.anglianwater.co.uk/_assets/media/Water_2020_LT_Challenges_-_Final.pdf

²¹³ Water UK (2016) *Water resources long term planning framework (2015-2065)*. Available online at:
<http://www.preventionweb.net/publications/view/50354>

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England and Wales

In 2013, the Environment Agency²¹⁴ modelled four potential future demand scenarios for England and Wales based on differing assumed patterns of behaviour. Under all four scenarios the water exploitation index²¹⁵ showed how for all parts of England and Wales, demand for water was expected to increase in all four scenarios. The lowest increase in pressure was in Wales, which ranged from a 2.4% to a 3.6% increase. The highest increase was in the south east and east midlands areas of England, which ranged from a 22.7% to 35.9% increase.

The level of stress was identified for each water company area as shown in **Table 6.4**.

Table 6.4 Water company stress classification showing how the current future and future scenarios have been combined.

Water Company Area	2013 Classification					Final Stress
	Current Stress	Future Scenario 1	Future Scenario 2	Future Scenario 3	Future Scenario 4	
Affinity Water (formerly Veolia Water Central)	S	S	S	S	S	Serious
Affinity Water (formerly Veolia Water East)	S	S	S	S	S	Serious
Affinity Water (formerly Veolia Water South East)	S	S	S	S	S	Serious
Anglian Water	S	S	S	S	S	Serious
Bristol Water	M	M	M	M	M	Not Serious
Cambridge Water	M	M	M	M	M	Not Serious
Cholderton & District Water	M	M	M	M	M	Not Serious
Dee Valley Water	M	M	M	M	M	Not Serious
Dwr Cymru Welsh Water	M	M	M	M	M	Not Serious
Essex & Suffolk Water	S	S	S	S	S	Serious
Northumbrian Water	M	M	M	M	M	Not Serious
Portsmouth Water	M	S	M	S	M	Not Serious
Sembcorp Bournemouth Water	L	M	M	M	L	Not Serious
Severn Trent Water	M	M	M	M	M	Not Serious
South East Water	S	S	S	S	S	Serious
South Staffordshire Water	M	M	M	M	M	Not Serious
South West Water	M	M	M	M	M	Not Serious
Southern Water	S	S	S	S	S	Serious
Sutton & East Surrey Water	S	S	S	S	S	Serious
Thames Water	S	S	S	S	S	Serious
United Utilities	M	M	M	M	M	Not Serious
Veolia Water Projects	M	M	M	M	M	Not Serious
Wessex Water	M	M	M	M	M	Not Serious
Yorkshire Water	M	M	M	M	M	Not Serious

Source: Environment Agency

In May 2016, PwC and Yorkshire Water²¹⁶ published a review of the water sector including six future scenarios that provide six different views of the overall direction for the water environment. Its conclusions

²¹⁴ Environment Agency (2013) *The case for change - current and future water availability*. Available online at: <http://webarchive.nationalarchives.gov.uk/20140328154328/http://cdn.environment-agency.gov.uk/geho1111bvep-e-e.pdf>

²¹⁵ The water exploitation index (WEI) in a country is the mean annual total demand for freshwater divided by the long-term average freshwater resources. It gives an indication of how the total water demand puts pressure on the water resource. It also identifies those countries that have high demand in relation to their resources and therefore are prone to suffer problems of water stress.

²¹⁶ PwC and Yorkshire Water (2016) *The water and wastewater sectors*. Available online at:

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include that there is the potential for extending the life of water wholesale assets using a combination of digital technology, microbiology and nanotechnology as doing more with less will be important given the need to build resilience and achieve good ecological status. It also concludes that the upward pressure on customers' bills is likely to continue, with the bulk of the work to achieve good ecological status likely to fall within the third cycle of the Water Framework Directive (2021-2028). Companies will also need to improve resilience to climate change which is likely to involve strategic investment.

England

The Environment Agency's Catchment Abstraction Management Strategies (CAMS) have identified a number of catchments in England which are designated as Over-Licensed or Over-Abstracted. Climate change is likely to result in lower summer rainfalls and more frequent/severe winter flood events. Such changes are likely to increase pressure on summer freshwater water availability and increase pollutant run-off into controlled waters during flood events. Unsustainable groundwater and surface water abstraction may contribute to environmental damage of rivers and wetlands at 500 sites in England and Wales, important conservation sites, including sites of national and international conservation importance. However, it should be noted that the Environment Agency's approach to abstraction management and the restrictions placed on abstraction by the Water Framework Directive would both be expected to act in mitigation of these potential trends.

Defra's Creating a Space for Living²¹⁷ identifies that by the 2050s, summer temperatures are likely to increase while summer rainfall decreases, leading to increased risks of short-duration droughts. The population in England is forecast to grow by over 10 million people over the same period, with a large part of this growth occurring in areas where water is already scarce. While demand management will have an important role, significant new water resources will be needed to meet the needs of people, businesses and the environment. The changing climate and growing population are also putting pressure on the sewerage network. Population growth and new development increase the flows entering the network. More intense rainfall can overwhelm the wastewater system and cause sewer flooding and environmental pollution.

Water Resources Planning Guidance²¹⁸ sets out the Government's expectations for water companies, requiring their WRMPs to be aimed at providing secure, sustainable and affordable supplies of water to customers. This includes taking better account of the value of water by reflecting its scarcity and the environmental and social costs of abstraction in order to make the water sector's activities more sustainable. The Guidance identifies that leakage has fallen by 36% since 1994-95 and is expected to fall by a further 3% by 2015 and the guidance requires water companies to ensure that this downward trend continues.

This is further reinforced through the Guiding Principles for Water Resources Planning²¹⁹ which explains the key policy priorities the government expects water resources management plans (WRMP) to address. This includes thorough testing of vulnerability of water supply systems taking into account reasonably predictable

<https://www.yorkshirewater.com/sites/default/files/The%20Water%20and%20Wastewater%20Sectors%20-%20The%20Long%20View.pdf>

²¹⁷ Defra (2016) Creating a great place for living: enabling resilience in the water sector. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504681/resilience-water-sector.pdf

²¹⁸ Environment Agency, Ofwat, Defra and the Welsh Government (2012) *Water resources planning guidance: The guiding principles for developing a water resources management plan*. Available online at: <http://webarchive.nationalarchives.gov.uk/20130304134533/http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0612bwpd-e-e.pdf>

²¹⁹ Defra (2016) Guiding principles for water resources planning. Available online at: <https://corporate.thameswater.co.uk/About-us/Our-strategies-and-plans/Water-resources/Document-library/-/media/5586F2E64E994C8182897B097A292618.ashx?bc=White&db=web&la=en&thn=1&ts=cc20fdf6-3d41-4ebb-a3ea-e9e6de0382e1.pdf>

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events. Plans need to show that they have considered a broad range of options including options to manage plausible droughts more severe than the WRMP has been designed to cope with. The options chosen are required to show the environmental and social costs and benefits including carbon costing, the value of natural assets, and customer support, with evidence about preferences and willingness to pay.

Both of these water resource planning documents identify that where an increase in population or commercial use leads to increases in total demand, the company must ensure that its plan demonstrates a decrease in per capita consumption.

Scotland

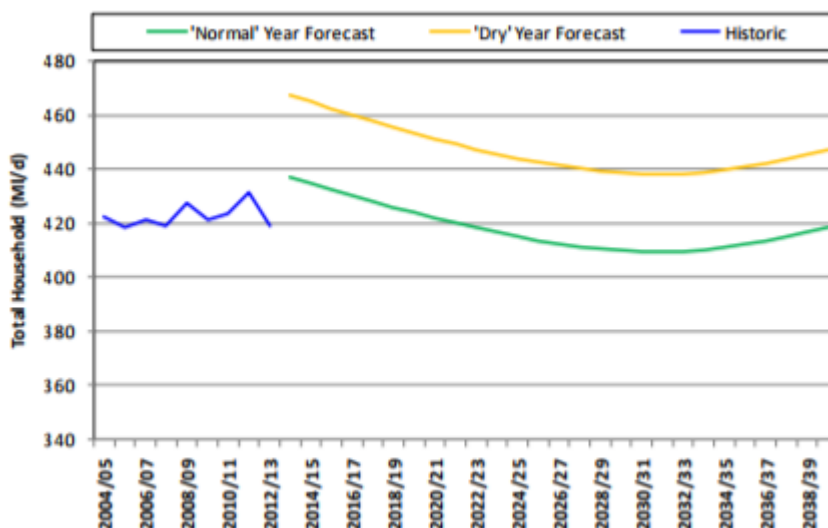
Climate change is likely to bring uncertainty and, with a projected decrease in summer rainfall, may exert pressure in areas that have not yet experienced water scarcity.

Climate change may also reduce the ability of the water environment to safely absorb and break down pollutants. In addition, the likelihood of reduced summer rainfall may mean less water for diluting pollutants. Conversely, expected higher annual river flows at some times of the year may help dilute pollutant discharges to rivers. Consequently, the quantity of pollutants reaching the sea without first having been broken down in rivers may increase. Groundwater is also a valuable resource in Scotland providing water to households and small businesses, and maintaining base river flows in summer months. Groundwater recharge is vulnerable to drier summer conditions²²⁰.

Wales

Figure 6.5 shows Welsh Water's²²¹ predicted future water demand scenarios.

Figure 6.5 Welsh Water Historic and Future Household Demand



²²⁰ Scottish Government (2013) *Climate Ready Scotland: Strategic Environmental Assessment*. Available online at: <http://www.gov.scot/Resource/0042/00426535.pdf>

²²¹ Welsh Water (2014) *Final water resources management plan: Technical report*. Available online at: <http://www.dwrcymru.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx>

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Population increase estimates are lower for Wales than for many other parts of the UK. However, the percentage of households metered across Wales is also lower than most other parts of the UK, save for the North East. Overall, household demand for water in Wales is expected to increase from approximately 2030.

Climate change is expected to have significant effects on river flows in Wales, with most major watercourses experiencing 10-15% increase in mean monthly winter flows and 50-80% decreases in summer flows. These predictions are generally more pronounced than in England, primarily due to the lack of groundwater storage capacity in Wales.

Climate change may affect groundwater recharge. By 2025 it is likely that groundwater recharge will decrease, resulting in decreased dry weather river flows and a general lowering of groundwater levels. This may have impacts on base-flow to rivers and wetlands in dry periods and affects small domestic and agricultural water supplies²²².

6.5 Assessing Significance

The objectives and guide questions related to water quality and resources which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 6.5**, together with reasons for their selection.

Table 6.5 Approach to Assessing the Effects of the Water Resources NPS Proposals on Water Quantity

Objective/Guide Question	Reasoning
Objective: To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.	The SEA Directive (2001/42/EC) requires that likely significant effects on water be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report. The Water Framework Directive (2000/60/EC) encourages the sustainable use of water resources. Demand for water is expected to increase from a growing population alongside industrial, agricultural and commercial pressures. There is growing pressure on water resources in parts of the UK, particularly the south east and east of England. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.
Will the Water Resources NPS affect river flows and groundwater levels?	Abstraction of water from non-tidal surface water and groundwater in England and Wales had fallen steadily from a peak in 2001 to 8.2 billion cubic metres in 2011. However, since 2011, total abstraction has increased by 14%. The results from the first cycle of Catchment Abstraction Management Strategies in 2008 showed that there is considerable pressure on water resources throughout England and Wales but in particular in the South East and East of England. Climate change is likely to result in lower summer rainfalls and more frequent/severe winter flood events. Such changes are likely to increase pressure on summer freshwater water availability and increase pollutant run-off into controlled waters during flood events. Unsustainable groundwater and surface water abstraction may contribute to environmental damage of rivers and wetlands.
Will the NPS reduce the impact of drought measures on the environment?	In times of drought the flow rates on rivers can be reduced to ensure sufficient water supply for human consumption, which can adversely affect the environment water quality and biodiversity.
Will the Water Resources NPS affect demand for water resources?	The Water Framework Directive (2000/60/EC) encourages the sustainable use of water resources. Government strategies including Water for people and the environment - Water resources strategy for England and Wales (2009) and Water for Life (2011) promote the sustainable use of water. Some parts of the UK have

²²² Natural Resources Wales (2016) *The State of Natural Resources Report (SoNaRR): Assessment of the Sustainable Management of Natural Resources*. Available online at: <https://naturalresources.wales/media/681127/chapter-3-state-and-trends-final-for-publication.pdf>

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Objective/Guide Question	Reasoning
	abstraction above a sustainable level which could result in water shortages in some areas in the future.
Will the Water Resources NPS ensure the sustainable and resilient supply of water resources?	The Water Framework Directive (2000/60/EC) encourages the sustainable use of water resources. The Environment Agency's 2011 'Case for Change' considered the implications of climate change for water supplies regionally and nationally and concluded that while demand management will have an important role, significant new water resources will be needed to meet future needs. Water UK's 2016 'Water resources long term planning framework (2015-2065)' noted the importance of strategic schemes to provide future resilience. The Government confirmed in its 'Consultation on the Government's Strategic Priorities for Ofwat: Affordable, Resilient Water Supplies' (2017) that a strategic objective for Ofwat is to further a reduction in the long-term risk to water supply resilience from drought and other factors, through a range of measures including new supply solutions.

Table 6.6 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the population objective.

Table 6.6 Illustrative Guidance for the Assessment of Significance for Water Quantity

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would lead to a major increase in water supply/availability such that the risk of water shortages in an area is significantly decreased and abstraction is at a sustainable level in the long term; Option would lead to a major reduction in water use compared to prior to development such that the risk of water shortages in an area is significantly decreased and abstraction is at a sustainable level in the long term; Option would lead to a major reduction in the risk and/or severity of droughts.
+	Positive	<ul style="list-style-type: none"> Option would lead to a minor increase in water supply/availability such that the risk of water shortages in an area is decreased and abstraction is at a sustainable level in the long term; Option would lead to a minor reduction in water use compared to prior to development such that the risk of water shortages in an area is decreased in the short term and abstraction is closer to sustainable levels than prior to development; Option would lead to a minor reduction in the risk and/or severity of droughts.
0	Neutral	<ul style="list-style-type: none"> Option would not significantly affect water demand and abstraction levels would not be altered;
-	Negative	<ul style="list-style-type: none"> Option would lead to a minor reduction in water supply/availability such that the risk of water shortages in an area is increased; Option would lead to a minor increase in water use compared to prior to development such that the risk of water shortages in an area is increased to some level in the short term, particularly in periods of low flow, and abstraction is considered beyond sustainable levels; Option would lead to a minor increase in the risk and/or severity of droughts.
--	Significant Negative	<ul style="list-style-type: none"> Option would lead to a major reduction in water supply/availability such that the risk of water shortages in an area is significantly increased and abstraction is not at a sustainable level in the long term; Option would lead to major increases in water use compared to prior to development such that the risk of water shortages in an area is significantly increased and abstraction is significantly beyond sustainable levels; Option would lead to an exceedance of an abstraction license limit;

Water Quantity

Effect	Description	Illustrative Guidance
?	Uncertain	<ul style="list-style-type: none">Option would lead to a major increase in the risk and/or severity of droughts.From the level of information available, the effect that the option would have on this objective is uncertain.

Flood Risk and Coastal Change

7. Flood Risk and Coastal Change

7.1 Introduction

This section presents the overview of plans and programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources Infrastructure and reasonable alternatives in respect of flood risk and coastal change.

Flood risk within this context is defined as the risk of coastal, river, surface water, sewer and groundwater flooding. Coastal change in this context has been defined narrowly to include coastal processes coastal erosion.

There are links between flood risk and coastal change and a number of other Appraisal of Sustainability (AoS) topics, in particular water quality, water quantity and climatic factors.

7.2 Review of Plans and Programmes

A significant proportion of the UK population is at risk of flooding, with the level of risk ranging from minor through to potentially life threatening. As such, there is a well established policy framework to identify, quantify, assess, avoid, minimise and mitigate flood risk in the UK. Key to the protection of people, homes and communities is the consideration of the long-term effects of climate change in terms of how issues such as increased rainfall and sea level rise will be managed. Water resources infrastructure will also need to be designed to take into account flood risk, both in terms of the direct threat to infrastructure from flooding as well as ensuring that the infrastructure is appropriate given the anticipated increase in flood risk.

International/European

The **Floods Directive (2007/60/EC)** aims to provide a consistent approach to managing flood risk across Europe. The approach is based on a 6 year cycle of planning which includes the publication of Preliminary Flood Risk Assessments, hazard and risk maps and flood risk management plans. The Directive is transposed into English law by the **Flood Risk Regulations 2009** (SI 2009/3042).

The Floods Directive is linked to the **Water Framework Directive (WFD) (2000/60/EC)** and requires flood risk appraisals to be produced at a River Basin District scale and working with the timing of the WFD River Basin Planning cycles.

The **Marine Strategy Framework Directive (2008/56/EC)** requires Member States to take the necessary measures to achieve or maintain good environmental status in the marine environment by 2020 at the latest through the development and implementation of marine strategies.

UK

The **Flood and Water Management Act 2010** contains provisions for regional working and co-operation such as the establishment of regional flood and coastal committees and the bringing together of lead local flood authorities, who will have a duty to cooperate, to develop local strategies for managing local flood risk. In addition, the **Flood Risk Regulations 2009** (SI 2009/3042) impose a duty on the Environment Agency and lead local flood authorities to take steps to identify and prepare for significant flood risk.

The **Climate Change Act 2008** also imposes a duty on the UK Government to compile every five years an assessment of the risks and opportunities arising for the UK from climate change, including in relation to flood and coastal erosion risks. The UK Committee on Climate Change Adaptation Sub-committee ('the UK

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CCC ASC') is responsible for preparing these climate change risk assessments, the latest of which, the second UK Climate Change Risk Assessment (CCRA2) Evidence Report, was published in July 2016²²³.

As set out in **Section 5, Shoreline Management Plans (SMPs)** assess the risks to people, development and the natural and historic environment from coastal processes.

The **Marine and Coastal Access Act 2009** provides the legal mechanism to help ensure clean, healthy, safe, productive and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment. The Act comprises several key elements or parts. In relation to coastal processes (in the context of this report), three elements are particularly pertinent. First, the Act allows for the creation of a Marine Management Organisation (MMO) to deliver marine functions in the waters around England and in the UK offshore area (for matters that are not devolved), including the preparation of marine plans. Second, the Act creates a new UK-wide strategic marine planning system to enable more strategic and effective management of seas. Third, the Act makes changes to the marine licensing system that will result in more consistent licensing decisions for marine works and activities.

The Marine Strategy Framework Directive has been transposed into UK law through the **Marine Strategy Regulations 2010** (SI 2010/1627). It aims to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend.

The main objectives of the **Marine Policy Statement (2011)** prepared under the Marine and Coastal Access Act 2009 are to enable an appropriate and consistent approach to marine planning across UK waters, and to ensure the sustainable use of marine resources and strategic management of marine activities from renewable energy to nature conservation, fishing, recreation and tourism.

England

The Floods Directive is transposed into English law through the **Flood Risk Regulations 2009** (SI 2009/3042) which complement the Flood and Water Management Act 2010. Following this legislation, the 2011 Environment Agency **National Flood and Coastal Erosion Risk Management Strategy for England**²²⁴ seeks to ensure that flooding and coastal erosion risks are well-managed and co-ordinated, so that their impacts are minimised through better understanding of the risks, management of the likelihood, helping people to manage their own risk, preventing inappropriate development and improving flood prediction and post-flood recovery.

Section 171 of the **Housing and Planning Act 2016** requires the Secretary of State to carry out a review of planning legislation, government planning policy and local planning policies concerning sustainable drainage in relation to the development of land in England, and this is presently ongoing.

The MMO has identified 11 marine planning areas (MPAs) around England and is currently preparing marine plans for these areas, all of which are scheduled to be in place by 2021 and thereafter reviewed every 3 years. The East Inshore and East Offshore marine plan areas were the first two areas where work commenced on their marine plans, with other areas now following.

To complement the National Flood and Coastal Erosion Risk Management Strategy for England, risks associated with coastal change are being addressed through **Shoreline Management Plans** which are being developed across England (and Wales), whilst information on the national risk from coast erosion has

²²³ UK CCC ASC (2016) *UK Climate Change Risk Assessment 2017: CCRA2 Evidence Report*. Available online at: <https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/>

²²⁴ Environment Agency (2011) *National flood and coastal erosion risk management strategy for England*. Available online at: <https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england>

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been collated. **Surface Water Management Plans** are being developed and revised across England (and Wales), with accompanying technical guidance²²⁵.

The **National Planning Policy Framework (Department for Communities and Local Government. 2012)** (at paragraph 100) seeks to avoid inappropriate development in areas at risk of flooding by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. Technical guidance published alongside the NPPF sets out how this policy should be implemented, including the Flood Risk and Coastal Change section of the **Planning Practice Guidance** and Defra's **Non-statutory technical standards for sustainable drainage systems**²²⁶. Local Plans should be supported by Strategic Flood Risk Assessments and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change. This includes applying a sequential test to steer new development to areas with the lowest probability of flooding. Local planning authorities are also expected to set out the strategic priorities for their area in the Local Plan including strategic policies to deliver the provision of infrastructure for flood risk and coastal change management.

When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider appropriate development in areas at risk of flooding, informed by a site-specific flood risk assessment (NPPF paragraph 103). A site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

Flood defence consents under the **Land Drainage Act 1991** and the **Water Resources Act 1991** (and associated byelaws) will be required if any of the following apply:

- ▶ works in, over, under, or within the byelaw margin of main rivers, or likely to affect the integrity of tidal defences;
- ▶ raising ground levels in the floodplain beside a main river; and
- ▶ constructing or altering a culvert or structure to control the flow of the river (such as a weir) on any ordinary watercourse.

Scotland

The **Flood Risk Management (Scotland) Act 2009** includes a duty placed upon Scottish Ministers, the SEPA, local authorities, Scottish Water and other responsible authorities to exercise their functions with a view to managing and reducing flood risk and to promote sustainable flood risk management. As a means of identifying the highest risk areas, **Surface Water Management Plans** are being developed across the country, based on accompanying technical guidance²²⁷.

²²⁵ Defra (2010) *Surface Water Management Plan Technical Guidance*. Available online at: <https://www.gov.uk/government/publications/surface-water-management-plan-technical-guidance>

²²⁶ Defra (2015) *Non-statutory technical standards for sustainable drainage systems*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

²²⁷ Scottish Government (2013) *Surface Water Management Planning Guidance*. Available online at: <http://www.scotland.gov.uk/Publications/2013/02/7909> and The Scottish Government (2015) *Online Planning Advice on Flood Risk*. Available online at:

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The **Climate Change (Scotland) Act 2009** requires the Scottish Ministers to lay a Climate Change Adaptation Programme before the Scottish Parliament after the UK Secretary of State publishes a climate change risk assessment report, as required by the Climate Change Act 2008. The first **Climate Ready Scotland: Scottish Climate Change Adaptation Programme**, which included consideration of climate related flood risks, was published in March 2014 and another will follow once the second UK Climate Change Risk Assessment (CCRA2) is finalised in 2017

Flood Risk Management Strategies for Scotland are currently being prepared for 14 local plan districts. Once adopted, the Strategies will set out the most sustainable combination of actions to address flooding in the areas at greatest risk, where the benefits of intervention can have the greatest impact. Taken together, the 14 Flood Risk Management Strategies will provide a national plan for Scotland.

Scotland's **National Marine Plan (2015)**²²⁸ has been adopted by the Scottish Government and is a single framework to enable the sustainable development of Scotland's marine area in a way which will protect and enhance the marine environment, whilst ensuring the sustainable growth of both existing and emerging marine industries.

The key aims of the **Scottish Planning Policy (SPP) (2014)** in relation to flooding are:

- ▶ to prevent developments which would be at significant risk of being affected by flooding;
- ▶ to prevent developments which would increase the probability of flooding elsewhere; and
- ▶ to provide a basis for planning decision making related to flood risk (the SPP provides a risk framework which divides flood risk into three categories and outlines an appropriate planning response).

With regard to flood risk, the SPP (2014) states that developers and planning authorities should take a precautionary approach in making decisions when flood risk is an issue and that development should not take place on land that could otherwise contribute to managing flood risk, for instance through managed coastal realignment, washland creation or as part of a scheme to manage flood risk. With respect to coastal issues, SPP states that planning authorities should take the likely effect of proposed development on the marine environment into account when making decisions on planning applications. The SPP also notes that the risks associated with rising sea levels and coastal flooding should be taken into account when identifying areas that are suitable for development.

Wales

Chapter 13: Minimising and managing environmental risks and pollution of **Planning Policy Wales (Edition 9) (2016)** sets out the policies of the Welsh Government regarding flood risk and climate change. Flood risk, whether inland or from the sea, is a material consideration in land use planning. The Welsh Government's objective in relation to flood risk management is to move towards positive avoidance of development in areas defined as being of flood hazard.

In support of Planning Policy Wales, **TAN 14: Coastal planning (1998)** and **TAN 15: Development and flood risk (2004)** provide detailed planning advice on their respective subjects. TAN 14 provides advice on planning the coastal zone, recreation, heritage coasts and non-statutory coastal groupings and shoreline management plans. TAN 15 provides advice on development advice maps, nature of development or land use, justifying the location of built development, assessing flooding consequences, surface water run-off from new development, action through development plans and development control.

<http://www.gov.scot/Topics/Built-Environment/planning/Policy/Subject-Policies/natural-resilient-place/Flood-Drainage/Floodrisk-advice>

²²⁸ Scottish Government (2015) *Scotland's National Marine Plan*. Available online at: <http://www.gov.scot/Resource/0047/00475466.pdf>

Flood Risk and Coastal Change

The **Environment (Wales) Act 2016** establishes a Flood and Coastal Erosion Committee and contains a range of other relevant provisions. This committee replaced the Flood Risk Management Wales (FRMW), which was established under section 22 of the Flood and Water Management Act 2010 to scrutinise the work and budget of Environment Agency Wales, now Natural Resources Wales (NRW). The establishment of this committee seeks to resolve dual accountability issues and to adopt a wider, advisory/consultative role than solely the scrutiny role previously undertaken by FRMW. In doing so the new committee is responsible for providing advice to the Welsh Ministers on a wider range of flood and coastal erosion issues from various bodies, not just to NRW.

7.3 Overview of the Baseline

UK

Flooding is associated with a range of sources: river, coastal, surface water, sewer, groundwater and reservoir²²⁹.

Coastal erosion is occurring along 17% of the UK coastline²³⁰. Sea levels are rising, and are greater in the south of the UK than the north. The global-average sea level rose during the 20th century at an average rate of 1-2 mm/year, with some consensus on the larger value by the research community. The rate was larger (approximately 3mm/year) during the 1990s. UK sea level records are consistent with these values but with smaller trends observed in Scotland (where the land is uplifting) than in the south of the UK²³¹.

England

Approximately 2.4 million properties in England are currently at risk from flooding from rivers and the sea, of which approximately 155,000 residential properties are within high flood risk areas, and around 3 million properties are at risk from surface water flooding, including approximately 215,000 residential properties within high flood risk areas. The total area of agricultural land at risk of flooding is around 12% (1.3 million ha) whilst 122,000 and 290,000 properties are located within areas at risk of groundwater flooding (not including properties also in areas at risk of flooding from rivers and the sea)²³².

Regionally, Greater London has the highest number of people at risk from flooding, with around 542,000 properties and one million people located in the floodplain. However, although London does have the largest number of people at risk, 84% are in areas with a low chance of flooding. This is mainly due to the major flood defences and flood defence structures in the Thames Estuary, including the Thames Barrier. The City of Kingston-upon-Hull and East Riding in Yorkshire are the two local authorities with the highest number of properties with a chance of flooding. However, other local authorities, such as Boston and North Somerset,

²²⁹ Environment Agency. Sources of flooding. Available online at:

<http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/homeandleisure/floods/31652.aspx>

²³⁰ Marine Climate Change Impacts Partnerships. *Impacts of climate change on coastal erosion*. Available online at:

<http://www.mccip.org.uk/annual-report-card/2013/climate-of-the-marine-environment/coastal-erosion/>

²³¹ Marine Climate Change Impacts Partnerships, sea level. Available online at:

<http://www.mccip.org.uk/media/1301/mccip-arc2013.pdf>

²³² Environment Agency (2016) *Adapting to a changing climate: The Environment Agency's second adaptation report under the Climate Change Act*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/526000/climate-adrep-environment-agency.pdf and

Environment Agency (2015) *Managing flood and coastal erosion risks in England: 1 April 2014 to 31 March 2015*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447646/LIT_10125_FCERM_Annual_Report_2014_to_2015.pdf

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have a higher share of properties in areas of significant flood risk. For instance, Boston has about two-thirds of its properties in areas with a significant chance of flooding²³³.

Coastal erosion is occurring along 30% of England's coastline²³⁴ and current estimates suggest that around 740 properties in England are vulnerable to coastal erosion by around 2030, with a further 1,500 vulnerable by around 2060²³⁵. Of the regions in England, Yorkshire and Humber has the greatest proportion of coastal length which is eroding at 56% (203km). Coastal erosion is occurring along 30% to 32% of the south east, and south west coastlines whilst 27% and 18% of the north east and north west coastlines respectively are eroding. The east midlands has the smallest proportion of coastal length which is eroding at 9% or 21km²³⁶.

Scotland

In Scotland, SEPA has mapped a strategic national overview of flood risk in Scotland from rivers and the sea²³⁷. Around 1 in 22 of all residential properties and 1 in 13 non-residential properties is at medium risk of flooding from all sources (i.e. areas where the risk of flooding is greater than a 1 in 200 annual probability)²³⁸. The fourteen approved Flood Risk Management Strategies identify 'Potentially Vulnerable Areas' across Scotland and characterise flood risk within these²³⁹. Coastal erosion is occurring along 12% of Scotland's coastline²⁴⁰.

Wales

As at March 2014 there were 208,000 properties shown to be at risk from river and / or sea flooding in Wales, 61,000 being at high or medium risk (greater than a 1% chance every year). 163,000 properties were at risk of surface water flooding, with 43,000 being at high or medium risk²⁴¹.

²³³ Environment Agency (2009) *Flooding in England: A National Assessment of Flood Risk*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292928/geho0609bqds-e-e.pdf

²³⁴ Marine Climate Change Impacts Partnerships (2015) *Coastal erosion and coastal geomorphology*. Available online at: <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/coastal-erosion.aspx>

²³⁵ Environment Agency (2016) *Adapting to a changing climate: The Environment Agency's second adaptation report under the Climate Change Act*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/526000/climate-adrep-environment-agency.pdf

²³⁶ Marine Climate Change Impacts Partnerships. *Impacts of climate change on coastal erosion*. Available online at: <http://www.mccip.org.uk/annual-report-card/2013/climate-of-the-marine-environment/coastal-erosion/>

²³⁷ Scottish Environment Protection Agency (2015) *Flood Maps*. Available online at: <http://map.sepa.org.uk/floodmap/map.htm>

²³⁸ SEPA (2015) *Strategic Environmental Assessment: Flood Risk Management Strategies Environmental Report – consultation*. Available online at: http://www.sepa.org.uk/media/163415/sea_environmental_report.pdf

²³⁹ SEPA (2015) *Flood Risk Management Strategies*. Available online at: <http://apps.sepa.org.uk/FRMStrategies/>

²⁴⁰ Marine Climate Change Impacts Partnerships (2015) *Coastal erosion and coastal geomorphology*. Available online at: <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/coastal-erosion.aspx>

²⁴¹ Natural Resources Wales (2015) *Flood and Coastal Erosion Risk Management in Wales, 2011-2014*. Available online at: <http://naturalresources.wales/media/1039/flood-and-coastal-erosion-risk-management-in-wales-2011-2014.pdf>

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Across the local authorities in Wales, Cardiff has the highest numbers of properties at risk from flooding from rivers or the sea. However, many of these are at low risk (less than one in 200 chance in any given year), mainly because of the flood defence structures in place in Cardiff. Conwy has the largest number of properties at significant risk (greater than a 1 in 75 chance in any given year). This is largely because of the coastal flood risk. Coastal flooding is also the cause of the significant risk to property in Gwynedd and Newport²⁴². Coastal erosion is occurring along 23% of Wales' coastline²⁴³.

7.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for flood risk and coastal change have been identified:

- ▶ Significant proportions of the UK population are at risk from flooding, although the degree of risk varies.
- ▶ Sea levels are rising, with worst case scenarios of a 1.9m increase in sea level by 2100 (with up to 0.76m more likely). The south and east of England will experience the greatest effective increases, due to the effects of post-glacial rebalancing.
- ▶ Many coastal sites (especially in the south and east of the country) are already prone to erosion, due to their underlying geology, coupled with rising sea levels and increased storm intensity. Increasing development pressures on and around the coastal environment (often accompanied by coastal engineering projects such as sea defences) are conflicting with the need for their effective management in the face of climate change. Shoreline Management Plans (in England and Wales) are taking a long-term view of coastal change by identifying sustainable management approaches for up to the next 100 years.
- ▶ Flood risk presents a significant planning issue in the development of major infrastructure projects, both in terms of potential direct impacts on the project itself and indirect impacts associated with works (such as increased run-off).

7.5 Likely Evolution of the Baseline

UK

Climate change is likely to exacerbate erosion and flooding as a result of sea level rise together with a potential increase in the intensity, severity and frequency of storm events over the next 100 years. The most recent information for the UK from the UK Climate Impacts Programme (UKCIP) forecasts a range of relative sea level rise by the 2080s (relative to the 1961-1990 mean) of between 20 and 80cm in south-west England and 0 and 60cm in Scotland.

