

1. Biodiversity and Nature Conservation

1.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on biodiversity and nature conservation. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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, land use, geology and soils, climate change and landscape and townscape.

1.2 Review of Plans and Programmes

International/European

The UK is a signatory (along with another 189 parties) to the **Convention on Biological Diversity**, Nagoya, Japan, 2010 which sets out a conservation plan to protect global biodiversity, and an international treaty to establish a fair and equitable system to enable nations to co-operate in accessing and sharing the benefits of genetic resources. 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”.

In March 2010, the European Union (EU) agreed to **an EU vision and 2020 mission for biodiversity**:

- 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

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

- 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 European Commission adopted the **EU Biodiversity Strategy to 2020 – towards implementation** in 2011 to help deliver its vision. 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.

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 (79/409/EEC)** 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. The **Freshwater Fish Directive (2006/44/EC)** includes measure on the quality of fresh waters needing protection or improvement in order to support fish life.

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. The 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 first part of this strategy to do this in 2012 has been published. The second part of the strategy was published in 2014.

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).

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: Site of SSSIs². Under this Act, Natural England now 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 **Convention on Biological Diversity (CBD)** at the 1992 Rio Earth Summit. 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. 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. In 2002, world leaders agreed in Johannesburg on the urgent need to reduce the rate of loss of biodiversity by 2010, and in 2007, they recognised the need to take action to mitigate the impacts of climate change following the 2005 Millennium Ecosystem Assessment.

Since the publication in 2007 of **Conserving Biodiversity - the UK approach** by the Department for Environment, Food and Rural Affairs (Defra), the context in which the CBD is implemented in the UK has changed. Strategic thinking in all the four countries (England, Northern Ireland, Scotland and Wales) has pursued a direction away from a piecemeal approach dealing with different aspects of biodiversity and the environment separately, towards a new focus on managing the environment as a whole, with the true economic and societal value of nature properly acknowledged and taken into account in decision-making in all relevant sectors.

In October 2010, 192 governments and the EU agreed the **Strategic Plan for Biodiversity 2011-2020**. With its five strategic goals and 20 new global 'Aichi' targets, the Plan sets a new global vision and direction for biodiversity. The resulting **UK Post-2010 Biodiversity Framework (2012)** published by the Joint Nature Conservation Committee (JNCC) and Defra is designed to identify the activities needed to galvanise and complement country strategies, in pursuit of the Aichi targets. As such, it is an important framework that is owned, governed and implemented by the four countries, assisted by Defra and JNCC in their UK co-ordination capacities. Although differing in details and approach, the four UK countries have published strategies which promote the same principles and address the same global targets: joining-up

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

our approach to biodiversity across sectors; and identifying, valuing and protecting our 'Natural Capital' to protect national well-being now and in the future.

More specifically, the purpose of this UK Biodiversity Framework³ is to set a broad enabling structure for action across the UK between now and 2020:

- 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 ***Conservation of Habitats and Species Regulations 2010*** (SI 2010/490) (in England and Wales and, in combination with the 1994 regulations, 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 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*** establishes 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;
- move to a net gain in the value of nature;
- arrest the decline in habitats and species and the degradation of landscapes;

³ http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf

- 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 (2014) 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 Act (Scotland) 2004** places duties on public bodies in relation to the conservation of biodiversity, increases protection for SSSI, amends legislation on Nature Conservation 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** is a supplement to the **Scottish Biodiversity Strategy (2004)**, focussed on desired outcomes for 2020, responds to new international targets and updates elements of the 2004 strategy. Both the 2020 Challenge and the original 2004 Strategy, comprise the current Scottish Biodiversity Strategy.

The land use strategy for Scotland (**Getting the best from our land - A land use strategy for Scotland (2011)**) has 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.

Wales

Planning Policy Wales (Edition 7) (2014) 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 **Wales Environment Strategy Action Plan 2008-2011** is the second of its type and it facilitates a more strategic approach to environmental improvement and includes actions under the heading biodiversity.

Sustaining a Living Wales: A Green Paper on a New Approach to Natural Resource Management in Wales (2012) sets out, and seeks views on, proposals for the management and regulation of the environment in Wales. The consultation will principally inform the proposed Environment and Planning Bills. The central proposal is to move to an ecosystem approach to environmental regulation and management which is expected to:

- improve the resilience and diversity of the environment and its supporting biodiversity;
- provide simpler and more cost-effective regulation; and
- offer greater certainty for decision-makers.

In this context, the Green Paper is underpinned by the aim to “ensure that Wales has increasingly resilient and diverse ecosystems that deliver environmental, economic and social benefits now and in the future”.

Environment (Wales) Bill introduced 11 May 2015; sets out the legislation needed to plan and manage Wales’ natural resources in a more sustainable and joined up way. The Bill is expected to receive Royal Assent by 2016.

1.3 Overview of the Baseline

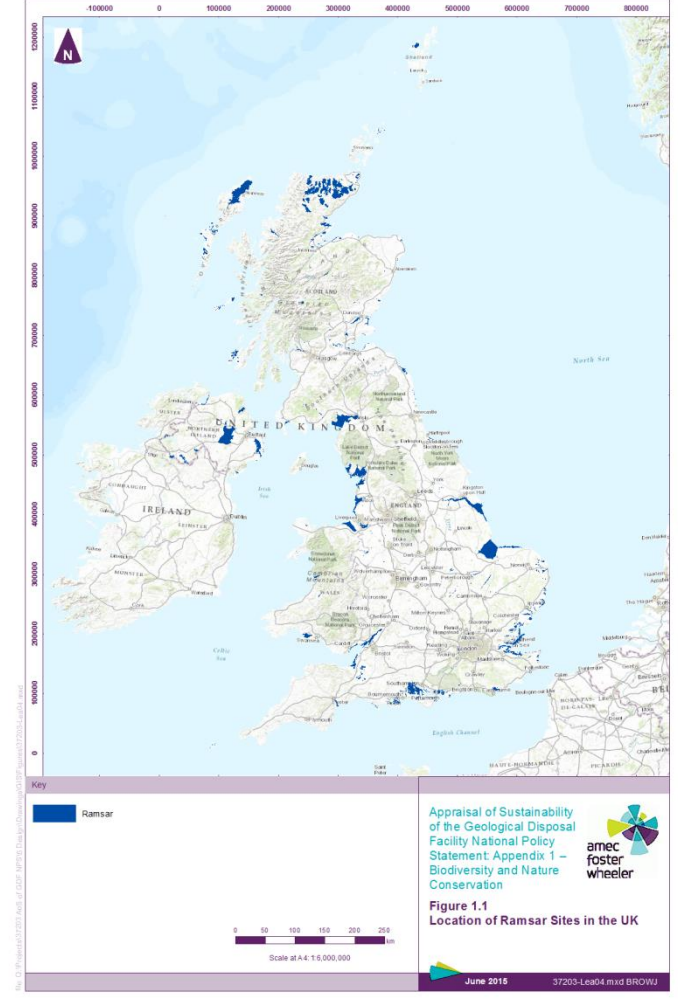
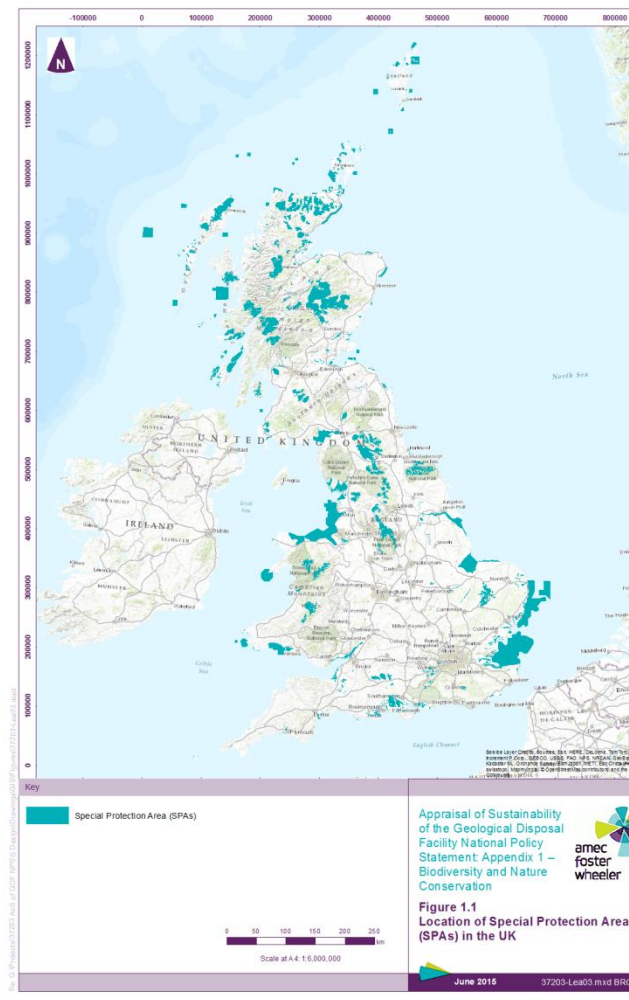
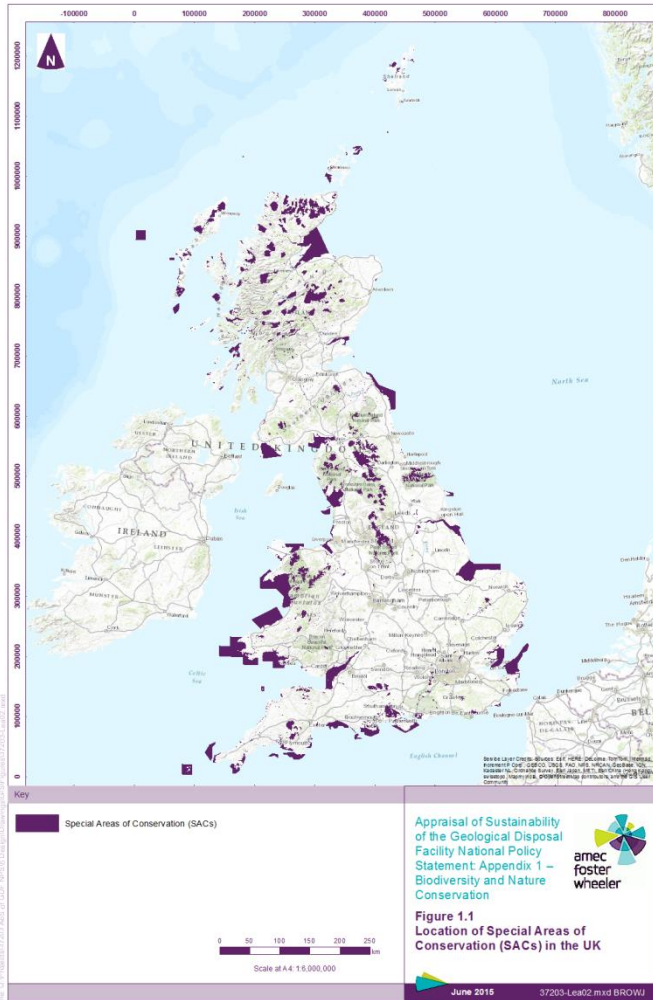
UK

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 652 SACs/SCIs (covering 8,013,587 hectares and including 1 candidate SACs (cSAC)), 270 SPAs (covering a total of 2,799,426 hectares and including one potential SPA (pSPA)) and 148 Ramsar sites (covering 785,361 hectares)⁴. **Figure 1.1** illustrates the distribution of European designed sites in England, Scotland and Wales. In addition, there are also over 6,550 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 108 SACs with marine component, covering 7.6% of UK waters. 88 of these SACs are completely in inshore waters. There are three marine habitats and three marine habitats and four marine species in UK waters currently⁵.

⁴ <http://jncc.defra.gov.uk/page-1388>

⁵ <http://jncc.defra.gov.uk/page-1445>

Figure 1.1 Location of Special Areas of Conservation (SACs), Special Protection Areas (SPA) and Ramsar Sites in the UK



Condition of Species and Habitat Features (SSSI, SAC, SPA and Ramsar)

A report⁶ describing the first six years of common standards monitoring of UK designated sites (SSSI, SAC, SPA and Ramsar) was produced by the JNCC, involving an assessment of the conditions of those features for which the sites were designated. In total, 12,937 feature assessments were carried out between April 1998 and March 2005, representing about 57% of all UK designated features.

In general, taking in all features assessed, the condition of Ramsar and SPA features were found to be the most favourable - 86% and 78% favourable (and favourable and recovering) respectively. SSSI features were 57% favourable as opposed to SAC features which were only 37% favourable. The favourable state of Ramsar and SPA sites is largely a reflection of the condition of bird features in general (see **Table 1.1**).

Table 1.1 Condition of Species Features by % Favourable and Recovering

Reporting Category	No. of Assessments	% Favourable and Recovering
Dragonflies and damselflies	41	85.4
Aggregations of non-breeding birds	732	81.3
Amphibians	49	79.6
Assemblages of breeding birds	180	78.9
Mammals	144	77.8
Aggregations of breeding birds	760	75.9
Other invertebrates	298	75.2
Butterflies	91	68.1
Flowering plants and ferns	324	67.3
Non-flowering plants and fungi	131	59.5
Fish	86	37.2
Species total	2,840	74.6

⁶ Williams, JM (ed.) (2006). Common Standards Monitoring for Designated Sites: First Six Year Report. Peterborough, JNCC.

Bird features were found to be faring well, with between 75% and 81% in a favourable and recovering condition. Mammal, invertebrate and plant features formed an intermediate group, while fish (37.2%) had a low proportion of favourable and recovering assessments.

The JNCC report presented assessments under a range of broad feature categories for species and habitats (see **Table 1.2**).

Table 1.2 Condition of Habitat Features by % Favourable and Recovering

Reporting Category	No. of Assessments	% Favourable and Recovering
Upland assemblages	55	89.1
Lagoons	47	83
Rocky shores, reefs and caves	46	82.6
Sea cliffs	180	76.1
Intertidal sands and muds	148	75.7
Limestone pavement, inland cliffs and screes	272	73.9
Acid grassland – lowland	174	70.1
Calcareous grassland – lowland	625	70.1
Blanket bogs	222	68.9
Neutral grassland	1,074	68.2
Subtidal sandbanks	9	66.7
Broadleaved and mixed woodland	1842	66.3
Heathlands – lowland	374	64.4
Fens and marshes – upland	114	64
Dunes, shingle and machair	342	63.7
Standing water	513	63.5

Reporting Category	No. of Assessments	% Favourable and Recovering
Saltmarsh	146	63
Lowland raised bogs	199	62.3
Fens and marshes – lowland	789	61.2
Coniferous woodland	56	57.1
Calcareous grassland – upland	84	53.6
Acid grassland – upland	56	51.8
Heathlands - upland	195	46.2
Montane grasslands and heaths	69	43.5
Rivers and streams	89	37.1
Habitats total	7,720	65.6

Many of the features in best condition were ones less easily damaged by human activities; this may be because they are relatively robust or because they are relatively difficult to access (e.g. cliffs). The features which 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, fires on heaths adjacent to housing developments), or which require concerted effort by many agencies (e.g. water quality affecting fish).

Lack of remedial management and grazing were mentioned most often as the activities leading to an unfavourable condition. Of particular relevance was that the effects of air pollution on SSSIs were often very difficult to determine given the complex interactions between pollution impacts, management and abiotic influences. This resulted in the impacts of air pollution being substantially under-reported in the assessment.

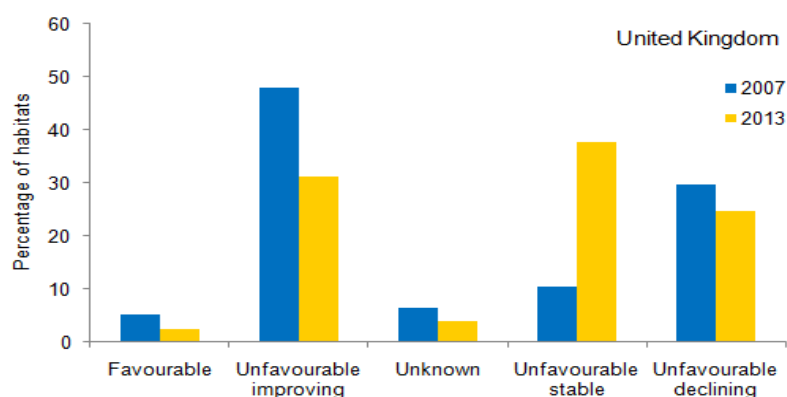
UK Post-2010 Biodiversity Framework

The ***UK Post-2010 Biodiversity Framework***, published in July 2012, has now succeeded the UK Biodiversity Action Plan (BAP). In particular, due to devolution and the creation of country-level biodiversity strategies, much of the work previously carried out under the UK BAP is now focused at a country level. Additionally, international priorities have changed: the framework particularly sets out the priorities for UK-level work to support the Convention on Biological Diversity's ***Strategic Plan for Biodiversity 2011-2020*** and its

five strategic goals and 20 'Aichi Targets', agreed in October 2010; and the new EU Biodiversity Strategy (EUBS) in May 2011⁷.

However, the UK BAP lists of priority species and habitats remain important and valuable reference sources. Notably, they have been used to help draw up statutory lists of priorities in England, Scotland and Wales. An assessment⁸ of change in status of UK habitats of European importance reports that in 2007, 5% of UK habitats listed on Annex I of the Habitats Directive were in favourable conservation status, declining to 3 per cent in 2013. The conservation status of 48 per cent of habitats was improving in 2007. In 2013, 31 per cent were improving. The conservation status of 30 per cent of the habitats was declining in 2007. In 2013, 25 per cent were declining (see **Figure 1.2**).

Figure 1.2 Percentage of UK habitats of European importance in improving or declining conservation status in 2007 and 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.

Source: UK Habitats Directive (Article 17) reports 2007 and 2013.

The number of species that have moved from the decreasing category to 'stable' or 'increasing' outweighs those moving in the other direction, but there are no obvious patterns in these changes. Sixty six of the species that were declining in 2008 were also declining in 2005, while six species changed from 'declining' in 2005 to 'lost' in 2008. This turnover between categories means that while there is an increase in the number of species stable or increasing, it is not necessarily the same species which are improving. Species that have moved from 'decreasing' in 2002 to either 'increasing' or 'stable' in 2008 include the shrill carder bee (*Bombus syvarum*), great yellow bumblebee (*Bombus distinguendus*), reed bunting (*Emberiza schoeniclus*) and the heath tiger beetle (*Cicindela sylvatica*). Very few species have moved from 'increasing' to 'declining' although examples include: Newman's lady fern (*Athyrium flexile*) and fen orchid (*Liparis loeselii*).