The scenarios in UKCIP 09 lead to several predictions relevant to flooding:

- ▶ Annual average precipitation across the UK may decrease by between 0% and 15% by the 2080s, depending on the scenario.
- ▶ The seasonal distribution of precipitation will change. Winters will become wetter and summers drier. The biggest relative changes will be in the south and east. Under the High

²⁴² Environment Agency Wales (2009) *Flooding in Wales: A National Assessment of Flood Risk*. Available online at: [http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/static/documents/Research/ENV0005_Flooding_in_Wales_ENGLISH_AW_LR\(1\).pdf](http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/static/documents/Research/ENV0005_Flooding_in_Wales_ENGLISH_AW_LR(1).pdf)

²⁴³ Marine Climate Change Impacts Partnerships (2015) *Coastal erosion and coastal geomorphology*. Available online at: <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/coastal-erosion.aspx>

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emissions scenario, winter precipitation in the south-east may increase by up to 30% by the 2080s.

- ▶ By the 2080s, the daily precipitation intensities that are experienced once every two years on average may become up to 20% heavier. The scenarios give no guidance on the effects of climate change on more extreme precipitation events.
- ▶ By the 2080s, depending on scenario, relative sea level may be between 2cm below and 58cm above the current level in western Scotland and between 26 and 86cm above the current level in south-east England.
- ▶ For some coastal locations, a water level that at present has a 2% annual probability of occurrence may have a 33% annual probability by the 2080s for Medium High emissions²⁴⁴.

UK Climate Change Risk Assessment 2017: Projections of future flood risk²⁴⁵, which was commissioned by the UK CCC ASC to inform the CCRA2 projected that the number of residential properties exposed to flooding more frequently than 1:75 years (on average) increases significantly; increasing from 860,000 today to 1.2 million (a 40% increase) by the 2080s under a 2°C increase in Global Mean Temperature (GMT), and to 1.7 million (a 93% increase) under 4°C. The area of Special Protection Areas, Special Areas of Conservation and Ramsar sites exposed to flooding more frequently than 1:75 (on average) increases by 25% and 44% for 2°C and 4°C respectively by the 2080s. The area of Best and Most Versatile (BMV) agricultural land at risk from flooding increases by 32% and 65% under these climate projections. Impacts on social infrastructure are similar to those seen for residential property. By the 2080s, for scenarios based on GMT increases of 2°C and 4°C respectively, the number of care homes located in the highest flood probability category increase by 48% and 140%; schools by 32% and 95%; emergency services sites by 36% and 100%; hospitals by 23% and 68%; and GPs surgeries by 46% and 140%, assuming current levels of adaptation are continued and no population growth.

England

The latest set of projected changes in climate for England comes from the 2009 UK Climate Projections. Under a medium emissions (A1B) scenario, regional summer mean temperatures are projected to increase by between 0.9 – 5.2°C by the 2050s compared to a 1961-1990 baseline.

Assuming no population growth and a continuation of current levels of adaptation, it is considered that by the 2050s the projected number of people at 1:75 or greater risk of flooding rises to around 1.7 million under a 2 degree scenario and 2.2 million for a 4 degree scenario. For the 2080s, the projections suggest 2 million people under a 2 degree scenario and 2.9 million people under a 4 degree scenario. Expected annual damage to residential properties is projected to rise by between 22 – 78% in the 2050s and 47 – 160% in the 2080s depending on climate scenario.

Given the depth limited nature of the wave conditions along much of the coast of England, sea level is the most significant factor affecting loading on coastal defences, with the total amount of coastline at risk increasing from an estimated 114km in the 2020s to 171km in the 2080s. Sea level rise for London is expected to increase by between 35 – 49.7cm by 2090 depending on the emissions scenario, compared to a 1990 baseline.

²⁴⁴ UK Climate projections. Maps and key findings. Available online at:

<http://ukclimateprojections.defra.gov.uk/21708#key>

²⁴⁵ Sayers, P.B; Horritt, M; Penning-Rowsell, E; McKenzie, A (2015) *Climate Change Risk Assessment 2017: Projections of future flood risk in the UK. Research undertaken by Sayers and Partners on behalf of the Committee on Climate Change*. Available online at:

<https://www.theccc.org.uk/wp-content/uploads/2015/10/CCRA-Future-Flooding-Main-Report-Final-06Oct2015.pdf.pdf>

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Around 480,000 ha of Best and Most Versatile (BMV) agricultural land is currently at a 1-in-75 or greater annual chance of flooding from rivers, surface water or the sea. This is projected to increase by 15% by the 2050s under a 2 degree centigrade rise in mean global temperatures and 41% under a 4 degree centigrade rise. Over 40,000 ha of agricultural land were inundated during the 2007 floods in England, causing damage estimated at £50 million. The floods and storm surge in 2013/14 caused an estimated £19 million of damage to agriculture.

Warmer, wetter winters and drier summers in the future could increase rates of soil weathering and increase soil erosion. This could in turn increase peak flows and hence fluvial and groundwater flood risk. This risk will be exacerbated where soils are degraded and compacted due to land management practices (medium magnitude/medium confidence)²⁴⁶.

The Environment Agency estimates that over 700 properties could be lost to coastal erosion by around 2030, and over 2000 could be lost by around 2060. These estimates take into account the interventions proposed in shoreline management plans (SMPs). Without the interventions, these figures could increase to about 5,000 properties by 2030 and about 28,000 by 2060²⁴⁷.

Scotland

As noted in **Section 6.2** above, **Flood Risk Management Strategies for Scotland** have been currently being prepared for 14 local plan districts, covering all of Scotland. These identify Potentially Vulnerable Areas where flood risks are greatest and set out the most sustainable combination of actions to address flooding in these areas. **Local Flood Risk Management Plans** have been developed in parallel and will provide additional local detail on the funding and delivery timetable for actions in six yearly periods, the first of which runs from 2016-2021²⁴⁸.

The **UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland**²⁴⁹ notes that some coastal communities especially in the Hebrides, areas of the Solway Firth, Firth of Clyde and the coastline from Moray to Fife (including Aberdeen) may be at risk from increased storminess and wave overtopping, however there are uncertainties over the scale and timing of these risks.

On average, coastal floods have occurred once or twice a year based with a seasonal peak in winter (especially in January or February). The North Atlantic Oscillation (NAO) (the difference in sea level atmospheric pressure between the Azores and Iceland) is a major driver for storms and coastal floods in the North Atlantic. Positive values of the NAO index are associated with higher incidence of coastal floods in Scotland. As it is likely that NAO will become more positive by 2080, the frequency of coastal flooding may also increase²⁵⁰.

²⁴⁶ UK CCC ASC (2017) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for England*. Available online at: <https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-England-National-Summary-1.pdf>

²⁴⁷ Environment Agency (2015) *Managing flood and coastal erosion risks in England: 1 April 2014 to 31 March 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447646/LIT_10125_FCERM_Annual_Report_2014_to_2015.pdf

²⁴⁸ SEPA (2015) *Flood Risk Management Strategies*. Available online at: <http://apps.sepa.org.uk/FRMStrategies/>

²⁴⁹ UK CCC ASC (2017) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Available online at: <https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Scotland-National-Summary.pdf>

²⁵⁰ SNIFFER (2008) <http://www.sniffer.org.uk/Webcontrol/Secure/ClientSpecific/ResourceManagement/UploadedFiles/FRM10%20final%20030908%20with%20security.pdf>

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Wales

Assuming no population growth and a continuation of current levels of adaptation, by the 2080s, the projections from the CCRA suggest 142,000 people under a 2 degree scenario and 209,000 people under a 4 degree scenario would be living in areas of Wales at a 1-in-75 or greater chance of flooding in any given year. Expected annual damage to residential properties in Wales is projected to rise by between 35 – 110% in the 2050s and 59 - 220% in the 2080s depending on climate scenario.

Some locations in Wales are known to be at risk from long-term changes to the coastline, such as the village of Fairbourne. Baseline rates of coastal erosion are between 30 and 100 metres per century. With sea-level rise, the rates could be 1.75 – 2.5 higher than the baseline due to strengthened wave action and other factors (equivalent to 52 – 250 metres per century). The Shoreline Management Plan for Fairbourne states that while the village's defences can and should be maintained for several decades (c. 40 years) in the long term the defences are unsustainable. The dominant factor in the case of Fairbourne is the rate of sea-level rise, about which there is much uncertainty²⁵¹.

7.6 Assessing Significance

The objectives and guide questions related to food risk and coastal change which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 7.1**, together with reasons for their selection.

Table 7.1 Approach to Assessing the Effects of the Water Resources NPS Proposals on Flood Risk and Coastal Change

Objective/Guide Question	Reasoning
Objective: To minimise the risks from coastal change and flooding to people, property and communities, taking into account the effects of climate change.	The SEA Directive (2001/42/EC) requires that the likely significant effects on the environment, which includes population, human health, climatic factors, material assets and their integration, should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report. Flood risk presents a significant planning issue in the development of major infrastructure projects, both in terms of potential direct impacts on the project itself and indirect impacts associated with works (such as increased run-off). The operation of water resources infrastructure (e.g. reservoirs) may provide an opportunity to address flood risk issues (for example, by providing extra space for flood water storage). The inclusion of this AoS objective ensures that these effects can be considered within the AoS.
Will the Water Resources NPS help to avoid development in areas of flood risk and, where possible, reduce flood risk?	Minimising flood risk is a key part of sustainable development and is reflected in relevant legislation (such as Flood Risk Regulations 2009 and the Flood and Water Management Act 2010). Environmental and planning policy seeks to ensure that new development does not exacerbate risks (e.g. paragraph 100 of the National Planning Policy Framework 2012).
Will the Water Resources NPS help to avoid development in areas affected by coastal erosion and not affect coastal processes and/or erosion rates?	Changes to coastal processes or erosion rate caused by development have a potential to negatively impact on the marine environment. The Marine Strategy Framework Directive (2008/56/EC) require member states to achieve or maintain good environmental status in the marine environment by 2020.

²⁵¹ UK CCC ASC (2017) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Wales*. Available online at: <https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Wales-National-Summary.pdf>

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Table 7.2 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the flood risk and coastal change objective.

Table 7.2 Illustrative Guidance for the Assessment of Significance for Flood Risk and Coastal Change

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would result in a significant decrease in people or property at risk of, or affected by, flooding, coastal inundation or sea level rise.
+	Positive	<ul style="list-style-type: none"> Option would result in a decrease in people or property at risk of, or affected by, flooding, coastal inundation or sea level rise.
0	Neutral	<ul style="list-style-type: none"> Option would not lead to an overall change in the number of people or property at risk of, or affected by, flooding, coastal inundation or sea level rise. Option would result in development being sited in Flood Zone 1 (or equivalent) areas.
-	Negative	<ul style="list-style-type: none"> Option would result in an increase in people or property at risk of, or affected by, flooding, coastal inundation or sea level rise. Option would result in development being sited in Flood Zone 2 (or equivalent) areas.
--	Negative	<ul style="list-style-type: none"> Option would result in a significant number of people or property affected by flooding, coastal inundation or sea level rise. Option would result in development being sited in Flood Zone 3 (or equivalent) areas.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

8. Air Quality

8.1 Introduction

This section presents the overview of plans and programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources and reasonable alternatives in respect of air quality.

Air quality within this context concerns the levels of pollutants emitted into the air and their significance, in terms of the risk of adverse effects on the environment and/or human health. Carbon dioxide (CO₂) and other greenhouse gas emissions are excluded from the air quality topic and are reported under the climate change topic.

There are links between the air quality topic and other topics in the Appraisal of Sustainability (AoS) including biodiversity and nature conservation, human health, climatic factors and traffic and transport.

8.2 Review of Plans and Programmes

Whilst not directly commenting on water infrastructure, the regulations provide the legislative context to ensure that risks to air quality, particularly to the construction phase of any infrastructure, are minimised.

Policies are also in place to manage the levels of certain atmospheric pollutants, such as sulphur dioxide and nitrogen dioxide, which when deposited into aquatic environments can result in acidification and nitrogen eutrophication.

International/European

The **Ambient Air Quality and Cleaner Air for Europe Directive (2008/50/EC)** consolidated earlier air quality directives and also defines and establishes objectives and targets for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment as a whole. It sets legally binding limits for concentrations in outdoor air of major air pollutants that impact on public health such as particulate matter (PM₁₀ and PM_{2.5}) and nitrogen dioxide (NO₂). The 2008 Directive replaced nearly all the previous EU air quality legislation and was implemented in England through the **Air Quality Standards Regulations 2010** (SI 2010/1001), which also incorporates the 4th air quality daughter **Directive 2004/107/EC** that set targets for levels in outdoor air of certain toxic heavy metals and polycyclic aromatic hydrocarbons. Equivalent regulations exist in Scotland (**The Air Quality Standards (Scotland) Regulations 2010** (SSI 2010/204) and Wales (**The Air Quality Standards (Wales) Regulations 2010** (WSI 2010/1433)).

Following a review of EU air quality policy, the EU published the **Clean Air Policy Package** in 2013 with new proposals on ambient air quality and emissions ceilings. The package included a new **Clean Air Programme for Europe (2013)**, which set out new air policy objectives for 2030 to reduce health impacts and eutrophication in ecosystems. The package will also involve revisions to the National Emissions Ceiling Directive.

The objectives of the Clean Air Programme have been enacted via **Directive 2016/2284/EU** on the reduction of national emissions of certain atmospheric pollutants, which entered into force on 31 December 2016. This Directive sets national reduction commitments for the five pollutants (sulphur dioxide, nitrogen oxides, volatile organic compounds, ammonia and fine particulate matter) responsible for acidification, eutrophication and ground-level ozone pollution which leads to significant negative impacts on human health and the

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environment. It repealed and replaced Directive 2001/81/EC, the National Emission Ceilings Directive (NEC Directive) from the date of its transposition (30 June 2018)²⁵².

The **Industrial Emissions Directive (IED) (2010/75/EU)** combines seven existing air pollution directives, including the Large Combustion Plant Directive and the Integrated Pollution Prevention and Control (IPPC) Directive. As with previous directives aimed at minimising emission release, part of the benefit of the IED is that it includes several new industrial processes, sets new minimum emission limit values (ELVs) for large combustion plant and addresses some of the implementation issues of the IPPC.

The UK monitors and models air quality to assess compliance with the air quality limit and target values set out in the EU legislation above. The results of the assessment are reported to the Commission on an annual basis. Air quality monitoring is also carried out by local authorities to meet local air quality management objectives.

UK

Air quality is a devolved matter, though the UK Government leads on international and European legislation. Part IV of the **Environment Act 1995** sets provisions for protecting air quality in the UK and for local air quality management. It requires local authorities to undertake local air quality management (LAQM) assessments against the standards and objectives prescribed in regulations. Where any of these objectives are not being achieved, local authorities must designate air quality management areas and prepare and implement remedial action plans to tackle the problem.

The **Air Quality Standards Regulations 2010** (SI 2010/1001) transposed into English law the requirements of Directives 2008/50/EC and 2004/107/EC on ambient air quality. Equivalent regulations have been made by the devolved administrations in Scotland (**The Air Quality Standards (Scotland) Regulations 2010** (SSI 2010/204) and Wales (**The Air Quality Standards (Wales) Regulations 2010** (WSI 2010/1433)). The objective of the Regulations is to improve air quality by reducing the impact of air pollution on human health and ecosystems. The standards set out air quality objectives, limit values and target values for pollutants, namely benzene, 1,3 butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide, PM₁₀, and PM_{2.5}.

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007) sets out a way forward for work and planning on air quality issues.

The **Ozone-Depleting Substances Regulations 2015** (SI 2015/168) introduces controls on the production, use and emissions from equipment of a large number of 'controlled substances' that deplete the ozone layer.

The **Environmental Permitting (England and Wales) Regulations 2010** (SI 2010/675) sets up a pollution control regime. The environmental regulator would specify conditions for environmental permits, for example limiting the type and quantity of emissions released to air.

The **Local Air Quality Management: Technical Guidance (TG 16) 2016** sets out the technical guidance and approach for local authorities to carry out their responsibilities under the Environment Act 1995, the Environment (Northern Ireland) Order 2002, and subsequent regulations. This includes their responsibility to monitor, assess and take action to improve local air quality including Air Quality Management Areas²⁵³.

In July 2017 the UK Government has published the **UK plan for tackling roadside nitrogen dioxide concentrations**. It sets out the UK Government's plan for bringing nitrogen dioxide air pollution within statutory limits in the shortest possible time as it is the only statutory air quality limit that the UK is currently

²⁵² <http://ec.europa.eu/environment/air/pollutants/ceilings.htm>

²⁵³ Defra (2016) Local Air Quality Management: Technical Guidance (TG 16)
<https://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf>

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failing to meet. This is important for water courses and soils as NO₂ contributes to acidification and eutrophication.

England

The **National Planning Policy Framework (Department for Communities and Local Government, 2012)** expects the planning system to prevent new development from contributing to unacceptable levels of air pollution. Planning policies and decisions are therefore expected to ensure that new development is appropriate for its location and take into account “*The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution*” (paragraph 120).

The Framework expects planning policies to “sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan” (paragraph 124). In doing so, local planning authorities are expected to focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes.

Planning Practice Guidance relating to Air Quality²⁵⁴ provides guiding principles on how planning can take account of the impact of new development on air quality. The guidance provides information a range of topics including why planning should be concerned about air quality, the role the local plan has in regards to air quality, what information is available about air quality and when air quality could be relevant to a planning decision.

Scotland

The purpose of the **Scottish Planning Policy (SPP) (2014)** is to set out national planning policies which reflect Scottish priorities for operation of the planning system and for the development and use of land. It highlights the important role that planning has in realising sustainable development and protecting natural heritage, including air. In addition to this, **Scotland's Third National Planning Framework (2014)** is the spatial expression of the Government Economic Strategy and Scottish plans for infrastructure investment. It notes that air quality can be improved through reducing the impact of transport on city and town centres and the significant health benefits this would bring.

The Scottish Executive's **Air Quality and Land Use Planning (2004)** guidance outlines some of the main ways in which land use planning can help deliver air quality objectives.

Cleaner Air for Scotland: The Road to a Healthier future (2015) is the national strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health and fulfil Scotland's legal responsibilities as soon as possible.

Delivering Cleaner Air for Scotland – Development Planning & Development Management (2017) presents guidance from Environmental Protection Scotland and the Royal Town Planning Institute Scotland the tailors the UK-wide approach to planning and air quality protection to be relevant for the Scottish planning system and associated air quality objectives.

²⁵⁴ <https://www.gov.uk/guidance/air-quality--3>

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Wales

The ***Air Quality Standards (Wales) Regulations 2010*** bring into law in Wales the limits set out in European Union (EU) Daughter Directives on Air Quality. The regulations require that Welsh Ministers divide Wales into air quality zones.

The ***Well-being of Future Generations (Wales) Act 2015*** requires public bodies including the Welsh Government to undertake sustainable development. At the national level, the Welsh government have published 46 national indicators for Wales, which includes 'Levels of nitrogen dioxide (NO₂) pollution in the air' (Indicator No. 4).

Planning Policy Wales (Edition 9) (2016) sets out the land use planning policies of the Welsh Government. Regarding air quality, Planning Policy Wales sets out potential material planning considerations in relation to: location and site selection; impact on health and amenity; the risk and impact of potential pollution from the development as well as the effect of the surrounding environment; the prevention of nuisance; and the impact on the road and other transport networks.

In June 2017 the Welsh Government published **Local Air Quality Management in Wales 2017** which provides policy guidance on the overall approach to local air quality management in Wales.

8.3 Overview of the Baseline

UK

The UK is compliant with its 2010 national emission ceilings for air pollutants. National emissions totals each year for the main pollutants are reported to the European Commission.

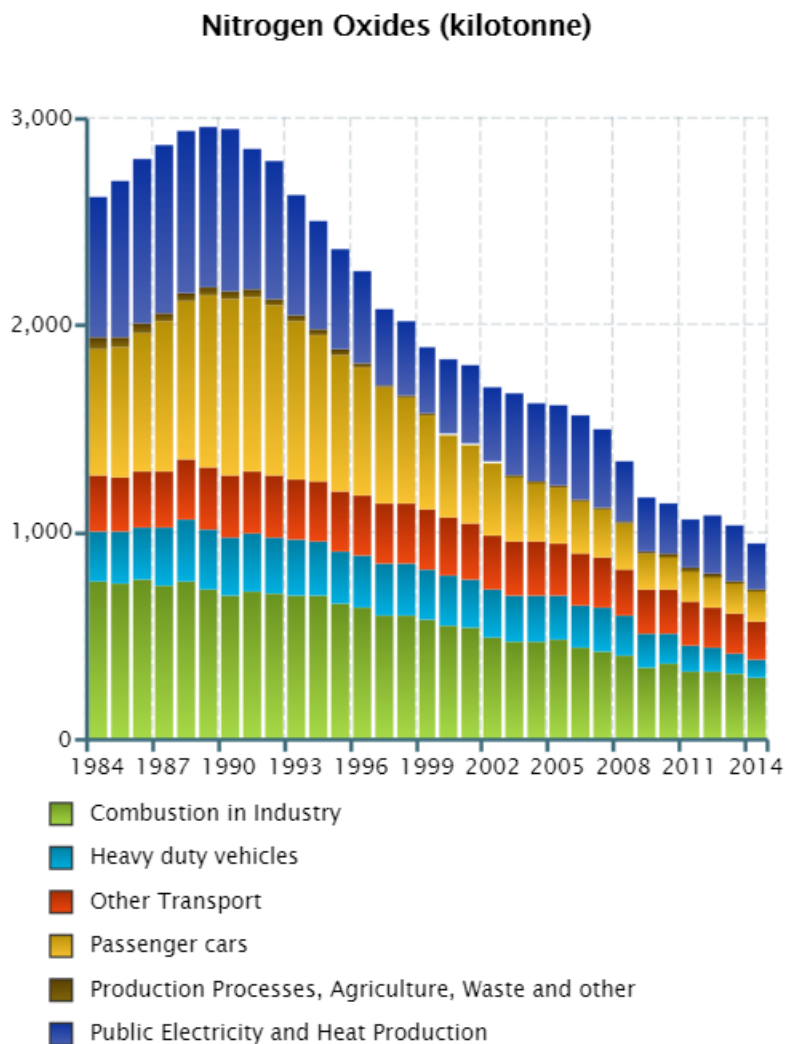
In 1990 UK emissions of Nitrogen Oxide (NO_x) (as NO₂) were 2.7 Mt. These have reduced to 1.1 Mt in 2011 and continued to reduce up to the latest 2014 data from the National Atmospheric Emissions Inventory²⁵⁵. This has largely been due to abatement measures for road transport and at coal-fired power stations. Sulphur dioxide (SO₂) emissions in the UK have reduced from 3.7 Mt in 1990 to 0.4 Mt in 2007. This is largely due to the decrease in the use of coal and use of increasingly effective abatement²⁵⁶.

²⁵⁵ National Atmospheric Emissions Inventory (2017) *About Nitrogen Oxides*. Available online at: http://naei.defra.gov.uk/overview/pollutants?pollutant_id=6

²⁵⁶ Defra - AQPI Summary Report: Emissions of Air Quality Pollutants – 1970-2011

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Figure 8.1 Estimated Annual UK Emissions of Nitrogen Oxides (kt)



Source: National Atmospheric Emissions Inventory

Urban background and roadside particulate pollution has shown long-term improvement however small increases in concentration are observed from 2015 to 2016 for roadside sites. There is some year-on-year variability with a long-term downward trend in urban background and roadside particulate pollution. For background sites the concentration of particulate pollution was similar in 2015 and 2016²⁵⁷.

In 2017, 254 Local Authorities in the UK had declared Air Quality Management Areas (AQMA), a designation made by a Local Authority where an assessment of air quality results in the need to devise an action plan to improve the quality of air²⁵⁸. AQMAs are predominantly in urban areas along busy and congested road networks and are generally related to nitrogen dioxide (NO₂) (in 93% of cases), with

²⁵⁷ Defra. National Statistics Release: Air quality statistics in the UK, 1987 to 2016. 2017.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/610927/Air_Quality_National_Statistic_apr17_FINAL.pdf

²⁵⁸ <https://uk-air.defra.gov.uk/aqma/maps>

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particulates (PM₁₀) featuring in 6% of cases and SO₂ in 1%. Transport is identified as the main source of pollution for the clear majority of all AQMA²⁵⁹.

The UK is divided into 43 zones for ambient air quality reporting. This includes 28 agglomeration zones and 15 non-agglomeration zones. In 2015, two zones had locations where the 1-hour limit value for NO₂ was exceeded on more than the permitted 18 occasions during 2015. They were the Greater London Urban Area (UK0001) and South Wales (UK0041). The remaining 41 zones and agglomerations complied with the 1-hour mean NO₂ limit value.

Six zones met the annual mean limit value for NO₂ in 2015:

- ▶ Brighton/Worthing/Littlehampton (UK0010);
- ▶ Blackpool Urban Area (UK0022);
- ▶ Preston Urban Area (UK0023);
- ▶ Highland (UK0039);
- ▶ Scottish Borders (UK0040);
- ▶ Northern Ireland (UK0043).

The remaining 37 zones had locations with measured or modelled annual mean NO₂ concentrations higher than the annual mean limit value (40 µg m⁻³).

England

As of 2017 there are 221 local authorities in England with Air Quality Management Areas (AQMA), 33 of which were within London²⁶⁰. As many Local Authorities have multiple AQMA, there are a total of 626 AQMA in England. Most AQMA in England (and the UK as a whole) are in urban areas and result from traffic emissions of nitrogen dioxide or PM₁₀. Emissions from transport (road and other types) are the main source in 97% of the AQMA declared for NO₂; only a few have been declared as a result of other sources, such as industrial or domestic emissions.

Scotland

As of 2017 there are 14 Local Authorities in Scotland with a declared AQMA²⁶¹. Air quality annual mean air quality trend data up to and including 2014 shows that with regards to NO₂ at urban background monitoring sites there is a decreasing trend year-on-year, albeit the decrease is relatively small. For traffic related monitoring sites there is a greater variation in trends, with four of the nine monitoring sites showing a downward trend, one site showing an upward trend and four sites showing no significant trend. As such it is considered that concentrations of this pollutant depend greatly on conditions at the various sites.

Urban background PM₁₀ concentrations were shown to be reducing at all four monitoring stations. PM₁₀ concentrations were also reducing at the urban traffic sites. Annual mean trends for PM_{2.5} vary between the 5 monitored sites, with two showing a clear upward trend, one showing a clear downward trend and two

²⁵⁹ Defra. Review of local air quality management. 2009.

<http://webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/environment/quality/air/airquality/local/document/s/lqgm-report.pdf>

²⁶⁰ <https://uk-air.defra.gov.uk/aqma/maps>

²⁶¹ Ibid

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showing no significant change. Rural concentrations of zone have shown a minor upward trend, with urban concentrations reducing²⁶².

Wales

Air quality in Wales continues to improve year on year and both emissions and ambient concentrations of key pollutants are decreasing, though annual average concentrations across the country have started to level out in recent years.

Urban air quality in Wales is generally worse than in rural areas. The main causes of pollution at urban sites are fine particles (PM₁₀) and ozone (O₃). The main cause of pollution in rural areas is the variation in ozone levels, which is affected by the weather. Four Welsh monitoring sites (Rhondda Mountain Ash, Caerphilly Hafodyrynys, Newport M4 Junction 25 and Swansea Station Court High Street) exceeded the annual mean objective of 40 µg m⁻³ for NO₂. Caerphilly Hafodyrynys and Rhondda Mountain Ash also exceeded the AQS Objective for hourly mean NO₂ concentration on more than the permitted 18 occasions in 2015. One site in Wales exceeded the AQS Objective for O₃ (100 µg m⁻³ as a maximum daily 8-hour mean) on more than the permitted 10 occasions. This was Pembroke Power Station²⁶³.

As of 2017, there are 10 Local Authorities with a declared AQMA²⁶⁴. There are 26,353 people living in AQMAs in Wales. This represents 0.9% of the total population of Wales.

8.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for air quality have been identified:

- ▶ Poor air quality is generally associated with urban/industrial areas and major road infrastructure. A relatively large number of AQMAs are located in urban areas, many of which have been designated due to high NO₂ and PM₁₀ levels.
- ▶ Historical emissions have resulted in high levels of sulphur and nitrogen deposits in wetter parts of the UK such as northern England and the Welsh uplands. This has resulted in acidification and nitrogen eutrophication in some areas. Around a third of the UK land area is sensitive to acid deposition and a third to eutrophication. By 2010, the percentage of sensitive habitat area where acid deposited exceeded critical load was 49%. Similarly, 68% of sensitive habitat area exceeded the critical load as a result of nitrogen²⁶⁵.

8.5 Likely Evolution of the Baseline

UK

Figure 8.2 identifies the trends in in UK sulphur dioxide, nitrogen oxides, non-methane volatile organic compounds, ammonia and particulate matter (PM₁₀, PM_{2.5}) emissions from 1970 to 2015.

²⁶² <http://www.scottishairquality.co.uk/data/trends>

²⁶³ Welsh Assembly Government & Welsh Air Quality Forum. Air pollution in Wales 2015. 2015 http://www.welshairquality.co.uk/documents/reports/507161019_AQ_wales_2015_v12_Press.pdf

²⁶⁴ Ibid

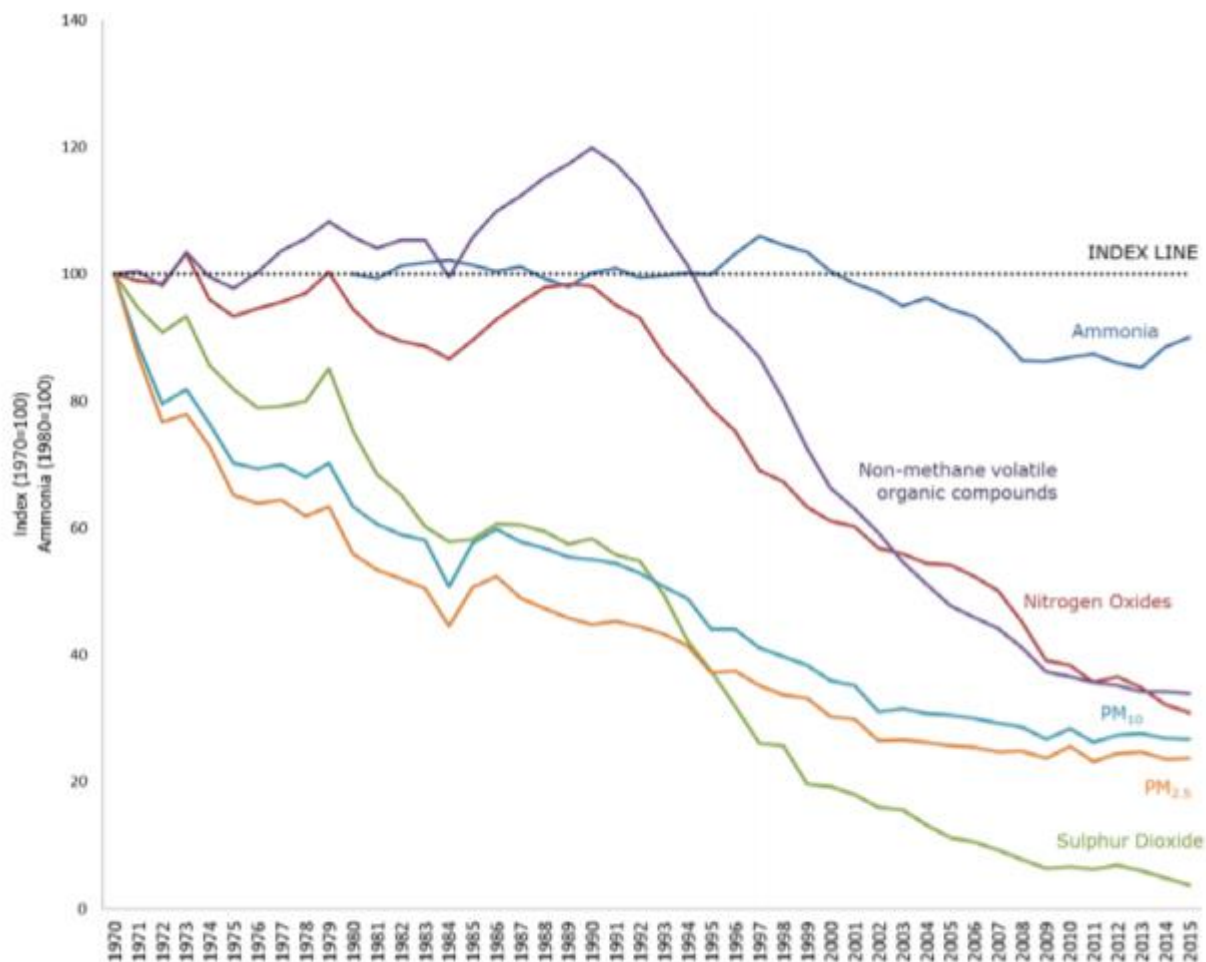
²⁶⁵ Joint Nature Conservation Committee. Air Pollution Bulletin. 2014 http://jncc.defra.gov.uk/pdf/Air_pollution_bulletin2_2014.pdf

Air Quality

In 2015, total emissions of NO_x were 919 kt, and since 1990, emissions have decreased by 69%. In 2015, total emissions of SO₂ were 236 kt, and since 1990, emissions have decreased by 94%. In 2015, total emissions of NMVOCs had decreased by 72%²⁶⁶ when compared to 1990 levels.

This is further evidenced by the NO_x modelling undertaken for roads directly managed by local authorities and Transport for London. This projected trend did not take into account the effects of the plans itself. The data shows all local authorities achieving the statutory limit for NO₂ by 2025, except for Greater London, which would take a further 3 years²⁶⁷.

Figure 8.2 UK air quality trend data.



The index line is a comparator that shows the level of emissions if they had remained constant from the beginning of the time series.

Source: Defra

²⁶⁶ Department for Business, Energy and Industrial Strategy (2017) *UK Greenhouse Gas Inventory, 1990 - 2015*
https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1705121352_ukghgi-90-15_Main_Issue2.pdf

²⁶⁷ Defra and the DfT (2017) *UK plan for tackling roadside nitrogen dioxide concentrations*. Available online at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf

Air Quality

Based on this trend data and in the context of increasingly restrictive legislation with regards to key sources of air pollution, such as from road transport and energy generation, it is reasonable to predict a continued improvement in air quality over time in accordance with the UK Informative Inventory Report (1990 to 2015)²⁶⁸.

England

PM₁₀ pollution overall has been decreasing in recent years and this is predicted to continue in the future. By 2015, 71.7km of main urban road is predicted to be in exceedance of 31.5µg/m³ (roughly equivalent to the Stage 1 PM₁₀ 24-hour limit value and objective), this is a 96.7% decrease compared to the 2003 baseline²⁶⁹.

Concentrations of NO₂ have been declining on average, although London Marylebone Road (the site with the highest NO₂ levels in England) and several other sites are showing increasing concentrations in the most recent years. Long-term trend data combined with increasingly restrictive emissions legislation for road transport would be expected to lead to an improvement in air quality in the long term.

Scotland

There is an improving trend in air pollution in Scotland in recent years. For instance²⁷⁰:

- ▶ Scotland's NO_x emissions have declined by 65% since 1990 and currently account for 9% of the UK total.
- ▶ Power generation is a very significant source of NO_x emissions, accounting for 27% of the Scotland total in 2012.
- ▶ Scotland's PM₁₀ emissions have declined by 59% since 1990 and account for 10% of the UK total.
- ▶ At 37%, emissions from commercial, domestic and agricultural combustion were the main source of PM₁₀ in 2012.
- ▶ Emissions from power generation account for 25% of total emissions in 1990 but have significantly reduced to 8% in 2012. This has been primarily attributed to the move from coal fired to gas energy generation, which has negligible particulate matter emissions.

Wales

In Wales (and the rest of the UK) the most widely exceeded limit value is for the annual mean NO₂ concentration (40 µg m⁻³). The mean for the long-running sites shows a slight decrease through the 2000s, although 2010 was a high year. Annual mean PM₁₀ concentrations have generally decreased in recent years, at both urban background and urban traffic sites. Ozone concentrations tended to be highest at rural locations, although there are no clear trends, concentrations vary considerably from year to year because of variation in metrological factors. Improvements in air quality are anticipated in the long term, mirroring trends elsewhere in the UK.

²⁶⁸ BEIS (2017) *UK Informative Inventory Report (1990 to 2015)*. Available online at: https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1703161205_GB_IIR_2017_Final_v1.0.pdf

²⁶⁹ Defra (2007). *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Volume 2*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69337/pb12670-air-quality-strategy-vol2-070712.pdf

²⁷⁰ Scottish Government. *Scottish Air Quality Database Annual Report 2014*. 2015. http://www.scottishairquality.co.uk/assets/documents/technical%20reports/SAQD_annual_report_2014_Issue_1.pdf

Air Quality

8.6 Assessing Significance

The objectives and guide questions related to air quality which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 8.1**, together with reasons for their selection.

Table 8.1 Approach to Assessing the Effects of the Water Resources NPS on Air Quality

Objective/Guide Question	Reasoning
Objective: To minimise emissions of pollutant gases and particulates and enhance air quality, helping to achieve the objectives of the Air Quality and Ambient Air Quality and Cleaner Air for Europe Directives.	<p>The SEA Directive (2001/42/EC) requires that likely significant effects on air quality be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>Increases in transport movements and works associated with the construction and operation of nationally significant water resources infrastructure could affect air quality, particularly in areas with existing air quality issues. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>
Will the Water Resources NPS affect air quality?	The Ambient Air Quality and Cleaner Air for Europe Directive (2008/50/EC) aims to avoid the harmful effects on human health and the environment from air pollution and includes objectives and targets for ambient air quality. This is transposed into UK law by Air Quality Standards Regulations 2010.
Will the Water Resources NPS create a nuisance for people or wildlife (for example, from dust or odours)?	Emissions to air may create dust or odours that have the potential to affect air quality or to be classed as a statutory nuisance (as under Environmental Protection Act 1990).

Table 8.2 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the air quality objective.

Table 8.2 Illustrative Guidance for the Assessment of Significance for Air Quality

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would significantly improve local air quality through a sustained reduction in concentrations of pollutants identified in national air quality objectives.
+	Positive	<ul style="list-style-type: none"> Option would lead to a minor improvement in local air quality from a reduction in concentrations of pollutants identified in national air quality objectives.
0	Neutral	<ul style="list-style-type: none"> Option would not affect local air quality.

Air Quality

Effect	Description	Illustrative Guidance
-	Negative	<ul style="list-style-type: none"> Option would result in a minor decrease in local air quality; Option would have a negative effect on local communities and biodiversity due to an increase in air and odour pollution and particulate deposition.
--	Significant Negative	<ul style="list-style-type: none"> Option would cause a significant decrease in local air quality (e.g. leading to an exceedance of Air Quality Objectives for designated pollutants and the designation of a new Air Quality Management Area); Option would have a strong and sustained negative effect on local communities and biodiversity due to significant increases in air and odour pollution and particulate deposition.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

Noise

9. Noise

9.1 Introduction

This section presents the overview of plans and programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources in respect of noise.

Noise in an environmental context is defined as unwanted sound. Emissions of noise may arise during construction, operation and decommissioning of development and could affect human and ecological receptors.

There are links between the noise topic and other topics in the Appraisal of Sustainability (AoS), specifically human health, biodiversity and nature conservation and landscape.

9.2 Review of Plans and Programmes

The policies seek to manage both ambient noise and noise emitting from a particular point source. Whilst water resource infrastructure is not typically associated with high levels of noise once operational, the policies provide the framework to manage potentially high levels of noise during the construction phase of any infrastructure, both on site and noise associated with transport movements

International

The World Health Organisation's (WHO) **Guidelines for Community Noise 1999** notes that in comparison to many other environmental problems, noise pollution levels continue to increase rather than reduce, coupled with an increasing number of complaints from affected individuals. The document states that 'Noise is likely to continue as a major issue well into the next century'. WHO research has identified noise exposure levels within the population that are considered to have harmful effects on human health. Based on this research, the WHO has developed a number of recommended noise levels that should prevent adverse health effects. This document is widely referenced in the field of acoustics; however, it has not been adopted into any subsequent guidelines or UK regulation. The WHO's **Night Noise Guidelines for Europe (2009)**, meanwhile, seeks to avoid health impacts from exposure to noise during sleep.

The **Environmental Noise Directive (END) (2002/49/EC)** is concerned with noise from road, rail, air traffic and industry. The level of exposure to environmental noise has been determined through noise mapping to which it has been proposed will give rise to noise action plans. The four sets of **Environmental Noise Regulations 2006** (SI 2006/2238 in England; WSI 2006/2629 in Wales; SSI 2006/465 in Scotland; and NSIR 2006/387 in Northern Ireland), address the requirements of END to inform the production of noise action plans for large urban areas (END agglomerations), major transport sources, and significant industrial sites. The action plans are intended to manage noise issues and effects to ensure the noise environment is preserved or noise levels are reduced where possible. The first noise maps were completed in 2007 and updated in 2012.

UK

The **Environmental Protection Act (1990)** defines the legal framework with England, Scotland and Wales for duty of care for waste, contaminated land and statutory nuisance (including noise emitted from Premises be prejudicial to health or a nuisance). Further provisions with respect to noise (as well as waste disposal, water pollution, atmospheric pollution and public health) are set out in the **Control of Pollution Act 1974**. Noise, litter and waste controls are introduced in the **Clean Neighbourhoods and Environment Act 2005**.

Noise

The **Control of Noise at Work Regulations 2005 (the Noise Regulations)** (SI 2005/1643) aims to ensure that workers' hearing is protected from excessive noise at their place of work, which could cause them to lose their hearing and/or to suffer from tinnitus.

The Institute of Environmental Management and Assessment (IEMA) / Institute of Acoustics (IoA) document Updated **Guidelines for Noise Impact Assessment** were published in October 2014. The guidelines are applicable to noise impact assessment for any scale of development proposal.

The British Standards Institution (BSI) document **BS 8233: 2014 - Sound Insulation and Noise Reduction for Buildings – Code of Practice** gives recommendations for the control of noise in and around buildings, and suggests appropriate criteria and limits for different situations. The code is primarily intended to guide the design of new or refurbished buildings, but it does provide a source of noise levels for common situations, such as typical traffic noise levels at the facades of buildings.

The BSI document **BS 5228-1: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites** gives recommendations for basic methods of noise control relating to construction and open sites where work/activities generate significant noise levels. Part 1 provides guidance concerning methods of predicting and measuring noise and assessing its effects. Part 2 provides guidance concerning methods of predicting and measuring vibration and assessing its effects.

England

The **National Planning Policy Framework (Department for Communities and Local Government, 2012)** (NPPF) sets out the core land use planning principles that should underpin both plan-making and decision taking. The Framework expects the planning system to prevent “both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of [inter alia] noise pollution”.

In addition, paragraph 123 of the NPPF provides that planning policies and decisions should aim to: avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development; mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions; recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason. The noise section of the **Planning Practice Guidance** provides advice regarding the consideration of potential noise impacts in planning decisions.

Noise Policy Statement for England (Defra, 2010) sets out the long-term vision of Government noise policy which seeks to promote good health and quality of life through the effective management of noise within the framework of Government policy on sustainable development.

In accordance with the Environmental Noise (England) Regulations 2006, Defra has prepared a Noise Action Plan, designed to address the management of noise issues and effects from roads and railways in the 65 agglomeration areas in England. The Action Plan is underpinned by the results of a second strategic mapping exercise.

Scotland

The **Environmental Noise (Scotland) Regulations 2006** (SSI 2006/465) requires that Scottish ministers must prepare Strategic Noise Maps and Noise Action Plans which identify Quiet Areas and areas where management of noise is required. The Scottish Government identifies such areas as Noise Management Areas (NMAs).

In accordance with the Regulations, action plans have been prepared (and in some cases prepared and subsequently updated) for:

Noise

- ▶ Edinburgh Agglomeration;
- ▶ Glasgow Agglomeration;
- ▶ Dundee Agglomeration;
- ▶ Aberdeen Agglomeration;
- ▶ Transportation;
- ▶ Aberdeen Airport;
- ▶ Edinburgh Airport; and
- ▶ Glasgow Airport.

The **Scottish Planning Policy (SPP) (2014)** stresses the role of noise impact assessments in developments where noise is likely to be considerable, and emphasises the need for mitigation where noise is likely to require some form of control.

Planning Advice Note 1/2011 (PAN) Planning and Noise (2011) provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise.

Wales

The **Wales Spatial Plan Update (2008)** recognises the work of multiple organisations in helping to promote shared learning and the development a medium-term strategy for the sustainable development of Wales. The Update is in keeping with the One Wales, One Planet principles published in 2008 and provides the context and direction of travel for local development plans and the work of local service boards. The key themes of the update are:

- ▶ building sustainable communities;
- ▶ promoting a sustainable economy;
- ▶ valuing our environment;
- ▶ achieving sustainable accessibility; and
- ▶ respecting distinctiveness.

Planning Policy Wales (9th: Chapter 13 – Minimising and Managing Environmental Risks and Pollution (2016)) sets the Welsh Government's objectives to maximise environmental protection for people, prevent or manage pollution and promote good environmental practice.

Technical Advice Note (TAN) 11: Noise (1997) sets out the Welsh Government's land use planning policy in respect of noise generating development, noise-sensitive development and measures to mitigate the impact of noise. It sets out that local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.

Noise

9.3 Overview of the Baseline

UK

Noise and vibration are predominantly local in nature and difficult to measure on a regional or national scale.

The National Noise Attitude Survey 2012 – NO0237 (December 2014)²⁷¹ was undertaken to:

- ▶ provide the Government with a good estimate of current attitudes to various aspects of environmental, neighbour and neighbourhood noise (including the percentage of the population affected); and
- ▶ allow the Government to detect any substantive changes in attitudes to noise in the UK since the 2000 survey.

A summary of findings revealed that 72% of respondents reported general satisfaction with their noise environment. However, between 2000 and 2012 there was an increase of between 11% and 17% (depending on the noise source) in the proportion of people surveyed who felt that they were to some extent adversely affected by the four most commonly heard sources of noise ('road traffic', 'neighbours and/or other people nearby', 'aircraft, airports and airfields' and 'building, construction, demolition, renovation and road works'). Also in the same period, there was a decrease of between 10% and 16% (depending on the noise source) in the proportion of people surveyed who felt that they were not at all adversely affected by the four most commonly heard sources of noise.

The survey also found that the proportion of those reporting themselves as being significantly adversely affected by noise had remained broadly the same since 2000, i.e. the proportion of those experiencing potentially significant adverse effects had not worsened. The number reporting hearing the four most commonly heard sources of noise had also remained broadly the same. In general, 48% of respondents said that their home life was spoilt to some extent by noise, with 52% reporting that noise did "not at all" spoil their home life.

England

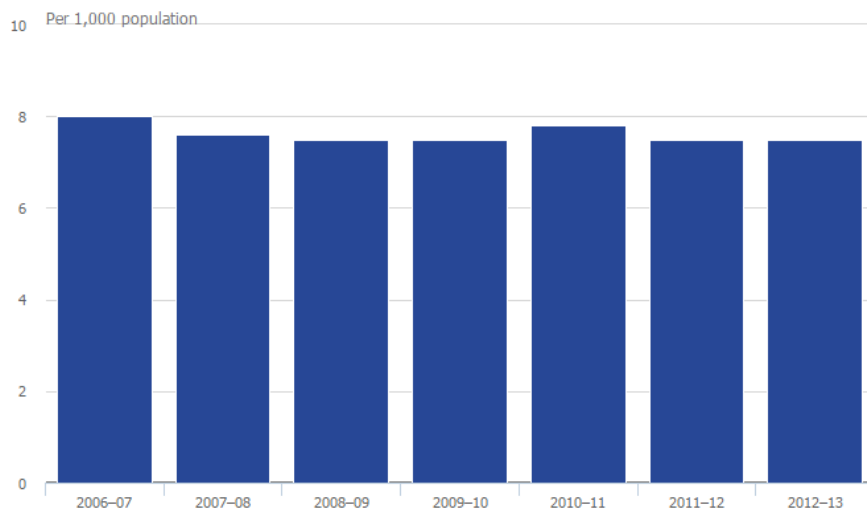
Figure 9.1 below shows the proportion of people making noise complaints in England, as reported within the last published edition of the Office for National Statistics Sustainable Development Indicators publication²⁷² (note that this is no longer published, but data for the indicators is still available from its original source).

²⁷¹ Defra (2014) The National Noise Attitude Survey 2012 – NO0237. Available online at: <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18288>

²⁷² Office for National Statistics (2015) *Sustainable Development Indicators - Figure 20.1: Noise complaints per 1,000 population, 2006-07 to 2012-13*. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/sustainabledevelopmentindicators/2015-07-13->

Noise

Figure 9.1 Noise complaints per 1,000 population



Source: Office for National Statistics.

Under the terms of the END, Defra has prepared a Noise Action Plan; underpinned by the results of a strategic mapping exercise²⁷³. They indicate that road traffic is the most dominant noise exposure source.

The estimated number of people in agglomerations above noise level L_{den} due to noise from roads is shown in **Table 9.1**.

Table 9.1 Estimated number of people in agglomerations above various noise levels due to noise from roads, L_{den}

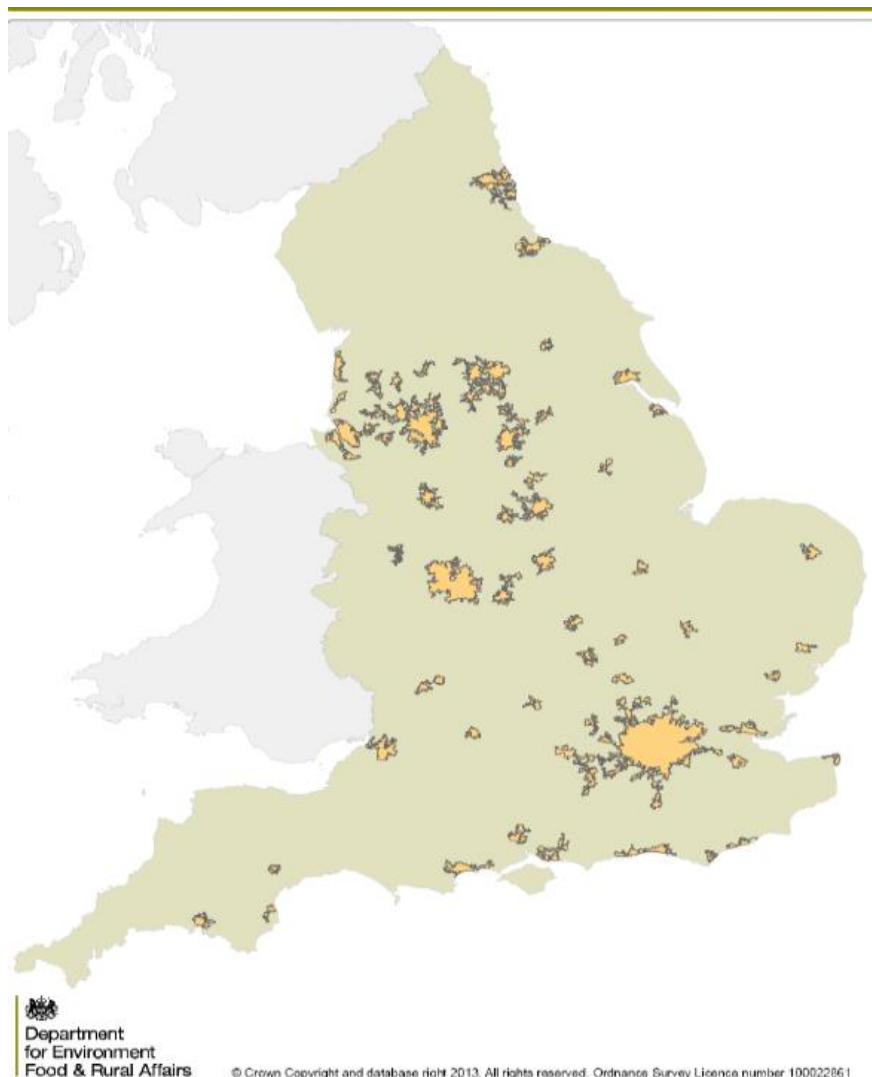
Noise Level (L_{den}) (dB)	Number of People
≥55	7,401,000
≥60	3,717,000
≥65	2,325,000
≥70	1,122,000
≥75	135,000

Defra has identified a number of “Important Areas” or “noise hotspots” through the strategic mapping. It has been estimated that the number of people immediately associated with the Important Areas identified for roads inside agglomerations is just over 119,000.

²⁷³ Extrium (2017) *England noise map viewer*. Available online at: <http://www.extrium.co.uk/noiseviewer.html>

Noise

Figure 9.2 Map showing the approximate location of END agglomerations



Scotland

Interactive noise maps can be generated from the Scottish Government's Scottish Noise Mapping facility²⁷⁴. They indicate that road traffic is the most dominant noise exposure source.

Agglomerations have been mapped for the urban areas of Edinburgh, Glasgow, Aberdeen and Dundee. The number of people exposed to noise levels above L_{den} is 991,200.

Wales

Interactive noise maps showing estimated levels of road traffic, railway and industrial noise in Wales' three largest urban areas, and noise from the busiest roads and railways across Wales are available via the Welsh

²⁷⁴ Scottish Government (2017) *Welcome to Scotland's noise*. Available online at: <http://www.scottishnoisemapping.org/>

Noise

Government's website²⁷⁵. Based on these maps a total of 220 priority areas for road noise and 27 for railway noise have been identified²⁷⁶.

9.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for noise have been identified:

- ▶ Ambient noise levels are gradually rising in the UK as a result of an increasing - and increasingly mobile - population. The cumulative impacts of noise on sensitive groups in local communities may create or exacerbate existing health issues.
- ▶ Road traffic is a dominant source of noise.
- ▶ There is a need to address noise issues in the UK's most affected communities.
- ▶ Noise from the construction and operation of the water resources infrastructure will need to be assessed and where possible reduced or mitigated through guidance in the NPS.

9.5 Likely Evolution of the Baseline

It is difficult to quantify the likely evolution of noise in UK (and for England, Scotland and Wales) although it seems likely that new development will result in increases in noise levels and could thereby negatively affect people's health and the environment (e.g. disturbance to biodiversity, decreased enjoyment of the countryside). However, the Environmental Noise Regulations and associated action plans may result in the reduction of noise in priority areas over time. The most recent trend data in **Figure 8.1** would suggest that levels of noise complaints have remained stable for the most recent 10 years' worth of data.

It needs to be recognised that as the effects of noise are felt at the local level, it is possible that even if noise levels in the UK as a whole increase or decrease, there is the potential that at the local level noise could improve or get worse as a result of an individual development (for example, if a quieter process replaces existing development). The noise from transport could also decline in the future due to quieter technology being employed in cars, buses and aeroplanes, although if the overall volume of traffic increases this could result in increased noise levels.

9.6 Assessing Significance

The objectives and guide questions related to noise (and vibration) which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 9.2** together with reasons for their selection.

²⁷⁵ Welsh Government (2017) *Wales Noise Mapping*. Available online at:
<http://data.wales.gov.uk/apps/noise/>

²⁷⁶ Welsh Government (2014) *Noise areas*. Available online at:
<http://gov.wales/topics/environmentcountryside/epg/noiseandnuisance/environmentalnoise/noisemonitoringmapping/priority-areas/?lang=en>

Noise

Table 9.2 Approach to Assessing the Effects of the Water Resources NPS on Noise

Objective/Guide Question	Reasoning
Objective: To minimise noise pollution and the effects of vibration.	EU and UK policy on noise management and reduction guides the preparation of strategies at the UK and local levels to avoid and limit what is a pollutant. The construction and operation of water resources infrastructure is likely to have noise impacts associated with vehicle movements and the operation of plant and machinery. As such, the issues are important to the AoS Report in respect of human health, in particular.
Will the Water Resources NPS help to minimise noise and vibration effects from construction and operational activities on residential amenity and on sensitive locations and receptors?	The impacts of noise pollution and from vibration on specific localities will need careful consideration in all phases of any project associated with the development of new water infrastructure. This could include local strategies based on general principles and practical measures for noise and vibration avoidance and limitation.

Table 9.3 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the noise objective.

Table 9.3 Illustrative Guidance for the Assessment of Significance for Noise

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would significantly improve the ambient noise environment in the vicinity of potential or actual sites.
+	Positive	<ul style="list-style-type: none"> Option would lead to an improvement in the ambient noise environment in the vicinity of potential or actual sites.
0	Neutral	<ul style="list-style-type: none"> Option would not affect the noise environment of potential or actual sites.
-	Negative	<ul style="list-style-type: none"> Option would result in a minor negative effect on the ambient noise environment in the vicinity of potential or actual sites; Option would cause minor disturbance associated with vibration on potential or actual sites.
--	Significant Negative	<ul style="list-style-type: none"> Option would result in a major negative effect on the ambient noise environment in the vicinity of potential or actual sites over the short or longer term; Option would cause major disturbance associated with vibration on potential or actual sites over the short or longer term.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

Climatic Factors

10. Climatic Factors

10.1 Introduction

This section presents the overview of plans and programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources Infrastructure and reasonable alternatives in respect of climatic factors.

Climate change within this context is concerned with increasing the likelihood of climate change effects through greenhouse gas emissions, and the ability to adapt to the effects of climate change such as the occurrence of more extreme weather events.

There are links between climate change and the majority of other topics in the Appraisal of Sustainability (AoS), including biodiversity and nature conservation, land use, geology and soil, water quality and quantity, human health, flood risk, traffic and transport and air quality.

10.2 Review of Plans and Programmes

The range of plans and policies reviewed seek to promote both climate change mitigation and adaptation. Climate change is expected to have a significant effect on the water environment, both affecting water availability and there are a number of key international agreements in place that seek to mitigate climate change, including most recently the **Paris Agreement (2015)**. The **Climate Change Act (2008)** puts targets for reducing greenhouse gas emissions on a statutory footing.

Climate change adaptation is actively promoted through the NPPF and associated Planning Practice Guidance. **Adapting Energy, Transport and Water Infrastructure to the Long-term Impacts of Climate Change (2010)** takes a long-term view of adapting water resources infrastructure to climate change.

International/European

The **United Nations Framework Convention on Climate Change** (UNFCCC) sets an overall framework for international action to tackle the challenges posed by climate change. The Convention sets an ultimate objective of stabilising greenhouse gas concentrations "*at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system.*" The Convention requires the development and regular update of greenhouse gas emissions inventories from industrialised countries, with developing countries also being encouraged to carry out inventories. The countries who have ratified the Treaty, known as the Parties to the Convention, agree to take climate change into account in such matters as agriculture, industry, energy, natural resources and where activities involve coastal regions. The Parties also agree to develop national programmes to slow climate change.

The two main agreements resulting from the UNFCCC to date are the **Kyoto Protocol (1997)** and the **Paris Agreement (2015)**. The Kyoto Protocol sought to establish an international mechanism to reduce emissions of greenhouse gas emissions and in consequence set binding emissions reduction targets for 37 industrialised countries and the European Community. These targets equated to an average of 5% reductions relative to 1990 levels over the five-year period 2008-12. The key distinction between this and the UNFCCC is that the Convention encourages nations to stabilise greenhouse gases while the Kyoto Protocol committed them to doing so through greenhouse gas reductions. It included three market-based mechanisms to meet these targets: emissions trading; the clean development mechanism (CDM); and Joint Implementation (JI).

The Protocol's first commitment period started in 2008 and ended in 2012. At the Durban conference in December 2011, governments decided that the Kyoto Protocol would move into a second commitment period in 2013, in a seamless transition from the end of the second commitment period in 2012.

Climatic Factors

Governments of Parties to the Kyoto Protocol also made amendments to the Protocol, among others, the range of greenhouse gases covered.

The Paris Agreement (2015) was agreed in December 2015 and, upon ratification by signatories responsible for more than 55% of global greenhouse gas emissions, came into force on 5th October 2016. The Agreement's main aim is to keep a global temperature rise this century "*well below*" 2 degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. The main climate change mitigation delivery mechanism is the submission of five year Nationally Determined Contributions (NDCs) by all signatories with a steadily increasing ambition in the long term.

At the European level, the European Union's (EU) submission to the Paris Agreement establishes an overall binding commitment to reduce domestic greenhouse gas emissions by at least 40% by 2030 compared to 1990, in line with targets set out in the EU 2030 Climate and Energy Policy Framework (October 2014). Given the result of the EU referendum held on 23rd June 2016, in due course it may be necessary for the UK Government to submit separate NDCs to the UNFCCC. However, at the present time the UK remains a member of the EU and is therefore obligated to contribute towards achieving the emissions reduction targets specified in the EU's submission to the Paris Agreement.

In March 2007, the European Union's (EU) leaders endorsed an integrated approach to climate and energy policy that aims to combat climate change and increase the EU's energy security while strengthening its competitiveness. They committed Europe to transforming itself into a highly energy-efficient, low carbon economy. It set a series of demanding climate and energy targets to be met by 2020, known as the "20-20-20" targets. These are:

- ▶ a reduction in EU greenhouse gas emissions of at least 20% below 1990 levels;
- ▶ 20% of EU energy consumption to come from renewable resources; and
- ▶ a 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

To secure a reduction in EU greenhouse gases, the **EU Emissions Trading Scheme (EU ETS)**, a Europe wide scheme was introduced in 2005. EU ETS puts a price on carbon that businesses use and creates a market for carbon. It allows countries that have emission units to spare (emissions permitted to them but not "used") to sell this excess capacity to countries which are likely to exceed their own targets. **The Integrated Climate and Energy Package** included a revision and strengthening of the ETS. A single EU-wide cap on emission allowances applied from 2013 and will be cut annually, reducing the number of allowances available to businesses to 21% below the 2005 level in 2020. The free allocation of allowances will be progressively replaced by auctioning, and the sectors and gases covered by the system will be somewhat expanded.

The **Seventh EU Environmental Action Plan (EAP) (2013-2020)** reviews the significant environmental challenges and provides a framework for European environmental policy up to 2020. The programme identifies three priority areas where more action is needed to protect nature and strengthen ecological resilience, boost resource-efficient, low-carbon growth, and reduce threats to human health and well-being linked to pollution, chemical substances, and the impacts of climate change.

The **Renewable Energy Directive (2009/28/EC)** mandates levels of renewable energy use within the EU. The Directive requires EU Member States to produce a pre-agreed proportion of energy consumption from renewable sources such that the EU as a whole shall obtain at least 20% of total energy consumption from renewables by 2020. This is then apportioned across Member States. The UK's target is for 15% of energy consumption in 2020 to be from renewable sources. Under Article 4 of the Directive, each Member State is also required to adopt a National Renewable Energy Action Plan that will set out the trajectory and measures that will enable the target to be met.

The **Energy Efficiency Directive (2012/27/EU)** sets the framework for measures to promote energy efficiency across the EU and help the EU reduce its energy consumption by 20%.

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EU leaders agreed on 23 October 2014 the domestic 2030 greenhouse gas reduction target of at least 40% compared to 1990 together with the other main building blocks of the **2030 Policy Framework for Climate and Energy**, as proposed by the European Commission in January 2014. This 2030 policy framework aims to make the EU's economy and energy system more competitive, secure and sustainable and also sets a target of at least 27% for renewable energy and energy savings by 2030.

The Commission adopted the **EU Strategy on Adaptation to Climate Change** in April 2013. The Strategy has three key objectives:

- ▶ Promoting action by Member States: The Commission will encourage all Member States to adopt comprehensive adaptation strategies and will provide funding to help them build up their adaptation capacities and take action.
- ▶ 'Climate-proofing' action at EU level by further promoting adaptation in key vulnerable sectors such as agriculture, fisheries and cohesion policy, ensuring that Europe's infrastructure is made more resilient, and promoting the use of insurance against natural and man-made disasters.
- ▶ Better informed decision-making by addressing gaps in knowledge about adaptation and further developing the European climate adaptation platform (Climate-ADAPT) as the 'one-stop shop' for adaptation information in Europe.

UK

In the UK, the **Climate Change Act 2008** introduced legislative targets for reducing the UK's impacts on climate change and the need to prepare for its impacts. The Act sets binding targets for a reduction in CO₂ emissions of 80% by 2050, compared to a 1990 baseline. Interim targets and five-year carbon budget periods are used to ensure progress towards the 2050 target. The Climate Change Act 2008 also requires the Government, on a regular basis, to assess the risks to the UK from the impact of climate change and report to Parliament. The UK Committee on Climate Change Adaptation Sub-committee is responsible for preparing these climate change risk assessments, the latest of which, the second UK Climate Change Risk Assessment (CCRA2) Evidence Report, was published in July 2016²⁷⁷. As required under sections 12 and 14 of the Climate Change Act 2008, **The Carbon Plan: Delivering our Low Carbon Future (2011)** sets out proposed measures to implement the UK's first four carbon budgets and thereby achieve a 50% reduction in the UK's annual net carbon account by 2027 (from 1990 levels). The plan builds upon the previous Low Carbon Transition Plan (2009) and includes proposals for energy efficiency, heating, transport and industry.

On 30th June 2016, the UK Government confirmed its intention to set the Fifth Carbon Budget to reduce UK greenhouse gas emissions by 57% by 2030 relative to 1990 levels²⁷⁸. This is in line with advice provided to the UK Government by the UK Committee on Climate Change, and in due course a report on policies and proposals to achieve this Fifth Carbon Budget will need to be laid before the UK Parliament.

In relation to the decarbonisation of the energy generation sector, the UK Government's **Renewables Strategy (2009)** sets out the path for the UK to meet the legally-binding target (under the Renewable Energy Directive (2009/28/EC)) to ensure 15% of energy comes from renewable sources by 2020. The **UK Renewable Energy Roadmap Update 2013** provides the latest available analysis regarding achievements

²⁷⁷ UK CCC ASC. UK Climate Change Risk Assessment 2017: CCRA2 Evidence Report. 2016. <https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/>

²⁷⁸ UK Committee on Climate Change. CCC welcomes Government backing for fifth carbon budget and continued ambition to meet 2050 target. 2016. <https://www.theccc.org.uk/2016/06/30/ccc-welcomes-government-backing-for-fifth-carbon-budget-and-continued-ambition-to-meet-2050-target/>

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and changes that have taken place in pursuit of achieving this target. The update includes energy demand and technology cost projections, as well as a 'bottom up' review of projects that could well come forward.

The **Energy Act 2013** establishes a legislative framework for delivering secure, affordable and low carbon energy and includes provisions on: decarbonisation; electricity market reform; nuclear regulation; government pipe-line and storage system; and consumer protection amongst others.

On the 23rd June 2011, the Department for Energy and Climate Change (now BEIS) designated the **National Policy Statements** (NPS) for energy infrastructure. These statements set out the Government's policy for delivery of major energy infrastructure. NPS **EN-1** sets out the Government's overall policy for delivery of major energy infrastructure. A further five technology-specific NPSs for the energy sector cover: fossil fuel electricity generation (**EN-2**); renewable electricity generation (both onshore and offshore) (**EN-3**); gas supply infrastructure and gas and oil pipelines (**EN-4**); the electricity transmissions and distribution network (**EN-5**); and nuclear electricity generation (**EN-6**).

England

The **National Planning Policy Framework (Department for Communities and Local Government, 2012)** provides a set of core land-use planning principles that should underpin both plan-making and decision-taking. These include supporting "the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the re-use of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy)". The NPPF underlines that planning's role in tackling climate change is central to the economic, social and environmental dimensions of sustainable development. Local planning authorities are therefore expected to adopt proactive strategies to mitigate and adapt to climate change (in line with the objectives and provisions of the Climate Change Act 2008), taking full account of flood risk, coastal change and water supply and demand considerations.