⁷ <http://incc.defra.gov.uk/page-5705>

⁸ UK Habitats Directive (Article 17) reports 2007 and 2013

The ongoing increase in number of species reported as lost, which came from the declining and unknown categories in 2005 is an additional cause for concern.

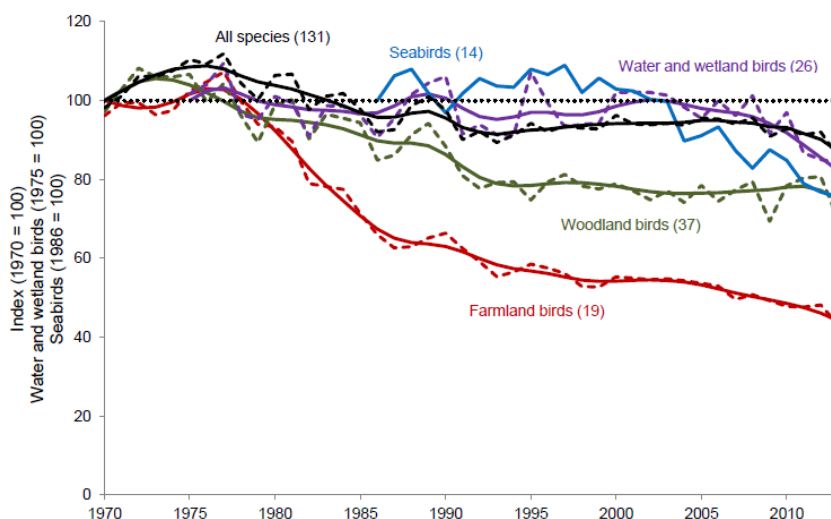
There is a very small net decrease in the number of habitats that are stable or increasing and there was a limited amount of turnover of habitats over the period 1999-2008. Lowland beech and yew woodland habitats were recorded as decreasing in 2002 and increasing in 2008. Lowland calcareous grassland and upland calcareous grassland were both stable in 2002 but decreasing in 2008. There was a change in the number of habitats reported as 'unknown' from 11 in 2005 to six in 2008. The number of habitats reported as 'increasing' fell from ten in 2005 to seven in 2008.

In Scotland, 23% of BAP species and 20% of BAP habitats were identified as 'stable', with an additional 4% of species and 13% of habitats recorded as 'increasing' in 2008. In Wales, biodiversity is regarded as a high level summary indicator. In 2005, 34% of Welsh BAP species were stable or increasing (compared with 22% in 2002) and 18% (2002 and 2005) declining. In 2005, 36% of priority habitats were stable or increasing compared with 20% in 2002. The number of habitats with a 'declining' status increased from 46% in 2002 to 59% in 2005. The increase in the number of habitats in decline was partly due to a change in the number of habitats considered (five more than in 2002) in addition to an increase in the number of BAP habitats as a whole (by two, both of which were in decline).

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 1.3** and **Figure 1.4** which provide an overview of population changes since 1970)⁹. The species used to calculate the indicators are set out in **Annex A**.

Figure 1.3 Populations of wild birds in the UK, by habitat, 1970-2013¹⁰



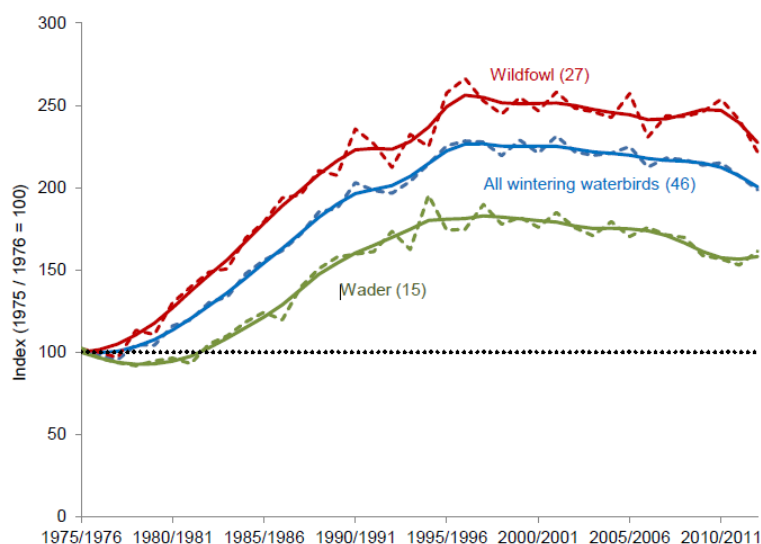
Source: RSPB, BTO, JNCC, Defra

⁹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/85736/Wild_birds_statistical_release_1970-2011_UK.pdf

¹⁰ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/372755/UK_Wild_birds_1970-2013_final_-_revision_2.pdf

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.

Figure 1.4 Populations of wintering waterbirds in the UK, 1975-76 to 2012-13¹¹



Source: RSPB, BTO, JNCC, Defra, WWT

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.

In 2013, the all-species index in the UK was 12% below its 1970 level. The smoothed index showed a small but statistically significant decline of 5% between 2007 and 2012.

Since 2000, populations of breeding farmland birds have declined by almost 14%, whilst water and wetland birds, woodland birds and seabirds have all declined by just over 3%, although the analysis of the underlying trends shows little or no overall change.

Although there remains uncertainty over the drivers of the overall decline in woodland bird populations in the UK, factors such as changes in woodland structure through aging, a decline in active woodland management and overgrazing by deer are implicated in the steep declines in a number of woodland specialists. In addition, problems overseas may be implicated in the declines of a number of long-distance migrants which breed in UK woodlands and spend the winter in Africa. Milder winters in the last decades may have been beneficial for a number of resident and short-distance migrant species.

The long-term decline of farmland birds in the UK has been driven mainly by the decline of those species that are restricted to, or highly dependent on, farmland habitats (the 'specialists'). By 2013, the UK breeding farmland bird index had fallen by 55% to a level less than half that of 1970. The period between the late 1970s and early 1990s saw the

¹¹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/372755/UK_Wild_birds_1970-2013_final_-_revision_2.pdf

largest declines in farmland bird populations, but there has been a statistically significant on-going decline of 10% between 2007 and 2012.

The breeding water and wetland bird measure was introduced for the first time in 2009, and can be disaggregated to four sub-habitat indicators showing differing trends, although all are derived from relatively few species trends. Of these, birds of slow flowing and standing water have shown the most positive trend having increased by 43% since 1975, whilst birds of reed beds have declined by 18%. Conversely, the index for wet grassland birds decreased by 53%, while the index for fast flowing water birds decreased by 30% compared to 1975.

In 2012-13, populations of the wintering waterbirds in the UK were almost double its 1975-76 level (up 95%). The index peaked in the late 1990s and has declined since, with the smoothed index falling by almost 5% between 2006-07 and 2011-12.

In Scotland, waterbird numbers peaked in 1996-7 (120% of 1975-76 baseline), and remained relatively stable until recent years, declining to 107% of the 1975-6 baseline in 2006-07. Geese showed the largest increase, being 294% of the baseline figure in 2006-07. Wildfowl and waders are at 99% and 78% of the baseline their baseline figures respectively in 2006-07.

Bat Populations

Bat species make up a third of the UK's mammal fauna and occur in most lowland habitats across the UK. The species used in this index (Table C8i) are widespread throughout a variety of landscapes including urban areas, farmland, woodland, and river/lake systems. All bats in the UK feed at night and prey on insects. 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, land management change). Climatic shifts are predicted to affect bat populations through changes in their yearly hibernation cycles, breeding success and food availability.

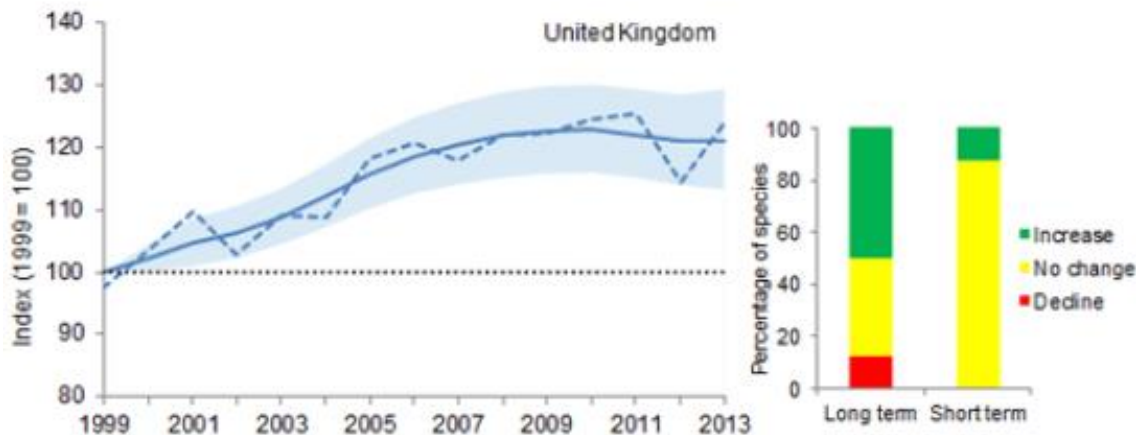
Between 1999 and 2013, bat populations have increased significantly by 18 per cent. An assessment of the underlying smoothed trend shows this to be a statistically significant increase.

In the short term, between 2007 and 2012, an assessment of the underlying smoothed trend shows that bat populations have shown a small, insignificant decrease of less than 3 per cent, and are therefore considered to be stable.

Four species (50 per cent) have increased in the long-term; one species, soprano pipistrelle, has decreased. In the short term, between 2007 and 2012, seven of the eight species have shown no significant change in population size. Lesser horseshoe bats have shown a statistically significant increase.

Bats have undergone severe declines historically. Data from roost counts of pipistrelle bats show there was a 60 per cent decline from 1977 to 1999 in England; assessment of the underlying smoothed trend shows this was a significant decrease (see **Figure 1.5**)¹².

Figure 1.5 Trends in Bat Populations, 1999-2013



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.

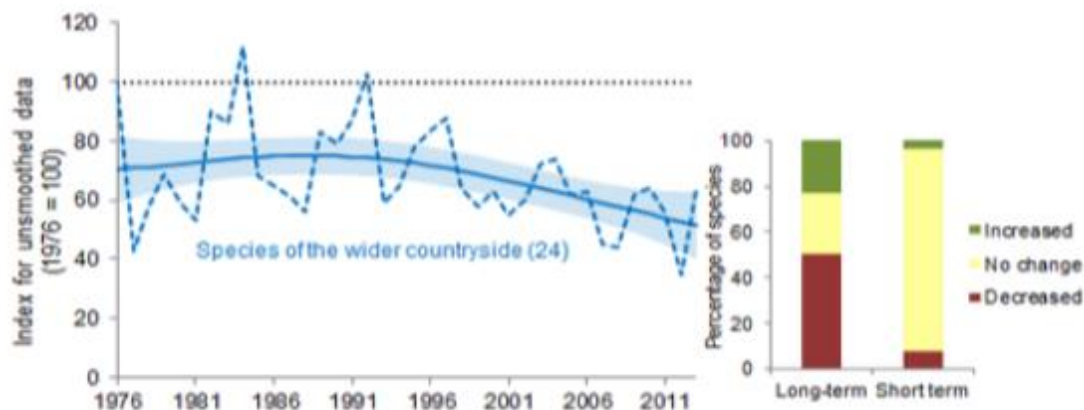
Trends are monitored in annual populations of specialist butterfly populations (those strongly associated with particular habitats, such as unimproved grassland) and generalist butterflies of the wider countryside. The data shows a high degree of annual variation^{13,14}. The assessment of change is therefore made on an analysis of the underlying trends undertaken by Butterfly Conservation and the Centre for Ecology and Hydrology. **Figure 1.6** presents monitored trends since 1976.

¹² <http://jncc.defra.gov.uk/page-4271>

¹³ <http://www.jncc.gov.uk/page-4236> [Accessed May 2015]

¹⁴ 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.

Figure 1.6 Trends in Butterfly Populations in the UK: species of the wider countryside, 1976-2013



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

Note:

- Figure in brackets shows the number of species included in the index.
- Graph shows unsmoothed trend (dashed line) and smoothed trend (solid line) with its 95 per cent confidence interval (shaded).
- Histogram shows the percentage of species within the indicator that have shown a statistically significant increase, statistically significant decrease or no change.
- In 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. Since 1976, the indices for butterflies associated strongly with semi-natural habitats (specialists) and for those found in the wider countryside show declines of 73% and 36% respectively. The unsmoothed data for both the habitat specialist butterflies and species of the wider countryside show an increase between 2008 and 2013. However, the underlying analysis of the smoothed trend shows that these increases are not significant; there has been no overall change in either of the two indices in the five years to 2013.

In 2013, habitat specialist butterflies increased by 9 per cent from the previous year, whilst wider countryside species increased by 29 per cent.¹⁵

England

As at June 2015, there were a total of 4,129 SSSIs in England, covering 1,082,984ha (including open water and coastal habitats)¹⁶.

In terms of land area, approximately 8% of England is designated as SSSI. In England, there are 254 SACs, 83 SPAs, 72 Ramsar and 226 NNR sites¹⁷. As at 11 June 2015, the overall condition of SSSIs in England was assessed by Natural England to be 37.63% as area favourable; 58.27% area unfavourable recovering; 2.41% area unfavourable no change; 1.65% area unfavourable declining; and 0.02% area destroyed and 0.01% part

¹⁵ <http://jncc.defra.gov.uk/page-4236>

¹⁶ <https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=ALL>

¹⁷ <https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=RAMSAR>

destroyed¹⁸. The reasons for adverse conditions at sites are set out in **Table 1.3**. This indicates that planning permission (general) was linked to 0.41% of the area not meeting the Natural England Prevention of Significant Deterioration (PSD) Target.

Table 1.3 Reasons for Adverse Condition Summary

Adverse Condition Reason	Num Units	Area of Units (ha)	% of unit area not meeting the PSD target
Other - Other - Specify In Comments	344	9,901.42	16.07%
Freshwater Pollution - Water Pollution - Agriculture/Run Off	281	5,303.57	8.61%
Agriculture - Undergrazing	419	4,847.03	7.87%
Freshwater - Inappropriate Water Levels	177	4,108.57	6.67%
Lack Of Corrective Works - Inappropriate Scrub Control	475	3,943.26	6.40%
Freshwater - Invasive Freshwater Species	118	3,644.03	5.91%
Agriculture - Overgrazing	178	3,598.03	5.84%
Freshwater - Drainage	134	2,494.46	4.05%
Forestry - Forestry And Woodland Management	225	2,355.77	3.82%
Freshwater Pollution - Water Pollution - Discharge	98	2,010.55	3.26%
Coastal - Coastal Squeeze	41	1,727.46	2.80%
Lack Of Corrective Works - Inappropriate Weed Control	129	1,434.86	2.33%

¹⁸ <https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=ALL>

Adverse Condition Reason	Num Units	Area of Units (ha)	% of unit area not meeting the PSD target
Forestry - Deer Grazing/Browsing	76	1,325.19	2.15%
Public Access/Disturbance - Public Access/Disturbance	97	1,206.16	1.96%
Agriculture - Inappropriate Cutting/Mowing	108	1,200.02	1.95%
Lack Of Corrective Works - Inappropriate Ditch Management	103	1,187.66	1.93%
Freshwater - Fish Stocking	55	1,129.32	1.83%
Agriculture - Inappropriate Csa/Esa Prescription	29	1,015.85	1.65%
Freshwater - Inappropriate Weirs Dams And Other Structures	59	891.02	1.45%
Freshwater - Siltation	82	865.78	1.41%
Freshwater - Water Abstraction	49	799.02	1.30%
Fire - Moor Burning	7	765.57	1.24%
Agriculture - Fertiliser Use	27	746.01	1.21%
Agriculture - Agriculture – Other	74	714.32	1.16%
Vehicles - Vehicles - Other	16	625.59	1.02%
Coastal - Inappropriate Coastal Management	31	583.75	0.95%
Fire - Fire - Other	36	516.59	0.84%

Adverse Condition Reason	Num Units	Area of Units (ha)	% of unit area not meeting the PSD target
Vehicles - Vehicles - Illicit	24	406.11	0.66%
Earth Science - Earth Science Feature Obstructed	126	402.70	0.65%
Air Pollution - Air Pollution	13	362.38	0.59%
Lack Of Corrective Works - Inappropriate Pest Control	11	319.75	0.52%
Coastal - Sea Fisheries	1	256.48	0.42%
Planning Permission - Planning Permission - General	48	251.89	0.41%
Planning Permission - Peat Extraction	9	174.07	0.28%
Military - Military	2	94.97	0.15%
Planning Permission - Planning Permission - Other Mineral And Waste	14	91.13	0.15%
Game Management - Game Management - Pheasant Rearing	10	89.16	0.14%
Coastal - Inappropriate Dredging	7	73.15	0.12%
Game Management - Game Management - Other	9	68.34	0.11%
Earth Science - Earth Science Feature Removed	10	31.53	0.05%
Freshwater - Inland Flood	8	26.00	0.04%

Adverse Condition Reason	Num Units	Area of Units (ha)	% of unit area not meeting the PSD target
Defence Works			
Agriculture - Inappropriate Stock-Feeding	5	22.37	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%20a%20adverse%20conditions> [Accessed 11 June 2015]

As at 11 June 2015, the overall condition of NNRs in England was assessed by Natural England to be 52.62% as area favourable; 43.84% area unfavourable recovering; 2.26% area unfavourable no change; 1.28% area unfavourable declining; and 0% area destroyed and 0% part destroyed¹⁹.

As at 11 June 2015, the overall condition of SACs in England was assessed by Natural England to be 34.06% as area favourable; 63% area unfavourable recovering; 1.94% area unfavourable no change; 1% area unfavourable declining; and 0% area destroyed and 0% part destroyed²⁰.