To support the move to a low carbon future, local planning authorities are expected to plan for new development in locations and ways which reduce greenhouse gas emissions; actively support energy efficiency improvements to existing buildings and have a positive strategy to promote energy from renewable and low carbon sources. Local Plans are also expected to take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change.

The section of **Planning Practice Guidance** (2014) regarding Climate Change advises how planning can identify suitable mitigation and adaptation measures in plan-making and the application process to address the potential impacts of climate change. This includes potential climate change adaptation options such as the availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.

In 2010 Defra published **Adapting Energy, Transport and Water Infrastructure to the Long-term Impacts of Climate Change**. The report sets out the case for adapting infrastructure in the energy, transport and water sectors so that new and existing infrastructure is able to operate effectively in a long-term changing climate. The report focuses on the long-term impacts of climate change (2030s to 2100) to the infrastructure in the 3 sectors, setting out:

- ▶ the long-term risks from climate to the infrastructure, both technically and operationally;
- ▶ the need to consider the interdependency risks of the infrastructure system and how this can be exacerbated by long-term climate change;
- ▶ the need for all infrastructure to consider the long-term impacts of climate change in its design, build and operation;
- ▶ the adaptation options available, as well as barriers possibly preventing action; and

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- ▶ suggested recommendations to the Infrastructure and Adaptation project as part of its 2-year programme of work.

Scotland

The **Climate Change (Scotland) Act 2009** sets binding net carbon emission reduction targets of 42% by 2020 and 80% by 2050 compared with 1990 levels, and also requires Scottish Ministers to meet annual emission reductions targets in line with a trajectory towards the 2050 target. Taken together, the Climate Change (Annual Targets) (Scotland) Orders of 2010, 2011 and 2016 specify annual emission reduction targets until 2032. All of these targets relate to a basket of six greenhouse gases recognised by the UNFCCC and includes Scotland's share of emissions from international aviation and international shipping. In addition, section 44 of the Act requires all public bodies, including planning authorities and the Scottish Government itself, to "act in the way best calculated to contribute to the delivery of the emissions targets". **A Low Carbon Economic Strategy for Scotland: Scotland – A Low Carbon Society (2011)** is an integral part of the Scottish Government's Economic Strategy to secure economic growth, and a key component of the broader approach to meet Scotland's climate change targets and secure the transition to a low carbon economy in Scotland.

The **Electricity Generation Policy Statement – 2013 (EGPS)** examines the way in which Scotland generates electricity, and considers the changes which will be necessary to meet the targets which the Scottish Government has established, and reflects both views from industry and other stakeholders and also developments in UK and EU electricity policy. It looks at the sources from which that electricity is produced, the amount of electricity which we use to meet our own needs and the technological and infrastructural advances and requirements which Scotland will require over the coming decade and beyond.

On the 27th June 2013, the Scottish Government published the report **Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027: The Second Report on Proposals and Policies (RPP2)**. This fulfils the duty placed on Scottish Ministers by Section 35 of the Climate Change (Scotland) Act 2009, to lay before the Scottish Parliament a Report on Proposals and Policies setting out specific measures for reducing greenhouse gas emissions to meet Scotland's ambitions statutory targets. The RPP2 is structured around the key sectors of energy supply, homes and communities, business and the public sector, transport, waste and rural land use. For each of these sectors, policies to reduce greenhouse gas emissions are identified, as are a number of proposals for further consideration and development. Taken together, these policies and proposals show that it is possible to meet the climate change targets established by the Climate Change (Scotland) Act 2009.

The **2020 Route map for Renewable Energy in Scotland (2011)** is an update and extension to the **Scottish Renewables Action Plan 2009**. This updated and expanded Route map reflects the challenge of the new target to meet an equivalent of 100% demand for electricity from renewable energy by 2020, as well as the target of 11% renewable heat.

The **Scottish Planning Policy (SPP) (2014)** sets out that the planning system should:

- ▶ support the transformational change to a low carbon economy, consistent with national objectives and targets, including deriving:
 - ▶ 30% of overall energy demand from renewable sources by 2020;
 - ▶ 11% of heat demand from renewable sources by 2020; and
 - ▶ the equivalent of 100% of electricity demand from renewable sources by 2020;
- ▶ support the development of a diverse range of electricity generation from renewable energy technologies – including the expansion of renewable energy generation capacity – and the development of heat networks;
- ▶ guide development to appropriate locations and advise on the issues that will be taken into account when specific proposals are being assessed;

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- ▶ help to reduce emissions and energy use in new buildings and from new infrastructure by enabling development at appropriate locations that contributes to:
 - ▶ energy efficiency;
 - ▶ heat recovery;
 - ▶ efficient energy supply and storage;
 - ▶ electricity and heat from renewable sources; and
 - ▶ electricity and heat from non-renewable sources where greenhouse gas emissions can be significantly reduced.

Scotland's Third National Planning Framework (NPF) (2014) is a long-term strategy for Scotland. It is the spatial expression of the Government Economic Strategy, and the plans for development and investment in infrastructure. NPF identifies national developments and other strategically important development opportunities in Scotland. It is accompanied by an Action Programme which identifies how they expect it to be implemented, by who, and when. Their ambition is to achieve at least an 80% reduction in greenhouse gas emissions by 2050 and foresee that planning will play a key role in delivering on the commitments set out in Low Carbon Scotland: the Scottish Government's report on proposals and policies (RPP2). The priorities identified in the NPF set a clear direction of travel which is consistent with their climate change legislation.

Wales

Energy Wales: A Low Carbon Transition (2012) sets out the Welsh Government's aim to enhance the economic, social and environmental wellbeing of the people and communities of Wales – to achieve a better quality of life for our own and future generations. As set out in the Programme for Government, their ambition is therefore to: 'create a sustainable, low carbon economy for Wales'. In doing so, they want to ensure full advantage is taken of the transition to a low carbon economy to secure a wealthier, more resilient and sustainable future for Wales.

The Welsh Assembly Government have a clear role to play in tackling climate change. **Climate Change Strategy for Wales (2010)** and its associated delivery plans set targets to reduce greenhouse gas emissions in Wales by 3% every year and achieve at least a 40% reduction by 2020 compared to figures from 1990, as well as establishing measures to address climate change adaption.

Part 2 of the **Environment (Wales) Act 2016** establishes a statutory framework for action on climate change, including targets for reducing emissions of greenhouse gasses and associated duties. The Welsh Ministers are required to ensure that the 'net Welsh emissions account' for the year 2050 is at least 80% lower than the baseline, set at 1990 emissions levels, and they must also specify in regulations interim targets for 2020, 2030 and 2040 and set five yearly carbon budgets. The targets must be set after the Welsh Ministers have received advice from the UK CCC, and the Welsh Ministers must produce a report detailing the policies and proposals that will deliver emissions reductions necessary to meet the interim and overall targets, as well as regular progress reports. The Act also contains a range of other provisions regarding the sustainable management of natural resources, specifically including measures to enhance resilience.

Planning Policy Wales (Edition 9, 2016) (PPW) sets out several objectives in respect of climate change mitigation and adaptation. It promotes:

- ▶ Planning to minimise the causes of climate change by taking decisive action to move towards a low carbon economy by proactively reducing the demand for energy, facilitating the delivery of new and more sustainable forms of energy provision at all scales and minimising the emissions of greenhouse gases to the atmosphere.
- ▶ Planning for the consequences of climate change.

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PPW is supported by the following Technical Advice Notes (TANs) that are particularly relevant to climate change:

- ▶ TAN 8: Renewable Energy (2005);
- ▶ TAN12: Design (2016); and,
- ▶ TAN 15: Development and Flood Risk (2004).

10.3 Overview of the Baseline

International

Climate

The UNFCCC, Paris Agreement and other international measures to combat climate change are influenced by regular reports from the Intergovernmental Panel on Climate Change (IPCC). The IPCC's **Fifth Assessment Report**²⁷⁹ (referred to as AR5) provides the most up to date view of scientific knowledge regarding climate change and in summary concludes that:

- ▶ unprecedented atmospheric concentrations of carbon dioxide, methane and nitrous oxide, resulting from industrial activities including fossil fuel combustion, are “extremely likely to have been the dominant cause of the observed warming since the mid-20th century”. Total anthropogenic greenhouse gas (GHG) emissions were the highest in human history from 2000 to 2010 and the energy supply sector generated 25% of total GHG emissions in 2010; and
- ▶ climate change risks and impacts “can be reduced by limiting the rate and magnitude of climate change”. AR5 calls for low carbon energy technologies to generate more than 80% of electricity by 2050 and for unabated fossil fuel generation to be virtually phased out by 2100.

The report also identifies certain impacts that climate change has already had on freshwater ecosystems, for example:

- ▶ Many terrestrial, freshwater and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances and species interactions in response to ongoing climate change.

UK

Climate

The UK is presently influenced by predominantly westerly tracking storm systems throughout the year. Variations in temperature, precipitation and wind speeds may be partly accounted for by exposure, latitude and altitude. The surrounding seas also have a significant effect on the national and local weather conditions. The temperatures of air masses reaching the UK have been modified by the ocean such that the UK tends to experience lower summer temperatures than mainland Europe, but milder winters. In the recent past, the Central England temperature has risen ~1°C since 1970, and Scottish temperatures have risen 0.8°C since 1980.

²⁷⁹ Intergovernmental Panel on Climate Change. Synthesis Report - Summary for Policymakers. 2015.
http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

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All areas of the UK are getting warmer, and the warming is greater in summer than in winter²⁸⁰. There is little change in the amount of precipitation (rain, hail, snow, etc.) that falls annually, but more is falling in the winter, with drier summers, for much of the UK. Sea levels are rising, and are greater in the south of the UK than the north. Widespread flooding events cannot be directly attributed to climate change but it is expected to see more extreme rainfall events in the future, and hence more flooding as the climate changes.

The UK is experiencing sea level rise of approximately 1mm per year. Global sea-level is rising at about 3mm per year²⁸¹. Sea-surface temperatures around the UK coast have risen over the past three decades by about 0.7°C. Global average temperatures are rising at about 0.2°C per decade. Severe windstorms around the UK have become more frequent in the past few decades, though not above that seen in the 1920s. Annual mean precipitation over England and Wales has not changed significantly since records began; however seasonal rainfall appears to be decreasing in summer and increasing in winter.

More specifically, the following observations can be made:

- ▶ Central England temperature has risen by about one degree Celsius since the 1970s, with 2006 being the warmest on record. All regions of the UK have experienced an increase in average temperatures between 1961 and 2006 annually, and for all seasons. Increases in annual average temperature are typically between 1.0 and 1.7°C, tending to be largest in the south and east of England and smallest in Scotland.
- ▶ All regions of the UK have experienced an increase over the past 45 years in the contribution to winter rainfall from heavy precipitation events; in summer, all regions except north east England and north Scotland show decreases.
- ▶ Severe windstorms around the UK have become more frequent in the past few decades, though not above that seen in the 1920s.
- ▶ There has been considerable variability in the North Atlantic Oscillation, but with no significant trend over the past few decades.
- ▶ Sea-surface temperatures around the UK coast have risen over the past three decades by about 0.7°C.
- ▶ Sea level around the UK rose by about 1 mm/yr in the 20th Century, corrected for land movement. The rates for the 1990s and 2000s have been higher than this.
- ▶ The annual number of days with air frost has reduced in all regions of the UK between 1961 and 2006. There are now typically between 20 and 30 fewer days of air frost per year, compared to the 1960s, with the largest reductions in northern England and Scotland.
- ▶ There has been a decrease in the average number of Heating Degree Days (HDD), and an increase in the average number of Cooling Degree Days (CDD) in all administrative regions of the UK as a whole, between 1961 and 2006.
- ▶ There has been a slight increase in average annual precipitation in all regions of the UK between 1961 and 2006, however this trend is only statistically significant above background natural variation in Scotland where an increase of around 20% has been observed. Likewise, an increase in average winter precipitation is only statistically significant in northern England and Scotland where increases of 30-65% have been experienced.

²⁸⁰ Defra. Adapting to climate change – UK Climate Projections. June 2009.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69257/pb13274-uk-climate-projections-090617.pdf

²⁸¹ UK Climate Impact Projects. The climate of the UK and recent trends. 2009.

<http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87933&filetype=pdf> [Accessed 25.11.2016]

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- ▶ Average annual and seasonal relative humidity has decreased in all regions of the UK, except Northern Ireland, between 1961 and 2006, by up to 5%.

The **second UK Climate Change Risk Assessment (CCRA2) Evidence Report (2016)**²⁸² reviews a range of evidence sources, including the UK Climate Impact Projections 2009 (UKCIP09), and concludes that climate change is already affecting both the natural and built environments across the UK.

Energy

The **Digest of UK Energy Statistics 2016**²⁸³ provides the latest official statistics regarding energy generation/production capacity and consumption across the UK in 2015. Key statistics of relevance include:

- ▶ In 2015 primary energy production rose by 9.6 per cent compared with a year earlier, its first increase since 1999, as output of oil and gas from the UK Continental Shelf were both up. Low carbon sources including nuclear, wind, solar photovoltaics and bioenergy all grew strongly. Coal output though was down to a record low level owing to recent mine closures.
- ▶ Final energy consumption rose by 0.4 per cent, reflecting the cooler weather in 2015 compared to 2014. On a temperature adjusted basis, final energy consumption was down 0.8 per cent continuing the downward trend of the last ten years.
- ▶ Electricity generated from renewable sources in the UK in 2015 increased by 29 per cent on a year earlier, and accounted for 25 per cent of total UK electricity generation, up from 19.1 per cent in 2014. Total renewables, as measured by the 2009 EU Renewable Energy Directive, accounted for 8.3 per cent of energy consumption in 2015, up from 7.1 per cent in 2014.
- ▶ The UK remained a net importer of energy, though with a decreased dependency level (imports / energy use) of 38 per cent; this continues the trend from 2004 when the UK once again became a net importer of fuel. In 2015 the UK was a net importer of all main fuels types.
- ▶ In 2015, gas was the main fuel used for electricity generation, with its share remaining at 30 per cent. Coal's share decreased from 30 per cent to 22 per cent, whilst nuclear's share increased to 21 per cent following outages in the second half of 2014.

Greenhouse Gas (GHG) Emissions

The Climate Change Act 2008 prescribes that the UK's GHG inventory covers the six direct greenhouse gases under the Kyoto Protocol, namely:

- ▶ Carbon dioxide (CO₂);
- ▶ Methane (CH₄);
- ▶ Nitrous oxide (N₂O);
- ▶ Hydrofluorocarbons (HFCs);
- ▶ Perfluorocarbons (PFCs); and
- ▶ Sulphur hexafluoride (SF₆).

²⁸² UK CCC ASC. UK Climate Change Risk Assessment 2017: CCRA2 Evidence Report. 2016. <https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/>

²⁸³ DECC. Digest of UK Energy Statistics 2016. <https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes>

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These gases contribute directly to climate change owing to their positive radiative forcing effect. HFCs, PFCs and SF₆ are collectively known as the 'F-gases'. In general terms, the largest contributor to global warming is CO₂ which makes it the focus of many climate change initiatives. Methane and nitrous oxide contribute to a smaller proportion, typically <10%, and the contribution of F-gases is even smaller (in spite of their high Global Warming Potentials) at <5% of the total. The Climate Change Act 2008 requires an 80% reduction in the UK's 'net carbon account' by 2050, covering all six of the individual greenhouse gases listed above.

The latest official statistics regarding greenhouse gas emissions covered under the Climate Change Act 2008 were provided by the Department for Business, Energy & Industrial Strategy for 2015 in the **Annual Statement of Emissions (2017)**. This statistical publication notes that:

- ▶ In 2015, UK net carbon account emissions were estimated to be 467.5 million tonnes carbon dioxide equivalent (MtCO₂e). This was 9.1 percent lower than the 2014 figure of 514.4 million tonnes and 16.8 percent lower than the 2013 figure of 557.3 million tonnes.
- ▶ Between 2013 and 2014, the largest decreases came from the energy supply sector, down 13.6 percent (25.7 MtCO₂e) due to a decrease in the use of coal for electricity generation; and the residential sector, down by 17.0 percent (13.1 MtCO₂e) due to a reduction in use of natural gas for space heating. Demand for heating was lower in 2014 due to the temperature being 1.2 degrees Celsius warmer on average than 2013.
- ▶ Carbon dioxide (CO₂) is the main greenhouse gas, accounting for 82 percent of total UK greenhouse gas emissions in 2014. In 2014, UK net emissions of carbon dioxide were estimated to be 422.0 million tonnes (Mt). This was around 8.9 percent lower than the 2013 figure of 463.3 Mt. Around half of this decrease was due to 2014 being a warmer year than 2013.
- ▶ For the purposes of carbon budgets reporting, UK greenhouse gas emissions in 2014 were 455.6 MtCO₂e which is 100.8 MtCO₂e below the average annual emissions required to meet the second carbon budget (2013-2017).

England

Greenhouse Gas inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2014 (2017)²⁸⁴ presents the latest estimates of greenhouse gas (GHG) emissions for the UK Devolved Administrations (DAs): England, Scotland, Wales and Northern Ireland.

With specific regard to England, it had a 76% share of total net UK GHG emissions in 2015. England has seen a decrease of 41% in greenhouse gas emissions between 1990 and 2015 with a reduction of approximately 5% between 2014 and 2015. This has predominantly been driven by a reduction in emissions from the use of coal in the power generation sector and natural gas in the residential sector, with a reduction in emissions from anaerobic managed waste disposal sites also making a substantial contribution. Greenhouse gas (GHG) emissions for England in 2015 totalled 368,812 ktCO₂e, with the dominant emission sources being electricity production (21% of total GHG emissions), cars (15%), residential combustion for heating and cooking (14%). Key sectoral trends in England up to 2015 were:

- ▶ Emissions from the energy supply sector decreased by 54% between 1990 and 2015, with a 19% decrease in overall emissions between 2014 and 2015. This decrease was mainly due to a reduction in the use of coal in the power generation sector.

²⁸⁴ Ricardo Energy & Environment for the Department of Energy and Climate Change, The Scottish Government, The Welsh Government and The Northern Ireland Department for Agriculture, Environment and Rural Affairs (2017) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2015*. 2017. Available online at: http://naei.defra.gov.uk/reports/reports?report_id=932

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- ▶ Emissions from the industrial process sector decreased significantly since 1990 by 84% mainly as a result of a declining chemical and fluorocarbon production industry.
- ▶ Emissions from the waste management sector significantly declined by 73% since 1990, largely due to the progressive introduction of methane capture and oxidation systems within landfill management. Emissions decreased by 8% between 2014 and 2015, primarily due to UK-wide reductions in methane emission estimates from landfill due to improved management systems.
- ▶ Emissions from the business sector reduced by 24% since 1990 as a result of reduced emissions in manufacturing industries (led by chemicals, non-ferrous metals and other manufacturing) through industrial decline and efficiency improvements. Emissions have recently remained relatively stable, decreasing by 2% between 2014 and 2015.
- ▶ Emissions from the residential sector decreased by 15% since 1990 as a result of a switch from less efficient solid and liquid fuels to natural gas for heating, and improvements in energy efficiency. Emissions between 2014 and 2015 increased by 4% primarily as a result of an increased energy demand for natural gas for residential heating.
- ▶ Emissions from the agricultural sector reduced by 20% since 1990 mainly due to reductions in fertiliser use and resulting nitrous oxide emissions from soils, and reduced animal numbers resulting in reduced methane from dairy cattle. There was a negligible change in agricultural emissions from 2014 to 2015.
- ▶ The Land Use, Land Use Change and Forestry (LULUCF) sector was a source of emissions between the Base Year and 2003 after which the LULUCF sector was a sink. This was as a result of significant decreases in the conversion of land to cropland and settlements, and an increase in grassland carbon storage. This change to a sink was slowed by increased carbon emissions from cropland activities and the harvesting of some of the forest carbon stocks. The net sink increased by 3% between 2014 and 2015 as a result of changes in harvested wood products.
- ▶ Emissions from the transport sector decreased by 3% between 1990 and 2015 due to improvements in efficiency of transport vehicles despite growth in transport demand over the period. Emissions between 2014 and 2015 increased by 2% mainly due to increasing emissions from light/heavy lorries and busses.
- ▶ Emissions from the public sector reduced by 38% since the Base Year. This is due to increased energy efficiency measures and the switch to gas-fired heating. . There was a negligible change in public sector emissions from 2014 to 2015.

Ofwat identified that in 2014-15, of the 19 water companies in England and Wales (noting that Severn Trent Water supplies both England and Wales) the performance of 16 of them with regards to greenhouse gas emissions was in line with or better than expected. For one, performance was not in line with expectations but had only slipped slightly. For two companies, performance was significantly below expectation²⁸⁵.

²⁸⁵ Ofwat. *Environmental Impact 2014-15*. Available online at:

<http://www.ofwat.gov.uk/regulated-companies/company-obligations/performance/companies-performance-2014-15/environmental-impact/>

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Scotland

Greenhouse Gas Emissions

Scottish Greenhouse Gas Emissions 2015²⁸⁶ provides the latest estimates of greenhouse gas emissions in Scotland for the years 1990 to 2015 and also provides information on the nation's performance against emissions reduction targets set under the Climate Change (Scotland) Act 2009. This publication notes that in 2015, Scottish source emissions of the basket of greenhouse gases are estimated to be 48.1 million tonnes carbon dioxide equivalent (MtCO₂e). This is 3.0 per cent lower than the 2014 figure of 49.5 MtCO₂e, a 1.5 MtCO₂e decrease. The main contributor to this reduction between 2014 and 2015 is:

- ▶ fall in energy supply emissions (such as power stations) (1.7 MtCO₂e; 12.0 per cent reduction)

Between 1990 and 2015, there was a 37.6 per cent reduction in estimated emissions, a 28.9 MtCO₂e decrease. The 3 main contributors to this reduction are:

- ▶ fall in energy supply emissions (such as power stations) (10.5 MtCO₂e; 46.4 per cent reduction);
- ▶ fall in business and industrial process emissions (such as manufacturing) (5.8 MtCO₂e; 40.2 per cent reduction);
- ▶ fall in waste management emissions (such as landfill) (4.2 MtCO₂e; 74.9 per cent reduction).

However, the adjusted emissions to account for Scotland's participation in EU-wide emissions trading and are used to measure progress against targets show a 1.8% increase in emissions. Despite the increase, The Climate Change (Scotland) Act 2009 provides for a fixed annual target for 2015 of 45.928 MtCO₂e, which was met.

Scottish Water identifies that after rising in 2014/15 due to an increase in the carbon intensity of grid electricity, its annual carbon footprint fell by 14,000 tonnes of carbon dioxide equivalent (tCO₂e) to 390,000 tCO₂e in 2015/16, a reduction of 3.5%. A reduction in grid carbon intensity was one of the main reasons behind this fall. Since Scottish Water began monitoring and reporting its carbon footprint in 2006/07, annual emissions have fallen by almost 16%²⁸⁷.

Energy

Energy in Scotland 2017²⁸⁸ states that renewable has more than trebled since the end of 2006 and is now equivalent to over half of the electricity consumed in Scotland. Already met the 2020 target to install 500 MW of community and locally owned renewable generation capacity. Renewable heat output is nearly 5 times the level it was in 2008/09.

²⁸⁶ Scottish Government (2017). *Scottish Greenhouse Gas Emissions 2015*. Available online at: <http://www.gov.scot/Resource/0052/00520839.pdf>

²⁸⁷ Scottish Water (2016) *Sustainability Report 2016*. Available online at: <http://www.scottishwater.co.uk/-/media/about-us/images/corporate-responsibility/a63157swsustainabilityreportthr.pdf?la=en>

²⁸⁸ Scottish Government (2017). *Energy in Scotland 2017*. Available online at: <http://www.gov.scot/Resource/0051/00514474.pdf>

Climatic Factors

Wales

Greenhouse Gas inventories for England, Scotland, Wales and Northern Ireland: 1990-2014 (2017)²⁸⁹ provides the latest estimates of greenhouse gas emissions in Wales, up to the year 2015. This publication notes that total emissions from Wales reduced between 1990 and 2015 by 20%. These emission reductions are mainly due to efficiencies in energy generation and business sector heating, the use of natural gas to replace some coal and other fuels as well as abatement in some chemical industries, and variations in manufacturing output (e.g. in iron and steel, bulk chemical production). Total greenhouse emissions decreased between 2014 and 2015 by 1%. This net figure is a balance between large reductions in emissions in some sectors, such as iron and steel, balanced aged increases in other sectors such as home energy use. Further details from the inventory include:

- ▶ Emissions from the energy supply sector decreased by 3% between 1990 and 2014 due to decreases in emissions from power stations. There was a negligible change in energy supply sector emissions from 2014 to 2015.
- ▶ Emissions from the transport sector only decreased by 1% between 1990 and 2014 despite improvements in efficiency of transport vehicles, as a result of growth in transport demand since 1990 and increased affordability of cars over the period. Emissions between 2014 and 2015 increased by 2% mainly due to increasing emissions from light/heavy lorries and buses.
- ▶ Emissions from the residential sector decreased by 26% since 1990 partly due to a change in the fuel mix from coal towards natural gas and also energy efficiency measures. Emissions between 2014 and 2015 increased by 2% mainly as a result of an increased demand for heating.
- ▶ Emissions from the business sector reduced by 35% since 1990, with a 7% reduction between 2014 and 2015. The trends in this sector are primarily driven by the activities from the iron and steel industry.
- ▶ Emissions from the public sector reduced by 57% since 1990. This is due to increased energy efficiency measures and fuel switching from more carbon-intensive fuels such as coal and oil to natural gas. Emissions between 2014 and 2015 increased by 2%.
- ▶ Emissions from the industrial process sector decreased by 2% since 1990 and have shown significant fluctuations during this timeframe reflecting manufacturing output and abatement installations. The trend is heavily influenced by iron and steel production.
- ▶ Emissions from the agricultural sector reduced by 15% since 1990 mainly due to a decrease in livestock numbers. There was a small increase of 1% in emissions from 2014 to 2015 mainly due to an increase in the number of dairy cattle and sheep.
- ▶ Emissions from the waste management sector significantly declined by 72% since 1990, largely due to the progressive introduction of methane capture and oxidation systems within landfill management. Emissions continued to fall between 2014 and 2015, decreasing by 1%.

The Welsh Government's **Sustainable Development and Climate Change Annual Report (2016)**²⁹⁰ provides the official overview of greenhouse gas emissions trends and determines the progress made in

²⁸⁹ Ricardo Energy & Environment for the Department of Energy and Climate Change, The Scottish Government, The Welsh Government and The Northern Ireland Department for Agriculture, Environment and Rural Affairs (2017) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2015*. 2017. Available online at: http://naei.defra.gov.uk/reports/reports?report_id=932

²⁹⁰ Welsh Government (2016) *Sustainable Development and Climate Change Annual Report*. Available online at: <http://gov.wales/docs/desh/publications/160315-sustainable-development-and-climate-change-annual-report-2015-en.pdf>

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reducing greenhouse gas emissions in Wales against pre-defined targets, namely to reduce emissions by 3% annually in areas of devolved competence and to reduce overall emissions by 40% by 2020.

The baseline emissions figure for the 3% annual reduction target is 34.53 MtCO₂e. In 2013, the emissions were 29.46 MtCO₂e which equates to a decrease from the baseline of 14.7%. This reduction is therefore in excess of the 3% reduction target of 9% for 2013. The most significant reductions occurring in waste (- 14.5%) and the devolved public (- 13.6%) sectors.

With regards to the 40% reduction target in overall emissions, emissions in Wales have declined from the baseline to 50.76 MtCO₂e in 2013. This represents an 11.9% reduction in total emissions since the baseline. It also shows that in 2013 emissions in Wales rose by 10.3% compared with 2012 driven predominantly by an increase in emissions from the iron and steel sector due to the restart of Tata Steel's Port Talbot No.4 Blast Furnace in February 2013, and a shift from natural gas to coal use in power stations.

10.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for climatic factors have been identified:

- ▶ The input of greenhouse gasses (e.g. CO₂, CH₄, N₂O, O₃) resulting from fossil fuel usage, agriculture and other land use have been linked with atmospheric warming and undesirable climate change.
- ▶ Fossil fuel dependency remains high and is likely to remain so for some time.
- ▶ Legally binding EU and government targets (see: the Climate Change Act 2008 and subsequent revisions: The Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009, The Carbon Budgets Order 2009) seek to reduce emissions (based on a carbon budget of MtCO₂ equivalent) by 80% on 1990 levels by 2050, with an interim target of 34% by 2020.
- ▶ Changes in temperature and rainfall patterns, along with more frequent extreme weather events creates the situation where a greater degree of resilience will have been incorporated into plans and proposals.

10.5 Likely Evolution of the Baseline

UK

Climate

UKCP09 provides the following predictions on changes to climate within the UK based on a medium emission scenario with 90% probability²⁹¹:

- ▶ 2080 mean winter temperature: the central estimates of change are projected to be generally between 2 and 3°C across most of the country, with slightly larger changes in the south-east and slightly smaller in the north-west of Britain;

²⁹¹ UK Climate Projections (2014) *Maps and key findings*. Available online at: <http://ukclimateprojections.defra.gov.uk/21708#key>

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- ▶ 2080 mean summer temperature: a more pronounced south to north gradient exists with changes in some parts of southern England being just over 4°C and in parts of northern Scotland about 2.5°C;
- ▶ 2080 mean summer daily maximum temperature: central estimates show a gradient between parts of southern England, where they can be 5°C or more, and northern Scotland, where they can be somewhat less than 3°C;
- ▶ 2080 mean annual precipitation: shows little change (few percent or zero);
- ▶ 2080 mean winter precipitation: increases are in the range +10 to +30% over the majority of the country. Increases are smaller than this in some parts of the country, generally on higher ground;
- ▶ 2080 mean summer precipitation: general south to north gradient, from decreases of almost 40% in south west England to almost no change in Shetland;
- ▶ The range of absolute sea level rise around the UK (before land movements are included) and across the three emissions scenarios is projected to be between 12 and 76cm for the period 1990-2095, which is a wider spread than that of the global average;
- ▶ The projected long-term future trends in storm surge found in UKCP09 are physically small everywhere around the UK, and in many places can be accounted for by natural variability. The surge level is expected to be exceeded on average once in 2, 10, 20 or 50 years is not projected to increase by more than 9cm by 2100 anywhere around the UK coast (not including the mean sea level change). The largest trends are found in the Bristol Channel and Severn Estuary;
- ▶ Seasonal mean and extreme waves are generally expected to increase in the south west of the UK, reduce to the north of the UK and experience a small change in the southern North Sea. Changes in the winter mean wave height are projected to be between –35 and +5cm. Changes in the annual maxima are projected to be between –1.5 and +1m.

It is anticipated that a new set of climate change projections (UKCP18) will become available in 2018²⁹².

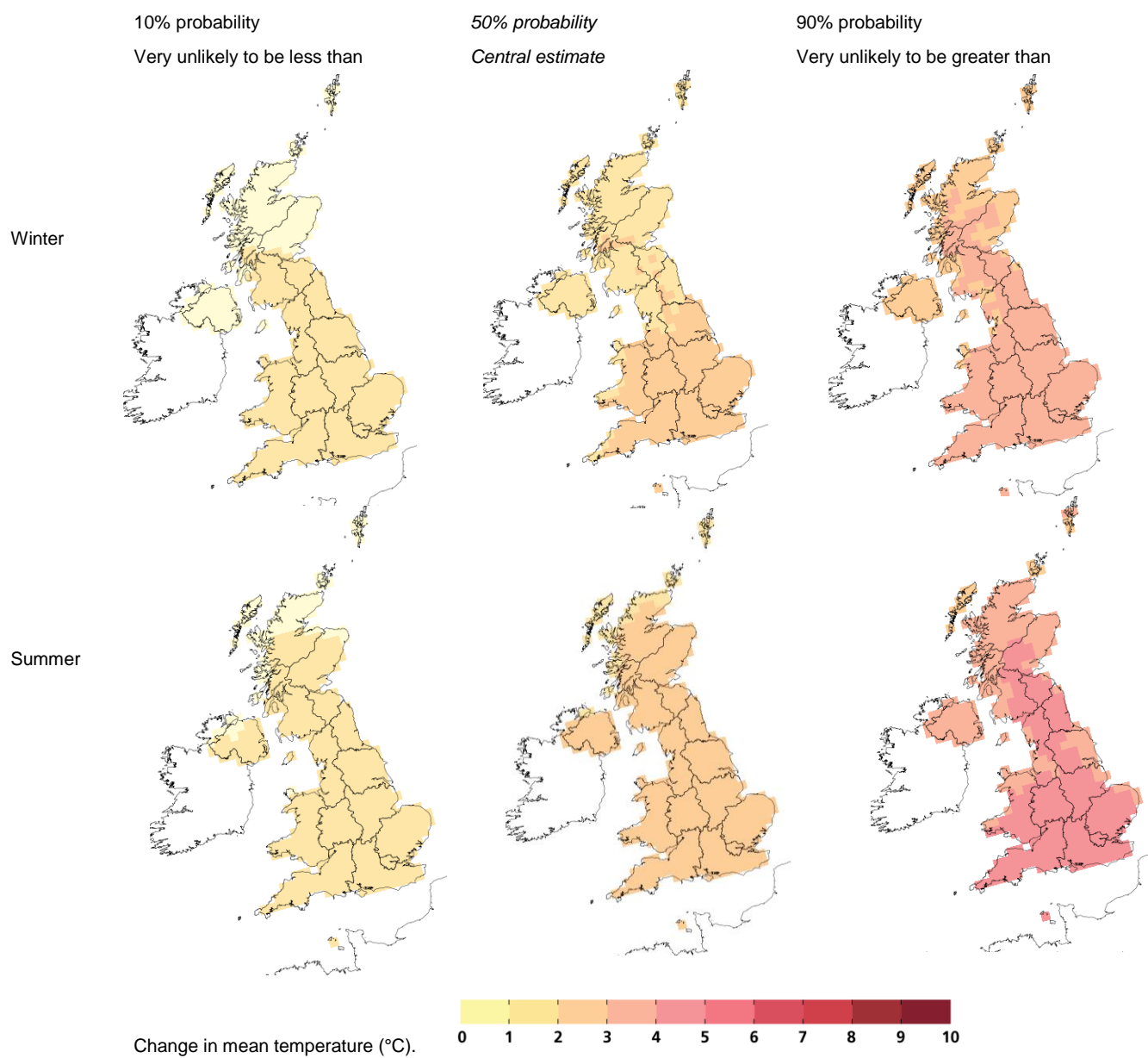
Figure 10.1, Figure 10.2 and Table 10.1 present projections for summer and winter temperature and precipitation for the 2050s (2040-2069) by administrative region, as defined in Murphy et al. (2009). Though impractical to reproduce all the relevant figures here, please refer to the UKCP09 technical website²⁹³ for more information.

²⁹² UK Climate Projections (2016) *UKCP18 Project*. Available online at: <http://ukclimateprojections.metoffice.gov.uk/24126>

²⁹³ UK Climate Projections (2014) *Maps and key findings*. Available online at: <http://ukclimateprojections.defra.gov.uk/21708#key>

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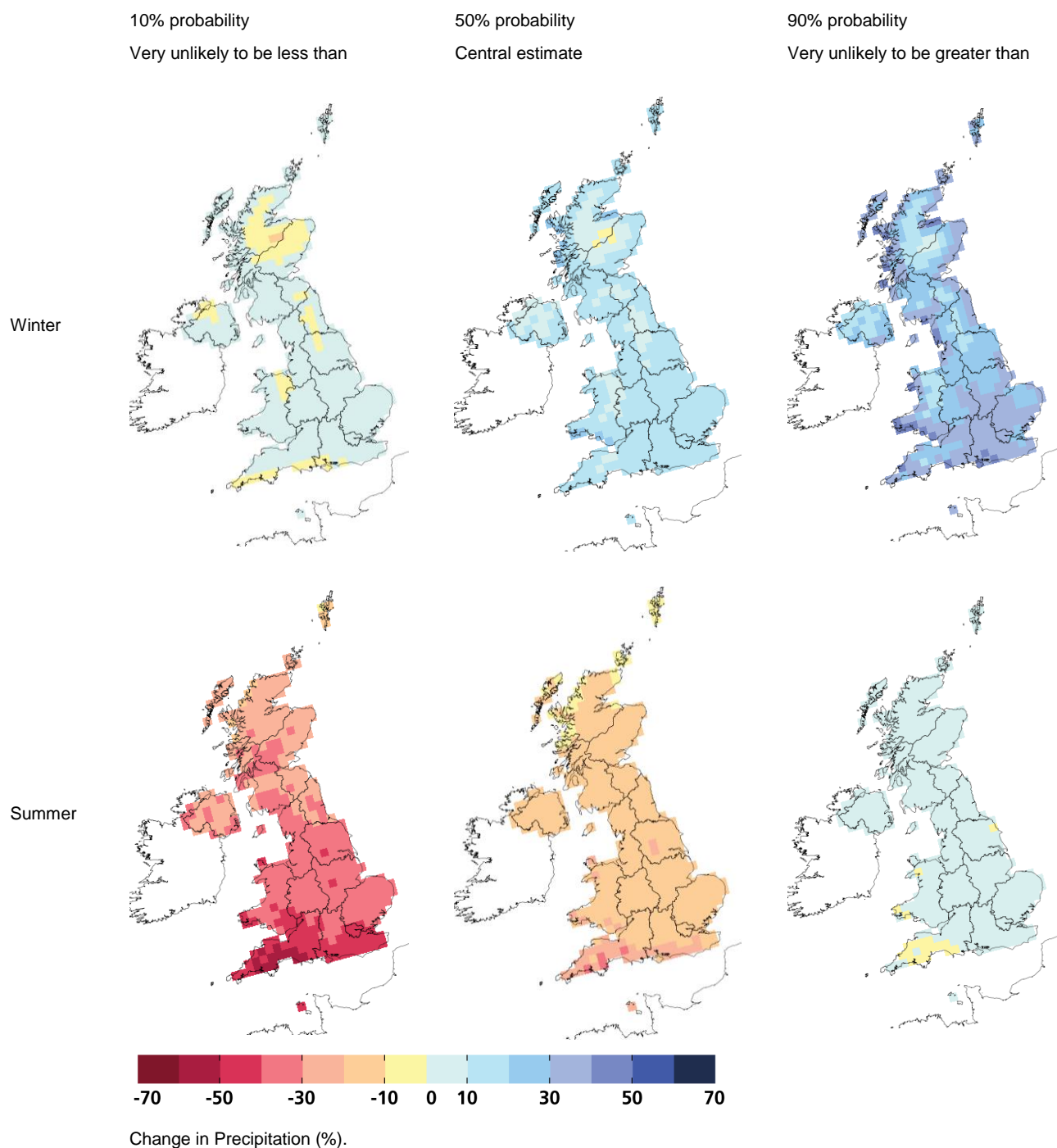
Figure 10.1 Mean Seasonal Probabilistic Temperature Projections for the 2050s, based on the Medium Emissions Scenario



Source: UK Climate Projections 2009 (<http://ukclimateprojections-ui.defra.gov.uk/ui/>).

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Figure 10.2 Mean Seasonal Probabilistic Precipitation Projections for the 2050s, based on the Medium Emissions Scenario



Source: UK Climate Projections 2009 (<http://ukclimateprojections-ui.defra.gov.uk/ui/>).

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Table 10.1 Highest and Lowest Changes in Mean Summer and Winter Temperature (°C) and Precipitation (%) by the 2050s, Relative to 1961-1990 for the Medium Emissions Scenario

Variable	Mean Winter Temperature			Mean Summer Temperature			Mean Winter Precipitation			Mean Summer Precipitation		
	10	50	90	10	50	90	10	50	90	10	50	90
North Scotland	0.6	1.7	2.8	0.9	2	3.4	3	13	24	-23	-10	2
East Scotland	0.7	1.7	2.9	1.1	2.3	3.9	2	10	20	-26	-12	1
West Scotland	1.0	1.9	3.0	1.1	2.4	3.8	5	15	28	-26	-12	1
NE England	1.0	2.0	3.1	1.2	2.5	4.1	1	11	24	-29	-14	1
NW England	1.0	2.0	3.0	1.2	2.6	4.1	3	13	26	-34	-17	1
Yorkshire & Humber	1.1	2.1	3.3	1.1	2.3	3.9	2	11	24	-35	-17	1
East Midlands	1.1	2.2	3.4	1.2	2.5	4.2	2	14	29	-35	-15	6
West Midlands	1.2	2.1	3.2	1.2	2.6	4.4	2	13	28	-36	-16	6
Wales	1.1	2.0	3.1	1.2	2.5	4.1	2	14	30	-36	-16	6
East England	1.1	2.2	3.4	1.2	2.5	4.3	3	14	31	-37	-16	6
London	1.2	2.2	3.5	1.3	2.7	4.6	2	15	33	-39	-18	7
SE England	1.1	2.2	3.4	1.3	2.7	4.6	2	16	36	-40	-18	7
SW England	1.1	2.1	3.2	1.3	2.7	4.6	4	17	38	-41	-19	7

Source: UK Climate Projections 2009 (<http://ukclimateprojections-ui.defra.gov.uk/ui/>).

Greenhouse Gas Emissions

The Climate Change Act 2008 was passed in November 2008 and created a new approach to managing and responding to climate change in the UK. This included putting in place legally binding targets with the aim of reducing emissions by at least 80% by 2050 (compared to 1990 levels) and a set of five-year carbon budgets (legally binding limits on the total quantity of greenhouse gas emissions that the country produces over a five-year period) to 2022. The UK Government has confirmed its intention within the Fifth Carbon Budget to reduce UK greenhouse gas emissions by 57% by 2030 relative to 1990 levels.

The Carbon Plan: Delivering our Low Carbon Future (2011)²⁹⁴ explains that if the UK is to cut emissions by 80% by 2050, there will have to be major changes in how energy is generated and used. In particular:

- ▶ energy efficiency will have to increase dramatically across all sectors;
- ▶ the oil and gas used to drive cars, heat buildings and power industry will, in large part, need to be replaced by electricity, sustainable bioenergy, or hydrogen;
- ▶ electricity will need to be decarbonised through renewable and nuclear power, and the use of carbon capture and storage (CCS);

²⁹⁴ DECC (2011) The Carbon Plan: Delivering our low carbon future. Available online at: <https://www.gov.uk/government/publications/the-carbon-plan-reducing-greenhouse-gas-emissions--2>

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- ▶ the electricity grid will be larger and smarter at balancing demand and supply. In the next decade, the UK is expected to complete the installation of proven and cost effective technologies that are worth installing under all future scenarios;
- ▶ all cavity walls and lofts in homes, where practicable, are expected to be insulated by 2020;
- ▶ the fuel efficiency of internal combustion engine cars will improve dramatically, with CO2 emissions from new cars set to fall by around a third;
- ▶ many of our existing coal-fired power stations will close, replaced primarily by gas and renewable;
- ▶ more efficient buildings and cars will cut fuel costs; and
- ▶ more diverse sources of electricity will improve energy security and reduce exposure to fossil fuel imports and price spikes.

As part of this evolution, under the Renewable Energy Directive (2009/28/EC) the UK is committed to delivering 15% of its energy from renewable sources by 2020.

England

Climate

UKCP09 provides the following changes in climate for England in 2080 based on a medium emission scenario with 90% probability:

- ▶ 2080 mean winter temperature: a change in temperature from 4.0°C in the northwest to 4.7°C in the south and east of England;
- ▶ 2080 mean summer temperature: a change in temperature from 5.4°C in Yorkshire to 6.5°C in the south east;
- ▶ 2080 mean winter precipitation: increases are in the range 41% in the east midlands to 54% in the south west; and
- ▶ 2080 mean summer precipitation: no change is expected in Yorkshire to a 7% increase in the south east and London.

Scotland

Climate

UKCP09 provides the following predictions on changes in climate for Scotland in 2080 based on a medium emission scenario with 90% probability:

- ▶ 2080 mean winter temperature: a change in temperature from 3.6°C to 4.0°C;
- ▶ 2080 mean summer temperature: a change in temperature from 4.9°C to 5.7°C;
- ▶ 2080 mean winter precipitation: increases are in the range 25% to 42%; and
- ▶ 2080 mean summer precipitation: increases are in the range 1-4%.

Greenhouse Gas Emissions

The Climate Change (Scotland) Act 2009 sets an interim 42% reduction target for greenhouse gases by 2020, increasing to 80% by 2050 on 1990 levels, whilst associated Orders set out annual targets to ensure

Climatic Factors

steady progress towards the 2050 target. This covers the basket of greenhouse gases recognised by the UNFCCC, and includes Scotland's share of emissions from international aviation and international shipping.

Wales

Climate

UKCP09 provides the following predictions on changes in climate in Wales for 2080 based on medium emission scenario with 90% probability:

- ▶ 2080 mean winter temperature: a change in temperature of 4.2°C;
- ▶ 2080 mean summer temperature: a change in temperature of 5.8°C;
- ▶ 2080 mean winter precipitation: increases of 42%; and
- ▶ 2080 mean summer precipitation: increases of 5%.

Greenhouse Gas Emissions

Part 2 of the **Environment (Wales) Act 2016** establishes a statutory framework for action on climate change, including targets for reducing emissions of greenhouse gasses and associated duties. The Welsh Ministers are required to ensure that the 'net Welsh emissions account' for the year 2050 is at least 80% lower than the baseline, set at 1990 emissions levels, and they must also specify in regulations interim targets for 2020, 2030 and 20240 and set five yearly carbon budgets.

The Welsh Government also intends to achieve at least a 40% reduction by 2020 compared to figures from 1990. This target is measured against a baseline of average emissions between 2006 and 2010. The 3% target includes all 'direct' greenhouse gas emissions in Wales except those from heavy industry and power generation. Those installations are covered by the EU Emissions Trading Scheme (EU ETS). They have set target ranges for the minimum level of emission reduction they would expect to see from each sector by 2020.

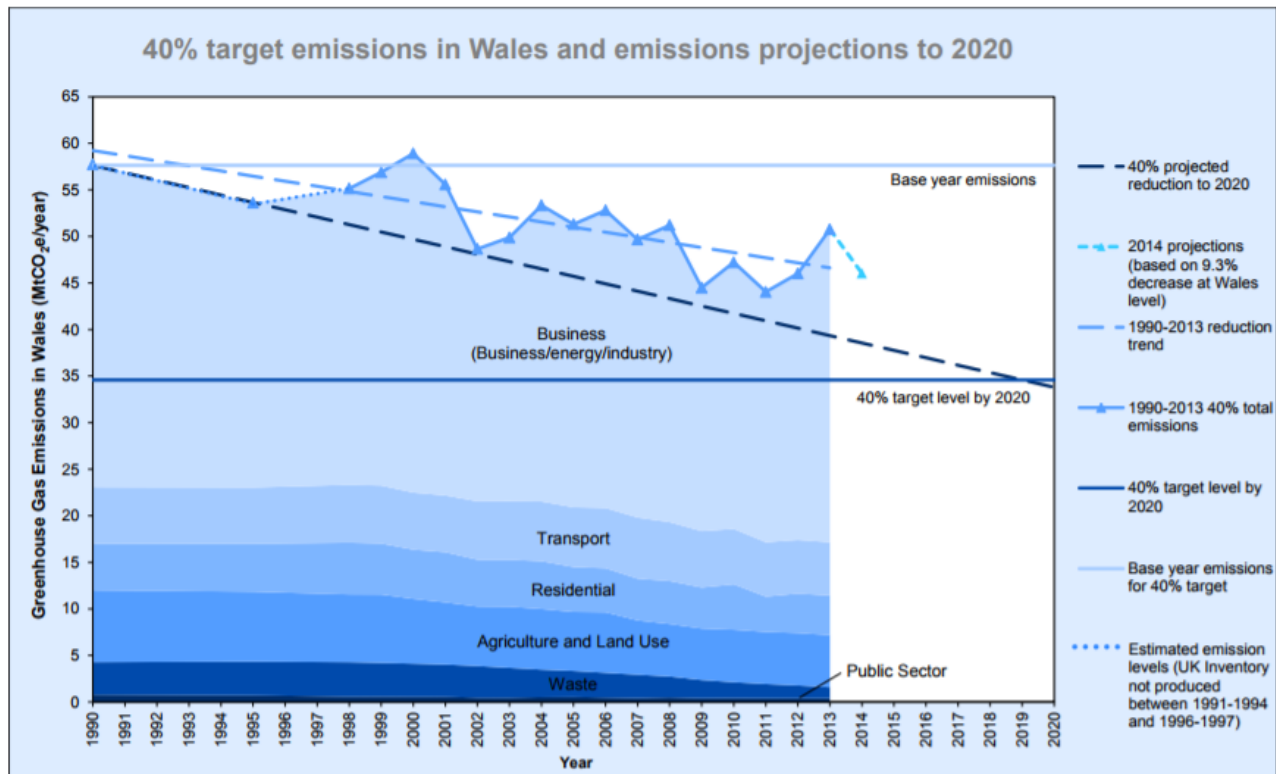
- ▶ public sector reduced to a maximum of 0.83 MtCO₂e, against a baseline of 1.13 MtCO₂e;
- ▶ business emissions (that fall within Wales' 3% target) reduced to between 8.33 and 10.30 MtCO₂e, against a baseline of 11.24 MtCO₂e;
- ▶ transport emissions reduced to between 5.21 and 5.78 MtCO₂e, against a baseline of 7.14 MtCO₂e;
- ▶ agriculture and land use emissions reduced to between 4.07 and 4.97 MtCO₂e, against a baseline of 5.57 MtCO₂e;
- ▶ residential emissions reduced to between 5.46 and 6.04 MtCO₂e, against a baseline of 7.48 MtCO₂e; and
- ▶ waste emissions reduced to between 0.64 and 0.95 MtCO₂e, against a baseline of 1.30 MtCO₂e.

Figure 10.3 shows the projected emissions for Wales and progress against the target of a 40% reductions in emissions compared to the 1990 baseline. Whilst anticipating a reduction in emission for future years, the overall trend in the reduction of emissions is not sufficient to meet the 40% target. This is attributed to an increase in emissions from the restart of Tata Steel's Port Talbot No.4 Blast Furnace in February 2013 and a

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shift from natural gas to coal use in power stations²⁹⁵. It should be noted however that Welsh Ministers must set in regulation before the end of 2018 the interim targets (for 2020, 2030 and 2040) and first two carbon budgets covering the periods 2016- 2020 and 2021- 2025 respectively²⁹⁶, which may further reduce emissions beyond current trends.

Figure 10.3 Emissions projections for Wales



10.6 Assessing Significance

The objectives and guide questions related to climate change which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 10.2**, together with reasons for their selection.

²⁹⁵ Welsh Government (2016) *Sustainable Development and Climate Change Annual Report*. Available online at: <http://gov.wales/docs/desh/publications/160315-sustainable-development-and-climate-change-annual-report-2015-en.pdf>

²⁹⁶ Welsh Government (2017) *Decarbonisation Programme: Newsletter June 2017*. Available online at: <http://gov.wales/docs/desh/publications/170531-decarbonisation-programme-newsletter-en.pdf>

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Table 10.2 Approach to Assessing the Effects of the Water Resources NPS on Climatic Factors

Objective/Guide Question	Reasoning
Objective: To minimise greenhouse gas emissions as a contribution to climate change and ensure resilience to any consequences of climate change.	<p>The SEA Directive (2001/42/EC) requires that the likely significant effects on the environment, which includes population, human health, climatic factors, material assets and their integration, should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>The availability of additional water supplies can increase the resilience of the existing water network and support adaptation to the effects of climate change such as drought. The construction and operation of large scale water resources infrastructure is likely to result in an increase in energy use and greenhouse gas emissions. Water resources infrastructure may be vulnerable to the effects of climate change such as flood risk and coastal change. The inclusion of this AoS objective ensures that these can be considered within the AoS.</p>
Will the Water Resources NPS help to ensure a low carbon design solution to the construction and operation of water resources infrastructure?	Government legislation (Climate Change Act 2008; Flood & Water Management Act 2010) and strategies seek to address the causes and consequences of climate change, minimising harmful emissions and investing in infrastructure that will help limit the consequences of climate change on life, property and other environmental indicators considered as part of this assessment. Government legislation (under international agreements) commits to the progressive reduction in CO ₂ and other greenhouse gas emissions.
Will the Water Resources NPS increase resilience to the effects of climate change?	The Environment Agency's 2011 'Case for Change' considered the implications of climate change for water supplies regionally and nationally and concluded that while demand management will have an important role, significant new water resources will be needed to meet future needs. Water UK's 2016 'Water resources long term planning framework (2015-2065)' noted the importance of strategic schemes to provide future resilience. The Government confirmed in its 'Consultation on the Government's Strategic Priorities for Ofwat: Affordable, Resilient Water Supplies' (2017) that a strategic objective for Ofwat is to further a reduction in the long-term risk to water supply resilience from drought and other factors, through a range of measures including new supply solutions.
Will the Water Resources NPS promote climate change adaptation (including rising temperatures and more extreme weather events)?	UKCP09 scenarios show that increasing temperatures and changes to precipitation, increased storminess and extreme weather is expected, which has the potential to impact on the proposals.

Table 10.3 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the climatic factors objective.

Climatic Factors

Table 10.3 Illustrative Guidance for the Assessment of Significance for Climate Change

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would help to significantly reduce carbon and other greenhouse gas emissions; Option would significantly increase resilience/decrease vulnerability to climate change in the water supply and wider environment.
+	Positive	<ul style="list-style-type: none"> Option would help to reduce carbon and other greenhouse gas emissions; Option would increase resilience/decrease vulnerability to climate change in the water supply and wider environment.
0	Neutral	<ul style="list-style-type: none"> Option would not lead to an overall change in carbon and other greenhouse gas emissions and would not contribute to climate change or resilience to climate change within the wider environment.
-	Negative	<ul style="list-style-type: none"> Option would increase carbon and other greenhouse gas emissions; Option would decrease resilience/increase vulnerability to climate change in the water supply and wider environment.
--	Significant Negative	<ul style="list-style-type: none"> Option would significantly increase carbon and other greenhouse gas emissions; Option would significantly decrease resilience/increase vulnerability to climate change in the water supply and wider environment.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

Waste and Resource Management

11. Waste and Resource Management

11.1 Introduction

This section presents the overview of plans and programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources Infrastructure in respect of waste and resource use.

Waste management in this context is defined as the processing, recycling or disposal of a range of waste types including municipal, commercial and industrial, construction, excavation and demolition and hazardous wastes. However, it is important to note that consideration of the management of waste links to a number of other Appraisal of Sustainability (AoS) topics, the most relevant being climate change given the potential for waste to be recovered for energy use. Resource use, meanwhile, primarily relates to minerals and raw materials with the use of water resources, soils and energy captured under the water quality, land use, geology and soils and climatic factors AoS topics.

11.2 Review of Plans and Programmes

The review of plans and programmes related to waste has identified two key objectives, firstly the need to minimise and manage waste in accordance with the waste management hierarchy and secondly the suitable disposal of hazardous wastes. The need to minimise and manage waste affects all industries and avoiding waste contamination in waterways is an important part of maintaining aquatic ecosystems and ensuring a safe water supply.

International/European

At the international level, the **Basel Convention** entered into force in 1992 and is a global agreement, ratified by several member countries and the European Union, for addressing the problems and challenges posed by hazardous waste. The key objectives of the Basel Convention are:

- ▶ to minimise the generation of hazardous wastes in terms of quantity and hazardousness;
- ▶ to dispose of them as close to the source of generation as possible; and
- ▶ to reduce the movement of hazardous wastes.

The **World Summit on Sustainable Development (2002)** in Johannesburg proposed broad-scale principles which should underlie sustainable development and growth, including an objective on greater resource efficiency.

At the European Level, the **Waste Framework Directive (2008/98/EC)** provides an overarching framework of waste management requirements and sets the basic waste management definitions for the EU. This Directive repealed Directive 2006/12/EC on waste (the codified version of Directive 75/442/EEC as amended), the Hazardous Waste Directive 91/689/EEC, and the Waste Oils Directive 75/439/EEC. The revised Waste Framework Directive includes waste disposal and the protection of the environment from harmful effects caused by the collection, transport, treatment, storage and tipping of waste. It aims to encourage the recovery and use of waste in order to conserve natural resources. The key principles of the Directive include the 'Waste Management Hierarchy' which provides an environmental priority order for waste management options which are: prevention; preparing for re-use; recycling; other recovery (e.g. energy recovery); and disposal. Key objectives are to reduce the adverse impacts of the generation of waste and the overall impacts of resource use. This should be done through a variety of mechanisms, including:

Waste and Resource Management

- ▶ by 2020, requiring Member States to re-use and recycle 50% of their household waste (by weight) and to reuse, recycle and recover 70% of their non-hazardous construction and demolition waste (by weight);
- ▶ applying the waste hierarchy - promoting waste minimisation followed by reuse and recycling, other recovery (such as energy recovery) and disposal - as a priority order in waste prevention and management legislation and policy;
- ▶ taking measures as appropriate to promote the re-use of products and preparing for re-use activities; and
- ▶ extending the self-sufficiency and proximity principles to apply to installations for recovery of mixed municipal waste from households.

Hazardous wastes pose more of a threat to human health and the environment than do non-hazardous wastes, and consequently require more stringent controls. These are set out in particular in Articles 17 to 20 of Directive 2008/98/EC. It provides additional labelling, record keeping, monitoring and control obligations from the "cradle to the grave", i.e., from the waste producer to the final disposal or recovery. In addition, mixing of hazardous substances is banned in order to prevent threats to the environment and human health. Also, the permit exemptions that may be granted to installations dealing with hazardous wastes are more restrictive than for installations dealing with other wastes.

The approach to classifying hazardous and non-hazardous waste hinge on the system for the classification and labelling of dangerous substances and preparations, which ensures the application of similar principles over their whole life cycle. The properties which render waste hazardous are laid down in Annex III of Directive 2008/98/EC and are further specified by European Commission Decision 2000/532/EC, which establishes a List of Wastes, as last amended by European Commission Decision 2001/573/EC. A review of the List of Wastes has recently been completed and guidance on the classification and assessment of waste has been published by the UK environment agencies²⁹⁷.

In this context, the **Landfill Directive (1999/31/EC)** focuses on waste minimisation and increasing levels of recycling and recovery. The overall aim of the Directive is to prevent, or reduce as far as possible, negative effects on the environment (in particular the pollution of surface water, groundwater, soil and air and on the global environment, including the greenhouse effect) as well as any resulting risk to human health from the landfilling of waste, during the whole lifecycle of the landfill. The Directive sets the target of reducing biodegradable municipal waste landfilled to 35% of that produced in 1995 by 2020.

There are a number of **Producer Responsibility Directives** relating specifically to consumer products. Their purpose is to require businesses to reuse, recover and recycle waste which comes from products they produce, and each Directive sets national targets for recovery and recycling of these wastes.

The **Mining Waste Directive (2006/21/EC)** aims to prevent or reduce as far as possible the adverse effects on the environment and any resultant risks to human health from the management of waste from the extractive industries (e.g. mining). The Directive sets out how to achieve this aim by providing for measures, procedures and guidance on how extractive industries should be managed.

The **Industrial Emissions Directive (2010/75/EU)** is the main EU instrument regulating pollutant emissions from industrial installations. The Directive prescribes emission limit values for certain industrial processes/plants including waste incineration, requires other emissions limit values to be based on Best

²⁹⁷ Natural Resources Wales, SEPA, NIEA, Environment Agency. Guidance on the classification and assessment of waste (1st edition 2015) Technical Guidance WM3. 2015.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Waste and Resource Management

Available Techniques (BAT), and introduces detailed technical and consultation requirements for permitting processes.

In addition to the above Directives a number of European level policy publications are also of relevance. In relation to general waste minimisation and management issues, the **European Sustainable Development Strategy (2006)** and the subsequent **Review of the EU Sustainable Development Strategy (2009)** identifies sustainable consumption and production as one of seven key challenges and cross-cutting themes, whilst the European Commission's **Closing the loop - An EU Action Plan for the Circular Economy** (2015) seeks to implement the Commission's long-term vision of significantly reducing waste landfilling and increasing recycling.

UK

In terms of relevant UK level national policy documents, the UK Government's Sustainable Development Strategy: Securing the Future and the UK's Shared Framework for Sustainable Development, One Future - Different Paths) include sustainable consumption and production as one of four priorities and consider the five guiding principles:

- ▶ living within environmental limits;
- ▶ ensuring a strong, healthy and just society;
- ▶ achieving a sustainable economy;
- ▶ using sound science responsibly; and
- ▶ promoting good governance.

England

The revised Waste Framework Directive has been implemented by the **Waste (England and Wales) Regulations 2011** (SI 2011/988), which sets out the main statutory provisions of relevance. This has been amended by the **Waste (England and Wales) (Amendment) Regulations 2012** and the **Waste (England and Wales) (Amendment) Regulations 2014**.

In June 2011 Defra published a **Government Review of Waste Policy in England**, which looked at the most effective ways of reducing waste, maximising the money to be made from waste and recycling and considering how waste policies affect local communities and individual households. The report set out a number of 'Principal Commitments' that aim to achieve a more sustainable approach to the use of materials, deliver environmental benefits and support economic growth. These include:

- ▶ promoting resource efficient product design and manufacture and target those waste streams with high carbon impacts, both in terms of embedded carbon (food, metals, plastics, textiles) and direct emissions from landfill (food, paper and card, textiles, wood);
- ▶ promoting the use of life cycle thinking in all waste policy and waste management decisions and the reporting of waste management in carbon terms, as an alternative to weight-based measures;
- ▶ developing a comprehensive Waste Prevention Programme and in the meantime working with businesses and other organisations across supply chains on a range of measures designed to drive waste reduction and re-use as part of a broader resource efficiency programme; and
- ▶ continuing to help local communities develop fit for purpose local solutions for collecting and dealing with household waste and working with councils to meet households' reasonable expectations for weekly collections, particularly of odorous waste.

Waste and Resource Management

In December 2013, the **Waste Management Plan for England (WMPE)** was released by Defra, replacing the National Waste Strategy 2007. It meets the requirements of the revised Waste Framework Directive by bringing together existing plans, policies and legislation under one umbrella. The WMPE does not set new policies or targets but refers to those from the revised Waste Framework Directive that are transposed into the **Waste (England and Wales) Regulations 2011** (SI 2011/988). It evaluates how it will support implementation of the objectives and provisions of the revised Waste Framework Directive, and fulfils Article 28 mandatory requirements which specify that the Plan should contain the following information:

- ▶ an analysis of the current waste management situation in the geographical entity concerned, as well as the measures to be taken to improve environmentally sound preparing for re-use, recycling, recovery and disposal of waste and an evaluation of how the Plan will support the implementation of the objectives and provisions of the revised Waste Framework Directive;
- ▶ the type, quantity and source of waste generated within the territory, the waste likely to be shipped from or to the national territory, and an evaluation of the development of waste streams in the future;
- ▶ existing waste collection schemes and major disposal and recovery installations, including any special arrangements for waste oils, hazardous waste or waste streams addressed by specific Community legislation;
- ▶ an assessment of the need for new collection schemes, the closure of existing waste installations, additional waste installation infrastructure in accordance with Article 16 (on the proximity principle), and, if necessary, the investments related thereto;
- ▶ sufficient information on the location criteria for site identification and on the capacity of future disposal or major recovery installations, if necessary; and
- ▶ general waste management policies, including planned waste management technologies and methods, or policies for waste posing specific management problems.

The **Waste Prevention Programme for England (December 2013)** sets out the roles and actions that government, businesses, the wider public sector and civil society must play, to reduce the amount of waste produced in England.

The **National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2012)** sets out the Government's expectation for local planning authorities to set out the strategic priorities for their area in the local plan and include strategic policies to deliver the provision of infrastructure for waste management and the provision of minerals. In doing so, they should work with other relevant organisations and providers to assess the quality and capacity of infrastructure for waste and its ability to meet forecast demands.

Minerals planning authorities are expected to develop and maintain an understanding of the mineral resource (of both local and national importance) in their areas and assess the projected demand for their use, taking full account of opportunities to use materials from secondary and other sources which could provide suitable alternatives to primary materials. The NPPF defines 'minerals of local and national importance' as minerals which are necessary to meet society's needs, including aggregates, brick, clay, silica sand, cement raw materials, gypsum, salt, fluorspar, coal, oil and gas (including hydrocarbons) tungsten, kaolin, ball clay, potash and local minerals of importance to heritage assets and local distinctiveness.

In order to facilitate the sustainable use of minerals, the NPPF sets out a number of expectations relating to specific minerals for local authority plan-making and decisions on planning applications. In doing so, the Framework includes safeguards so as to ensure permitted operations do not have unacceptable adverse impacts on the natural and historic environment or human health.

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National Planning Policy for Waste (October 2014) sets out detailed waste planning policies and is intended to be read in conjunction with the National Planning Policy Framework, the Waste Management Plan for England and National Policy Statements for Waste Water and Hazardous Waste.

Planning Practice Guidance (October 2014) provides guidance on the planning for mineral extraction in plan making and the application process, as well as further information in support of the implementation of waste planning policy.

Hazardous waste in England is addressed by the Hazardous Waste (England and Wales) Regulations 2005 as amended by The Hazardous Waste (England and Wales) (Amendment) Regulations 2009 and the Hazardous Waste (England and Wales) (Amended) Regulations 2016.

Defra's **Strategy for Hazardous Waste Management in England (2010)** sets out the following principles for hazardous waste management:

- ▶ waste hierarchy;
- ▶ infrastructure provision;
- ▶ reduce our reliance on landfill;
- ▶ no mixing or dilution;
- ▶ treatment of hazardous organic wastes; and
- ▶ end reliance on the use of Landfill Directive waste acceptance criteria derogations.

The **National Policy Statement for Hazardous Waste (Defra, 2013)** provides the framework for decisions on proposals for new nationally significant hazardous waste infrastructure.

The **Resource Security Action Plan (Defra, 2012)** provides a framework for business action to address risks about the availability of some non-renewable raw materials (including minerals), and sets out high level actions to build on the developing partnership between Government and businesses to address resource concerns. This Action Plan emphasises the need to make best use of resources currently in use, reducing as far as practicable the quantity of material used and waste generated, and using as much recycled and secondary material as possible, before securing the remainder of material needed through new primary extraction.

Scotland

The **revised Waste Framework Directive** has been transposed into law in Scotland through the following legislation, as amended:

- ▶ The National Waste Management Plan for Scotland Regulations 2007 (SSI 2007/251);
- ▶ The Waste Management Licensing (Scotland) Regulations 2011 (SSI 2011/228);
- ▶ The Waste (Scotland) Regulations 2011 (SSI 2011/226) and The Waste (Scotland) Regulations 2012 (SSI 2012/148); and
- ▶ Consequential amendments to existing pollution prevention/control and landfill regulations.

Choosing our Future: Scotland's Sustainable Development Strategy 2005 reflects the five principles found within the UK Sustainable Development Strategy and includes objectives on protecting Scotland's natural heritage and resources. **Scotland's Government Economic Strategy (2015)** reaffirms the Scottish Government's commitment to delivering increased sustainable economic growth.

Safeguarding Scotland's Resources – Blueprint for a More Resource Efficient and Circular Economy (2013) is a programme committed to making an immediate impact in Scotland's resource consumption, encouraging a reduction in raw material use to benefit the environment and economy. **Making things Last:**

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Consultation on creating a more circular economy in Scotland (2015) explores the priorities for building a more circular economy – where products and materials are kept in high value use for as long as possible.