As at 11 June 2015, the overall condition of SPAs in England was assessed by Natural England to be 37.15% as area favourable; 59.98% area unfavourable recovering; 1.54% area unfavourable no change; 1.31% area unfavourable declining; and 0% area destroyed and 0.01% part destroyed.²¹

As at 11 June 2015, the overall condition of Ramsar sites in England was assessed by Natural England to be 57.98% as area favourable; 38.6% area unfavourable recovering; 1.69% area unfavourable no change; 1.72% area unfavourable declining; and 0% area destroyed and 0.01% part destroyed.²²

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). Natural Areas have been formally defined as “biogeographic zones which reflect the geological

¹⁹ <https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=NNR>

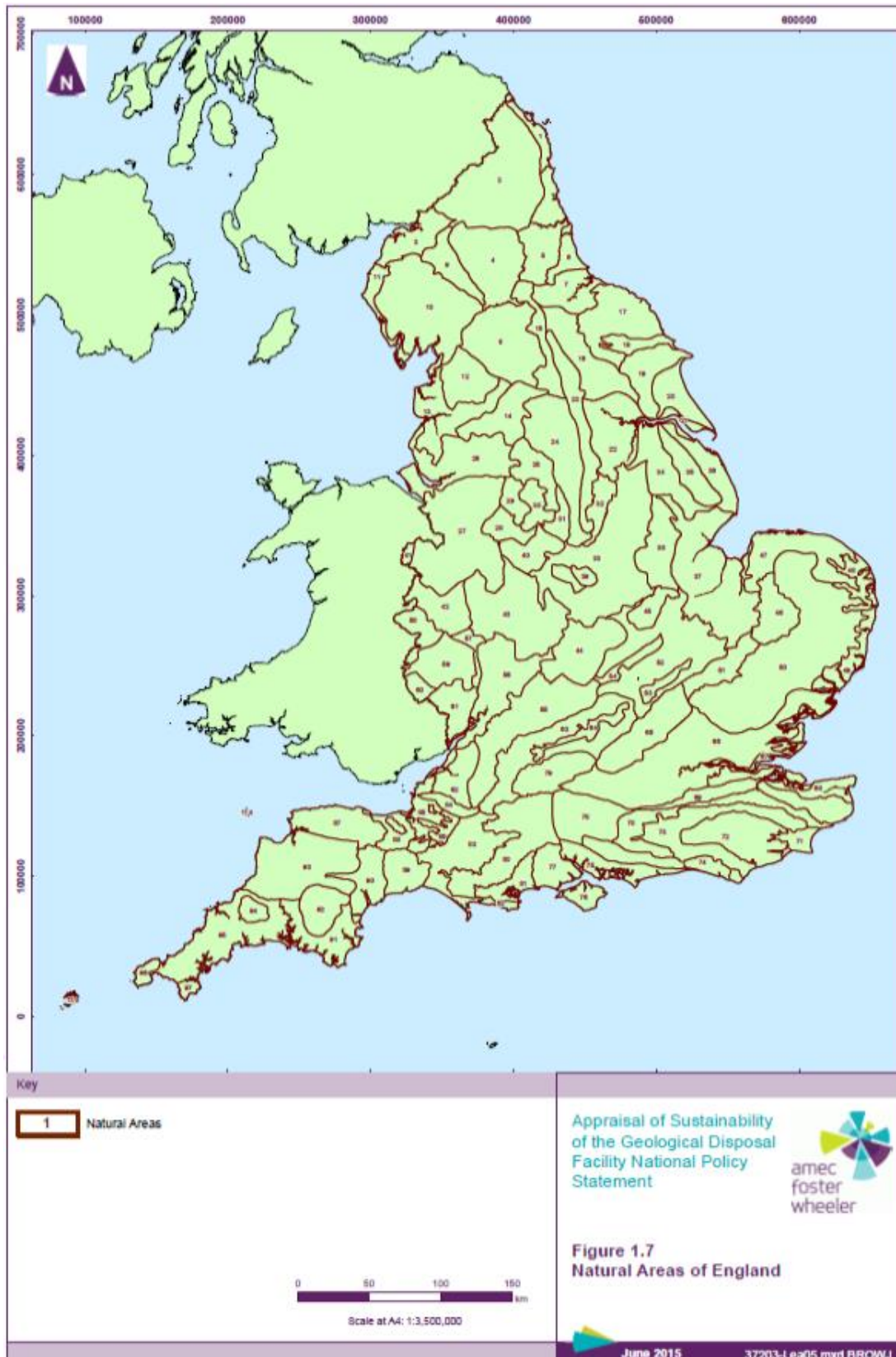
²⁰ <https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=SAC>

²¹ <https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=SPA>

²² <https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteType=RAMSAR>

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 1.7** identifies Natural Areas of England.

Figure 1.7 Natural Areas of 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 England.²³ 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.

Scotland

In Scotland there are:

- 152 SPAs, covering an area of 1,250,988 hectares²⁴;
- 236 SACs covering an area of approximately 939,727 hectares²⁵. This includes three sites that straddle the border with England;
- 50 Ramsar sites covering a total area of about 283,083 hectares, and
- 1,425 SSSIs covering 1,023,000 hectares or 13% of Scotland²⁶.

As at 1 February 2014, Scotland had over 1,425 SSSI covering just under 1,020,000 hectares or 12.7% of Scotland²⁷. In 2005, 55% of SSSI habitats were in favourable condition, 99% of marine features were favourable, 45% of habitats were unfavourable, unfavourable declining or destroyed. The greatest proportion of unfavourable features was among lowland heath and wetland (81% and 71% unfavourable, respectively).

By March 2015, 79.3% of natural features on protected nature sites were assessed as being in favourable condition; 0.5% points higher than in March 2014 and 3.3% higher than in 2007²⁸.

Scottish Natural Heritage identified a series of Natural Zones as part of their Natural Heritage Futures initiative, and used these areas to describe a vision for sustainable use of local natural heritage. Twenty one areas were identified in total, 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. There are 112 Natura 2000 sites in Wales (including along the border region with England). These include 10 Ramsar sites, 92 SACs, and 20 SPAs²⁹. 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)³⁰.

²³ National Character Area profiles: data for local decision making. 2014.

²⁴ <http://www.naturalengland.org.uk/ourwork/landscape/englands/character/areas/default.aspx> [Accessed 28.05.2015]

²⁵ <http://jncc.defra.gov.uk/page-1399>

²⁶ <http://jncc.defra.gov.uk/page-23>

²⁷ <http://www.gov.scot/Publications/2012/08/2023/48>

²⁸ <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssisi/sssisi-location/>

²⁹ <http://www.gov.scot/About/Performance/scotPerforms/indicator/naturesites#Chart>

²⁹ JNCC (2013). Protected Sites. Available at: www.jncc.gov.uk/page-4. [Accessed May 2013]

³⁰ 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.

During the 2000-10 monitoring period, the condition of the 112 Natura 2000 habitats was assessed as³¹:

- Favourable - 24%;
- Recovering - 15%; and
- Unfavourable - 61%.

There are 1,047 SSSIs in Wales, covering over 260,600 hectares (ha) which is just over 12.3% of the land area³². The 2006 Rapid Review recorded the condition of SSSI features. In Wales, 47% of SSSIs were assessed to high confidence levels and the results showed that 32% of sites were in favourable condition and 68% were in unfavourable condition. However, based on individual features within a SSSI, 47% of features were in favourable condition³³.

There are 73 National Nature Reserves (NNRs) protecting over 26,900 hectares of land in Wales. Data provided by Natural Resources Wales³⁴ indicates that, as of 2008, 57% of NNRs were in favourable condition (i.e. all assessed features have favourable or unfavourable recovering status). Conversely, 43% of NNRs had one or more features in unfavourable declining condition.

There are 38 priority habitats in Wales (an increase from 37 in 2002). In 2008, 15 priority habitats (40%) were classified as stable or increasing in Wales compared with 11 (30%) in 2002, and 14 (36%) in 2005. However, 20 priority habitats (53%) were declining in 2008 compared to 17 habitats (50%) in 2002, and 23 (59%) in 2005³⁵. Habitats within the marine environment exhibit the greatest deterioration, with continued or accelerated decline across 60% of marine habitats compared to only 8% for terrestrial habitats and 33% for freshwater habitats³⁶.

1.4 Summary of Existing Problems for Biodiversity and Nature Conservation Relevant to the Geological Disposal 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 79/409/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;

³¹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/274005/Appendix_B_DECC_SEA_Enviro_Report.pdf

³² Welsh Government (2012). Sustaining a Living Wales: A Green Paper on a New Approach to Natural Resource Management in Wales. Available at: <http://wales.gov.uk/consultations/environmentandcountryside/sustainingwales/?lang=en>

³³ CCW (2006). Condition of SSSI Sites and Features. Available at: www.ccw.gov.uk/landscape--wildlife/protecting-our-landscape/special-landscapes--sites/protected-landscapes-and-sites/sssisi/sssisi--report/condition-of-features.aspx

³⁴ CCW (2008). Status of National Nature Reserves. Available at: www.ccw.gov.uk/landscape--wildlife/protecting-our-landscape/special-landscapes--sites/protected-landscapes-and-sites/national-nature-reserves/nnr-report/status-of-nnr.aspx

³⁵ Welsh Government (2010) State of the Environment: Indicator 19a. Available at: www.statswales.wales.gov.uk/TableViewer/document.aspx?ReportId=5762

³⁶ NAT(2011) UK National Ecosystems Assessment Technical Report Available at <http://uknea.unep-wcmc.org/>

- 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 species³⁷.

The same threats occur across the devolved administration in the UK. For example, the Scottish Biodiversity Group's report, *Action for Scotland's Biodiversity* (2000) identified seven key issues for biodiversity in Scotland: farming, forestry and fisheries as the main three, along with land development, air quality, water quality and transport³⁸.

Table 1.4 presents an overview of the key issues for biodiversity and nature conservation relevant to the Geological Disposal NPS.

Table 1.4 Biodiversity and Nature Conservation Problems Relevant to the Geological Disposal NPS

Problem	Supporting Data	Implications
Loss of biodiversity	The status of UK priority habitats and species in 2008 indicates that the decline of biodiversity is a major issue. For example, only 31% of the 45 priority habitats and 44% of the 391 priority species were judged to be stable, stable and probably increasing, or increasing, and of those that are stable, some may have populations well below what is recommended.	Ensure policies do not adversely affect biodiversity.
Unfavourable condition of certain habitat features	Over the period 1999-2005, the national conservation agencies carried out a programme of monitoring the designated features of SSSI, SACs, SPAs and Ramsar sites. 57% of A/SSSI sites were	Ensure policies do not adversely affect the status of conservation features.

³⁷ State of the Natural Environment Report (2008)

³⁸ SEPA (2007) State of Scotland's Environment 2006

Problem	Supporting Data	Implications
	<p>reported in favourable condition, with 37% of SACs, 86% of Ramsars and 73% of SPAs reported as favourable.</p> <p>Conservation features which 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, pollution) and which require concerted effort by many agencies (e.g. water quality affecting fish).</p>	

1.5 Likely Evolution of the Baseline

UK

The general global trend in biodiversity is generally towards a decreased level of variability among living organisms. The European Commission indicates that “*Biodiversity loss has accelerated to an unprecedented level, both 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*”³⁹. The global trend towards a decline in biodiversity is mirrored in the UK. The annual review of biodiversity indicators reveals that of the 47 measures used to compile the ‘all measures’ summary chart, 15 of the 39 measures assessed over the long term show an improvement, compared to 14 of the 35 measures that are assessed over the short term. 12 measures show a decline in the long term, and six a decline in the short term. Measures that improved or deteriorated in the long term have not necessarily continued to improve or deteriorate respectively in the short term.⁴⁰

Measures showing an improvement in the short term include: the area of land in agri-environment schemes, sustainable fisheries, air pollution, the extent of protected sites on-land and at-sea, condition of areas/SSSI, status of species of European importance and plant genetic resources.

Measures which have improved in the long term include: conservation volunteering, sustainable fisheries, air and marine pollution, the extent of protected sites on-land and at-sea, populations of wintering water birds, plant genetic resources and expenditure on UK and international biodiversity.

³⁹ European Commission, http://ec.europa.eu/environment/nature/biodiversity/intro/index_en.htm

⁴⁰ UK Biodiversity Indicators 2014 <http://jncc.defra.gov.uk/pdf/UKBI2014.pdf>

Measures showing long-term deterioration include: prevalence of terrestrial, freshwater and marine (coastal) invasive species, status of priority species, populations of farmland, woodland and wetland birds, and populations of butterflies (both specialists and those associated with the wider countryside).

Some of these measures have continued to deteriorate in the short term (e.g. populations of farmland and wetland birds).

A recent report by the UK's non-statutory wildlife organisations⁴¹ sets out the following headline results of their assessment of the state of the UK's biodiversity resource:

- Using records of 3,148 species, some 60% of these have declined over the last 50 years and 31% have declined strongly;
- Half of the species assessed have shown strong changes in abundance or distribution, indicating that recent environmental changes are having a dramatic impact on the nature of the UK's land and seas. There is also evidence to suggest that species with specific habitat requirements are faring worse than generalist species that are better able to adapt to a changing environment;
- A new Watchlist Indicator has been developed to measure how conservation priority species are faring, based on 155 species for which we have suitable data. This group contains many of the most threatened and vulnerable species, and the indicator shows that their overall numbers have declined by 77% in the last 40 years, with little sign of recovery;
- Of more than 6,000 species that have been assessed using modern Red List criteria, more than one in ten are thought to be under threat of extinction in the UK. A further 885 species are listed as threatened using older Red List criteria or alternative methods to classify threat;
- There were considerable (albeit largely unquantified) declines in the UK's wildlife prior to the last 50 years, linked to habitat loss; and
- Climate change is having an increasing impact on nature in the UK. Rising average temperatures are known to be driving range expansion in some species, but evidence for harmful impacts is also mounting⁴².

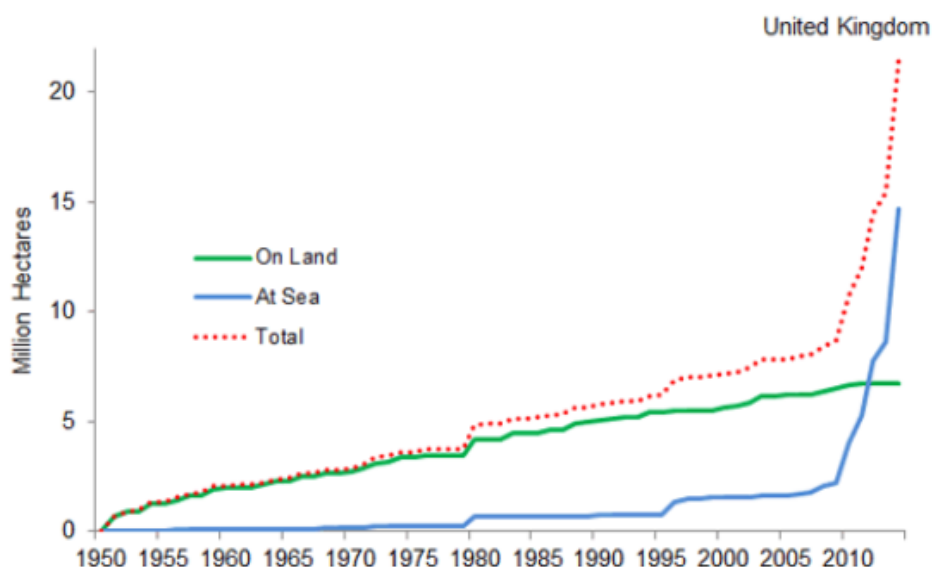
In response to these challenges and to ensure habitats and species receive protection, in the UK, there has been an increase in the number of sites and areas protected for biodiversity, flora and fauna⁴³ (see **Figure 1.8**).

⁴¹ Burns F, Eaton MA, Gregory RD, *et al.* (2013) *State of Nature report*. The State of Nature partnership at http://www.rspb.org.uk/Images/stateofnature_tcm9-345839.pdf

⁴² UK Biodiversity Indicators in Your Pocket 2012 http://jncc.defra.gov.uk/pdf/BIYP_2012.pdf

⁴³ <http://jncc.defra.gov.uk/page-4241>

Figure 1.8 Extent of UK Nationally and Internationally Important Protected Areas: (i) on-land; (ii) at-sea, 1950 to 2014



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

Notes:

The demarcation 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 2014, data only extend to 7 August (the date of designation of Scottish Nature Conservation Marine Protected Areas).

The 2013 indicator included a data revision, to account for the date of designation of sites designated under the National Parks and Access to the Countryside Act 1949 and their re-designation under the Wildlife and Countryside Act 1981. The 2014 indicator uses the same method. The indicator for the last two years is therefore not comparable with earlier years.

Extent is based on the following site designations: Areas of Special Scientific Interest, Sites of Special Scientific Interest, Special Areas of Conservation (including candidate Special Areas of Conservation and Sites of Community Importance), Special Protection Areas, Ramsar Sites, Marine Conservation Zones, Nature Conservation Marine Protected 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 has increased from just under 0.2 million hectares in 1980 to just over 7.5 million hectares in December 2011;
- 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 2000 and 2014, an increase of 74 per cent⁴⁴.
- 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 (recovering). Since 2005 the percentage of features or area of A/SSSIs in favourable or recovering condition has increased from 58% to 78% in 2014 for SACs, and from 73% to 84% for SPAs in the same period⁴⁵. 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

⁴⁴ Conservation on land and sea: Extent and condition of protected areas –Gov.uk https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/382482/1_Protected_Local_Sites_2014_final.pdf

⁴⁵ JNCC (2015). Protected Areas. Available at: <http://jncc.defra.gov.uk/page-4241> [Accessed May 2015]

majority of protected areas on land are A/SSSIs, so the condition indicator is not representative of marine sites.

Aichi Goals and Targets

The Strategic Plan for Biodiversity 2011-2020, agreed at Aichi, Japan at the tenth Conference of the Parties of the Convention on Biological Diversity established five strategic goals and 20 new global 'Aichi' targets in order to set a new direction for biodiversity. 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:

- **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 per cent of terrestrial and inland water, and 10 per cent 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 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

England

Results of the 2014 reporting of biodiversity indicators for England⁴⁶ reveal that:

- Overall there are 47 individual measures making up the indicators, and since 2000:
 - 15 of the 39 measures assessed over the long term, show an improvement, compared to 14 of the 35 measures that are assessed over the short term. 10 measures (38%) show an improvement;
 - 12 measures show a decline in the long term, and six a decline in the short term;
- Those showing a deterioration over the long-term are:
 - prevalence of terrestrial freshwater and marine (coastal) invasive species;
 - status of priority species;
 - populations of farmland;
 - woodland and wetland birds; and
 - populations of butterflies (both specialists and those associated with the wider countryside).