Scotland's **Zero Waste Plan (2010)** sets out the Scottish Government's vision for a zero-waste society. To achieve this vision, the Plan sets out new measures including:

- ▶ development of a Waste Prevention Programme for all wastes, ensuring the prevention and reuse of waste is central to all actions and policies;
- ▶ landfill bans for specific waste types therefore reducing greenhouse gas emissions and capturing the value from these resources;
- ▶ separate collections of specific waste types, including food, to avoid contaminating other materials, increasing reuse and recycling opportunities and contributing to renewable energy targets;
- ▶ two new targets that will apply to all waste: 70% target recycled, and maximum 5% sent to landfill, both by 2025;
- ▶ restrictions on the input to all energy from waste facilities;
- ▶ encouraging local authorities and the resource management sector to establish good practice commitments and to work together to create consistent waste management services, benefitting businesses and the public;
- ▶ improved information on different waste sources, types and management highlighting further economic and environmental opportunities; and
- ▶ measuring the carbon impacts of waste to prioritise the recycling of resources which offer the greatest environmental and climate change outcomes.

Scotland's **National Planning Framework 3 (2014)** sets out the spatial strategy for Scotland over the next 20 to 30 years. It is a spatial expression of the Government Economic Strategy and of its plans for development and investment in infrastructure. This strategy is underpinned by the following aims:

- ▶ to create high quality, diverse and sustainable places that promote well-being and attract investment;
- ▶ to achieve at least an 80% reduction in greenhouse gas emissions by 2050;
- ▶ to respect, enhance and make responsible use of its natural and cultural assets;
- ▶ to maintain and develop good internal and global connections.

Water management and flooding is highlighted as a key issue that is thought to become increasingly important, as are changing water supplies and water quality issues as some of a number of issues that should be factored into planning decisions over the longer term. Moreover, Scotland's abundant water resources are valued for their contribution to quality of life; specifically, through the food and drink sector.

Demand for minerals is sought to support the construction and energy sectors and the Government's ambition for diversifying the energy mix. However, the need to actively address the past impacts of mineral extraction, through restoration and enhancement is highlighted.

The framework sets out 30 Actions to ensure that the delivery of priorities is co-ordinated with other strategies and targets for the Scottish Government and its agencies. As part of aspirations to deliver a 'low carbon place', the framework requires the Highland Council, and Dumfries and Galloway Council to continue to work with partners and communities to develop planning frameworks associated with the decommissioning of nuclear power stations at Dounreay and Chapelcross.

The **Scottish Planning Policy (2014)** sets out policies for (inter alia) the extraction of resources. It stipulates that the planning system should:

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- ▶ safeguard workable resources and ensure that an adequate and steady supply is available to meet the needs of the construction, energy and other sectors;
- ▶ minimise the impacts of extraction on local communities, the environment and the built and natural heritage; and
- ▶ secure the sustainable restoration of sites to beneficial afteruse after working has ceased.

In recognition of Scotland's Zero Waste Plan (2010), the SPP (2014) states that the planning system should help deliver infrastructure at appropriate locations, prioritising development in line with the waste hierarchy.

Planning Advice Note: PAN 50 controlling the environmental effects of surface mineral workings (October 1996) provides advice on the more significant environmental effects arising from mineral working operations.

The Scottish Government's **Online Planning and Waste Management Advice (July 2015)** complements the National Planning Framework 3 (2014), SPP (2014) and Scotland's Zero Waste Plan (2010). It replaced PAN 63 under Part 2 of the National Waste Management Plan for Scotland Regulations 2007.

Wales

Part 1 of the **Environment (Wales) Act 2016** is concerned with the sustainable management of natural resources. It makes provisions for a new iterative process for the Welsh Ministers, Natural Resources Wales and other public bodies to contribute to achieving the sustainable management of natural resources. Part 1 of the Act also defines natural resources, sustainable management of natural resources and the principles of sustainable management of natural resources, and it confers functions on the Welsh Ministers and others to assist in the delivery of sustainable management of natural resources. Part 4 of the Act, meanwhile, is concerned with the collection and disposal of waste, and makes provision for requiring source segregation and separate collection of waste, banning the incineration of waste and banning the disposal of food waste to sewer from non-domestic premises. The purpose of the provisions is to promote increased separation of different types of waste, and prohibit certain forms of disposal of recoverable types of waste.

Planning Policy Wales (Edition 9): Chapter 12 Infrastructure and Services (2016) deals with infrastructure and services; specifically issues of water supply and waste water management, waste management, energy supply from renewable and low carbon sources, and telecommunications. The overriding objective is for local planning authorities to "*maximise the use of existing infrastructure and should consider how the provision of different types of infrastructure can be co-ordinated*".

Towards Zero Waste (2010) is the overarching waste strategy document for Wales. It was published in 2010. The document sets out at a high-level strategy for the management of waste in Wales to produce benefits not only for the environment, but also for the economy and social wellbeing. Delivery actions have been developed in a series of sector plans, a **Waste Prevention Programme (2013)** and **Technical Advice Note (TAN) 21: Waste (2014)**, which provide advice on the role of land use planning in the management and control of waste. The Welsh Government has also created the **Natural Resource Management Programme** to take forward the policy commitments proposed in the **Sustaining a Living Wales Green Paper on a New Approach to Natural Resource Management in Wales (2012)**. This Programme includes:

- ▶ natural resource management policy, including the setting of national priorities;
- ▶ the Environment Bill;
- ▶ embedding the ecosystem approach, including associated demonstration projects which will showcase the benefits this approach can bring, and from which we can learn about how and when the approach can be used;
- ▶ working with Natural Resources Wales and coordinating performance management arrangements; and

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- communications, engagement and knowledge sharing.

Those **waste regulation that apply to England as identified above also apply to Wales, namely the Waste (England and Wales) Regulations 2011 as amended by the Waste (England and Wales) (Amendment) Regulations 2012 and the Waste (England and Wales) (Amendment) Regulations 2014.**

The **Hazardous Waste (Wales) Regulations 2005** set out the regime in Wales for the control and tracking of the movement of hazardous waste, as amended by The Hazardous Waste (Wales) (Amendment) Regulations 2009 and The Hazardous Waste (Miscellaneous Amendments) (Wales) Regulations 2015.

Technical Advice Note (TAN) 12: Design (2014) sets out the Welsh Government's land use planning policy in respect of promoting sustainability through good design. Achieving the efficient use and protection of natural resources is identified as an objective for good design. **Minerals Technical Advice Note (MTAN) Wales 1: Aggregates (March 2004)** sets out planning policy guidance in relation to aggregates extraction and related development in Wales is to provide aggregate resources in a sustainable way to meet society's needs in respect of aggregates related development.

11.3 Overview of the Baseline

UK

The UK Statistics on waste for December 2016²⁹⁸ includes the following key points:

- The UK recycling rate for 'waste from households' was 44.3 per cent in 2015, falling from 44.9 per cent in 2014. This is the first time the rate has fallen since it began in 2010, though the 2015 figure still represents the second highest annual value on record. There is an EU target for the UK to recycle at least 50 per cent of household waste by 2020.
- UK Biodegradable Municipal Waste (BMW) sent to landfill has continued to reduce and in 2015 was 7.7 million tonnes. This represents 22 per cent of the 1995 baseline value. There is an EU target to restrict BMW landfilled to 35 per cent of the 1995 baseline by 2020. The UK comfortably met interim targets for 2010 and 2013.
- The recovery rate from non-hazardous construction and demolition waste in the UK in 2014 was 89.9 per cent. There is an EU target for the UK to recover at least 70 per cent of this type of waste by 2020.
- UK generation of commercial and industrial (C&I) waste was 27.7 million tonnes. This has fallen from 32.8 million tonnes in 2012.
- The UK generated 202.8 million tonnes of total waste in 2014. Over half of this (59.4 per cent) was generated by construction, demolition and excavation, with households responsible for a further 13.7 per cent.
- Of the 209.0 million tonnes of all waste that entered final treatment in the UK in 2014, 44.5% was recovered (including recycling and energy recovery). The proportion that went to landfill was 23.1 per cent.
- In 2014, 64.1 per cent of UK packaging waste was either recycled or recovered compared to 72.7 per cent in 2013. The 2014 EU target was for the UK to recycle or recover at least 60 per cent of packaging waste.

²⁹⁸ Defra (2016) *UK Statistics on Waste*. Available online at:

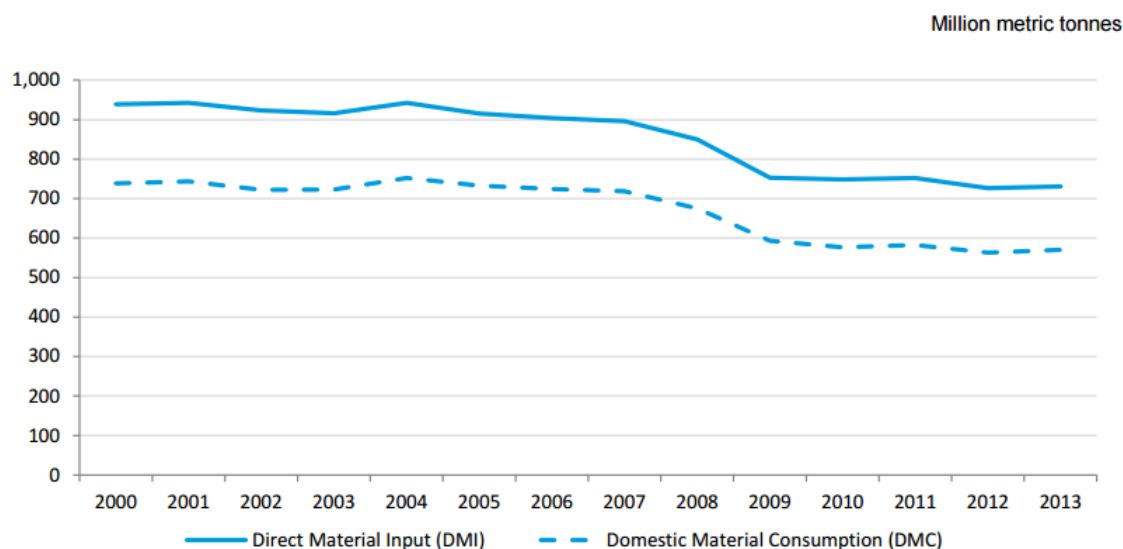
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593040/UK_statsonwaste_statsnotice_Dec2016_FINALv2_2.pdf

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Resource Use and Minerals

According to Defra Resource Statistics (2015)²⁹⁹, in 2013, the Domestic Material Consumption (DMC) was 570 million tonnes, and Direct Material Input (DMI) was 731 million tonnes – the lowest levels recorded on its records (See **Figure 11.1**)

Figure 11.1 UK Direct Material Input and Domestic Material Consumption, 2000 – 2012



Notes: Direct Material Input (DMI) (Domestic extraction + Imports) measures the total amount of materials available for use in the economy, Domestic Material Consumption (DMC) (Domestic extraction + Imports – Exports) measures the amount of materials used in the economy, and is calculated by subtracting exports from DMI.

Source: Defra: Digest of Waste and Resources Statistics – 2016 Edition.

Table 11.1 summarises totals for extractors' sales of material for agricultural and industrial uses for 2013 for different mineral types³⁰⁰.

²⁹⁹ Defra (2016) *Digest of Waste and Resource Statistics – 2016 Edition (revised)*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567502/Digest_waste_resource_2016_rev4.pdf

³⁰⁰ DCLG (2016) *Mineral Extraction in Great Britain 2014*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/505631/Mineral_Extraction_in_Great_Britain_2014_final.pdf

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Table 11.1 Summary of totals for extractors' sales of material for agricultural, industrial and construction uses for 2013 for different mineral types

Mineral Type	UK Total Extractors' sales of material for agricultural and industrial uses for 2013 (Thousand tonnes)
Limestone, Dolomite and Chalk	69,640
Industrial Sand	3,948
Sand and Gravel	56,129
Sandstone	9,737
Igneous Rock	338,283
Peat	795
Crushed Rock	98,423
Clay & Shale	6,806
Chalk*	3,312
Fireclay	129

*NB only those parts of GB producing chalk are identified.

Source: DCLG: Mineral Extraction in Great Britain 2014, Business Monitor PA1007 (March 2016).

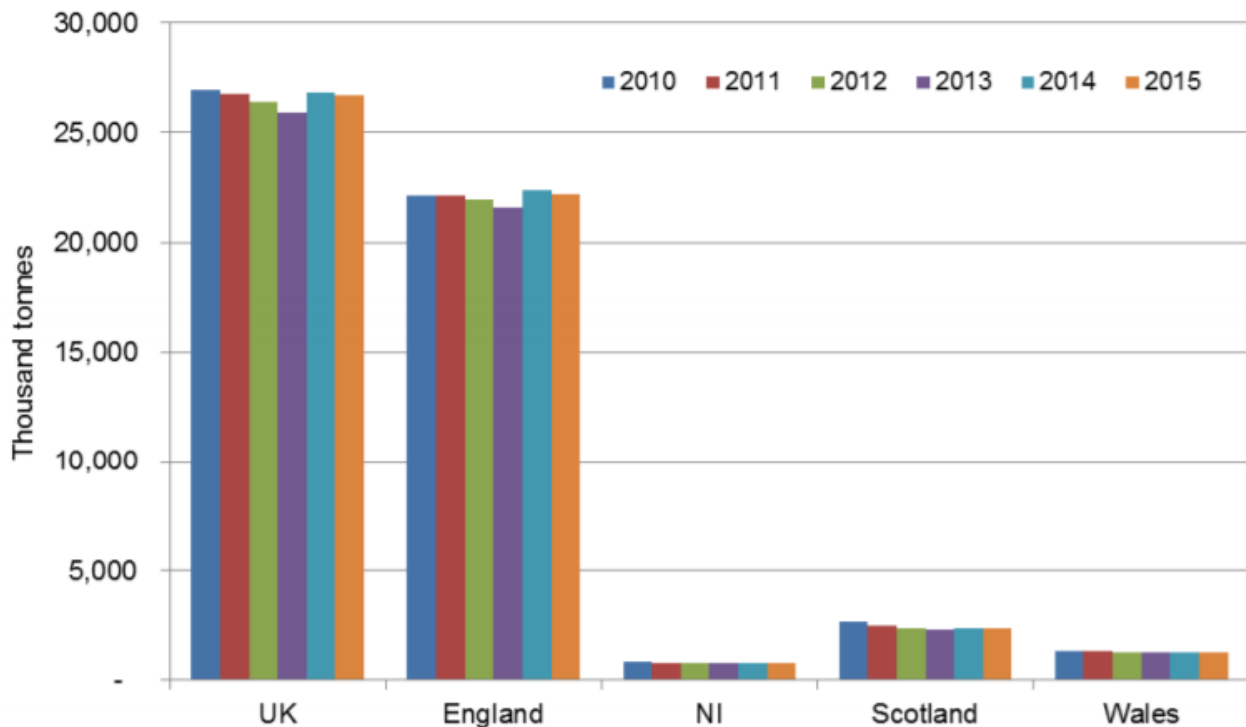
England

Waste

As can be seen in **Figure 11.2**, England is responsible for the majority of waste to landfill generated in the UK, with levels remaining relatively stable from 2010 – 2015

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Figure 11.2 Quantity of waste from households 2010-2015



Source: Defra

Commercial and industrial waste arising for the UK and England are shown in **Table 11.2**. The term 'commercial and industrial' spans a range of economic activities (based on the European NACE statistical classification of economic activities in the European Community) including manufacturing, industrial processes and service based enterprises. The UK Commercial and Industrial sectors generated 27.7 million tonnes of waste in 2014, of which 19.8 million tonnes was in England.

Table 11.2 Total waste generation from the commercial and industrial sectors 2010-2014

<i>million tonnes</i>						
	UK			England		
	Commercial	Industrial	Total C&I	Commercial	Industrial	Total C&I
2010	20.0	13.9	33.9	13.1	9.5	22.6
2011	UK 2011 Estimates not available			England 2011 Estimates not available		
2012	16.9	15.9	32.8	12.9	11.3	24.2
2013	UK 2013 Estimates not available			11.6	10.4	21.9
2014	15.1	12.6	27.7	11.1	8.7	19.8

Source: Defra statistics

The household recycling rate in England in 2015 was 43.9%, an increase of 2.7% since 2010 but below the UK rate of 44.3%³⁰¹.

³⁰¹ Defra (2016) *UK Statistics on Waste*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593040/UK_statsonwaste_statsnotice_Dec2016_FINALv2_2.pdf

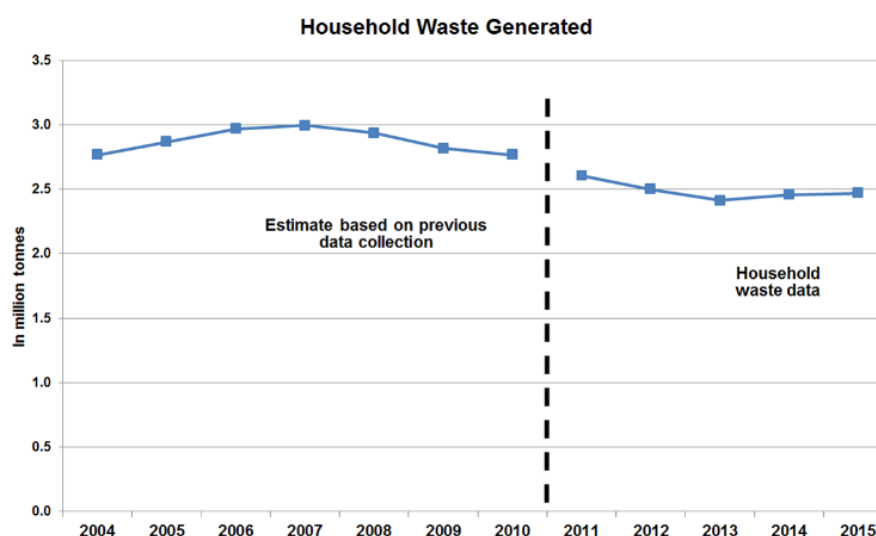
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Scotland

Waste

As shown in **Figure 11.3**, between 2004 and 2007 the amount of household waste generated in Scotland increased from 2.77 million tonnes to 3.00 million tonnes, before falling back to 2.77 million tonnes in 2010. Between 2011 and 2015, the total amount of household waste generated fell by 5.3% (0.14 million tonnes)³⁰².

Figure 11.3 Household Waste Generation in Scotland (2004-2015)



Source: Scottish Government (2016). Household Waste Generated - High Level Summary of Statistics Trend.

Between 2005 and 2014, the amount of Scottish waste sent to landfill decreased by 42%. Over the same period, the amount of biodegradable municipal waste landfilled in Scotland decreased by 51%. The household waste recycling rate in 2015 was 44.2%, increasing from 42.8% in 2014. There has also been a decline in households throwing food out with general waste, from 73% in 2012 to 55% in 2015. The proportion of households reporting that they recycled a range of other waste items increased each year between 2003 and 2011, however between 2011 and 2015 there was little change in the percentage of households recycling each item, except for plastic bottles which increased by 7 percentage points to 82%³⁰³.

Wales

Waste

Table 11.3 shows waste arisings by management method as reported by the Welsh Government.

³⁰² Scottish Government (2016) *Household Waste Generated - High Level Summary of Statistics Trend*. Available online at: <http://www.gov.scot/Topics/Statistics/Browse/Environment/TrendHouseholdWaste>

³⁰³ Scottish Government (2016) *Key Scottish Environment Statistics 2016*. Available online at: <http://www.gov.scot/Resource/0050/00508344.pdf>

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Table 11.3 Waste arisings by sector

	1998-99	2002-03	2007-08
Landfill	4,765	3,647	3,089
Recycled	4,524	6,671	13,476
Other recovery	1,329	2,353	101
Other disposal	306	156	357
Energy recovery	37	24	27

In 2015-16 total municipal waste produced in Wales amounted to approximately 1.59 million tonnes, of which approximately 289,000 tonnes of waste were sent to landfill. The percentage of waste which was reused, recycled or composted stood at 60.2%, up from 56.2% in 2014-15³⁰⁴.

11.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for waste and resource use have been identified:

- ▶ The total amount of waste produced each year is likely to decrease in coming years.
- ▶ The consumption of non-renewable sources will deplete overall stocks and result in a scarcity of resources for future generations.

11.5 Likely Evolution of the Baseline

UK

The majority of UK trend data shows an ongoing improvement in UK waste management practices, both in terms of a reduction in the level of waste generation and a greater use of sustainable alternatives to landfill. The UK recycling rate for 'waste from households' was 44.3 per cent in 2015, falling from 44.9 per cent in 2014. This is the first time the rate has fallen since it began in 2010, though the 2015 figure still represents the second highest annual value on record, suggesting that household recycling rates may have plateaued³⁰⁵.

England

Defra has established targets for England which includes a greater focus on waste prevention, seeking to achieve a fall of 50% per person in household waste arising. Recycling and composting of household waste targets have been established - at least 50% by 2020; and recovery of municipal waste - 75% by 2020.

³⁰⁴ Welsh Government (2016) *Waste managed (tonnes) by management method and year*. Available online at: <https://statswales.wales.gov.uk/Catalogue/Environment-and-Countryside/Waste-Management/Local-Authority-Municipal-Waste/Annual/wastemanaged-by-management-year>

³⁰⁵ Defra (2016) *UK Statistics on Waste*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593040/UK_statsonwaste_statsnotice_Dec2016_FINALv2_2.pdf

Waste and Resource Management

On the basis of an evaluation of the development of waste streams in the future set out in the Waste Management Plan for England³⁰⁶ commercial and industrial waste arisings are predicted to fall to 43.9 million tonnes by 2020.

Scotland

Under the 'Zero Waste Plan', the Scottish Government has set a long-term target of 70% recycling/composting and preparing for reuse of all waste arising in Scotland by 2025, regardless of its source. The Scottish Government has also set a target of no more than 5% of all waste produced to go to landfill by 2025³⁰⁷.

Wales

With regard to commercial wastes, Towards Zero Waste - One Wales: One Planet³⁰⁸ seeks to increase recycling from 57% in the period 2015/16 and to 70% in 2024/25. For industrial wastes, recycling is targeted to increase from 63% in the period 2015/16 to 70% in 2024/25.

11.6 Assessing Significance

The objectives and guide questions related to waste and resource use which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 11.4**, together with reasons for their selection.

³⁰⁶ Defra (2013) *Waste Management Plan for England*. Available online at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265810/pb14100-waste-management-plan-20131213.pdf

³⁰⁷ Scottish Environment Protection Agency (2010) *Scotland's Zero Waste Plan Data*. Available online at:
http://www.sepa.org.uk/waste/waste_data/zero_waste_plan_data.aspx

³⁰⁸ Welsh Assembly Government (2010) *Towards Zero Waste - One Wales: One Planet*. Available online at:
<http://gov.wales/docs/desh/publications/100621wastetowardszeroen.pdf>

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Table 11.4 Approach to Assessing the Effects of the Water Resources NPS on Waste and Resource Use

Objective/guide question	Reasoning
Objective: To minimise waste arisings, promote reuse, recovery and recycling, minimise the impact of wastes on the environment and communities and contribute to the sustainable use of natural and material assets.	<p>The SEA Directive (2001/42/EC) requires likely significant effects on material assets (including resources) be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>Large scale infrastructure projects have the potential to generate very high volumes of waste during both construction and operation. This waste should be managed in accordance with the waste hierarchy. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>
Will the Water Resources NPS maximise re-use and recycling of recovered components and materials?	<p>Recovering and recycling waste will assist in decreasing the amount of waste to landfill. The Landfill Directive (1999/31/EC) aims to reduce amount of biodegradable waste going to landfill to 35% of the 1995 figures by 2020.</p> <p>The Waste Management Plan for England also includes targets for recycling rates.</p>
Will the Water Resources NPS help achieve government and national targets for minimising, recovering and recycling waste?	<p>Minimising, recovering and recycling waste will assist in decreasing the amount of waste to landfill. The Landfill Directive (1999/31/EC) aims to reduce amount of biodegradable waste going to landfill to 35% of the 1995 figures by 2020.</p> <p>This is supported through the Waste Management Plan for England.</p>
Will the Water Resources NPS increase the burden on limited natural resources?	<p>Conservation of resources and living within environmental limits are underlying objectives of several of the international policies such as European Spatial Development Perspective, and national policy, such as Framework for Sustainable Development.</p> <p>The National Planning Policy Framework and Planning Practice Guidance seeks to facilitate the sustainable use of minerals.</p>
Will the Water Resources NPS make best use of existing infrastructure and resources?	Use of existing infrastructure and resources will decrease the total resources required and will increase efficiency.

Table 11.5 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the resource use and waste objectives.

Table 11.5 Illustrative Guidance for the Assessment of Significance for Waste and Resource Use

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would increase the capacity of waste management infrastructure; Option would create no additional hazardous or non-recyclable waste, whilst maximising the proportion of materials that are re-useable or recyclable; Option would ensure the safe handling of hazardous wastes; Option would make best use of existing infrastructure and resources (e.g. buildings and other facilities on sites) and help conserve natural resources.
+	Positive	<ul style="list-style-type: none"> Option would not create an increase in the volume of hazardous and non-recyclable wastes that require disposal; Option would increase the volume of materials reused and recycled; Option would make best use of existing infrastructure and resources (e.g. buildings and other facilities on sites).
0	Neutral	<ul style="list-style-type: none"> Option would not create an increase in the volume of hazardous and non-recyclable wastes that require disposal; Option would have no effect on the capacity of waste management infrastructure; Option would not have any impact on existing natural resources.

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Effect	Description	Illustrative Guidance
-	Negative	<ul style="list-style-type: none"> Option would increase volumes of hazardous and non-recyclable waste that would require disposal; Option would have a limited adverse impact on the capacity of existing waste management systems; Option would require the limited use of natural resources during construction and operational stages.
--	Significant Negative	<ul style="list-style-type: none"> Option would generate a high volume of hazardous and non-recyclable waste that would require disposal; Option would impede the achievement of government and national targets for minimising, recovering and recycling waste; Option would have a significant adverse impact on the capacity of existing waste management systems (e.g. leading to the permitting of additional landfill capacity to accommodate waste); Option would increase risks associated with the handling of hazardous wastes; Option would require a significant volume of natural resources and result in the direct loss of resources.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

12. Traffic and Transport

12.1 Introduction

This section presents the overview of plans, programmes and baseline information for the appraisal of sustainability of the Water Resources National Policy Statement in respect of traffic and transport. Within this context, the definitions of traffic and transport are provided below:

- ▶ Traffic - the aggregation of pedestrians or vehicles coming to or leaving from a particular locality during a defined period of time.
- ▶ Transport - the movement of people and goods from one place to another. Transport is performed by various modes, such as air, rail, road and water.

There are links between the traffic and transport topic and other topics in the Appraisal of Sustainability (AoS) including air quality, noise, climatic factors and population, economics and skills.

12.2 Review of Plans and Programmes

The focus of plans and programmes on transport is on both maintaining a free-flowing transport system, particularly with respect to roads, and on promoting sustainable modes of transport. Inland waterways are seen as an underutilised resource with the potential to be further utilised for freight movement and potentially bulk water transfers.

International/European

Directive 2008/68/EC on the inland transport of dangerous goods, establishes a common regime for all aspects of the inland transport of dangerous goods, by road, rail and inland waterways within the EU.

The European Commission's White Paper entitled **Roadmap to a Single European Transport Area (2011)** sets out a vision for the future of European transport up to 2050. The key goals include reducing the use of petrol and diesel cars in cities by half by 2030, phasing them out completely by 2050 to achieve CO₂-free city mobility by 2030; increasing the use of low-carbon sustainable fuels in air transport to 40 % by 2050; and achieving a 50% modal shift in medium distance intercity passenger and freight journeys from road to rail and waterborne transport. All of these goals seek to contribute to an overall target of reducing transport emissions by 60% by 2050.

UK

The **Transport Act 2000** aimed to give effect to the UK Government's strategy for an integrated transport policy set out in the White Paper entitled **A New Deal for Transport: Better for Everyone (1998)**³⁰⁹. The Act introduced a number of reforms to local transport planning and delivery, including the requirement for all local transport authorities in England, outside of London, to produce a local transport plan. It also granted new powers for local authorities to enter into quality partnerships with bus operators and to introduce road user charging schemes and workplace parking levies.

³⁰⁹ Department for Transport. A new deal for transport: better for everyone - white paper. 1998.

<http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/about/strategy/whitepapers/previous/aneuadealfortransportbetterfo5695>

Traffic and Transport

The **Local Transport Act 2008** empowers local authorities to take appropriate steps to meet local transport needs in the light of local circumstances.

England

Cutting Carbon, Creating Growth: Making Sustainable Local Transport Happen White Paper (Department for Transport (DfT), (2011)) sets out a vision for a transport system that is an engine for economic growth and also greener and safer and improves quality of life in communities. The White Paper sets out the Government's priority for local transport which is to encourage sustainable local travel and economic growth by making public transport and cycling and walking more attractive and effective, promoting lower carbon transport and tackling local road congestion.

The **National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2012)** aims to integrate planning and transport to promote more sustainable transport choices, enhance accessibility to jobs, shopping, leisure facilities and services by public transport, walking and cycling and to reduce the need to travel, especially by car.

The **National Networks National Policy Statement (DfT, 2014)** sets out the: need for development of road, rail and strategic rail freight interchange projects on the national networks; and the policy against which decisions on major road and rail projects will be made. The **National Policy Statement for Ports (DfT, 2012)** provides the framework for decisions on proposals for new port development.

Scotland

First published in 2006 and refreshed in January 2016, **Scotland's National Transport Strategy (2006)** aims to connect people to jobs, education, services and recreation. The refreshed strategy reaffirms the continued validity of the three key strategic outcomes identified in the original strategy, namely:

- ▶ improve journey times and connections between cities and towns and global markets to tackle congestion and provide access to key markets;
- ▶ reduce emissions to tackle climate change; and
- ▶ improve quality, accessibility and affordability of transport, to give people the choice of transport and alternatives to the car.

The **Scottish Planning Policy (2014)** seeks to promote sustainable transport and active travel and states that the planning system should support patterns of development which optimise the use of existing infrastructure, reduce the need to travel, provide safe and convenient opportunities for walking and cycling for both active travel and recreation, enable the integration of transport modes and facilitate freight movement by rail or water.

One of the visions of **Scotland's Third National Planning Framework (NPF3) (2014)** is that of a connected place and where the whole country has access to high-speed fixed and mobile digital networks. It sets out that better use of the existing infrastructure should be made, and that there should be improved digital and international transport links to facilitate growth and an inclusive society. The long-term development strategy provided by NPF3 complements other strategic documents and is important in delivering the Scottish Government's aspiration for sustainable economic growth. In this context, the NPF identifies the following spatial priorities for change:

- ▶ cities will be better connected and provide a gateway to the rest of the world;
- ▶ rural areas will be more accessible; and
- ▶ we will reduce the disadvantage of distance for our coastal and island communities.

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Planning Advice Note: PAN 75 – Planning for Transport (2005) aims to create greater awareness of how linkages between planning and transport can be managed. It highlights the roles of different bodies and professions in the process and points to other sources of information.

Wales

One Wales: Connecting the Nation (2008) is the Welsh strategy for transport. It contains 17 long-term social, economic and environment outcomes for transport in Wales, and these are set out under five key themes which include:

- ▶ reducing greenhouse gas emissions and other environmental impacts;
- ▶ improving public transport and better integration between modes;
- ▶ improving links and access between key settlements and sites across Wales and strategically important all-Wales links;
- ▶ enhancing international connectivity; and
- ▶ increasing safety and security.

The **National Transport Plan (2010)** sets out ten proposals to provide people with a range of transport options, including to continue to establish sustainable travel centres across Wales, increasing healthy and sustainable travel choices and improving local bus services. The **National Transport Finance Plan 2015** identifies the financing and delivery timetables for transport schemes undertaken by the Welsh government. This includes maintenance and safety schemes alongside new infrastructure

Planning Policy Wales (Edition 9) (2016) identifies several objectives including promoting sustainable transport for freight and commerce, supporting sustainable transport options in rural areas, supporting necessary infrastructure improvements and ensuring that, as far as possible, transport infrastructure does not contribute to land take, urban sprawl or neighbourhood severance.

Technical Advice Note (TAN 18) on Transport and the Transport Strategy for Wales (2008) sets out key planning policy objectives for transport. These include promoting resource and travel efficient settlement patterns, ensuring new development is located where there is or will be good access by public transport, walking and cycling and managing parking provision.

12.3 Overview of the Baseline

UK

The following sub-sections review the current situation on the UK's transport networks.

Road

The roads and streets of the UK are an important resource for commuting, private journeys and the transportation of freight. The UK has a road infrastructure network of 396 thousand kilometres, the majority of which is made up of minor roads (87.3%)³¹⁰.

Between 195 and 2015, the distance travelled by motor vehicles increased by 18.6%. In 2015, a total of 509.7 billion kilometres were travelled by all motor vehicles in the UK, an increase of 11.8 billion miles since

³¹⁰ Department for Transport (2016) *Road Lengths in Great Britain 2015 Report*. Available online at: <https://www.gov.uk/government/statistics/road-lengths-in-great-britain-2015>

Traffic and Transport

2013. In Great Britain, overall there has been a steady increase in domestic road freight with 73% of freight goods being moved by road in 2014. Lorry traffic saw the largest year-on-year increase since the 1980s, growing by 3.7% from 2014, whilst van traffic continued to grow more quickly than any other vehicle type, rising 4.2% from 2014 levels³¹¹.

In 2015, the number of reported road fatalities decreased by 3% to 1,730 compared to 2014. This is the second lowest annual total on record after 2013. There were 45 per cent fewer fatalities in 2015 than a decade earlier in 2006³¹².

Rail

Over the last two decades there has been substantial growth in rail usage, and rail passenger journeys are now at their highest level since the 1920s. An average of 4.7 million journeys per day are made in Great Britain. The majority of growth has been in the London and the South East, and 64% of journeys either start or end in London.

Around 12% of all freight moved in Great Britain was by rail in 2014. In 2015-16, freight moved by rail was 18 billion net tonne km, down 20% from 2014-15. This decrease was mainly due to a decline in the amount of coal moved, which has fallen substantially (72%) since 2005-06.³¹³

Aviation

There are 58 airports in the UK, with Heathrow being the largest and accounting for twice as many passengers and air transport movements as that next largest airport, Gatwick³¹⁴. Air traffic in the UK has been rising steadily. In 1953 there were 195,000 air traffic movements, by 2015 this figure was 2,111,000. In this time, both the number of passengers flying and the amount of freight transported has risen dramatically to 251.4 million passengers and 2.3 million tonnes respectively³¹⁵.

Water

The UK has 51 Major Ports, defined as ports with cargo volumes of at least 1 million tonnes annually, including Sullom Voe; Forth; Tees and Hartlepool; Hull; Grimsby and Immingham; Felixstowe; Harwich; London; Ramsgate; Dover; Portsmouth; Southampton; Milford Haven; Holyhead; and Liverpool. Overall total freight tonnage declined by 1 per cent in 2015 with 496.7 million tonnes being handled by UK ports in 2015.

³¹¹ Department for Transport (2016) *Traffic Estimates: Great Britain 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/524261/annual-road-traffic-estimates-2015.pdf

³¹² Department for Transport (2016) *Reported Road Casualties Great Britain: 2015 Annual Report*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/590561/rail-trends-factsheet-2016-revised.pdf

³¹³ Department for Transport (2017) *Rail Trends Factsheet*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/590561/rail-trends-factsheet-2016-revised.pdf

³¹⁴ Department for Transport (2016) *Transport Statistics Great Britain 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/489894/tsgb-2015.pdf

³¹⁵ Department for Transport (2016) *Air traffic at UK airports (AVI01)*. Available online at: <https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport>

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Whilst tonnage fell marginally, reflecting reduced demand for coal and ores, changes in steel production, and lower dependency on food imports, unitised traffic experienced a third consecutive year of growth.^{316,317}

England

Road

England has a road infrastructure network of approximately 303,000 km (as at 2015), of which 12% comprises major roads.³¹⁸ The average speed on local 'A' roads in England during the weekday morning peak in the year ending December 2015 was 23.4 mph. This is a 0.7% decrease on the year ending September 2015³¹⁹.

Over the last two decades the rate of car traffic growth has slowed. For an average person, car use fell throughout the 2000s, but this was partially offset by an increase in population using the roads. Van traffic has grown faster than car traffic on all types of road in recent years. HGV vehicles are travelling less distance, but carrying more goods since the 1990s, owing to a shift away from using smaller HGV vehicles towards larger vehicles or vans. HGV traffic has not yet returned to pre-recession levels. Recent trends show a resumption of traffic growth after the recession. Growth has been strongest on the SRN and for van traffic across all roads³²⁰.

Rail³²¹

In 2014/15, 70% of Great Britain rail journeys were made with London and South East operators.

Aviation³²²

Heathrow is the busiest airport in the UK, followed by Gatwick and Manchester, with approximately 75 million passengers in 2015³²³. The other major airports in London are Gatwick, Luton, Stansted and London City,

³¹⁶ Department for Transport (2016) *UK Port Freight Statistics: 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/555338/port-freight-statistics-2015.pdf

³¹⁷ Department for Transport (2015) *Domestic Waterborne Freight, 2014*. Available online at: <https://www.gov.uk/government/statistics/domestic-waterborne-freight-2014>

³¹⁸ Department for Transport (2016) *Road Lengths in Great Britain 2015 Report*. Available online at: <https://www.gov.uk/government/statistics/road-lengths-in-great-britain-2015>

³¹⁹ Department for Transport (2016) *Congestion on local 'A' roads, England: October to December 2015 Report*. Available online at: <https://www.gov.uk/government/statistics/congestion-on-local-a-roads-england-october-to-december-2015>

³²⁰ Department for Transport (2016) *Road use statistics Great Britain*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/514912/road-use-statistics.pdf

³²¹ Department for Transport (2016) *Rail passenger numbers and crowding on weekdays in major cities in England and Wales: 2015*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/541587/rail-passengers-crowding-2015.pdf

³²² Department for Transport (2016) *Air traffic at UK airports*. Available online at <https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport>

³²³ CAA (2016). *Summary of Activity at Reporting Airports 2015*. Available online at http://www.caa.co.uk/uploadedFiles/CAA/Content/Standard_Content/Data_and_analysis/Datasets/Airport_stats/Airport_data_2015/Table_02_2_Summary_Of_Activity_at_UK_Airports_2015.pdf]

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and other major airports in England include Birmingham, Bristol, Newcastle, East Midlands International and Liverpool (John Lennon).

Water

Grimsby and Immingham remained England and the UK's busiest port in terms of tonnage, handling 12 per cent of the UK market in 2015 with 59.1 million tonnes of goods. Grimsby and Immingham overtook London as the busiest port in 2000. It also accounted for the largest share of the UK's dry bulk traffic at 18 per cent (19.1 million tonnes). However, dry bulk tonnage at this port has decreased by 10 per cent compared to the previous year³²⁴.

In 2015, goods moved by domestic water transport accounted for 15% of total domestic freight transport in the UK.

Modes of Transport

The 2011 Census highlighted that the majority people in England travelled to work by car. The breakdown of methods of travel to work is as follows³²⁵:

- ▶ working mainly at or from home – 3.5 % (1,349,568 persons);
- ▶ underground, metro, light rail, tram – 2.6% (1,027,625 persons);
- ▶ train – 3.5% (1,343,684 persons);
- ▶ bus, minibus or coach – 4.9% (1,886,539 persons);
- ▶ taxi – 0.3% (131,465 persons);
- ▶ motorcycle, scooter or moped – 0.5% (206,550 persons);
- ▶ driving a car or van – 36.9% (14,345,882 persons);
- ▶ passenger in a car or van -3.3% (1,264,553 persons);
- ▶ bicycle – 1.9% (742,675 persons);
- ▶ walking – 6.9% (2,701,453 persons);
- ▶ other method of travel to work – 0.4% (162,727 persons); and
- ▶ not in employment 35.3% (13,718,653 persons).

UK Census data also indicates that the average distance travelled to work in England and Wales increased from 13.4km in 2011 to 15.0km in 2011³²⁶.

³²⁴ Department for Transport (2016) *UK Port Freight Statistics: 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/555338/port-freight-statistics-2015.pdf

³²⁵ ONS (2011) *Method of Travel to Work in England and Wales – 2011*. Available online at: <http://www.ons.gov.uk/ons/rel/census/2011-census-analysis/method-of-travel-to-work-in-england-and-wales/sty-method-of-travel-to-work.html>

³²⁶ ONS(2014) *2011 Census Analysis - Distance Travelled to Work*. Available online at: http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171776_357812.pdf

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Scotland

Road

There were 56,092 km of road in Scotland as of 2015. Of this, 6.4% (3,578 km) is Trunk road, which the Scottish Ministers are responsible for managing, whilst the remaining 52,514 km are managed by Local Authorities. There were 601 km of motorways, 775 km of dual carriageways and 27,674 km of single carriageway in Scotland in 2015³²⁷.

Rail

There were 93.2 million passengers carried by ScotRail in 2015/16, an increase of 34% since 2005/6. As of 2015/2016 there were 358 stations and 2,819 km of rail network in Scotland³²⁸.

Aviation

There were 25.5 million air passengers at Scottish airports in 2015. Three quarters travel to or from Edinburgh or Glasgow. A total of 56 thousand tonnes of freight were carried by air in 2015³²⁹.

Water

There were 44 million tonnes of freight lifted by water transport in Scotland in 2015 (around a quarter of freight lifted in Scotland, including exports). There was a total of 7.8 million passengers and 2.7 million vehicles carried on ferry routes within Scotland in 2015. There were 1.7 million passengers and 0.4 million vehicles carried between Scotland and Northern Ireland and 43,000 vehicles carried between Scotland and Europe in 2015³³⁰.

Modes of Transport

According to the 2011 Census results³³¹ of the 2.1 million 16 to 74 year olds in employment (excluding full-time students) who travel to work, 63 per cent (1.3 million) drove a car or van, an increase from 59 per cent in 2001. The next most common methods of transport, both at 11 per cent, were travelling by bus, minibus or coach (241,000) and on foot (238,000). The proportions travelling by bus and on foot had both decreased slightly from 12 per cent in 2001.

³²⁷ Transport Scotland (2016) *Scottish Transport Statistics No 53 2016 Edition Chapter 4: Road Network*. Available online at: <https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-2016-edition/SCT01171871341-07>

³²⁸ Transport Scotland (2016) *Scottish Transport Statistics No 35 2016 Edition Chapter 7: Rail Services*. Available online at: <https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-2016-edition/SCT01171871341-10>

³²⁹ Transport Scotland (2016) *Scottish Transport Statistics No 35 2016 Edition Chapter 8: Air Transport*. Available online at: <https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-2016-edition/SCT01171871341-11>

³³⁰ Transport Scotland (2016) *Scottish Transport Statistics No 35: 2016 Edition Chapter 9: Water Transport*. Available online at: <http://www.transport.gov.scot/statistics/j357783-12.htm>

³³¹ Scotland's Census (2013) *Census 2011: Key results on Households and Families, and Method of Travel to Work or Study in Scotland - Release 2C*. Available online at: <http://www.scotlandscensus.gov.uk/news/census-2011-key-results-households-and-families-and-method-travel-work-or-study-scotland>

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Wales

Road

The total road length in Wales in 2015-16 was 34,642 km. Unclassified minor surfaced roads contribute approximately half the total road length in Wales³³².

Rail

The numbers of rail passenger journeys in Wales have been increasing over the last decade. There were 30.3 million rail passenger journeys which either started or ended in Wales in 2015-16, an increase of 3.4 per cent when compared to the previous year. Over two-thirds (68 per cent) of these journeys were within Wales. Rail passenger journeys within Wales have increased annually with approximately 20.7 million journeys reported in 2015-16 which is a 3.7 per cent increase on the 2014-15 figures³³³.

Aviation

The total number of passengers using Cardiff International Airport increased by nearly 14 per cent between 2014 and 2015, to over 1.15 million. During 2015 there were 24 domestic routes and 73 international routes that operated out of Cardiff Airport. There were just over 15,000 commercial aircraft movements at Cardiff International Airport. There were just under 10,000 non-commercial aircraft movements making just over 25,000 in total³³⁴.

Water

In Wales during 2015 total freight traffic through Welsh ports was 56.4 million tonnes (Mt). Of this, 40.4 Mt were goods inwards and 15.9 Mt were goods outwards. Welsh ports accounted for 11 per cent of the total United Kingdom (UK) port traffic of 496.7 Mt.

12.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for traffic and transport have been identified:

- ▶ There are areas of the UK's transport network which are stretched beyond their capacity at peak times.
- ▶ Increasing levels of congestion are being experienced on the UK's road network.
- ▶ There is a need for investment in transportation infrastructure to meet future demand and support economic growth.
- ▶ There is a need to reduce the need to travel and facilitate a shift towards more sustainable modes of transport.

³³² Welsh Government (2017) *Road Lengths and Conditions 2014-15*. Available online at: <http://gov.wales/statistics-and-research/road-lengths-conditions/?lang=en>

³³³ Welsh Government (2017) *Rail Transport*. Available online at: <http://gov.wales/statistics-and-research/rail-transport/?lang=en>

³³⁴ Welsh Government (2016) *Air Transport*. Available online at: <http://gov.wales/statistics-and-research/air-travel/?lang=en>

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12.5 Likely Evolution of the Baseline

UK

Road

Between 195 and 2015, the distance travelled by motor vehicles increased by 18.6%. In 2015, a total of 316.7 billion miles were travelled by all motor vehicles in the UK, an increase of 7.3 billion miles since 2013³³⁵.

England's road traffic is expected to increase by between 19 - 55% above 2010 levels by 2040. Whilst new technologies will provide some relief through better use of network capacity, more highly automated vehicles may also be part of the problem by stimulating demand³³⁶.

Rail

The **National Policy Statement for National Networks (Department for Transport, 2014)**³³⁷ highlights that passenger demand is predicted to continue to grow significantly, by 50.1% by 2033 with long distance rail passenger travel increasing by 63.8%. Total rail freight, meanwhile, is forecast to grow by 3% annually to 2043.

The All-Party Parliamentary Group for High-Speed Rail's Report of the Inquiry into Britain's Rail Capacity highlights that if the current growth rate of demand continued for a sustained period, current infrastructure would be inadequate and incremental upgrades such as those suggested by Rail Package 2 (RP2) and 51m's 'Optimised Alternative' would be insufficient to accommodate the demand. It states that, given recent passenger growth and the country's overall economic and transport strategy, the risks from under providing rail capacity seem higher than the risks of overprovision. In this context, the UK Government has identified a need for development of the national rail network at the strategic level including the development of strategic rail freight interchanges and new high speed lines.

Aviation

Demand for air travel is forecast to increase within the range of 1% - 3% a year up to 2050, compared to historical growth rates of 5% a year over the last 40 years. The slowdown in growth rates in the future reflects the anticipation of market maturity across different passenger markets and a projected end to the long-term decline in average fares seen in the last two decades³³⁸.

The central forecast from the 2013 analysis, taking into account the impact of capacity constraints, is for passenger numbers at UK airports to increase from 219 million passengers in 2011 to 315 million in 2030 and 445 million by 2050. This is an increase of 225 million passengers over the next 40 years compared to an increase of 185 million since 1970. The major south east airports are forecast to be full by 2030.

³³⁵ Department for Transport (2016) *Traffic Estimates: Great Britain 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/524261/annual-road-traffic-estimates-2015.pdf

³³⁶ Reese Jeffrys (2016) *A major road network for England*. Available online at: <http://www.futureroadsengland.org/>

³³⁷ Department for Transport (2014) *National Policy Statement for National Networks*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

³³⁸ Department for Transport (2013) *UK Aviation Forecasts*. Available online at: <https://www.gov.uk/government/publications/uk-aviation-forecasts-2013>

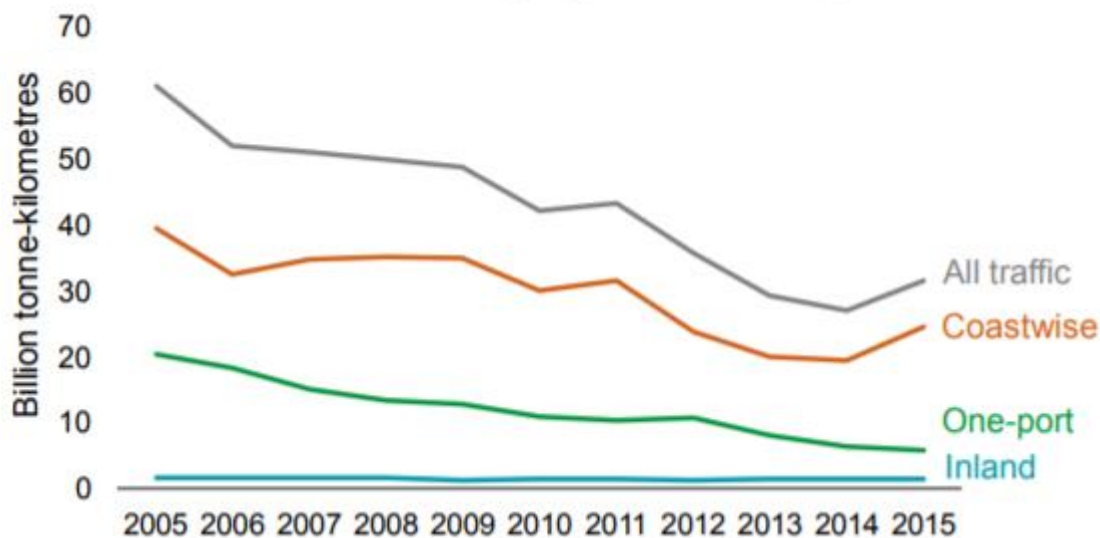
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However, there is a range around this projection and they could be full as soon as 2025 or as late as 2040. Heathrow remains full across all the demand cases considered by the DfT.

Water

Figure 12.1 shows the trend data for domestic water transport. There is an overall downward trend for coastwise (traffic carried around the coast from one UK port to another) and one-port (traffic to and from offshore locations, such as oil rigs and sea dredging) freight good moved, noting the increase in coastwise transport in 2015. Freight goods movements via inland waterways has remained largely static since 2015.

Figure 12.1 Domestic waterborne freight goods moved, 2005-2015



Source: Department for Transport

England

The latest forecasts conducted by the DfT predict that compared to the 2010 baseline (and under a central scenario), road traffic will be between 19% and 55% higher by 2040. Cars are the dominant mode of road transport and are forecast to remain so in spite of a slight reduction in the proportion of total traffic they make. Cars made up 80% of traffic miles in 2010 and are forecast to make up between 73% and 80% of traffic miles in 2040, whereas light goods vehicles (LGVs) made up 14% in 2010 and this is forecast to be in the range 15% to 20% in 2040. HGVs comprise 6% of total traffic in 2010 and this is forecast to be in the range of 4% to 6% in 2040³³⁹.

³³⁹ Department for Transport (2015) *Road Traffic Forecasts 2015*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/411471/road-traffic-forecasts-2015.pdf

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Scotland

Trends in Scotland are expected to mirror the broader UK, with a continuing increase in the total distance travelled by car and an increase in traffic congestion. Rail and air passenger numbers are also expected to continue to increase³⁴⁰.

Wales

Motor traffic in Wales peaked in 2015 at 28.4 billion vehicle kilometres, which is 1.5 per cent higher than the previous peak in 2007 and represents a 1.8 per cent increase on 2014. Road traffic would therefore be expected to continue to increase. Rail journeys are increasing by 3-4% year on year and would be expected to continue to increase³⁴¹.

12.6 Assessing Significance

The objectives and guide questions related to traffic and transport which have been identified for use in the appraisal of the effects of the Water Resources NPS proposals are set out in **Table 12.1**, together with reasons for their selection.

Table 12.1 Approach to Assessing the Effects of the Water Resources NPS on Traffic and Transport

Objective/Guide Question	Reasoning
Objective: To minimise the volume of traffic and promote more sustainable transport choices.	<p>Whilst traffic and transport is not specifically referred to in the SEA Directive (2001/42/EC), the issue is a significant one in the case of the nationally significant water resource infrastructure given the scale, duration and extent of construction, operation, decommissioning and closure.</p> <p>The construction and operation of large scale water resources infrastructure projects can result in increased traffic volumes and may involve pipeline works within/across roads which in-turn can lead to an increase in congestion on road networks and driver delay. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>
Will the Water Resources NPS help to minimise traffic volumes?	Traffic, comprising heavy goods vehicles, passenger vehicles and trains can have a significant influence over noise, air quality, climate change, wildlife habitats and quality of life of communities in the vicinity of operations. The control of traffic volumes will help to minimise these effects.
Will the Water Resources NPS help to minimise the direct effects of transport such as noise and vibration, severance ¹ of communities and wildlife habitats and safety concerns?	Minimising the direct effects of traffic and transport on people and the environment is a key aim of national planning policy, and by extension issues such as human health in the SEA Directive. As such, these effects should be taken into consideration in the planning and management of traffic associated with implementing the NPS.
Will the Water Resources NPS encourage alternative and sustainable means of transporting freight, waste and minerals, where possible?	The development and use of sustainable transport is a major theme in national planning policy and as such, transport substitution (for example road to rail) wherever possible is encouraged, as well as trip minimisation. In turn this will help to meet air quality targets set locally, nationally and internationally.

¹ Community severance is defined as the cumulative impact of transport infrastructure on the perceptions, behaviour, and wellbeing of people who use the surrounding areas

³⁴⁰ Transport Scotland (2017) Transport Statistics. Available online at: <https://www.transport.gov.scot/our-approach/statistics/>

³⁴¹ Welsh Government (2016) *Statistics and research*. Available online at: <http://gov.wales/statistics-and-research/road-traffic/?lang=en>

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Table 12.2 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the traffic and transport objective.

Table 12.2 Illustrative Guidance for the Assessment of Significance for Traffic and Transport

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would make a significant positive and long-term contribution to minimising the direct and indirect effects of traffic and transport associated with nationally significant water resources infrastructure.
+	Positive	<ul style="list-style-type: none"> Option would make a positive contribution to minimising the direct and indirect effects of traffic and transport associated with nationally significant water resources infrastructure.
0	Neutral	<ul style="list-style-type: none"> Option would not have any effects on traffic and transport.
-	Negative	<ul style="list-style-type: none"> Option would have minor, short-term adverse effects associated with the direct and indirect impacts of traffic and transport related to nationally significant water resources infrastructure.
--	Significant Negative	<ul style="list-style-type: none"> Option would cause significant long-term effects associated with the direct and indirect impacts of traffic and transport associated nationally significant water resources infrastructure.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

Cultural Heritage

13. Cultural Heritage

13.1 Introduction

This section presents the overview of plans, programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources in respect of cultural heritage.

Cultural heritage, including architectural and archaeological heritage, within this context is defined as below-ground and upstanding evidence of past human activity and encompasses artefacts, buried and underwater archaeological sites, earthworks, buildings, battlefields, historic gardens, historic landscapes, wrecks, hedgerows and ancient woodland.

There are links between the cultural heritage topic and other topics in the Appraisal of Sustainability (AoS), specifically landscape and townscape and land use, geology and soils.

13.2 Review of Plans and Programmes

The plans and programmes seek to maintain and enhance the range of historic assets in the UK. The *Strategy for Water and Wetland Heritage (2012)* is an importance piece of guidance for water resources infrastructure in providing specific emphasis on wetland archaeology, which due to the local conditions is often very well maintained but also easily lost if an area is permanently flooded or damaged if a wetland dries out.

International/European

The **UNESCO World Heritage Convention (1972)** aims to promote co-operation amongst nations to protect heritage that is of such outstanding value that its conservation is important for current and future generations. The Convention also established a register of World Heritage Sites. It is intended that properties on the World Heritage List will be conserved for all time. UNESCO member states commit themselves to ensure the identification, protection, conservation, and presentation of World Heritage properties.

The World Heritage Committee's **Operational Guidelines for the Implementation of the World Heritage Convention (2013)** set out the procedures for: the inscription of properties on the World Heritage List and the List of World Heritage in Danger; the protection and conservation of World Heritage properties; the granting of International Assistance under the World Heritage Fund; and the mobilisation of national and international support in favour of the Convention.

The **Valletta Convention 1992**, formally known as **Convention for the Protection of the Archaeological Heritage of Europe** was originally signed in London in 1969 but was revised in Valletta in 1992. It is a Europe-wide international treaty which establishes the basic common principles to be applied in national archaeological heritage policies. It supplements the general provisions of the UNESCO World Heritage Convention and aims to protect archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study. It sets out a framework which requires Member States to:

- ▶ maintain an inventory of archaeological heritage and designated protected monuments and areas;
- ▶ create archaeological reserves; and
- ▶ for finders of any element of archaeological heritage, to report and make it available to the competent authority.

It defines archaeological heritage as: "all remains and objects and any other traces of mankind from past epochs shall include structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water". The emphasis

Cultural Heritage

is on protection of sites for future study, the reporting of chance finds the control of excavations and the use of metal detectors.

UK

The ***Ancient Monuments and Archaeological Areas Act 1979*** provides for the scheduling of ancient monuments and offers the only legal protection specifically for archaeological sites in the UK. The ***Planning (Listed Buildings and Conservation Areas) Act 1990*** outlines the level of protection received by listed buildings and buildings within Conservation Areas in England and Wales.

There are a number of other Acts which afford protection to cultural and historical assets, including the ***Protection of Wrecks Act 1973***, which provides protection for shipwrecks of historical, archaeological or artistic value³⁴²; the ***Protection of Military Remains Act (1986)***, which provides protection for the wreckage of military aircraft and designated military vessels, and the ***Treasure Act (1996)***, which sets out procedures for dealing with finds of treasure, its ownership and rewards, in England, Wales and Northern Ireland.

The ***Enterprise and Regulatory Reform Act 2013*** made a number of changes to the specialised heritage protection system that affect heritage protection³⁴³:

- ▶ heritage partnership agreements may be entered into between local authorities and owners setting out works for which listed building consent is granted (excluding demolition);
- ▶ local or national Listed Building Consent Orders may be set up by a Local Planning Authority or the Secretary of State, respectively, under which works of the type described in the Order (excluding demolition) will not need listed building consent;
- ▶ a certificate of lawful proposed works is introduced (valid for 10 years) that categorically confirms that the works described in it do not affect the character of the listed building and do not therefore require consent;
- ▶ the extent of protection of a listed building can be better defined by excluding attached buildings and structures and those within the curtilage of the principal listed building from protection, and by stating definitively that some feature of a listed building is not of special architectural or historic interest;
- ▶ a certificate of immunity from listing may be applied for at any time; and
- ▶ conservation area consent has been replaced with planning permission.

England

The ***National Planning Policy Statement (NPPF) (Department for Communities and Local Government, 2012)*** sets out the core land use planning principles that should underpin both plan-making and decision-taking and in doing so expects planning to “conserve heritage assets in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of this and future generations”.

The Framework stipulates (at paragraph 126) that local planning authorities should set out in their Local Plan a positive strategy for the conservation and enjoyment of the historic environment. In addition, it provides (at paragraph 131) that in determining planning applications, local planning authorities should take account of: the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable

³⁴² Note that Section 1 of the Protection of Wrecks Act 1973 was repealed in Scotland on 1 November 2013. Sites in Scottish territorial waters previously designated under this legislation have been designated as Historic Marine Protection Areas under the Marine (Scotland) Act 2010, or de-designated altogether

³⁴³ <https://www.historicengland.org.uk/advice/hpg/HP>

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uses consistent with their conservation; the positive contribution that conservation of heritage assets can make to sustainable communities and their economic vitality; and the desirability of new development making a positive contribution to local character and distinctiveness.

As heritage assets are irreplaceable, the Framework expects any harm or loss to require clear and convincing justification. Where a proposed development will lead to substantial harm to, or total loss of, significance of a designated heritage asset, “local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or loss is necessary to achieve substantial public benefits that outweigh that harm or loss”, or all of the criteria set out in paragraph 133 (mostly relating to the lack of a viable use) apply.

The section of **National Planning Practice Guidance (2014)** regarding heritage provides guidance on the application of heritage policies. The Guidance also refines the definition of a logical hierarchy of heritage significance, particularly in conservation areas. It also helpfully provides clarification on the definition of the terms “optimum viable use”, “substantial harm” and “public benefits”, which have been the subject of wide interpretation.

Historic England, the Government's statutory adviser on the historic environment in England, and its predecessor organisations have published a number of relevant guidance documents, including the following:

- ▶ Preserving Archaeological Remains (2016);
- ▶ Conservation Area Designation, Appraisal and Management: Historic England Advice Note 1 (2016);
- ▶ Historic Environment Good Practice Advice in Planning Note 2: Managing Significance in Decision-Taking in the Historic Environment (2015);
- ▶ Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets (2015);
- ▶ The Historic Environment and Site Allocations in Local Plans. Historic England Advice Note 3 (2015); and
- ▶ Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (2008).

Historic England's **Strategy for Water and Wetland Heritage (2012)** sets out Historic England's approach to the management of historic assets in wetland environments.

Scotland

The framework for the protection and management of the Scottish historic environment is underpinned mainly by two pieces of UK legislation:

- ▶ **The Ancient Monuments and Archaeological Act 1979**; and,
- ▶ **Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997**.

The **Historic Environment (Scotland) Act 2014** made substantial amendments to this framework and established the new governing body of Historic Environment Scotland as a Non-Departmental Public Body to carry out the statutory functions previously delivered by Historic Scotland and the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS), which were dissolved in 2015.

Scottish Historic Environment Policy (2011) sets out Scottish Ministers' policies for the historic environment, including the following key outcomes:

- ▶ that the historic environment is cared for, protected and enhanced for the benefit of our own and future generations;
- ▶ to secure greater economic benefits from the historic environment; and

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- ▶ the people of Scotland and visitors understand and enjoy the historic environment.

Following the merger of Historic Scotland and the Royal Commission on the Ancient and Historic Monuments of Scotland, the first-ever overarching strategy for Scotland's historic environment was published in March 2014. "***Our Place in Time – The Historic Environment Strategy for Scotland***" (2014) contains a number of key aims including:

- ▶ to ensure that the cultural, social, environmental and economic value of heritage continues to make a major contribution to the nation's wellbeing;
- ▶ to investigate and record the historic environment to continually develop knowledge, understanding and interpretation of the past and how best to conserve, sustain and present it;
- ▶ to care for and protect the historic environment in order to both enjoy and benefit from it and conserve and enhance it for future benefit of future generations; and
- ▶ sharing and celebrating the richness and significance of the historic environment, enabling us to enjoy the fascinating and inspirational diversity of the heritage.

In relation to land use planning, the ***National Planning Framework 3 (2014)*** recognises the value of Scotland's historic environment and its world-renowned built heritage as a key asset³⁴⁴. Whilst the ***Scottish Planning Policy (SPP) (2014)*** reflects the value of the historic environment as a key part of Scotland's cultural heritage. The SPP (2014) sets out that with the careful application of policy and sensitive decision making, the historic environment can often be adapted to accommodate new uses, offering opportunities for new and creative design, whilst retaining its special character. In principle, therefore, the aim should be to identify the best viable use that is compatible with the fabric, setting and character of the historic environment, whilst also seeking to protect, enhance and promote access to cultural heritage.

The ***Historic Environment Scotland Policy Statement (2016)*** takes account of the Historic Environment (Scotland) Act 2014 and explains how provisions within the NPF3 92014) and SPP (2014) relating to the management of the historic environment should be interpreted. The document does not set out any planning policies or development management assessment criteria, however it does state that there should be a "presumption in favour of preservation of individual historic assets and also the pattern of the wider historic environment". Historic Environment Scotland has also published a revised ***Managing Change in the Historic Environment: Setting guidance note*** (June 2016) to align with the Historic Environment Scotland Policy Statement (2016).

Planning Advice Note: (PAN) 2/2011 provides guidance to developers on the treatment of archaeological remains which is proportionate to the relative value of the remains and of the developments under consideration ***Planning Advice Note PAN 71: Conservation Area Management*** (December 2004) identifies good practice for managing change to secure the protection and enhancement of conservation areas, sets out a checklist for appraising conservation areas and provides advice on funding and implementation.

Conserving the Underwater Heritage (2008) contains a number of policies on the management of the underwater historic environment whose key objective is to develop a protection regime which is effective in securing the long-term future of the most important underwater sites, including securing them against inadvertent or deliberate damage or destruction.

Wales

The framework for the protection and management of the Welsh historic environment is underpinned mainly by two pieces of UK legislation:

- ▶ The ***Ancient Monuments and Archaeological Act 1979***; and

³⁴⁴ <http://www.gov.scot/Topics/Built-Environment/planning/National-Planning-Framework>

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- ▶ The ***Planning (Listed Buildings and Conservation Areas) Act 1990***.

The ***Historic Environment (Wales) Act 2016*** amends and augments this framework for the protection and sustainable management of the Welsh historic environment. In broad terms, the Act: creates new measures for the protection of listed buildings and scheduled monuments; enhances existing mechanisms for the sustainable management of the historic environment; and introduces greater transparency and accountability into decisions taken on the historic environment.

The Well-being of Future Generations (Wales) Act 2015 aims to improve the social, economic, environmental and cultural well-being of Wales. For those public bodies listed in the Act, it encourages a more joined-up approach to consider more long term, work better with people and communities and each other to prevent problems.

Planning Policy Wales (9th Edition 2016) has the following objectives regarding the historic environment:

- ▶ to preserve or enhance the historic environment, recognising its contribution to economic vitality and culture, civic pride and the quality of life, and its importance as a resource for future generations;
- ▶ to protect archaeological remains, which are a finite and non-renewable resource, part of the historical and cultural identity of Wales, and valuable both for their own sake and for their role in education, leisure and the economy, particularly tourism;
- ▶ to ensure that the character of historic buildings is safeguarded from alterations, extensions or demolition that would compromise a building's special architectural and historic interest; and
- ▶ to ensure that conservation areas are protected or enhanced, while at the same time remaining alive and prosperous, avoiding unnecessarily detailed controls over businesses and householders.

Technical Advice Note 12 (TAN 12): Design (2016) sets out the Welsh Government's policy and advice in respect of the design of new development, including sustaining or enhancing local character.

Cadw is preparing new draft policy, advice and guidance documents to supplement the legislative changes in the Historic Environment (Wales) Act 2016. These will be consistent with the ***Conservation Principles (2011)*** published by Cadw for the sustainable management of the historic environment in Wales. These will help local planning authorities, third sector groups, owners and developers to manage change in the historic environment.

13.3 Overview of the Baseline

UK

The UK has over 459,000 listed buildings, approximately 33,720 scheduled monuments, 2,416 historic parks and gardens, in excess of 10,259 conservation areas and 28 World Heritage Sites.

England

In England, there are approximately 374,081 listed building entries, 19,717 scheduled monuments, 1,601 registered historic parks and gardens, 9,080 conservation areas, 43 registered historic battlefields, 46 designated wrecks and 17 World Heritage Sites.