Some measures have continued to deteriorate in the short term (e.g. populations of farmland and wetland birds). There has been a net decrease in the area of SSSIs in favourable condition; down from 44 per cent in 2003 to 37 per cent currently. 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 per cent in 2003 to 58.6 per cent in 2014. The overall proportion of SSSIs in favourable or recovering condition remained above 96 per cent since 2011.

Scotland

In Scotland, in 2008 over 60% of SACs and over 70% of SPAs were in favourable or recovering condition⁴⁷. Results of the 2008 reporting round of the UK Biodiversity Action Plan indicate that in Scotland⁴⁸:

Habitats:

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

⁴⁶ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/383902/England_full_2014_finalv2.pdf

⁴⁷ Joint Nature Conservation Committee, Protected Areas, <http://www.jncc.gov.uk/page-4241>

⁴⁸ <http://ukbars.defra.gov.uk/>

- 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).

The latest monitoring information on biodiversity in Scotland was reported in 2010⁴⁹. Scotland's 2010 biodiversity targets underpin the high level target to halt the loss of biodiversity by 2010. Based on the European Biodiversity Action Plan Framework and adopted by the Scottish Biodiversity Committee in March 2008, eight priority objectives, four supporting measures and 37 targets for action have been specified for Scotland. By the end of 2009, 54% of these actions were on target (e.g. principal pollutant pressures on terrestrial and freshwater biodiversity substantially reduced by 2010), 27% 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)⁵⁰. The Scottish Biodiversity Strategy – The **2020 Challenge for Scotland's Biodiversity** was launched on 19th June 2013. It is a supplement to the original Scottish Biodiversity Strategy – Scotland's Biodiversity: it's in your hands (2004).

⁴⁹ Mackey, E.C. and Mudge, G. (2010). Scotland's Wildlife: An assessment of biodiversity in 2010. Scottish Natural Heritage, Inverness. <http://www.snh.gov.uk/docs/B811968.pdf>

⁵⁰ Mackey, E.C. and Mudge, G. (2010). Scotland's Wildlife: An assessment of biodiversity in 2010. Scottish Natural Heritage, Inverness. <http://www.snh.gov.uk/docs/B811968.pdf>

Wales

A 2006 review⁵¹ of SSSIs in Wales found that:

- 12% of Wales is designated as SSSI;
- during 2005-6 Wales gained three SSSIs, an additional 399 hectares;
- 71% of SSSIs by area are also sites of international importance for wildlife;
- one quarter of SSSIs can be reached within 1km of a town or city;
- 62% of SSSIs by area are classed as open access land;
- from a sample of SSSIs, 47% of designated habitats and species were considered to be in favourable condition;
- 25% of SSSIs by area are known to be owned or managed by conservation sector bodies; and
- 62 infringements to SSSI legislation were reported during 2005-6.

This compares with a 2005 review of SSSIs by the then Countryside Council for Wales which found that 29% of the area covered by SSSIs was in favourable condition, 18% was in unfavourable but recovering condition, with a further 52% being in 'unfavourable and declining' condition. The remaining 1% was classified as partially destroyed. Results of the 2008 reporting round of the UK Biodiversity Action Plan indicate that in Wales:

Habitats:

- 5% of priority habitats were increasing (compared to 21% in 2005);
- 5% of priority habitats were stable (compared to 13% in 2005);
- 24% of habitats were declining (continuing/accelerating) (compared to 13% in 2005);
- 26% of habitats were declining (slowing) (compared to 41% in 2005);
- 16% of habitats were fluctuating (compared to 8% in 2005); and
- 8% of habitats showed no clear trend (compared to 5% status unknown in 2005).

Species:

- 7% of species were increasing (compared to 6% in 2005);
- 15% of species were stable (compared to 18% in 2005);
- 16% of species were fluctuating (compared to 14% in 2005);
- 5% of species were declining (slowing) (compared to 6% in 2005);
- 8% of species were declining (continuing/accelerating) (compared to 7% in 2005);

⁵¹ Countryside Council for Wales (2006) Sites of Special Scientific Interest (SSSIs) in Wales Current state of knowledge Report for April 2005 – Mar 2006

- 3% of species were lost (pre BAP publication) (compared to 4% in 2005);
- 9% of species showed no clear trend (compared to 6% in 2005); and
- the status of 35% of species was unknown (compared to 37% in 2005).

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 Geological Disposal NPS proposals and alternatives are set out in **Table 1.5**, together with reasons for their selection.

Table 1.5 Approach to Assessing the Effects of the Geological Disposal 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 requires that 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.
Will the Geological Disposal NPS protect and/or enhance internationally designated nature conservation sites e.g. SACs, SPAs and Ramsar Sites?	The Habitats Directive designates SPAs and SACs to help maintain or restore important natural habitats and species.
Will the Geological Disposal NPS protect and/or enhance nationally designated nature conservation sites e.g. SSSIs?	The Wildlife and Countryside Act includes measures relating to protected sites. Devolved administrations are preparing detailed action plans on protecting habitats and species e.g. Biodiversity 2020 – A Strategy for England’s Wildlife and Ecosystem Services.
Will the Geological Disposal NPS affect animals or plants including protected species?	The Wildlife and Countryside Act includes legislation relating to protected sites. Devolved administrations are preparing detailed action plans on protecting habitats and species.
Will the Geological Disposal 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 Principle 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

Objective/Guide Question	Reasoning
	and habitats).
Will the Geological Disposal 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 Geological Disposal 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 Geological Disposal have an impact on fisheries?	Various inland waters could be affected by the Geological Disposal NPS meaning that the provisions of the Freshwater Fish Directive apply, which includes measures on the quality of fresh waters needing protection or improvement in order to support fish life. Various inland waters could be affected by the Geological Disposal NPS meaning that the provisions of the Freshwater Fish Directive apply, which includes measures on the quality of fresh waters needing protection or improvement in order to support fish life.

Table 1.6 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the biodiversity and nature conservation objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 1.6 Illustrative Guidance for the Assessment of Significance for Biodiversity and Nature Conservation

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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

Effect	Description	Illustrative Guidance
		<p>emissions, or creation of new habitats leading to long term improvement to ecosystem structure and function);</p> <ul style="list-style-type: none"> Option would enhance existing public access to areas of wildlife interest in areas where there is some demand for these sites.
0	Neutral	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> From the level of information available the effect that the option would have on this objective is uncertain.

Annex A

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

Woodland Birds	Waterbirds	Seabirds	Farmland Birds
<i>Accipiter nisus</i> (Sparrowhawk)	<i>Actitis hypoleucos</i> (Common sandpiper)	<i>Stercorarius parasiticus</i> (Arctic skua)	<i>Alauda arvensis</i> (Skylark)
<i>Aegithalos caudatus</i> (Long-tailed tit)	<i>Mergus merganser</i> (Goosander)	<i>Alca torda</i> (Razorbill)	<i>Carduelis cannabina</i> (Linnet)
<i>Anthus trivialis</i> (Tree pipit)	<i>Motacilla cinerea</i> (Grey wagtail)	<i>Catharacta skua</i> (Great skua)	<i>Carduelis carduelis</i> (Goldfinch)
<i>Carduelis cabaret</i> (Lesser redpoll)	<i>Cinclus cinclus</i> (Dipper)	<i>Aria aalge</i> (Common guillemot)	<i>Carduelis chloris</i> (Greenfinch)
<i>Carduelis spinus</i> (Siskin)	<i>Tachybaptus ruficollis</i> (Little grebe)	<i>Fratercula arctica</i> (Puffin)	<i>Columba oenas</i> (Stock dove)
<i>Certhia familiaris</i> (Treetreeper)	<i>Podiceps cristatus</i> (Great crested grebe)	<i>Fulmarus glacialis</i> (Fulmar)	<i>Columba palumbus</i> (Woodpigeon)
<i>Coccothraustes coccothraustes</i> (Hawfinch)	<i>Anas platyrhynchos</i> (Mallard)	<i>Larus argentatus</i> (Herring gull)	<i>Corvus frugilegus</i> (Rook)
<i>Cyanistes caeruleus</i> (Blue tit)	<i>Aythya fuligula</i> (Tufted duck)	<i>Larus canus</i> (Common gull)	<i>Corvus monedula</i> (Jackdaw)
<i>Dendrocopos major</i> (Great spotted woodpecker)	<i>Gallinula chloropus</i> (Moorhen)	<i>Larus fuscus</i> (Lesser black-backed gull)	<i>Emberiza citronella</i> (Yellowhammer)
<i>Dendrocopos minor</i> (Lesser spotted woodpecker)	<i>Fulica atra</i> (Coot)	<i>Larus marinus</i> (Great black-backed gull)	<i>Emberiza schoeniclus</i> (Reed bunting)
<i>Erithacus rubecula</i> (Robin)	<i>Acrocephalus scirpaceus</i> (Reed warbler)	<i>Larus ridibundus</i> (Black-headed gull)	<i>Falco tinnunculus</i> (Kestrel)
<i>Ficedula hypoleuca</i>	<i>Acrocephalus</i>	<i>Morus bassanus</i>	<i>Miliaria calandra</i>

Woodland Birds	Waterbirds	Seabirds	Farmland Birds
(Pied flycatcher)	<i>schoenobaenus</i> (Sedge warbler)	(Gannet)	(Corn bunting)
<i>Fringilla coelebs</i> (Chaffinch)	<i>Cettia cetti</i> (Cetti's warbler)	<i>Phalacrocorax aristotelis</i> (Shag)	<i>Motacilla flava</i> (Yellow wagtail)
<i>Garrulus glandarius</i> (Jay)	<i>Emberiza schoeniclus</i> (Reed bunting)	<i>Phalacrocorax carbo</i> (Cormorant)	<i>Passer montanus</i> (Tree sparrow)
<i>Loxia curvirostra</i> (Crossbill)	<i>Cygnus olor</i> (Mute swan)	<i>Rissa tridactyla</i> (Kittiwake)	<i>Perdix perdix</i> (Grey partridge)
<i>Luscinia megarhynchos</i> (Nightingale)	<i>Anas crecca</i> (Teal)	<i>Sternula albifrons</i> (Little tern)	<i>Streptopelia turtur</i> (Turtle dove)
<i>Muscicapa striata</i> (Spotted flycatcher)	<i>Numenius arquata</i> (Curlew)	<i>Sterna hirundo</i> (Common tern)	<i>Sturnus vulgaris</i> (Starling)
<i>Parus major</i> (Great tit)	<i>Vanellus vanellus</i> (Lapwing)	<i>Sterna paradisaea</i> (Arctic tern)	<i>Sylvia communis</i> (Whitethroat)
<i>Pariparus ater</i> (Coal tit)	<i>Gallinago gallinago</i> (Snipe)	<i>Sterna sandvicensis</i> (Sandwich tern)	<i>Vanellus vanellus</i> (Lapwing)
<i>Phoenicurus phoenicurus</i> (Redstart)	<i>Tringa tetanus</i> (Redshank)		
<i>Phylloscopus collybita</i> (Chiffchaff)	<i>Motacilla flava</i> (Yellow wagtail)		
<i>Phylloscopus sibilatrix</i> (Wood warbler)	<i>Ardea cinerea</i> (Grey heron)		
<i>Phylloscopus trochilus</i> (Willow warbler)	<i>Alcedo atthis</i> (Kingfisher)		
<i>Picus viridis</i> (Green woodpecker)	<i>Haematopus ostralegus</i> (Oystercatcher)		

Woodland Birds	Waterbirds	Seabirds	Farmland Birds
<i>Poecile montanus</i> (Willow tit)	<i>Riparia riparia</i> (Sand martin)		
<i>Poecile palustris</i> (Marsh tit)			
<i>Prunella modularis</i> (Dunnock)			
<i>Pyrrhula pyrrhula</i> (Bullfinch)			
<i>Regulus regulus</i> (Goldcrest)			
<i>Sitta europaea</i> (Nuthatch)			
<i>Strix aluco</i> (Tawny owl)			
<i>Sylvia atricapilla</i> (Blackcap)			
<i>Sylvia borin</i> (Garden warbler)			
<i>Sylvia curruca</i> (Lesser whitethroat)			
<i>Tetrao urogallus</i> (Capercaillie)			
<i>Troglodytes troglodytes</i> (Wren)			
<i>Turdus merula</i> (Blackbird)			
<i>Turdus philomelos</i> (Song thrush)			

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

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

Table A.3 Species Used to Calculate Butterfly Population Indices

Generalist Butterflies	Habitat Specialist Butterflies
<i>Aglais urticae</i> (Small tortoiseshell)	<i>Apatura iris</i> (Purple emperor)
<i>Anthocharis cardamines</i> (Orange-tip)	<i>Argynnis adippe</i> (High brown fritillary)
<i>Aphantopus hyperantus</i> (Ringlet)	<i>Argynnis aglaja</i> (Dark green fritillary)
<i>Aricia agestis</i> (Brown argus)	<i>Argynnis paphia</i> (Silver-washed fritillary)
<i>Celastrina argiolus</i> (Holly blue)	<i>Aricia artaxerxes</i> (Northern brown argus)
<i>Coenonympha pamphilus</i> (Small heath)	<i>Boloria euphrosyne</i> (Pearl-bordered fritillary)
<i>Erebia aethiops</i> (Scotch argus)	<i>Boloria selene</i> (Small pearl-bordered fritillary)
<i>Gonepteryx rhamni</i> (Brimstone)	<i>Callophrys rubi</i> (Green hairstreak)
<i>Inachis io</i> (Peacock)	<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>Neozephyrus quercus</i> (Purple hairstreak)	<i>Hipparchia semele</i> (Grayling)
<i>Ochlodes venata</i> (Large skipper)	<i>Leptidea sinapis</i> (Wood white)
<i>Pararge aegeria</i> (Speckled wood)	<i>Limenitis camilla</i> (White admiral)
<i>Pieris brassicae</i> (Large white)	<i>Lysandra bellargus</i> (Adonis blue)
<i>Pieris napi</i> (Green-veined white)	<i>Lysandra coridon</i> (Chalkhill blue)
<i>Pieris rapae</i> (Small white)	<i>Melitaea athalia</i> (Heath fritillary)
<i>Polygonia c-album</i> (Comma)	<i>Papilio glaucas</i> (Swallowtail)
<i>Polyommatus icarus</i> (Common blue)	<i>Plebeius argus</i> (Silver-studded blue)
<i>Pyronia tithonus</i> (Gatekeeper)	<i>Pteridium aquilinum</i> (Large heath)
<i>Satyrrium w-album</i> (White-letter hairstreak)	<i>Pyrgus malvae</i> (Grizzled skipper)

Generalist Butterflies	Habitat Specialist Butterflies
<i>Thymelicus sylvestris</i> (Small skipper)	<i>Thecla betulae</i> (Brown hairstreak)
	<i>Thymelicus acteon</i> (Lulworth skipper)

2. Population, Economics and Skills

2.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on population, economics and skills. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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

International/European

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, takes inspiration from Europe 2020 and seeks to engender full employment, quality of work and increased productivity as well as the promotion of inclusion by addressing disparities in access to labour markets. These overarching aims are further espoused in the **Integrated Guideline for Growth and Jobs 2008-11** and later documents relating policy objectives into broad actions for the Member States (**A Shared Commitment for Employment, 2009**; and, **Implementation of the Lisbon Strategy Structural Reforms in the context of the European Economic Recovery Plan, 2009**).

The United Nation's **Aarhus Convention (2001)** grants the public rights and imposes on parties and public authority's obligations regarding access to information, public participation and access to justice. It contains three broad themes or 'pillars':

- access to information;
- public participation; and
- access to justice.

The SEA Directive (2001) sets out the following requirements for public consultation:

- Authorities which, because of their environmental responsibilities, are likely to be concerned by the effects of implementing the plan or programme, must be consulted on the scope and level of detail of the information to be included in the Environmental Report. These authorities are designated in the SEA Regulations as the Consultation Bodies;
- The public and the Consultation Bodies must be consulted on the draft plan or programme and the Environmental Report, and must be given an early and effective opportunity within appropriate time frames to express their opinions;

- Other EU Member States must be consulted if the plan or programme is likely to have significant effects on the environment in their territories; and
- The Consultation Bodies must also be consulted on screening determinations on whether SEA is needed for plans or programmes under Article 3(5), i.e. those which may be excluded if they are not likely to have significant environmental effects.

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;
- 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.

Achieving strong and sustainable economic growth (2013) details how the Government is removing barriers to growth allowing the UK to compete in a rapidly changing global economy. Included within the policy are a number of actions to attract investment within the UK, supporting local growth, investing in infrastructure and creating a more educated and flexible workforce.

In 2014, the UK Government published an updated ***National Infrastructure Plan***. This sets out the Government's long-term plan for the next decade 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 and science and research infrastructure as well as steps to attract major new private sector investment.

The ***NDA People and Skills Strategy (2014)*** sets out the NDA's approach to investment in skills. It contains the following vision statement: "Achieving success in delivering key NDA estate wide outcomes through having people with the appropriate skills in the right places at the optimum time." The ***NDA Supply Chain Development Strategy (2010)***,

meanwhile, aims “to ensure the optimum use of the supply chain available to the NDA estate to enable a safe, affordable, cost effective, innovative and dynamic market for clean-up and decommissioning”.

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 to 39 from the 24 originally announced.

Across England, the LEP’s are at different stages of establishment and are subject to further development and consultation. LEPs are expected to fund their own day to day running costs but may wish to submit bids to the Regional Growth Fund (RGF). The RGF is a discretionary Fund to stimulate enterprise by providing support for projects and programmes with significant potential for creating long term private sector led economic growth and employment and, in particular, help those areas and communities that are currently dependent on the public sector make the transition to sustainable private sector-led growth and prosperity.

The National Planning Policy Framework (Department for Communities and Local Government) (2012) sets out 12 core land-use principals to deliver sustainable development. It states that the Government is committed to securing economic growth to create jobs and prosperity and meet the twin challenges of global competition and of a low carbon future. Reference is made within the 12 core principals to supporting thriving rural communities and supporting the mixed use of land in those areas also.

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;
- 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.