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Historic England's ***Heritage at Risk Register (2016)***³⁴⁵ identifies sites most at risk of being lost as a result of neglect, decay or inappropriate development. There are fewer entries on the 2016 Register (5,341) when compared to the 2015 Register (5,478). Historic England report the following findings:

- ▶ 926 (6.3%) of listed places of worship are on the Register;
- ▶ 2,582 (13.0%) of England's 19,848 scheduled monuments are on the Register;
- ▶ Arable cultivation (39%) and unrestricted plant, scrub and tree growth (26%) remain the most common sources of risk;
- ▶ 95 (5.8%) of England's 1,639 registered parks and gardens are on the Register;
- ▶ Of the 46 registered battlefields in England, 6 (13.0%) are on the Register. 6 (12.2%) of the 49 protected wreck sites around England's coast are on the Register 4 lie off the South-East coast, 1 off the South West and 1 off the East of England.

In 2000, Historic England (as English Heritage) commissioned the University of Exeter to research Monuments at Risk in England's Wetlands. This study suggested that over the past 50 years, approximately half of England's original lowland peatlands have been lost and that as a result, around 3000 wetland archaeological sites have been lost and 10,000 damaged³⁴⁶.

Under the National Heritage Protection Plan (NHPP), research was carried out from 2011 to 2015 that identified wetland and waterlogged archaeological sites to help prevent their loss. The research identified those wetland and waterlogged sites considered to be of exceptional evidential value with a view to future projects reviewing the site-specific risks to their continued preservation and reviewing management options to win better protection where possible. In total, the NHPP "3A5 Identification of Wetland/ Waterlogged Sites" report identified 39 sites of exceptional value. The full details of those sites are set out in the inventory report³⁴⁷.

Scotland

In Scotland there are approximately 8,238 scheduled monuments in excess of 47,000 listed buildings³⁴⁸, in excess of 600 conservation areas, six World Heritage Sites, and more than 275 sites listed in the Inventory of Historic Parks, Gardens and Designed Landscapes. There are also seven Historic Marine Protected Areas³⁴⁹ and over 35 Inventory Battlefields³⁵⁰.

³⁴⁵ Historic England (2016) *Heritage at Risk Register 2016*. Available online at:

<https://historicengland.org.uk/whats-new/news/heritage-at-risk-2016>

³⁴⁶ Historic England (2017) *Wetland and Waterlogged Heritage Survey NHPP Activity 3A5*. Available online at:

<https://historicengland.org.uk/research/research-results/activities/3a5>

³⁴⁷ Historic England (2013) *NHPP 3A5 Identification of Wetland/ Waterlogged Sites*. Available online at:

<https://content.historicengland.org.uk/images-books/publications/6240-exceptional-waterlogged-heritage-stage1-inventory/6240-stage1-web-report-v2.pdf/>

³⁴⁸ Historic Environment Scotland (2017) *Designations*. Available online at: <http://data.historic-scotland.gov.uk/pls/htmldb/f?p=2300:30:0>

³⁴⁹ Scottish Government (2017) *Historic Marine Protected Area Records*. Available online at:

<https://www.historicenvironment.scot/advice-and-support/listing-scheduling-and-designations/marine-heritage/historic-marine-protected-area-records/>

³⁵⁰ Historic Environment Scotland (2106) *Scotland's Inventory of Historic Battlefields 2016*. Available online at:

<https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=c59262de-b652-4e68-b88d-a5fe008ff1c8>

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Wales

In Wales there are over 4,000 scheduled monuments, 30,000 listed buildings, 500 conservation areas, 3 World Heritage Sites, almost 400 historic parks and gardens, and 6 designated historic wrecks³⁵¹.

Since 2011, the percentage of buildings 'at risk' or in vulnerable condition has decreased from 9.22% to 8.92%³⁵². The Historic Landscapes Register for Wales has identified 58 landscapes across Wales which are regarded as representing the best examples of the variety of historic landscapes in Wales.

13.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for cultural heritage have been identified:

- ▶ Wetlands are fragile and vulnerable to subtle changes in burial conditions, in addition to the usual threats from development and changes in land-use. The impact of climate change on wetland heritage is currently poorly understood. Measures introduced to protect and enhance natural environmental qualities – water quality or biodiversity - may also inadvertently threaten wetland heritage if not handled sensitively.
- ▶ Scheduled monuments in rural areas are at risk from intensive grazing practices and unrestricted plant, scrub or tree growth.
- ▶ Challenging economic conditions are reducing the funds available to conserve and manage heritage assets.
- ▶ The settings of heritage assets are at risk from new development.

13.5 Likely Evolution of the Baseline

Key findings from the latest Buildings at Risk and Heritage at Risk registers are reported in section 13.3. Whilst these do not provide projections regarding the future state of the historic environment, they do indicate the level of known heritage assets which require ongoing conservation, protection and care.

Climate change poses an unknown risk to wetland archaeological remains, which may be exacerbated by future climate scenarios.

13.6 Assessing Significance

The objectives and guide questions related to cultural heritage which have been identified for use in the appraisal of the effects of Water Resources NPS proposals are set out in **Table 13.1**, together with reasons for their selection.

³⁵¹ Cadw (2016) *Protection*. Available online at:
<http://cadw.gov.wales/historicenvironment/protection/?lang=en>

³⁵² Cadw (2016) *Buildings at Risk*. Available online at:
<http://cadw.gov.wales/historicenvironment/recordsv1/buildingsatrisk/?lang=en>

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Table 13.1 Approach to Assessing the Effects of the Water Resources NPS on Cultural Heritage

Objective/Guide Question	Reasoning
Objective: To conserve and where appropriate enhance the historic environment including cultural heritage resources, historic buildings and archaeological features and their settings	<p>The SEA Directive (2001/42/EC) requires that the likely significant effects on cultural heritage including architectural and archaeological heritage should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>The construction and operation of large scale water resources infrastructure can have adverse impacts on the significance of heritage assets both directly (through the loss of, or damage to, assets) or indirectly (through effects on setting). The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>
Will the Water Resources NPS conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings	A number of legislative provisions require the protection of sites designated for archaeological or cultural heritage importance including the Ancient Monuments and Archaeological Areas Act 1979 and Planning (Listed Buildings and Conservation Areas) Act 1990.
Will the Water Resources NPS affect designated or locally-important archaeological features or their settings?	National planning policy in England requires the protection of the most important components of historic landscapes and encourages development that is consistent with maintaining its overall historic character.
Will the Water Resources NPS affect the fabric and setting of historic buildings, places or spaces that contribute to local distinctiveness, character and appearances?	
Will the Water Resources NPS avoid damage to important wetland areas with potential for paleoenvironmental deposits?	Research under the National Heritage Protection Plan (NHPP) identified wetland and waterlogged archaeological sites to help prevent their loss.
Will the Water Resources NPS affect public access to, or enjoyment of, features of cultural heritage?	Water resource infrastructure can include protected cultural structures that then attract visitors e.g. Derwent Reservoir.

Table 13.2 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the cultural heritage objective.

Table 13.2 Illustrative Guidance for the Assessment of Significance for Cultural Heritage

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would make a significant positive and long-term contribution to the setting and conservation of designated and locally important cultural heritage features (e.g. through enhancement of setting, permanent removal of a structure creating a negative visual impact, large scale enhancement of designated features).
+	Positive	<ul style="list-style-type: none"> Option would bring minor short-term improvements to the setting and conservation of designated and locally important cultural heritage features (e.g. temporary removal of a structure creating a negative visual impact).
0	Neutral	<ul style="list-style-type: none"> Option would not have any significant effects on any cultural heritage sites or assets or their setting.
-	Negative	<ul style="list-style-type: none"> Option would result in short-term degradation to the setting and conservation of designated and locally important cultural heritage features (e.g. temporary use of equipment/structures creating a negative visual impact).
--	Significant Negative	<ul style="list-style-type: none"> Option would cause long-term degradation to the setting and conservation of designated and locally important cultural heritage features (e.g. through direct and permanent loss or damage to assets or the introduction of a structure that will have a considerable and permanent negative visual impact).
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

Landscape and Townscape

14. Landscape and Townscape

14.1 Introduction

This section presents the overview of plans, programmes and baseline information for the appraisal of sustainability of the National Policy Statement for Water Resources in respect of landscape and townscape.

Landscape in this context is defined by The **European Landscape Convention** as “*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*”. This definition is stated as covering natural, rural, urban and peri-urban (i.e. the urban-rural fringe) and includes land, inland water and marine areas. For the purposes of this appraisal though, landscape is taken to apply to rural areas and townscapes in urban areas. Visual effects are those effects that influence how people see a landscape or townscape, such as the erection of a building.

There are links between the landscape and townscape topic and other topics in the Appraisal of Sustainability (AoS), including in particular biodiversity and nature conservation and cultural heritage.

14.2 Review of Plans and Programmes

The plans and programmes reviewed seek to protect and enhance the broad variety of landscapes and townscapes. The water environment is a key aspect of many of the most valuable landscapes including National Parks and as such any new water resources infrastructure would need be considered within the framework of policies that protect valued landscapes from adverse effects.

International

The **European Landscape Convention 2004** is principally directed at the national level, but emphasises the importance of landscape as a cultural as well as an aesthetic asset. The Convention also calls for improved public involvement in landscape matters. The UK became a signatory to the European Landscape Convention in 2006.

UK

In the UK, there are numerous Acts governing the protection of the countryside, landscape and natural environment. The **National Parks and Access to the Countryside Act 1949** makes provision for National Parks, confers powers for the establishment and maintenance of nature reserves, makes provision for the recording, creation, maintenance and improvement of public paths and for securing access to open country and confers further powers for preserving and enhancing natural beauty.

National Parks are areas of relatively undeveloped and scenic landscape. Designation as a National Park may include substantial settlements and human land uses which are often integral parts of the landscape. Land within a National Park remains largely in private ownership. Each National Park is operated by its own National Park authority, with two 'statutory purposes':

- ▶ to conserve and enhance the natural beauty, wildlife and cultural heritage of the area; and
- ▶ to promote opportunities for the understanding and enjoyment of the Parks.

Areas of Outstanding Natural Beauty (AONBs) are areas of high scenic quality that have statutory protection in order to conserve and enhance the natural beauty of their landscapes. AONB landscapes range from rugged coastline to water meadows to gentle lowland and upland moors. Natural England has a statutory power to designate land as AONB.

The **Countryside and Rights of Way Act 2000** increased the duty of provision of public access to the countryside and strengthened legislation relating to Sites of Special Scientific Interest (SSSIs). In particular,

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it requires public bodies to further the conservation and enhancement of SSSIs both in carrying out their operations, and in exercising their decision-making functions.

The **Marine and Coastal Access Act 2009** seeks to ensure clean, healthy, safe, productive and biologically diverse oceans and seas, by putting in place better systems for delivering sustainable development of marine and coastal environment.

Other relevant Acts include:

- ▶ The Forestry Act 1967 restricts and regulates the felling of trees. The Countryside Act 1968 enlarges the function of the Agency established under the National Parks and Access to the Countryside Act 1949, to confer new powers on local authorities and other bodies for the conservation and enhancement of natural beauty and for the benefit of those resorting to the countryside;
- ▶ The Agriculture Act 1986 (with numerous revisions) covers the provision of agricultural services and goods, agricultural marketing compensation to tenants for milk quotas, conservation and farm grants; and
- ▶ The Commons Act 2006, which protects common land and promotes sustainable farming, public access to the countryside and the interests of wildlife.

England

The **Natural Environment and Rural Communities Act 2006** ('the NERC Act') is designed to help achieve a rich and diverse natural environment and thriving rural communities through modernised and simplified arrangements for delivering Government policy. The NERC Act established a new independent body - Natural England - responsible for conserving, enhancing, and managing England's natural environment for the benefit of current and future generations. The Act made amendments to both the Wildlife and Countryside Act 1981 and the Countryside and Rights of Way Act 2000, which further enhance provisions to biodiversity generally and SSSIs in particular.

The **National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2012)** includes strong protections for valued landscapes and townscape as well as recognising the intrinsic character and beauty of the countryside. The importance of planning positively for high quality design is underlined and local and neighbourhood plans are expected to "*develop robust and comprehensive policies that set out the quality of development that will be expected for the area*". Planning policies and decisions are expected to respond to local character and history, and reflect the identity of local surroundings and materials, while not preventing or discouraging appropriate innovation. The Framework states (at paragraph 64) that: "*Permission should be refused for development of poor design that fails to take the opportunities available for improving the character and quality of an area and the way it functions*".

The Framework has a number of specific requirements relating to planning and landscape including a clear expectation that the planning system should contribute to, and enhance, the natural and local environment by protecting and enhancing valued landscapes. Local planning authorities are expected to set criteria based policies against which proposals for any development on or affecting protected landscape areas will be judged. In doing so, distinctions should be made between the hierarchy of international, national and locally designated sites and "*great weight*" should be given to "*conserving landscape and scenic beauty in National Parks, the Broads and Areas of Outstanding Natural Beauty*". Local planning authorities in their plan-making are also expected to take account of changes to landscape and develop a clear strategy for enhancing the natural, built and historic environment. Where appropriate, "*landscape character assessments should also be prepared, integrated with assessment of historic landscape character, and for areas where there are major expansion options, assessments of landscape sensitivity*".

One of the core principles in the NPPF is that planning should recognise the intrinsic character and beauty of the countryside. Local plans should include strategic policies for the conservation and enhancement of the natural environment, including landscape. This includes designated landscapes but also the wider countryside. Where appropriate, landscape character assessments should be prepared to complement Natural England's National Character Area profiles. Landscape Character Assessment is a tool to help understand the character and local distinctiveness of the landscape and identify the features that give it a

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sense of place. It can help inform, plan and manage change and may be undertaken at a scale appropriate to local and neighbourhood plan-making.

National Planning Practice Guidance provides guidance on the application of landscape policies. It sets out that planning policies and decisions should be based on up-to-date information about the natural environment and other characteristics of the area including management plans for National Parks and Areas of Outstanding Natural Beauty (AONBs).

The **Natural Environment White Paper (NEWP) The Natural Choice: securing the value of nature (2011)** recognises that a healthy natural environment is the foundation of sustained economic growth, prospering communities and wellbeing. It sets out how the value of nature can be mainstreamed across society by facilitating action; strengthening the connections between people and nature; creating a green economy and showing leadership in the EU and internationally. It sets out 92 specific commitments for an action and since its publication in 2011, Defra has published periodic NEWP implementation updates highlighting significant progress.

Scotland

The **Countryside (Scotland) Act 1967** makes provision for the better enjoyment of the Scottish countryside, the establishment of a Countryside Commission for Scotland and for the improvement of recreational and other facilities. The **National Parks (Scotland) Act 2000** provides the legislative framework for National Park designations in Scotland. The Land Reform (Scotland) Act 2003 establishes a right to be on land for recreational, educational and certain other purposes and a right to cross land. The Act also places a duty on each a local authority to prepare a Core Paths Plan and provides that access rights are exercisable in respect of all Core Paths.

The **Scottish Planning Policy (SSP) 2014** sets out several broad principles with regard to landscape, including taking a broader approach to landscape and natural heritage, considering the natural and cultural components of the landscape together, promoting opportunities for enhancement or restoration of degraded landscapes, safeguarding the character of the most sensitive landscapes, and considering potential effects on the landscape, including the cumulative effect of incremental changes, when deciding planning applications. SSP requires local authorities to apply the precautionary principle where the impacts of a proposed development on nationally or internationally significant landscape or natural heritage resources are uncertain but there is sound evidence for believing that significant irreversible damage could occur.

Scotland's **Third National Planning Framework (NPF3)**, the spatial expression of the Government Economic Strategy, sets out a long-term vision for development and investment across Scotland over the next 20 to 30 years. NPF3 focuses on supporting sustainable economic growth and the transition to a low carbon economy. NPF3 sets out the ambition for Scotland as a whole, and highlights the distinctive opportunities for sustainable growth in the cities and towns, the rural areas and coast and islands. NPF3 will be taken into account in all strategic and local development plans in Scotland. Fourteen national developments across Scotland are identified to deliver the strategy.

Planning Advice Note 60 (PAN60): Planning for Natural Heritage provides guidance on how development and the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment and encourages developers and planning authorities to be positive and creative in addressing natural heritage issues.

Wales

The **Well-being of Future Generations (Wales) Act 2015** became law in Wales on 29th April 2015 and strengthens existing governance arrangements for improving the well-being of Wales to ensure that present needs are met without compromising the ability of future generations to meet their own needs. The act identifies goals to improve the well-being of Wales, introduces national indicators that will measure the difference being made to the well-being of Wales, establishes a Future Generations Commissioner for Wales to act as an advocate for future generations and puts local service boards and well-being plans on a statutory basis and simplifies requirements for integrated community planning.

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The ***Environment (Wales) Act 2016*** establishes the principles that determine how the sustainable management of natural resources is to be delivered. The principles, which are complementary and interlinked, include requires that the benefits provided by natural resources and ecosystems be identified and considered, as well as the intrinsic value of those ecosystems and resources, which is the value of natural resources and ecosystems for their own sake. All provisioning, supporting, regulating and cultural benefits (or services) should be considered, as appropriate, in the sustainable management of natural resources.

The ***Planning (Wales) Act 2015*** requires public bodies to exercise their functions relating to development plans and applications for planning permission as part of carrying out sustainable development, so that the development and use of land contribute to improving the well-being of Wales.

Planning Policy Wales (Edition 9) (2016) sets out several objectives regarding landscape, including promoting the conservation of landscape and biodiversity, ensuring that Wales contributes to meeting international responsibilities and obligations and ensuring that statutorily designated sites are properly protected and managed. It also notes that it is important that landscape considerations are taken into account at an early stage in both development plan preparation and development management.

Technical Advice Note (TAN) 6: Planning for Sustainable Rural Communities (2010) provides practical guidance on the role of the planning system in supporting the delivery of sustainable rural communities. The TAN seeks to protect and enhance Wales' landscapes.

Technical Advice Note 12 (TAN 12): Design (2016) sets out the Welsh Government's policy and advice in respect of the design of new development, including sustaining or enhancing local character.

14.3 Overview of the Baseline

UK

Statutory sites designated (wholly or partially) for their landscape value include National Parks, Areas Outstanding Natural Beauty (AONBs) (in England and Wales), Country Parks, Registered Historic Parks and Gardens, Historic Gardens and Designed Landscapes, National Scenic Areas (NSAs) and Regional Parks (in Scotland) and World Heritage Sites. Other important (non-statutory) sites include Areas of Great Landscape Value (AGLV) in Scotland; Heritage Coasts (in England and Wales); and National Trust/National Trust for Scotland properties.

The UK has 15 National Parks and (excluding Scotland) 46 AONBs. Each National Park is administered by its own National Park Authority whose duty it is to conserve and enhance natural beauty, wildlife and cultural heritage; and to promote opportunities for the understanding and enjoyment of the special qualities of National Parks by the public. The Broads Authority in England has a third purpose to protect the interests of navigation. The primary purpose of AONB is to conserve and enhance the natural beauty of the landscape.

England

England has been divided into areas with similar landscape character, which are called National Character Areas (NCAs). A total of 159 NCAs have been identified in England³⁵³. The boundaries of the NCAs are not precise and many should be considered as broad zones of transition. Natural England have rewritten and redesigned all of England's 159 NCA profiles and published the revised profiles in September 2014. The NCAs are defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity.

³⁵³ Natural England (2014) *National Character Area profiles: data for local decision making*. Available online at: <https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making>

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There are ten National Parks in England; the most recently designated National Park being the South Downs National Park (designated on 31 March 2010). Together, National Parks cover 9.3% of the land area in England and include 453 conservation areas³⁵⁴.

There are 34 AONBs in England, one of which straddles England and Wales (the Wye Valley AONB). AONBs cover 18% of England and Wales³⁵⁵. The East Hampshire and Sussex Downs AONB designations were revoked on the 31 March 2010 when the South Downs National Park Designation Order came into effect.

England has been divided into areas with similar landscape character, which are called National Character Areas (NCAs). A total of 159 NCAs have been identified in England³⁵⁶. The boundaries of the NCAs are not precise and many should be considered as broad zones of transition. Natural England have rewritten and redesigned all of England's 159 NCA profiles and published the revised profiles in September 2014.

Heritage Coasts are areas defined (they are not statutorily designated) for the beauty and undeveloped nature of the coastline. They represent 1,057km of England's coastline and are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors. Most Heritage Coasts are within the boundaries of National Parks or AONBs, although some including Lundy, the Durham Coast, and Flamborough Head stand alone³⁵⁷.

A national record of over 1,600 Registered Historic Parks and Gardens³⁵⁸ which contribute to the landscape is maintained by Historic England. It is a non-statutory designation but the designation is a material planning consideration.

There are 18 World Heritage Sites in England including Saltaire an exceptionally complete and well preserved industrial village of the second half of the 19th century, located on the river Aire³⁵⁹.

Scotland

Scottish Natural Heritage identified a series of Natural Heritage Zones as part of their Natural Heritage Futures initiative, and used these areas to describe a vision for sustainable use of local natural heritage. A total of 21 zones were identified³⁶⁰, each having their own identity resulting from the interaction of geology, landforms, wildlife and land use.

Scotland has 40 National Scenic Areas (NSAs) covering more than one million hectares (12.7% of Scotland). The Planning etc. (Scotland) Act 2006 gives a statutory basis to NSAs. The purpose of the NSA designation is both to identify our finest scenery and to ensure it is protected from inappropriate development. This is

³⁵⁴ National Parks(2016)) *National park facts and figures*. Available online at: <http://www.nationalparks.gov.uk/learningabout/whatisanationalpark/factsandfigures>

³⁵⁵ National Association of AONBs (2017) *Areas of Outstanding Natural Beauty*. Available online at: <http://www.landscapesforlife.org.uk/>

³⁵⁶ Natural England (2014) *National Character Area profiles: data for local decision making*. Available online at: <http://www.naturalengland.org.uk/ourwork/landscape/englands/character/areas/default.aspx>

³⁵⁷ Natural England (2006) *Review and evaluation of heritage coasts in England*. Available online at: <http://publications.naturalengland.org.uk/publication/4594438590431232?category=56001>

³⁵⁸ Historic England (2017) *Registered Parks & Gardens*. Available online at: <https://historicengland.org.uk/listing/what-is-designation/registered-parks-and-gardens/>

³⁵⁹ UNESCO (2017) *Properties inscribed on the World Heritage List for Great Britain and Northern Ireland*. Available online at: <http://whc.unesco.org/en/statesparties/gb>

³⁶⁰ Scottish Natural Heritage (2002) *Natural Heritage Zones: A National Assessment of Scottish Landscapes*. Available online at: <http://www.snh.org.uk/futures/Data/pdfdocs/LANDSCAPES.pdf>

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achieved through the local authority planning system³⁶¹. Other areas designated for their landscape include two National Parks and three Regional Parks together with a number of Special (local) Landscape Areas³⁶².

There are six World Heritage Sites in Scotland: The Forth Bridge, St. Kilda; Old and New Towns of Edinburgh; the Frontiers of the Roman Empire; Heart of Neolithic Orkney; and New Lanark³⁶³.

The Scottish Government's third National Planning Framework, published in June 2014, recognises wild land as a "nationally important asset", and indicates Scotland's wildest landscapes merit strong protection. Scottish Natural Heritage published a new map of wild land areas in June 2014³⁶⁴. 'Wildness' in this context depends on four physical attributes, namely: the perceived naturalness of the land cover; the ruggedness of the terrain which is therefore difficult to cross; remoteness from public roads or ferries; and the visible lack of buildings, roads, pylons and other modern artefacts.

Wales

There are five AONBs in Wales, one of which straddles England and Wales (the Wye Valley AONB)³⁶⁵. Other areas designated for their landscape include three National Parks covering 20% of Wales (Brecon Beacons, Snowdonia and Pembrokeshire Coast National Park) and 495km of Heritage Coast.

To recognise the value of Wales' historic landscapes, Cadw in partnership with the then Countryside Council for Wales (now called Natural Resources Wales) and the International Council on Monuments and Sites compiled a non-statutory Register of 58 landscapes of outstanding or special historic interest in Wales. It is a non-statutory, advisory register whose primary aim is to provide information and raise awareness of an initial selection of the most important and significant historic landscape areas in Wales in order to aid their protection and conservation³⁶⁶.

There are three World Heritage Sites in Wales; Castles and Town Walls of King Edward in Gwynedd, Blaenavon Industrial Landscape and Pontcysyllte Aqueduct & Canal³⁶⁷.

14.4 Summary of Existing Problems Relevant to the Water Resources NPS

The following existing problems for landscape have been identified:

³⁶¹ Scottish Natural Heritage (2017) *National Scenic Areas*. Available online at: <http://www.scotland.gov.uk/Resource/Doc/1051/0095735.pdf>

³⁶² The term used for such local landscape designations varies from one local authority to another. For example, they are currently termed "Areas of Great Landscape Value" in Moray, 'Special Landscape Areas' in Dumfries and Galloway, and 'Sensitive Landscape Character Areas' in Ayrshire. However, guidance published by Scottish Natural Heritage and Historic Environment Scotland suggests the name be standardised to Special Landscape Area (SLA)

³⁶³ UNESCO (2017) *Properties inscribed on the World Heritage List for Great Britain and Northern Ireland*. Available online at: <http://whc.unesco.org/en/statesparties/gb>

³⁶⁴ Scottish Natural Heritage (2014) *Mapping Scotland's wildness and wild land*. Available online at: <http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/wild-land/mapping/>

³⁶⁵ Visit Wales (2017) *Areas of Outstanding Natural Beauty*. Available online at: <http://www.visitwales.com/explore/areas-of-outstanding-natural-beauty/natural-beauty>

³⁶⁶ Cadw (2017) *The registered landscapes of outstanding and of special interest in Wales*. Available online at: <http://lle.gov.wales/catalogue/item/RegisteredLandscapesOfOutstandingHistoricInterestInWales/?lang=en>

³⁶⁷ UNESCO (2017) *Properties inscribed on the World Heritage List for Great Britain and Northern Ireland*. Available online at: <http://whc.unesco.org/en/statesparties/gb>

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- ▶ Over the last century, the following landscape character trends have been experienced in the UK³⁶⁸:
 - ▶ a gradual erosion of local distinctiveness in some areas, through a process of standardisation and simplification of some of the components that make up landscape character;
 - ▶ a loss of some natural and semi-natural features and habitats such as ancient woodlands and unimproved grassland;
 - ▶ a decline in some traditional agricultural landscape features such as farm ponds and hedgerows, and a loss of archaeological sites and traditional buildings;
 - ▶ increased urbanisation, often accompanied by poor design standards and a decline in the variety of building materials, and the importation of urban and suburban building styles into rural areas; and
 - ▶ a loss of remoteness and reduced tranquillity because of built development and traffic growth.
- ▶ Light pollution appears to have increased considerably over the last 30-40 years over much of the UK. The growth of urban areas, road networks and industrial areas are all major contributors to increased light levels.
- ▶ The Scottish landscape is vulnerable to a variety of pressures. Key threats and opportunities to landscape character include the development of new infrastructure, agriculture, the loss and expansion of woodland and natural processes. Wind energy development is placing a pressure on landscape character, in particular in Southern Scotland where there are 83 windfarms installed or approved.

14.5 Likely Evolution of the Baseline

England

There are a number of pressures and risks outlined in the **State of the Natural Environment 2008** Report that may affect the quality of landscapes in England. These include:

- ▶ Sea-level rise: Over the next few decades it is anticipated that there will be major sea incursions inland during storms, particularly on the south and east coasts of England. If measures such as managed retreat are not adopted in low-lying areas, there may be widespread losses of intertidal and coastal habitats. In the coastal zone, sea-level rise may also result in the direct loss of freshwater habitats such as reedbeds and wet grasslands;
- ▶ Fire: More droughts in the future will make the countryside increasingly vulnerable to wildfire, with potential for heathland, grassland, broadleaved woodlands and bogs to undergo major change in their structure;
- ▶ Grazing management: More summer droughts may mean that grazing is no longer possible in some open habitats such as fens, grasslands and heathlands due to die-back of vegetation and a lack of drinking water for animals. The spread of diseases (e.g. bluetongue) related to climate change may also reduce livestock numbers and restrict movement, altering grazing patterns and landscapes;

³⁶⁸ Natural England (2008) *State of the Natural Environment 2008*. Available online at: <http://publications.naturalengland.org.uk/publication/31043>

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- ▶ Energy production: The production of biofuels in the countryside may result in changes to landscapes. Wind energy developments are likely to be more common; and
- ▶ Development pressure: Within rural England, the area of developed land has increased by about 4% since 1990. It is expected that the pace of development within England will increase in the future to make up for the current shortfall in housing provision. The effect of this increase pressure for development is likely to be felt most acutely in central and southern England where demand for housing is greatest.

Natural England report that in 2008, existing landscape character was being maintained in 51% of England's landscapes, whilst in a further 10%, existing character was being enhanced. However, 20% of landscapes were showing signs of neglect, while in the remaining 19% new landscape characteristics are emerging.

Data from 1990 to 2003 indicates that in England, the number of Character Areas with patterns of change that either maintain or enhance character has increased from 36% to 61%. The number of Character Areas with evidence of neglect or erosion of character has decreased. This evidence suggests that the character of the majority of English landscapes, at Character Area scale, is being sustained.

The protected nature of National Park and AONB landscapes make it less likely that these landscapes will be affected by some of the risks outlined above (e.g. development pressure) although those protected landscapes nearest to existing urban areas are more likely to be at risk.

Scotland

Between 1994 and 1999 Scottish Natural Heritage, in partnership with others, commissioned a series of LCA studies that together cover the whole of Scotland. The national suite of LCAs is now over 15 years old. Scottish Natural Heritage is reviewing Scotland's LCA studies, at character type level, to create a single dataset in an interactive digital version to be hosted on the new SNH website. It is understood that by late 2017 the revised LCAs will be available, providing further clarity on the long-term trends³⁶⁹.

Wales

The changing climate will have an effect on Wales' distinctive landscapes and seascapes. Changes in weather patterns and soil conditions will alter the vegetation that is an important landscape feature. Climate change can also have an effect on flooding or increases in temperatures may also present challenges for the landscape. Coastal areas may be most at risk. Responses to changing climate such as the introduction of new crops and land uses will also have an impact on the visual appearance of the landscape.

14.6 Assessing Significance

The objectives and guide questions related to landscape which have been identified for use in the appraisal of the effects of the Water Resources NPS proposals and alternatives are set out in **Table 14.1**, together with reasons for their selection.

³⁶⁹ Scottish Natural Heritage (2017) *Landscape Character Assessment*. Available online at: <http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/lca/>

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Table 14.1 Approach to Assessing the Effects of the Water Resources NPS Landscape and Townscape

Objective/Guide Question	Reasoning
Objective: To protect and enhance landscape and townscape quality and visual amenity.	<p>The SEA Directive (2001/42/EC) requires that the likely significant effects on landscape should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.</p> <p>The construction and operation of large scale water resources infrastructure can have adverse impacts on landscape character and visual amenity. Where works are located in areas of high landscape value (for example, National Parks), these effects could be significant. Water infrastructure can also contribute positively to landscapes, introducing new features that can provide opportunities for nature and wildlife in the medium to long term. The inclusion of this AoS objective ensures that these effects can be considered within the AoS.</p>
Will the Water Resources NPS have detrimental visual impacts?	Visual impacts can influence how people perceive a landscape or townscape and can decrease the character and intrinsic value.
Will the Water Resources NPS affect protected/designated landscapes or their setting?	Areas designated for their landscape value are important at a national level and should be protected from adverse effects and enhanced where possible.
Will the Water Resources NPS affect the intrinsic character or setting of local landscapes or townscapes?	Considering the protection and enhancement of landscape and townscape character is a requirement of the NPPF, SPP and PPW.
Will the Water Resources NPS help to minimise light pollution from construction and operational activities on residential amenity and on sensitive locations and receptors?	The consideration of light pollution is a requirement of the NPPF and PPW.
Will the Water Resources NPS affect public access to open spaces or the countryside?	National Parks and Access to the Countryside Act 1949 and Countryside and Rights of Way Act 2000 make provision for the recording, creation, maintenance and improvement of public paths and for securing access to open country and confers further powers for preserving and enhancing natural beauty.

Table 14.2 sets out guidance that has been utilised during the assessment to help determine the relative significance of potential effects on the landscape objective.

Table 14.2 Illustrative Guidance for the Assessment of Significance for Landscape and Townscape

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> Option would make a significant positive contribution to statutorily-designated landscapes and/or their setting; Option would have a significant positive effect on local landscapes and townscapes and/or their setting (e.g. through the replacement of poorly designed/derelict buildings with high quality development); Option would enhance public access to the countryside and increase open space provision.
+	Positive	<ul style="list-style-type: none"> Option would serve to enhance statutorily-designated landscapes and/or their setting; Option would have a positive effect on local landscapes and townscapes and/or their setting; Option would enhance public access to open spaces and the countryside.
0	Neutral	<ul style="list-style-type: none"> Option would not have any effect on statutorily-designated landscapes or their setting; Option would not have any effects on local landscapes and townscapes or their setting Option would not affect visual amenity; Option would not enhance or restrict public access to open spaces and the countryside.
-	Negative	<ul style="list-style-type: none"> Option would have short-term negative effects on statutorily-designated landscapes and/or their setting; Option would have a negative effect on the intrinsic character of local landscapes and

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Effect	Description	Illustrative Guidance
		townscapes and/or their setting; <ul style="list-style-type: none"> Option would affect the visual amenity of local communities; Option would temporally restrict public access to open spaces and the countryside.
--	Significant Negative	<ul style="list-style-type: none"> Option would have long-term negative effects on statutorily-designated landscapes (such as AONBs) and/or their setting; Option would severely affect the intrinsic character of local landscapes and townscapes and/or their setting; Option would severely affect the visual amenity of local communities; Option would result in the loss of open spaces and restrict public access to the countryside.
?	Uncertain	<ul style="list-style-type: none"> From the level of information available, the effect that the option would have on this objective is uncertain.