The **One Scotland Programme for Government (2014)** sets out three key themes to try and deliver a strong economy and fairer society. These include creating more, better paid jobs in a strong, sustainable economy; building a fairer Scotland and tackling inequality and passing power to people and communities.

The **Gaelic Language Plan (2010)** sets out how the Scottish Government will use and enable the use of Gaelic in the delivery of its services. The Gaelic Language Plan also outlines the measures which have put in place to support the promotion of Gaelic throughout Scotland.

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 will make the public bodies listed think more about the long term, work better with people and communities and each other, look to prevent problems and take a more joined-up approach. Public bodies will need to make sure that any action or process they carry out they must do so in a sustainable way and that when making decisions they take into account the impact those decision could have on people living their lives in Wales in the future. The Act will expect public bodies to: work better together; involve people reflecting the diversity of their communities; look to the long term as well as focusing on now; and take action to try and stop problems getting worse – or even stop them happening in the first place.

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 delivers 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.

The ***Programme for Government (2011)*** includes a chapter on Growth and Sustainable Jobs. The aim of this chapter is to “strengthen the conditions that will enable business to create jobs and sustainable economic growth.” It includes the following key principles:

- further integrating economic, education, skills, procurement and planning policies to deliver greater benefits to the Welsh economy;
- encouraging greater levels of private sector investment and employment;
- increasing the links between academia and businesses; and
- positioning Wales as a low carbon, green economy.

The ***Programme for Government Annual Report (2014)*** in relation to the chapter on Growth and Sustainable Jobs highlights the vision for an economy that is confident, outward looking and balanced, with exports and inward investment generating wealth and a thriving private sector providing stable, high quality employment.

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.

A living language: a language for living – Welsh language strategy 2012 to 2017 (2012) is the strategy for the promotion and facilitation of the use of Welsh language in everyday life. The strategy’s vision is to see the Welsh language thriving in Wales. The strategy aims to see an increase in the number of people who both speak and use the language. The six aims of the strategy are: encourage and support the use of the Welsh language within families; increase the provision of Welsh-medium activities for children and young people and to increase their awareness of the value of the language; strengthen the position of the Welsh language in the community; increase opportunities for people to use Welsh in the workplace; improve Welsh language services to citizens; and strengthen the infrastructure for the language, including digital technology.

Planning Policy Wales (7th Edition, 2014) 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, should aim 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. In addition, wherever possible local planning authorities should seek to guide and control economic development to facilitate regeneration and promote social and environmental sustainability. Planning Policy Wales contains sections on the following topics: Planning for sustainability; Conserving and improving natural heritage and the coast; Conserving the historic environment; economic development; Transport; Housing; Planning for retailing and town centres; Tourism, sport and recreation; infrastructure and services; and minimising and managing environmental risks and pollution.

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

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

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 (2014) (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) (TAN23) 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 integrate 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-2014, the resident population of Great Britain was 64,596,800⁵² (49.2% male and 50.8% female), representing a gain of 491,100 (0.77%) over the previous year mid-2013 (this growth was above the average annual increase of 0.75%) and 64% of the population was of working age (aged 16 to 64). This means that the UK’s population has increased by around 5 million since 2001, and by more than 10 million since 1964.

⁵² Office for National Statistics 2014 mid-year population estimates.

The working age population for the period January 2015 to March 2015 was broken down as follows⁵³:

- 78.1% economically active;
- 73.6% in employment; and
- 5.5% unemployed.

Since January to March 2014, there was a 0.2% increase with regard to those in the working age population who were economically active, a 0.1% increase in employment and no change in those who are unemployed.

Education and Skills

The breakdown of qualifications of the working age population in 2014 was as follows:

- 35.8 % had NVQ4 and above⁵⁴;
- 17.2 % had NVQ3 and above⁵⁵;
- 16.6 % had NVQ2 and above⁵⁶;
- 11.7 % had NVQ1 and above⁵⁷;
- 6.2 % had other qualifications; and
- 9.0 % have no qualifications.

The total number of full-time students in 2013/14 studying for a first degree decreased by 2% since 2012/13.

In 2013/2014, the UK had a total of 32,323 schools, comprising:

- 3,031 nursery;
- 21,040 primary;
- 4 middle;
- 4,116 secondary;
- 2,497 non-maintained;
- 1,264 special; and
- 371 pupil referral units⁵⁸.

Crime

In England and Wales, between 2013 and 2014 estimates from the Crime Survey England and Wales (CSEW) indicate that vehicle related theft fell by 17%, and other theft of personal property fell by 8%. All CSEW crime fell by 7%.

⁵³ NOMIS, Official Labour Market Statistics, Annual Population Survey, <https://www.nomisweb.co.uk>

⁵⁴ The proportion of the working age population qualified at Level 4 and above indicates those with an HND, Degree, or above

⁵⁵ The proportion of the working age population qualified at Level 3 and above indicates those with two or more A levels, or equivalent

⁵⁶ The proportion of the working age population qualified at Level 2 and above includes those with GCSE's at grades A* - C, or equivalent

⁵⁷ The proportion of the working age population qualified at Level 1 and above includes those with GCSE's at grades D – G and above

⁵⁸ DCSF, Education and Training Statistics for the United Kingdom:2014 , <https://www.gov.uk/government/statistics/education-and-training-statistics-for-the-uk-2014>

Table 2.1 Number of Crimes Recorded by the Police in England and Wales⁵⁹

Type of Crime	2013	2014	Change
	Number of Offences (thousands)		%
Violence	1,679	1,299	-23
Robbery	168	153	-9
Theft from person	4,823	4,250	-12
Other theft of personal property	969	884	-8
Domestic burglary	882	779	-9
Other household theft	951	789	-12
Vehicle- related theft	1,043	905	-17
Bicycle Theft	415	376	-13
Criminal Damage	1,706	1,372	-9
All CSEW (Crime Survey England & Wales) Crime	8,377	7,075	-16

Economic Baseline

In 2013, UK per capita Gross Value Added (GVA) was £23,394.00⁶⁰. The 2013 headline estimates show that both total GVA and GVA per head at current basic prices have increased in all UK regions. In 2013, the North West and Wales had the largest increase in GVA per head at 3.4%, followed by the North East and the West Midlands at 2.8%. In terms of GVA per head, London had the largest at £40,215.00 while Wales had the lowest at £16,893.00.

In 2014, the median full-time gross hourly pay in UK was £13.08 (males' median being £13.59 and the female median being £12.31). This compares to £11.98 in 2008⁶¹.

In the period January to March 2015, the UK had a total of 32,924,000⁶² people in employment aged 16 and over, up 166,000 on the quarter. The number of people employed in the private sector increased by 380,000 to reach 24.2 million but the number of people employed in the public sector fell by 104,000 to 5.7million. In 2013 the job density of the UK was 0.79 (ratio of total jobs to working age population).

⁵⁹ Home Office, British Crime Survey in England and Wales (2014),

<http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=Crime+in+England+and+Wales>

⁶⁰ Office for National Statistics. Regional Gross Value Added (income approach). 2014. <http://www.ons.gov.uk/ons/rel/regional-accounts/regional-gross-value-added--income-approach-/december-2014/stb-regional-gva-dec-2014.html#tab-Summary> [Accessed 12.06.2015]

⁶¹ Official Labour Market Statistics, Annual survey of hours and earnings –resident analysis 2012, NOMIS <https://www.nomisweb.co.uk/reports/lmp/gor/2092957698/report.aspx?#tabearn>

⁶² Labour Market Statistics, March 2015, Office of National Statistics https://www.nomisweb.co.uk/reports/lmp/gor/2092957698/subreports/nrhi_time_series/report.aspx

In January to March 2015, the UK had an unemployment rate of 5.5% (all people of working age). This is a reduction of 0.2% on the previous quarter and compares to the previous year when the UK had an unemployment rate of 6.8%. This shows a steady decline in unemployment rates following the recent UK recession which peaked at 8.4% in December 2011⁶³.

UK gross domestic product (GDP) in volume terms is estimated to have increased by 0.3% in the first quarter of 2015, with GDP 2.4% higher compared with the same quarter a year ago. Construction industries fell by 1.6%, production by 0.1% and agriculture by 0.2%, whilst the output of the service industries rose by 0.5%⁶⁴.

Between 2009 and 2013, the largest job sector increase has been in the professional, scientific and technical industry group (12.2%), followed by business administration and support services (10.7%). The industries with the largest increases in this group are temporary employment activities (employment agencies) and head offices. Almost half of the growth in professional, scientific and technical is accounted for by London⁶⁵.

Between 2012 and 2013, the professional, scientific & technical industry group has again showed the largest growth (7.6%). In fact most of the growth in this sector between 2009 and 2013 is as a result of the growth during this final year. The information and communication sector has also shown a relatively large percentage increase between 2012 and 2013 (5.3%). The industries with the largest increases in these groups are management consultancy activities, and computer programming, consultancy and related activities. More than half of the growth in these industries is accounted for by London.

The Nuclear Decommissioning Authority (NDA) Geological Disposal generic socio-economic assessment⁶⁶ estimates up to 1,600 Full Time Equivalent (FTE) jobs will be supported at a national level as an annual average over the lifetime of a GDF. The economic development benefits of the GDF, at the national level are expected to range from £1 billion to £5 billion.

England

Demographics

In mid-2014, England had a resident population of 54,316,600 (49.3% males and 50.7% females) and 63.5% of the population was of working age (aged 16 to 64). The population of England increased by 372,100 (0.7%), accounting for 84% of the UK's population. England's population grew quicker than any other UK country during the year.

In the period January to March 2015, the working age population breakdown was as follows:

- 78.1% were economically active;
- 73.8% of working age population were in employment; and

⁶³ Economically Active NOMIS https://www.nomisweb.co.uk/reports/lmp/gor/2092957698/subreports/nrhi_time_series/report.aspx?

⁶⁴ UK Snapshot, Office of National Statistics http://www.ons.gov.uk/ons/dcp171778_402219.pdf

⁶⁵ Office for National Statistics. Annual estimates of employees from the Business Register and Employment Survey. 2013. <http://www.ons.gov.uk/ons/rel/bus-register/business-register-employment-survey/2013-provisional/stb-bres-2013-p.html#tab-4--Results-by-Broad-Industry-Group> [Accessed 12.06.2015]

⁶⁶ Nuclear Decommissioning Agency, Geological Disposal Generic socio-economic assessment, December 2014

- 5.4% of working age population were unemployed.⁶⁷

Education and Skills

The working age population in 2014 had the following qualifications:

- 35.7% had NVQ4 and above;
- 17.5% had NVQ3 and above;
- 16.7% had NVQ2 and above;
- 12.0% had NVQ1 and above;
- 6.2% had other qualifications;
- 3.3% had trade apprenticeships; and
- 8.6% had no qualifications.

In 2013/2014, England had 24,347 schools, comprising:

- 414 nursery;
- 16,788 primary;
- 3,326 secondary;
- 2,421 non-maintained;
- 1,033 special; and
- 371 pupil referral units⁶⁸

In January 2014, 8.3 million pupils were enrolled in schools in England (including state funded and independent schools). A total of 2.4 million pupils were enrolled in academies, an increase of 0.4 million pupils since the previous year.⁶⁹

Economic Baseline

In 2013, England's per capita GVA was £24,091. This represents a 2.6% increase on 2012 and accounts for 85.2% of the UK.

In 2014, the median full-time gross hourly pay in England was £13.20 (males' median being £13.75 and the female median being £12.40).⁷⁰

In January to March 2015, England had an unemployment rate of 5.4% (all people of working age). This compares to same period in the previous year when the unemployment rate stood at 5.7%.

Between 2009 and 2013 there was a 1.6% increase in employment in England, circa 567,200 people. More recently, between 2012 and 2013 there was a 1.4% increase in employment, circa 376,000 people. In 2013 the job density of England was 0.78 (ratio of total jobs to working age population).

⁶⁷ Labour Force Survey NOMIS <http://www.nomisweb.co.uk/reports/lmp/gor/2092957699/report.aspx>

⁶⁸ Department for Education, Education & Training Statistics for the UK, 2014 <https://www.gov.uk/government/statistics/education-and-training-statistics-for-the-uk-2014>

⁶⁹ Department for Education, Schools, pupils and their characteristics, 2014

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/410543/2014_SPC_SFR_Text_v102.pdf

⁷⁰ ONS: Earning by workplace <https://www.nomisweb.co.uk/reports/lmp/gor/2092957699/report.aspx?town=england>

Deprivation

In England, over 5 million people lived in the most deprived areas in England in 2008 and 38% of them were income deprived. Liverpool, Middlesbrough, Manchester, Knowsley, the City of Kingston-upon-Hull, Hackney and Tower Hamlets are the local authorities with the highest proportion of Lower layer Super Output Areas (LSOAs) amongst the most deprived in the UK⁷¹. 98% of the most deprived LSOAs are in urban areas but there are also pockets of deprivation across rural areas. 56% of local authorities contain at least one LSOA amongst the 10% most deprived in England. 88% of the LSOAs that are the most deprived in 2010 were also amongst the most deprived in 2007.

Scotland

Demographics

In mid-2014, Scotland had a resident population of 5,347,600 (48.6% male and 51.4% female) and 64.8% of the population was of working age (aged 16 to 64)⁷²

In the period January to March 2015, the working age population breakdown was as follows:

- 79.3% were economically active;
- 74.5% of working age population were in employment; and
- 6.0% of working age population were unemployed⁷³.

Education and Skills

The working age population in 2014 had the following qualifications:

- 41.0% had NVQ4 and above;
- 14.7% had NVQ3 and above;
- 14.6% had NVQ2 and above;
- 9.6% had NVQ1 and above;
- 6.2% had other qualifications;
- 4.5% had trade apprenticeships; and
- 9.4% had no qualifications.

In 2014, Scotland had 5,073 schools, comprising:

- 2,504 pre-school;
- 2,056 primary;
- 364 secondary; and

⁷¹ Communities and Local Government. The English Indices of Deprivation 2010. 2010 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6871/1871208.pdf. [Accessed 12.06.2015]

⁷² Office for National Statistics 2013 mid-year population estimates <https://www.nomisweb.co.uk/reports/lmp/gor/2013265931/report.aspx>

⁷³ NOMIS, Labour Supply <https://www.nomisweb.co.uk/reports/lmp/gor/2013265931/report.aspx>

- 149 special.⁷⁴

Crime

Differences in legal systems and police recording mean that the recorded crime figures for Scotland are not directly comparable with recorded crime figures for England and Wales. In Scotland, overall crimes recorded by police was 270,397 in 2013-2014, a 1% decrease compared to 2012-2013 and the lowest level since 1974. Over the same time period, the number of non-sexual crimes of violence and crimes of fire-raising decreased by 10% and 9% respectively, whilst the number of sexual crimes increased by 12%.⁷⁵

Economic Baseline

In 2014, Scotland's per capita GVA was £21,982. In 2014, the median full-time gross hourly pay in Scotland was £13.10 (males' median being £13.61 and the female median being £12.39). This compares to £12.87 in 2013.⁷⁶

In 2015, Scotland had a total of 2,532,000 jobs⁷⁷. In 2013 the job density of Scotland was 0.76 (ratio of total jobs to working age population)⁷⁸.

In January to March 2015 Scotland had an unemployment rate of 6% (all people of working age). This compares to the same period in the previous year when the unemployment rate stood at 6.5%.

Deprivation

The Scottish index of Multiple Deprivation (SIMD) 2012 shows that multiple deprivation in Scotland has become less concentrated over time. In SIMD 2004, nearly half of all data zones in the most deprived 10% across Scotland were in Glasgow City. In SIMD 2012 this has dropped to 35.8%, with corresponding rises in other Local Authorities. The areas identified as multiply deprived by SIMD 2012 are similar to those identified by previous editions of the Index (SIMD 2009, 2006, 2004). Of the 976 data zones in the 15% most deprived in SIMD 2012, about three quarters (77%) were also in the 15% most deprived in all the previous editions of the Index.

Wales

Demographics

In mid-2014, the resident population of Wales was 3,092,000 (49.2% males and 50.8% females) and 62.2% of the population were of working age⁷⁹.

In the period January to March 2015, the working age population was broken down as follows:

- 74.6% economically active;

⁷⁴ Department for Education, Education & Training Statistics for the UK, 2014 <https://www.gov.uk/government/statistics/education-and-training-statistics-for-the-uk-2014>

⁷⁵ Scottish Government, High Level Statistical Bulletin Crime and Justice, 2014 <http://www.gov.scot/Resource/0046/00466162.pdf>

⁷⁶ NOMIS, Official Labour Market Statistics, 2014 <https://www.nomisweb.co.uk/reports/lmp/gor/2013265931/report.aspx?town=scotland>

⁷⁷ Office for National Statistics. Regional Labour Market. 2015. <http://www.ons.gov.uk/ons/rel/subnational-labour/regional-labour-market-statistics/may-2015/stb-regional-labour-market-may-2015.html#tab-In-this-bulletin-> [Accessed 12.06.2015]

⁷⁸ NOMIS. Job density area comparison. 2013.

http://www.nomisweb.co.uk/reports/lmp/gor/2092957698/subreports/gor_id_compared/report.aspx? [Accessed 12.06.2015]

⁷⁹ Office for National Statistics 2013 mid-year population estimates

<https://www.nomisweb.co.uk/reports/lmp/gor/2013265930/report.aspx?town=wales>

- 69.4% in employment; and
- 6.7% unemployed⁸⁰

Education and Skills

The working age population in 2014 had the following qualifications:

- 33.2% NVQ4 and above;
- 18.2% NVQ3 and above;
- 17.4% NVQ2 and above;
- 11.6% NVQ1 and above;
- 6.0% other qualifications;
- 3.8% trade apprenticeships; and
- 10% no qualifications.

In 2014, Wales had 1,703 schools, comprising:

- 17 nursery;
- 1,357 primary;
- 4 middle;
- 213 secondary;
- 42 special; and
- 70 non-maintained mainstream⁸¹.

Economic Baseline

In 2013, Wales' per capita GVA was £16,893.00, an increase of 3.4% compared to 2012.

In 2014, the median full-time gross hourly pay in Wales was £11.82 (males' median being £12.29 and the female median being £11.26). This compares to £11.83 in 2013.⁸²

In 2015, Wales had a total of 1,482,000 jobs⁸³. In 2013 the job density of Wales was 0.72 (ratio of total jobs to working age population).

In the period January to March 2015, Wales had an unemployment rate of 6.7% (all people of working age). This compares to the previous year when it had an unemployment rate of 6.8%.⁸⁴

Deprivation

In WIMD 2014, 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

⁸⁰ NOMIS, Official Labour Market Statistics <https://www.nomisweb.co.uk/reports/lmp/gor/2013265930/report.aspx?town=wale>

⁸¹ Department for Education, Education & Training Statistics for the UK, 2014 <https://www.gov.uk/government/statistics/education-and-training-statistics-for-the-uk-2014>

⁸² NOMIS, Official Labour Market Statistics, Annual survey of hours and earnings - resident analysis <https://www.nomisweb.co.uk/reports/lmp/gor/2013265930/report.aspx?town=wales>

⁸³ ONS <https://www.nomisweb.co.uk/reports/lmp/gor/2013265930/report.aspx>

⁸⁴ NOMIS, Official Labour Market Profile, <https://www.nomisweb.co.uk/reports/lmp/gor/2013265930/report.aspx?town=wales>

similar to that of WIMD 2011, with seven of the ten most deprived LSOAs from WIMD 2011 remaining in the ten most deprived areas in WIMD 2014. The most deprived LSOA in Wales in WIMD 2014 was St James 3, Caerphilly (it was ranked 2 in WIMD 2011). The local authority with the highest proportion of LSOAs in the most deprived 10 per cent in Wales in WIMD 2014 was Blaenau Gwent (23.4 per cent), while Monmouthshire had no LSOAs in the most deprived 10 per cent.

2.4 Summary of Existing Problems Relevant to the Geological Disposal NPS

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

- The growing population within the UK will increase population densities and, in turn, the likelihood of communities being within close proximity to a GDF or transport of High Level Waste (HLW) and Intermediate Level Waste (ILW). This could increase the likelihood of operations having, or being perceived to have, a negative impact on communities.
- There is a broad level of consistency with regard to the qualifications of the working age population in England, Scotland and Wales, with approximately 37% having a NVQ4, or equivalent, qualification and above. That said, 9.3% had not qualifications what so ever and this should be addressed.
- The respective indicators and areas of multiple deprivation in England, Scotland and Wales are similar in that they continue to be focused in the same areas year after year. That said, there is some variation to the areas of deprivation.

2.5 Likely Evolution of the Baseline

UK

Demographics

The current UK population is generally increasing and is projected to reach 73.3million by 2037⁸⁵.

The age structure of the UK population is moving towards an ageing population: those of pensionable age are projected to increase from 12.3 million in 2012 to 16.1 million by 2037. The number of people aged 80 and over is projected to more than double to 6 million by mid-2037. Those aged under 16 is projected to increase from 12 million in mid-2012 to 13 million in mid-2022, and stay at this level for the next 15 years. There are no formal targets for population growth in the UK.

⁸⁵ ONS, National Population Projections2012 based http://www.ons.gov.uk/ons/dcp171778_334975.pdf

Economics

There are current uncertainties over market conditions and a range of economic forecasts available indicate a number of future scenarios. The Bank of England recently noted that in the UK, output growth remains solid and domestic demand growth robust. Unemployment in the UK has continued to fall, reaching its lowest level for more than six years. As the labour market has tightened, growth rates of wages and unit labour costs are beginning to pick up.⁸⁶

England

Demographics

Between 2012 and 2037, the population of England is projected to increase from 53.5million to 62.2million, an increase of 16.3%⁸⁷.

Economics

GVA growth in 2013 was up, on average, 3.3% from 2012. GVA has risen year on year since 2009, it could be expected that it will continue to increase in the future.

Scotland

Demographic

Between 2012 and 2037, the population of Scotland is projected to increase from 5.3 to 5.8 million, an increase of 9.5%⁸⁸.

Scotland has a population target of matching the average European (EU15) population growth over the period from 2007 to 2017. Population growth 2009-10 was faster than that of the EU 15 countries for the first time since the series began in 1999.⁸⁹

Economics

Scottish GDP grew 0.6% during the fourth quarter of 2014. On an annual basis, comparing the latest quarter to the same period in the previous year, Scottish GDP grew by 2.8%.⁹⁰

Scotland's approach to delivering sustainable economic growth is characterised by four key priorities:

- An economy where growth is underpinned by long-term sustainable investment in people, infrastructure and assets;
- An economy where growth is based on innovation, change and openness to new ways of doing things;

⁸⁶ Bank of England, Inflation Report 2015 <http://www.bankofengland.co.uk/publications/Pages/inflationreport/2015/feb.aspx>

⁸⁷ ONS, National Population Projections 2012 based, http://www.ons.gov.uk/ons/dcp171778_334975.pdf?format=hi-vis

⁸⁸ ONS, National Population Projections 2012 based http://www.ons.gov.uk/ons/dcp171778_334975.pdf?format=hi-vis

⁸⁹ Scottish Government, <http://www.scotland.gov.uk/About/scotPerforms/purposes/population>

⁹⁰ Scottish Government Statistics, Key Economy Statistics. <http://www.gov.scot/Topics/Statistics/Browse/Economy/GDP2014Q4>

- A society that promotes inclusive growth and creates opportunity through a fair and inclusive jobs market and regional cohesion to provide economic opportunities across all of Scotland; and
- A country with an international outlook and focus, open to trade, migration and new ideas⁹¹.

Wales

Demographic

The population of Wales is projected to increase to 3.3 million by 2037 (a 6% increase compared to 3.1 million in 2012). Although more births than deaths are projected throughout most of the projection period, net inward migration is the main reason for projected population growth.⁹²

Economics

The longer term trend for the Index of Production for Wales shows a fall of 1.1% when comparing the four quarters until the end of 2012 to the four quarters of 2011. The fall over the longer term in Wales was largely accounted for by a fall in Electricity, Gas and Water Supply. The longer term trend for the Index of Construction for Wales shows a 0.7% fall when comparing 2014 to 2013.

The sub-index Electricity, Gas and Water Supply accounts for 19.1% of the Welsh Index of Production under the 2011 weights. This sector has shown a fall in output for Wales over the longer term and a sharp increase over the short term, despite a fall in output over both longer term and short term in this sector in the UK. Whilst Electricity, Gas and Water Supply has seen the largest weighted change overall in Wales, Food, Beverages and Tobacco has shown the largest positive weighted in change in Wales.⁹³

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 Geological Disposal NPS proposals and alternatives are set out in **Table 2.2**, together with reasons for their selection.

⁹¹ The Scottish Government. Scotland's Economic Strategy. 2015. <http://www.gov.scot/Resource/0047/00472389.pdf> [Accessed 12.06.2015]

⁹² ONS, National Population Projections 2010based, <http://www.ons.gov.uk/ons/rel/npp/national-population-projections/2010-based-projections/sum-2010-based-national-population-projections.html>

⁹³ Welsh Government (2014) Index Production for Wales and Index of Construction for Wales Q4 <http://gov.wales/docs/statistics/2015/150416-index-production-construction-quarter-4-2014-en.pdf>

Table 2.2 Approach to Assessing the Effects of the Geological Disposal NPS Proposals on Population, Economics and Skills

Objective/Guide Question	Reasoning
Objective: To promote a strong, diverse and stable economy with opportunities for all; improve education and skills, minimise disturbance to local communities and maximise positive social impacts.	The SEA Directive requires that the likely significant effects on the population should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.
Will the Geological Disposal NPS affect the social infrastructure and amenities available to local communities?	Any development of radioactive waste geological disposal facilities (in common with all major projects) has the potential to impact on the local social infrastructure and amenities which could affect the quality of life of individuals in local communities.
Will the Geological Disposal NPS affect local population demographics and/ or levels of deprivation in surrounding areas?	The Geological Disposal NPS may result in change to population demographics (for example, through in migration of workers skilled to work in the industry). 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. Changes to these factors may alter the levels of deprivation in an area.
Will the Geological Disposal NPS affect opportunities for investment in education and skills development?	Investment in education and skills development are vital for economic growth.

Table 2.3 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the population objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 2.3 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 incorporate the provision of social infrastructure and amenities; Option would provide educational services/facilities and offer long term opportunities for skills development

Effect	Description	Illustrative Guidance
		<p>including, for example, apprenticeship schemes;</p> <ul style="list-style-type: none"> Option would generate in the order of 500 or more direct full time equivalent (FTE) employment opportunities per annum¹, a large proportion of which will 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 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 500) which may benefit the local community; Option would generate 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 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;

Effect	Description	Illustrative Guidance
		<ul style="list-style-type: none"> Option would not affect the attractiveness of the area to existing and prospective residents and businesses.
-	Negative	<ul style="list-style-type: none"> 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 500 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 some complaints could be expected.
--	Significant Negative	<ul style="list-style-type: none"> 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 500 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 will 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 the 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 construction or operation of facilities) such that the project and local authority would be likely to experience a considerable number of complaints.

Effect	Description	Illustrative Guidance
?	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 1% of the existing 80,000 jobs supported by the nuclear industry in the UK (<http://www.niauk.org/facts-and-information-for-nuclear-energy>). This threshold is subject to consultee responses.

3. Human Health

3.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on human health. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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

International/European

The World Health Organization (WHO)⁹⁴ states that *“health promotion goes beyond health care. It puts health on the agenda of policy makers in all sectors and at all levels”*; consequently, healthy public policy has been a main goal of health development in many countries. The ***Canadian Lalonde Report (1974)*** identified four health fields independently responsible for individual health: environment, human biology, lifestyle and health care organisation.

The WHO ***Children’s Environment and Health Action Plan for Europe (CEHAPE) (2004)*** was launched 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 EU has a Programme for Community action in the field of Health (2008-2013) and, on the 23rd/4th October 2007 the Commission adopted a new overarching Health Strategy ***Together for Health - A Strategic Approach for the EU 2008-2013***. Community Action focuses on tackling health determinants which are categorised as: personal behaviour and lifestyles; influences within communities which can sustain or damage health; living and working conditions and access to health services; and general socio-economic, cultural and environmental conditions. 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 Commission published ***Towards Social Investment for Growth and Cohesion 2014-2020*** to show how investing in health contributes towards the Europe 2020 objective of smart, sustainable and inclusive growth.

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) implements the political commitments made at the Third European Conference on Environment and Health and uses the term ‘environment and health’ throughout. It

⁹⁴See the Ottawa Charter adopted at the First International Conference on Health Promotion in 1986.

indicates that health authorities should be consulted at the different stages of the process and so goes further than the SEA Directive. Once ratified, it will require changes to the SEA Directive to require that health authorities are statutory consultees.

The WHO publication ***Health Impact Assessment in Strategic Environmental Assessment (2001)*** provides a review of Health Impact Assessment concepts, methods and practice to support the development of a protocol on Strategic Environmental Assessment to the Espoo Convention, which adequately covers health impacts.

Publication 103: The 2007 Recommendations of the International Commission of Radiological Protection (2007) provides recommendations and guidance on protection against the risks associated with ionising radiation, from artificial sources used widely in medicine, general industry and nuclear enterprises, and from naturally occurring sources.

Basic Safety Standards (BSS) Directive (2013/59/Eurotom), was adopted on the 5th December 2013. It lays down the basic safety standards for protection against the dangers arising from exposure to ionising radiation. And repealing Directives 89/618/Eurotom, 90/641/Eurotom, 96/29/Eurotom, 97/43/Eurotom and 2003/122/Eurotom.

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 Government White Paper: ***Implementing Geological Disposal White Paper (July 2014)*** sets out each of the devolved administrations' positions on radioactive waste management. The White Paper is issued jointly by the UK government and the Northern Ireland Executive. The Northern Ireland Executive has responsibility for ensuring that any proposed GDF will not have an adverse impact upon the environment, health or safety of Northern Ireland.

The Health Protection ***Agency's Children's Environment and Health Action Plan, a summary of current activities which address children's environment and health issues in the UK (2007)*** applies the objectives of CEHAPE (2004) to the UK context and ***A Children's Environment and Health Strategy for the United Kingdom (2009)*** provides recommendations from the Health Protection Agency to the UK Government as to how it best can meet its commitment to the CEHAPE.

The ***Ionising Radiations Regulations 1999*** (SI 1999/3232) requires employers to keep exposure to ionising radiations 'As Low As Reasonably Practicable' (ALARP) and exposures must not exceed specified dose limits. Restriction of exposure should be achieved first by means of engineering control and design features. Where this is not reasonably practicable employers should introduce safe systems of work and only rely on the provision of personal protective equipment as a last resort. Any employer who undertakes work with ionising radiation must comply with IRR99.

Application of the 2007 Recommendations of the ICRP to the UK: Advice from the Health Protection Agency (2009) advises UK bodies with responsibility for protection

against radiation on the application of the UK recommendations for radiological protection issued by the ICRP. The document provides background to the recommendations, addresses the biological basis for the recommendations, outlines the ICRP system of protection and advises on implementation.

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 details 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 NHS 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 (DoPH) was created. The role of the DoPH is to influence local services, for example joining up activity on rights of way, countryside access and green space management to improve public health by connecting people with nature.

The ***Health and Social Care Act 2012*** enacts the proposals set out in the White Paper and the subsequent rounds of consultation, and significantly modified the National Health Service Act 2006. The changes are designed to make the National Health Service (NHS) more responsive, efficient and accountable, and capable of responding to future challenges. Key elements of the Act include: clinically led commissioning; service innovation; giving greater voice for patients; providing a new focus for public health; ensuring greater accountability; and streamlining arms-length bodies.

The ***National Planning Policy Framework (DCLG, 2012)*** 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 ***20:20 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)*** is

the approach and shared focus for all the work to realise the 2020 Vision. The Strategy developed three quality ambitions:

- **Safe** - There will be no avoidable injury or harm to people from healthcare, and an appropriate, clean and safe environment will be provided for the delivery of healthcare services at all time;
- **Person-Centred** - Mutually beneficial partnerships between patients, their families and those delivering healthcare services which respect individual needs and values and which demonstrates compassion, continuity, clear communication and shared decision-making; and
- **Effective** - The most appropriate treatments, interventions, support and services will be provided at the right time to everyone who will benefit, and wasteful or harmful variation will be eradicated.

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.

The **National Planning Framework (NPF 3)** 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.

Planning Policy Wales (PPW) (2014) 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.

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.

3.3 Overview of the Baseline

UK

In the UK, life expectancy at birth during the period 2011-2013 was 78.9 years for males and 82.7 years for females.⁹⁵

There are high levels of hypertension and overweight/obesity in the UK. Public health trends often correlate with deprivation and these figures for illness are invariably far less favourable in deprived areas.⁹⁶

Deaths 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 than in any other EU Member State. In the UK, in 2010, there were 87.7 deaths per 100,000 males and 64.0 deaths per 100,000 females from respiratory diseases, compared to an EU average of 63.4 and 32.5.⁹⁷

In 2013, more than one in three adults 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 disability.⁹⁸

The amount of natural radiation a person is exposed to varies around the world. Sources of natural radiation include cosmic rays from space and the presence of naturally occurring radioactive isotopes in food and water.

Public radiological dose limits in the UK (excluding natural background radiation and medical procedures) set out in the Ionising Radiation Regulations are:

- the sum of exposures should not exceed the dose limit of 1mSv⁹⁹ per year;
- the dose received from any new source does not exceed 0.3mSv per year; and
- Exposures to members of the public from artificial sources remain at a very low level.

Individual annual doses to members of the public from practices, other than medical procedures, are generally much less than the annual dose limit of 1 mSv. The average radiation dose (including natural background radiation and medical procedures) to the UK population is approximately 2.7mSv/y (around 84% is due to natural sources, which varies in intensity as a function of underlying geology). Only 0.1% of the annual average dose is directly due to radioactive discharges from nuclear and non-nuclear sources. The 2.7mSv is composed of: 0.33mSv natural Cosmic radiation; 0.35mSv natural Gamma radiation; 0.25mSv natural internal radiation; 1.3mSv natural Radon radiation; 0.41mSv artificial medical radiation; 0.006mSv artificial occupational radiation; 0.006mSv artificial fallout radiation from weapons testing in the past; 0.0009mSv artificial disposal radiation; and

⁹⁵ ONS National Life Tables, UK 2011-2013, http://www.ons.gov.uk/ons/dcp171778_377972.pdf

⁹⁶ Health Survey for England 2007 Healthy lifestyles: knowledge, attitudes and behaviour Summary of key findings, Office of National Statistics, <http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=6637>

⁹⁷ ONS, United Kingdom Health Statistics 2010, http://www.statistics.gov.uk/downloads/theme_health/ukhs4/ukhs4-2010.pdf

⁹⁸ ONS, Adult Health in GB, 2013 http://www.ons.gov.uk/ons/dcp171778_398686.pdf

⁹⁹ The Sievert (Sv) is a derived SI unit for ionising radiation. It provides an index for the risk of harm from radiation exposure.

0.0001mSv artificial consumer products radiation). The legal radiation dose limit set for workers is 20 mSv/y.¹⁰⁰

England

In England, life expectancy at birth during the period 2011-2013 was 79.4 years for males and 83.1 years for females¹⁰¹.

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 bad.¹⁰²

The 2013 Health Survey for England, published in 2014, sets out the following key findings.¹⁰³

- Overall, 11% of men and 14% 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.
- The most frequently prescribed medicine classes were lipid-lowering medicines (16% of men and 12% women), anti-hypertensive medicines (14% and 15% respectively), and for women, analgesics and non-steroidal anti-inflammatory drugs (12%).
- In 2013, mean BMI was higher among men than women. Around a quarter of adults were obese (26% of men and 24% of women), and 67% of men and 57% of women were overweight or obese.

Scotland

In Scotland, life expectancy at birth during the period 2011-2013 was 76.8 years for males and 80.9 years for females.¹⁰⁴

The 2013 Health Survey for Scotland, published in 2014, sets out the following key findings.¹⁰⁵

- 74% of adults aged 16 and over described their health as 'good' or 'very good'; while 8% assessed their health as being either 'bad' or 'very bad'.
- 27.1% of adults were obese, while 64.6% were overweight including obese.
- 15.5% of adults reported having cardiovascular disease (CVD), while 18.9% reported being diagnosed with any CVD condition including diabetes.
- 6.1% of men and 5.1% of women had doctor diagnosed diabetes.
- 29.1% of adults aged 16 and over had hypertension.

¹⁰⁰ Watson, S.J., Jones, A.L., Oatway, W.B. and Hughes, J.S., 2005, Ionising radiation exposure of the UK population: 2005 Review, HPA-RPD-001, HPA, Chilton, March 2005

¹⁰¹ ONS, National Life Tables, 2011 – 2013 http://www.ons.gov.uk/ons/dcp171778_377972.pdf

¹⁰² ONS, Census 2011

¹⁰³ Health Survey for England 2013 <http://www.hscic.gov.uk/catalogue/PUB16076/HSE2013-Sum-bklet.pdf>

¹⁰⁴ National Records of Scotland, <http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/life-expectancy>

¹⁰⁵ Scottish Health Survey 2013 <http://www.gov.scot/Publications/2014/12/9982>

Wales

In Wales, life expectancy at birth for the period 2011-2013 was 78.2 years for males and 82.2 years for females.¹⁰⁶

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

The 2013 Health Survey for Wales, published in 2014, includes the following key findings.¹⁰⁸

- 58% of adults were classified as overweight or obese, including 22% obese.
- 20% of adults reported currently being treated for high blood pressure, 14% for a respiratory illness, 12% for arthritis, 12% 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 16% who were limited a lot.

3.4 Summary of Existing Problems Relevant to the Geological Disposal 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).¹⁰⁹
- Health problems associated with radiological exposure are generally a minor issue in the UK; the great majority of the average public dose comes from natural sources of radiation, although testing and accidental releases do contribute to this. Background levels of natural radiation vary considerably from area to area, and any additional exposure (however small) may be an important issue for those communities who are already exposed to high natural background levels.

¹⁰⁶ ONS National Life Tables 2011-2013, http://www.ons.gov.uk/ons/dcp171778_377972.pdf

¹⁰⁷ ONS, Census 2011 <http://www.ons.gov.uk/ons/rel/census/2011-census/key-statistics-and-quick-statistics-for-wards-and-output-areas-in-england-and-wales/rpt-general-health-short-story.html>

¹⁰⁸ Welsh Health Survey (2013) <http://gov.wales/statistics-and-research/welsh-health-survey/?lang=en>

¹⁰⁹ WHO (2014). Burden of disease from ambient air pollution for 2012, Geneva, www.who.int/phe/health_topics/outdoorair/databases/AAP_BoD_results_March2014.pdf?ua=1.

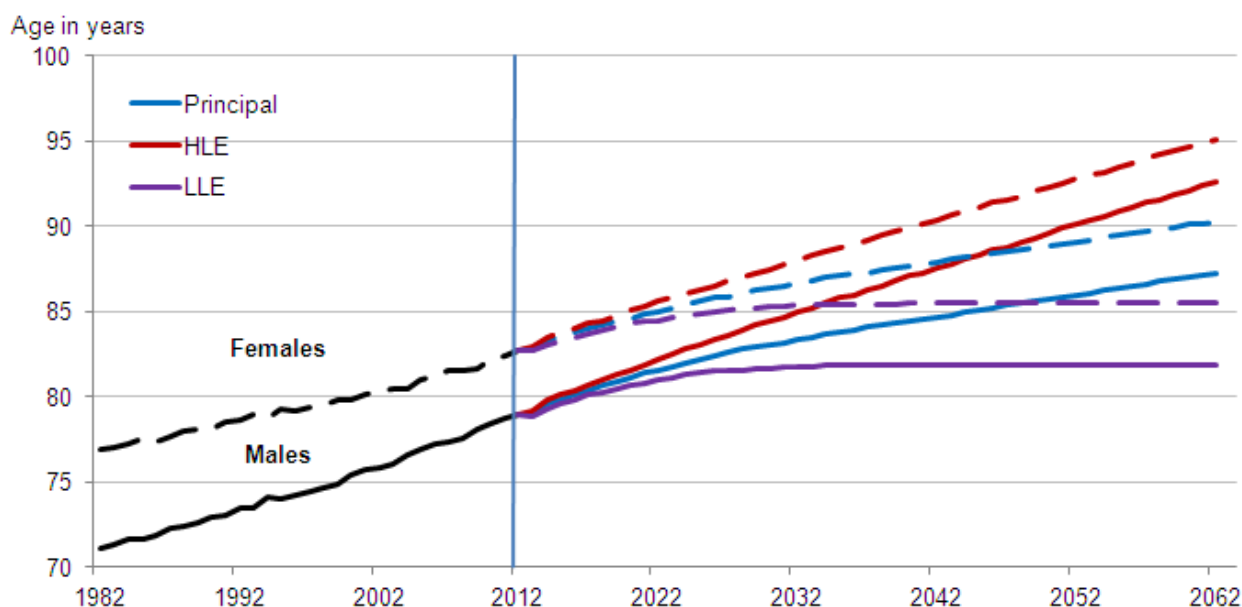
3.5 Likely Evolution of the Baseline

UK

Life expectancy¹¹⁰ at birth in the UK has reached its highest level on record for both males and females. From 1982 to 2012, life expectancy at birth has increased, from 71.1 to 79.0 years for males and 77.0 to 82.7 years for females.¹¹¹

Period life expectancy¹¹² at birth is projected to rise by eight years for males and females over the 50 year projection period 2012 – 2062. **Figure 3.1** shows period life expectancy at birth for males and females 1982-2012 and then for each of the variant life expectancy projections to 2062. In the high life expectancy variant, period life expectancy at birth is projected to reach age 92.6 and age 95.1 for males and females respectively in 2062, but the low life expectancy variant projects period life expectancy as low as 81.9 and 85.5 respectively.¹¹³

Figure 3.1 Life expectancy at birth for males and females 1982-2012



Source: Office for National Statistics

England

The current general trend in human health is generally towards improved health, greater life expectancy and reduced mortality from treatable conditions.¹¹⁴

Life expectancy at birth for males in England has increased from 70.8 years in 1980-82 to 78.9 years in 2011-2013, an increase of 8.1 years. For females, life expectancy increased by 5.9 years from 76.8 to 82.7 years over the same period. As a result, the gap in life expectancy between genders over this time has decreased from 6 years to 3.8 years. Life

¹¹⁰ The average period that a person may expect to live.

¹¹¹ ONS (2013) Historic and Projected Mortality Data from the Period and Cohort Life Tables, 2012-based

¹¹² 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.

¹¹³ http://www.ons.gov.uk/ons/dcp171778_345078.pdf

¹¹⁴ Health Survey for England 2013 Trend Tables, Office of National Statistics, <http://www.hscic.gov.uk/catalogue/PUB16077>

expectancy at birth has increased by 6.3 hours per day since 1980 – 1982 for males, and by 4.6 hours per day for females in the UK.¹¹⁵

Between 1993 and 2011, 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.

Scotland

Male life expectancy has improved across Scotland as a whole (from 72.4 years during 1996-98 to 76.8 years during 2011-2013). Female life expectancy has improved across Scotland as a whole (from 78.1 years during 1996-98 to 80.9 years during 2011-2013). As a result, the gap in life expectancy between genders over this time has decreased from 5.7 years to 4.1 years.¹¹⁶ Alcohol related and attributable hospital patient rates have increased over time for Scotland as a whole, although rates are declining in some areas. The number of people being admitted to hospital with heart disease has been declining over time in Scotland as a whole, and in most but not all Community Health Partnerships.¹¹⁷

NHS Scotland health improvement targets (named HEAT targets based on the four priorities) include:

- All people newly diagnosed with dementia will have a minimum of a year's worth of post-diagnostic support coordinated by a link worker by 2015/2016;
- Reduce the rate of emergency inpatient bed days for people aged 75 and over per 1,000 population by 12% between 2009-10 and 2014-15; and
- To increase the proportion of people diagnosed and treated in the first stage of breast, colorectal and lung cancer by 25% by 2014-15.¹¹⁸

Wales

Life expectancy for males in Wales has increased from 70.4 years in 1980-82 to 78.2 years in 2011-2013, an increase of 7.8 years. For females, life expectancy increased by 5.8 years from 76.4 to 82.2 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.¹¹⁹

In Wales, the population aged 75 and over varies by 3.9% across Local Health Board areas. On average, 58.7% of adults are overweight or obese.¹²⁰ The greatest causes of death in people aged under 75 in Wales are cancer, circulatory disease and respiratory disease, together accounting for 40%, 27% and 9% of approximately 11,000 deaths in 2007.¹²¹

¹¹⁵ ONS, National Life Tables, 2011-2013 http://www.ons.gov.uk/ons/dcp171778_377972.pdf

¹¹⁶ ONS, Life Expectancy in Scotland <http://news.scotland.gov.uk/News/Life-expectancy-in-Scotland-1160.aspx>

¹¹⁷ NHS Scotland, Health and Wellbeing Profiles 2010, Scotland Overview Report,

http://scotpho.org.uk/web/FILES/Profiles/2010/ScotPHO_overview_2010-tiffs-print-and-web.pdf

¹¹⁸ NHS Scotland, HEAT targets <http://www.scotland.gov.uk/About/Performance/scotPerforms/partnerstories/NHSScotlandperformance>

¹¹⁹ ONS National Life Tables 2011-2013 http://www.ons.gov.uk/ons/dcp171778_377972.pdf

¹²⁰ Public Health Wales Observatory, Health Assets <http://www.wales.nhs.uk/sitesplus/922/home>

¹²¹ NHS Wales, Wales and its Local Health Boards, <http://www.wales.nhs.uk/sitesplus/documents/888/All%20Wales%20-%20Eng.pdf>

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 world.¹²²

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 Geological Disposal 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 Geological Disposal NPS on Human Health

Objective/Guide Question	Reasoning
Objective: To protect and enhance health, safety and wellbeing of workers and communities and minimise any health risks associated with disposal operations.	The SEA Directive 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.
Will the Geological Disposal NPS protect and/or enhance the health and safety of workers, or other people working at any proposed sites?	All employers have a general duty to protect the health and safety of their employees and those affected by their work activities, as set out in the Health and Safety at Work etc Act (1974).
Will the Geological Disposal NPS protect and/or enhance the health, safety and well-being of local communities and specific groups within those communities?	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).

¹²² Together for Health (2011) Welsh Government <http://wales.gov.uk/docs/dhss/publications/111101togetheren.pdf>

Objective/Guide Question	Reasoning
Will the Geological Disposal NPS protect and/or enhance the health, safety and well-being of wider communities (i.e. those communities that are not host to a GDF or deep boreholes)?	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 Geological Disposal 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 Geological Disposal NPS minimise the risk or consequences of a major accident?	Enables the consideration of the requirements of the Article 13(1)(c) of the Seveso III Directive that provides that in taking account of the need to prevent major accidents in land use policies where the siting or developments may be the source of or increase the risk or consequences of a major accident'.

Table 3.2 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the health objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

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, improvements to 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 (children, mums to be and the elderly); Option supports the provision of healthcare facilities.
+	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,

Effect	Description	Illustrative Guidance
		<p>access to open space and recreational activities, improvements to environmental quality and community safety);</p> <ul style="list-style-type: none"> Option would have a positive effect on health and well-being and acknowledges the health needs of specific groups in society (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 (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 (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 (children, mums to be and the elderly) and communities; Option causes 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

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on land use, geology and soils. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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

International/European

The **European Thematic Strategy on Soil Protection (2006)** sets out the European Commission's strategy on soils and includes a proposal for a European Union (EU)-wide **Soils Directive** (although proposals for a Directive have since been withdrawn). 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 **EU Integrated Pollution, Prevention and Control (IPPC) Directive (2008/1/EC)** defines the obligations to which industrial and agricultural activities with a high pollution potential must comply, through a single permitting process. It sets minimum requirements to be included in all permits, particularly in terms of pollutants released. The aim of the Directive is to prevent or reduce pollution being released to the atmosphere, water and soil, as well as reducing the quantities of waste arising from industry and agriculture. In order to gain an IPPC permit, operators must demonstrate that they have systematically developed proposals to apply the 'Best Available Techniques' (BAT) to pollution prevention and control and that they address other requirements relevant to local factors.

The European Commission reviewed European legislation on industrial emissions in order to ensure clearer environmental benefits, remove ambiguities, promote cost-effectiveness and to encourage technological innovation. The review led to the Commission proposing and adopting a recast ***Directive on Industrial Emissions (IED) (2010/75/EU)*** which came into force on 06 January 2011.

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

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. Reusing previously developed land is a good example of resource efficiency of land.

The conservation of resources is one of the underlying objectives of the ***European Spatial Development Perspective (ESDP) (1999)***, the framework for policy guidance to improve cooperation among community sectoral policies. There also exists a range of legislation in relation to resources.

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 Environmental Protection Act 1990 was also modified in 2006 to cover radioactivity, and then a further modification was made in 2007 to cover land contaminated with radioactivity originating from nuclear installations.

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 ***Pollution Prevention and Control (England and Wales) Regulations 2000*** (SI 2000/1973) permit and regulate many industrial activities that may pollute the environment.

The ***National Forest Inventory*** began in 2009 and was completed in 2014. 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. 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 Britain and 225 thousand hectares more than previously estimated.

The ***Ancient Woodland Inventory*** 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 June 2011, the Government outlined its vision for England's soils in the ***Natural Environment White Paper (Defra, 2011)***. This set a clear target that by 2030, all of England's soils will be managed sustainably and degradation threats tackled successfully, in order to improve the quality of soil and to safeguard its ability to provide essential ecosystem services and functions for future generations. 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 our 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 2015/1391) 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 ***Radioactive Contaminated Land (Modification of Enactments) (England) Regulations 2006*** (SI 2006/1379) (as amended) are concerned with the remediation of land contaminated with radioactive substances in certain circumstances.

The Government has reviewed the contaminated land regime in England for the first time since its introduction in 2000. Following the review, revised Statutory Guidance was issued (in April 2012) under Part 2A of the Environmental Protection Act 1990 relating to radioactive contaminated land (similar guidance was also issued in Scotland and Wales). This revised Statutory Guidance while still taking a precautionary approach, allows regulators to make quicker decisions about whether or not land is contaminated under Part 2A. It also offers better protection against potential health impacts by concentrating on the sites where action is actually needed.

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.

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). Local planning authorities should 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). The NPPF also 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). In 2014, the Department for Communities and Local Government (DCLG) published online Planning Practice Guidance. Sections of specific relevance include *Land affected by contamination and Brownfield land, soils and agricultural land*.

Local Plans set out the policies for the use of land at the local level including in respect of minerals and waste and must be prepared in accordance with the NPPF and under the ***Planning and Compulsory Purchase Act 2004***.

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.

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 first land use strategy, ***Getting the Best from Our Land: A land use strategy for Scotland*** was published in March 2011. The Strategy 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.

Local Development Plans are prepared by local councils and set out more detailed policies and proposals to guide development. Additionally, in the four main cities (Aberdeen, Dundee, Edinburgh and Glasgow) and their surrounding areas the development plan also includes **Strategic Development Plans**.

A scheme for remedying contaminated land is introduced in the **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.

Radioactive Contaminated Land (Scotland) Amendment Regulations 2009 (SSI 2009/202) provide regulations for access to and identification of land that may be contaminated by radioactivity. Where such land is causing lasting exposure of radiation to any person or where there is a significant possibility of such exposure, the regime will also allow for remediation, under circumstances where intervention is liable to be justified.

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. This act will be supported by the Planning (Wales) Bill and Environment (Wales) Bill once they have been given royal assent.

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 **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, 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.

Planning Policy Wales (Edition 7) (2014) 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.

Technical Advice Note 6: Planning for Sustainable 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.

Minerals Planning Policy Wales (2001) sets out planning policy guidance in relation to minerals extraction and related development in Wales, which includes all minerals and substances in, on or under land extracted either by underground or surface mining. The overriding objective is to provide a sustainable pattern of minerals extraction including by providing mineral resources to meet society’s needs and to safeguard resources from sterilisation.

The **Minerals Technical Advice Note (MTAN) Wales 1: Aggregates’ (March 2004)** main objective is to provide aggregate resources in a sustainable way to meet society’s needs in respect of aggregates related development.

Local Development Plans (LDPs) set out local planning authority proposals and policies for future development and use of land in Wales. As of March 2015, sixteen authorities had an adopted LDP with the remainder relying on extant adopted and emerging Unitary Development Plans.

The **Contaminated Land (Wales) (Amendment) Regulations 2012** (WSI 2012/283) 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.

The ***Radioactive Contaminated Land (Wales) Regulations (2007)*** (WSI 2007/3250) were modified in 2006 to cover land contaminated with radioactivity originating from nuclear installations.

Woodlands for Wales (2009) is the Welsh Government's strategy for woodlands and trees, which sets out the following challenging 50 year vision: "Wales will be known for its high-quality woodlands that enhance the landscape, are appropriate to local conditions and have a diverse mixture of species and habitats". To deliver this vision, Woodlands for Wales identifies a series of high level outcomes under the following strategic themes:

- Welsh woodlands and trees;
- Responding to climate change – coping with climate change, and helping to reduce our carbon footprint;
- Woodlands for people - serving local needs for health, education, and jobs;
- A competitive and integrated forest sector - innovative, skilled industries supplying renewable products from Wales; and
- Environmental quality - making a positive contribution to biodiversity, landscapes and heritage, and reducing other environmental pressures.

The ***Woodlands for Wales Action Plan (2012)*** shows the progress of actions identified in the 2009 Action Plan up to March 2012.

4.3 Overview of the Baseline

UK

Geology

The geology of the UK is diverse and has over 800 soil types. 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 Cretaceous.¹²³

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 Dartmoor.¹²⁴

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

¹²³ Natural England. England's geology. <http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/englands/default.aspx> [Accessed 28.05.2015]

¹²⁴ Natural England. State of the Natural Environment. 2008. <http://publications.naturalengland.org.uk/publication/31043> [Accessed 28.05.2015]

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 an estimated 2,050 geological Sites of Special Scientific Interest (SSSIs) in the UK.¹²⁵

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 24,251,400 hectares (242,514km²). England comprises the largest land area in the UK, covering an area of 13,028,100 hectares (130,281km²). The smallest land area in the UK is Northern Ireland, which covers an area of 1,357,600 hectares (13,576km²).

Average population density of the UK is 261 people per square kilometre.¹²⁶

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 respectively.

¹²⁵ [Natural England. Protected Areas. http://publications.naturalengland.org.uk/category/10001](http://publications.naturalengland.org.uk/category/10001) [Accessed 28.05.2015]

¹²⁶ ONS. Population and Household Estimates for the United Kingdom. 2011. http://www.ons.gov.uk/ons/dcp171778_304116.pdf [Accessed 01/06/2015]

Table 4.1 Estimated Areas of Broad Habitats in the UK in 2007¹²⁷

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	24682.5	100%

Source: Countryside Survey 2007

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.

¹²⁷ Countryside Survey. Final Report for LCM2007. 2011
<http://www.countrysidesurvey.org.uk/sites/default/files/pdfs/LCM2007%20Final%20Report%20-%20vCS%20Web.pdf> [Accessed 14.05.2015]

¹²⁸ Natural England. Agricultural Land Classification: protecting the best and most versatile agricultural land. 2009.
<http://publications.naturalengland.org.uk/publication/35012?category=23033> [Accessed 14.05.2015]

In 2005 there was estimated to be around 413,906 hectares of land affected by industrial activity in England and Wales which may be contaminated, (around 2% of the land area in England and Wales).¹²⁹

According to the 2012 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 countryside.

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.

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, Chilterns, Cotswolds 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.

¹²⁹ Environment Agency (2005) Indicators for Land Contamination, available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290711/scho0805bjmd-e-e.pdf [Accessed 05.06.2015]
¹³⁰ Natural England. State of the Natural Environment. 2008. <http://publications.naturalengland.org.uk/publication/31043> [Accessed 28.05.2015]

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

Land Use and Soils

As at 2013, the average population density of England was estimated to be 413 people per square kilometre.¹³¹

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).

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

¹³¹ ONS (2014) Compendium of UK Statistics. Available from <http://www.ons.gov.uk/ons/guide-method/compendiums/compendium-of-uk-statistics/population-and-migration/index.html> [Accessed 05/06/15].

England Land Cover 2007	'000 ha	% Area
Littoral rock	11.2	0.1
Littoral sediment	161.7	1.2
TOTAL	13182.9	100

Source: Countryside Survey 2007

The majority of land in England (around 72%) is in agricultural use. A further 8.6% is used for woodland and forestry. Whilst developed land accounts for around 10% of the total area, only a very small proportion of the land (1.14%) is occupied by domestic buildings (e.g. houses), with domestic gardens accounting for almost half of the 'developed area' (over 4% of the national land area). Roads account for around 2% and rail 0.14% of the total.

Within England, 87.7% of the land area is classed as agricultural land.¹³² Of the remainder, 5% is non-agricultural and 7.3% is urban. Of the 87.7% of land classed as agricultural, 65.1% is classed as moderate or better.

In England there was estimated to be 307,672 hectares of land that may be contaminated. A total of 659 sites had been determined as 'contaminated land' in England by the end of March 2007¹³³.

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.

There are estimated to be 309 SSSIs with geological designation in Scotland. Scotland has three Geoparks: North West Highlands Geopark, Lochaber Geopark and Shetland Geopark¹³⁴.

¹³² Natural England. Agricultural land classification. 2010.

http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&cad=rja&uact=8&ved=0CCIQFjAA&url=http%3A%2F%2Fswarchive.cpredevon.org.uk%2FAgricultural%2520land%2520classification%2520statistics.doc&ei=mAhnVemVB4XuUpHhgZAE&usq=AFQjCNGUqZ_31sh-SfREiFzGlamC2VYG2g&bvm=bv.93990622.d.d24 [Accessed 28.05.2015]

¹³³ Environment Agency. Dealing with contaminated land in England and Wales. 2009.

http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&cad=rja&uact=8&ved=0CCIQFjAA&url=http%3A%2F%2Fwww.ashford.gov.uk%2Fdownload.cfm%3Fdoc%3Ddocm93ijim4n761.pdf%26ver%3D1535&ei=HQInVaPpNMawUZrJgUg&usq=AFQjCNHiOVVTuxsDWwO_Nayh8iEHblTITg&bvm=bv.93990622.d.d24 [Accessed 28.05.2015]

¹³⁴ Scottish Natural Heritage. Protecting Scotland's nature. Geopark. <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/geoparks/> [Accessed 08.06.2015]

Land Use and Soils

The average population density of Scotland is 68 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	1117.8	14.0
Neutral Grassland	575.8	7.2
Calcareous Grassland	1.2	0.03
Acid Grassland & Bracken	1024.0	12.8
Dwarf Shrub Heath	1566.0	19.6
Fen, Marsh and Swamp	2.6	0.07
Bog	768.9	9.6
Freshwater	170.3	2.1
Montane	452.0	5.7
Inland Rock	70.5	0.9
Supra-littoral rock	6.0	0.1
Supra-littoral sediment	22.0	0.3
Littoral rock	35.1	0.4
Littoral sediment	60.4	0.8
TOTAL	7976.8	100

Source: Countryside Survey 2007

Agricultural holdings in Scotland cover an area of over 6.2 million hectares. This represents about 80% of the total land area of Scotland (7.8 million hectares).

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 UK.¹³⁵

The quality of land is highly variable with much of Scotland classified as Less Favoured Areas (suited only for improved grassland and rough grazing). Class 1 agricultural soils (suitable for a very wide range of crops) make up just 0.1% 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 Tay.

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' in Scotland by the end of 2008.

Wales

Geology

Sedimentary rocks underlie the majority of Wales, which are then overlain by a suite of acid soils, characterised by a peaty surface horizon. As a broad overview, the following rock types exist in a progression from north west to south east Wales (predominant rock types): Ordovician; Silurian; Devonian; and Carboniferous Peat which covers 3% to 4% of Wales and is predominantly acid blanket peat, but with small areas of raised bog and fen peat scattered in lowland areas.¹³⁶

Information obtained from Natural Resources Wales indicates that of the 1,019 SSSIs in Wales, 30% were notified for geological and geomorphological features (based on 2006 data). 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.¹³⁷

There are 443 Geological Conservation Review (GCR) sites located in the Wales and three Geoparks (Fforest Fawr and Ynys Môn with Abberley - Malvern Hills also extending into Herefordshire).

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).

¹³⁵ The Scottish Government. Land Use Strategy - Strategic Environmental Assessment. 2010. <http://www.scotland.gov.uk/Topics/Environment/Countryside/Landusestrategy/sea> [Accessed 28.05.2015]

¹³⁶ Welsh Water. Review of Plans and Programmes. 2011. www.dwrcymru.com/library/wrmp/SEA_Part2.pdf [Accessed 29.05.2015]

¹³⁷ Countryside Council for Wales. Sites of Special Scientific Interest (SSSIs) in Wales. 2006. http://www.ccg.gov.uk/PDF/SSSIs_Report%20SMALL.pdf [Accessed 28.05.2015]

Table 4.4 Land Cover in Wales in 2007

Wales Land Cover 2007	'000 ha	% Area
Broadleaved, Mixed and Yew Woodland	125.1	5.9
Coniferous Woodland	143.1	6.8
Arable and Horticulture	176.9	8.4
Improved Grassland	842.2	40.0
Neutral Grassland	227.1	10.8
Calcareous Grassland	0	0
Acid Grassland & Bracken	284.5	13.5
Dwarf Shrub Heath	112.2	5.3
Fen, Marsh and Swamp	6	0.05
Bog	41.5	2.0
Freshwater	11.4	0.5
Montane	1.7	0.1
Inland Rock	8.8	0.4
Built-up Areas and Gardens	89.3	4.3
Supra-littoral rock	0.8	0.04
Supra-littoral sediment	6.3	0.4
Littoral rock	3.0	0.1
Littoral sediment	30.2	1.4
TOTAL	2110.1	100

Source: Countryside Survey 2007

Land use in Wales is dominated by agricultural land under pasture and rough grazing (72.3%); a small proportion of the land in Wales is under crop or 'other' types of agriculture (4.2%) (Urban land including land not otherwise specified accounts for 9.8% of land area in Wales compared to 19.2% in England). These characteristics reflect the climate, relief and soil type of Wales. Although the total proportion of land classified as agricultural is similar in England, there is a smaller proportion under pasture or rough grazing.¹³⁸

The proportion of land area classified as either Grade 1 ('Excellent') or Grade 2 ('Very Good') in Wales is significantly lower than in England (2.5% compared to 16.9%) whilst

¹³⁸ Environment Agency. The state of soils in England and Wales. 2005.
http://www.adlib.ac.uk/resources/000/030/045/stateofsoils_775492.pdf [Accessed 28.05.2015]

over 80% of land in Wales is classified as either Grade 4 ('Poor') or Grade 5 ('Very Poor'), significantly higher than in England (22.5%).

In 2005, there was estimated to be around 24,200 hectares of land affected by industrial activity in Wales that may be contaminated. A total of 122 sites had been determined as 'contaminated land' in Wales by the end of March 2007.

4.4 Summary of Existing Problems Relevant to the Geological Disposal NPS

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

Geology

- Mining activities have left a legacy of hazards in some parts of the UK such as landslips, subsidence, contamination of ground and surface water sources from metals such as tin, copper and arsenic, and radon gas and flooding.

Land Use and Soils

- Significant areas across the UK carry a burden of contamination 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 matter.¹³⁹ Effects include:
 - Soil erosion by wind and rain: erosion affects both the productivity of soils but also water quality and aquatic ecosystems;
 - Compaction of soil reduces agricultural productivity and water infiltration, and increases flood risk through higher levels of run-off;
 - Organic matter decline: the loss of soil organic matter reduces soil quality, affecting the supply of nutrients and making it more difficult for plants to grow, and increases emissions to the atmosphere; and
 - Impacts on soil carbon sequestration and the release of carbon to the atmosphere.
- As the climate (including temperature and rainfall patterns) changes in the future, it is likely that soils have the potential to be further degraded, both as a

¹³⁹ Environment Agency. Manage water on land. 2015. <http://www.defra.gov.uk/food-farm/land-manage/soil/> [Accessed 28.05.2015]

result of the direct and indirect impacts of climate change, for example as land managers adapt their practices and the crops that they grow. Climate change and loss of organic matter are the most significant threats to Scottish soils.¹⁴⁰ 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;

- In Wales the small proportion of land that is classified as ‘best and most versatile’ agricultural land needs to be conserved. There is also a need to protect soils in uplands and wetlands which contain high amounts of carbon and are vulnerable to acidification;¹⁴¹
- Of UK land, 11% is currently classified as ‘built up.’ Development pressure remains a constant factor in parts of the country, and it is not expected that previously-developed land will be able to fully deliver the UK’s future needs. This will continue to place development pressures in rural areas and the urban fringe;
- When Greenfield land is used for development, it is likely to result in the permanent loss of that land from other uses such as agriculture. There are similar pressures to build across each of the UK administrations, however the details differ slightly between each;
- The 2008 State of the Natural Environment Report noted that within rural England, the area of developed land had increased by about 4% since 1990, largely by using agricultural land and that between 1998 and 2003 substantial greenfield development has occurred near many urban areas, notably at key growth points, but also in former coalfield belts. It said the pace of development within England was increasing, particularly for housing in response to demand and a historic shortfall in housing provision and that this was expected to have a dramatic effect on a large part of central and southern England though the series of the then identified Growth Areas and Growth Points;
- With respect to woodlands, Woodlands for Wales (2009) identifies a need to ensure that:
 - more woodlands and trees are managed sustainably;
 - woodland ecosystems are healthy and resilient;
 - woodlands are better adapted to deliver a full range of benefits;
 - woodland cover in Wales increases;
 - the management of woodland and trees is more closely related to that of other land uses; and
 - Urban woodlands and trees deliver a full range of benefits.

¹⁴⁰ Scottish Environment Protection Agency. State of the environment and trends – Scotland. 2013. <http://www.seaguidance.org.uk/11/State-of-the-Environment.aspx> [Accessed 28.05.2015]

¹⁴¹ Welsh Assembly Government. Environment Strategy for Wales. 2006. <http://wales.gov.uk/topics/environmentcountryside/epg/envstratforwales/strategy/?lang=en> [Accessed 28.05.2015]

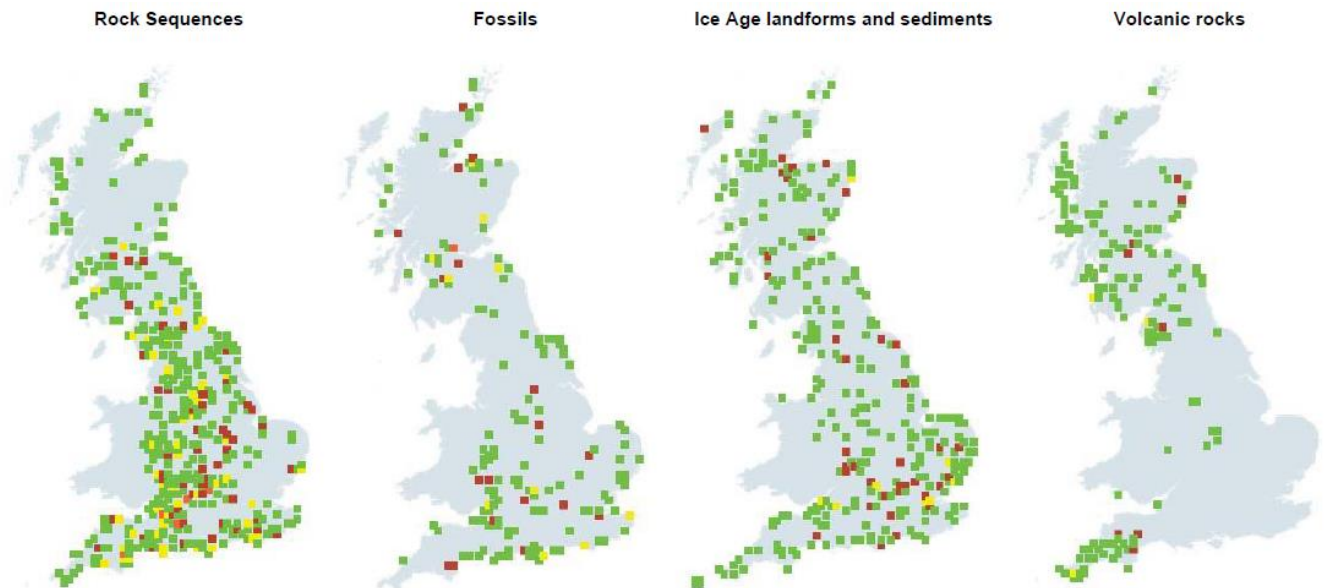
4.5 Likely Evolution of the Baseline

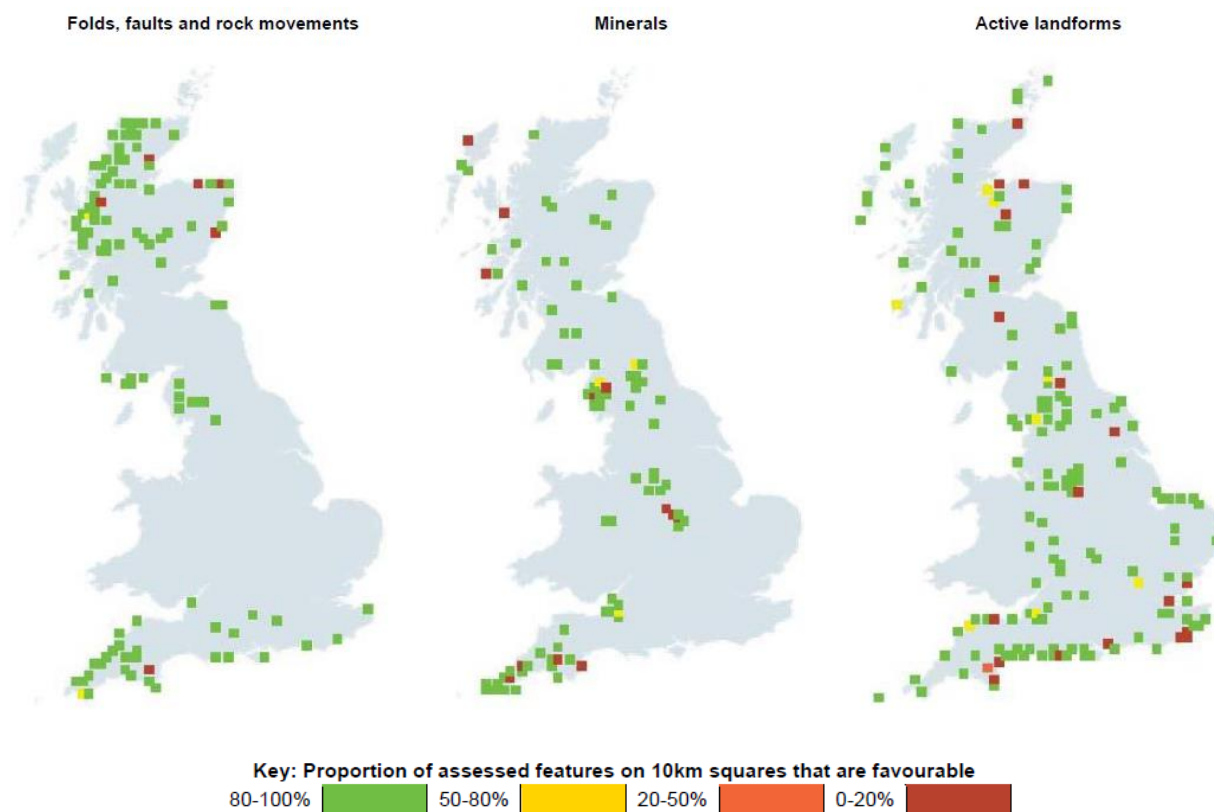
UK

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 principle 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 overall results of the survey for broad geological features are indicated in **Table 4.5**, and the spatial distribution of sites and their condition is shown in **Figure 4.1**.

Figure 4.1 Condition of SSSI Features (Where Unfavourable-Recovering is Counted as Unfavourable)





Source: Williams, JM (ed.) (2006). *Common Standards Monitoring for Designated Sites: First Six Year Report*. Peterborough, JNCC. http://jncc.defra.gov.uk/pdf/CSM_06geology.pdf [Accessed 28.05.2015]

Table 4.5 Condition of Geological Features

Category	No. of Assessments	% Favourable and Unfavourable-Recovering	% Destroyed (whole or part)
Rock sequences	859	84.5	1
Fossils	274	87.6	1
Ice Age landforms & sediments	410	90.2	1
Volcanic rocks	215	95.3	-
Folds, faults & rock movements	139	93.5	1
Minerals	120	85.8	8
Active landforms	225	89.3	1
Total	2242	88.1	1.3

Source: Williams, JM (ed.) (2006). *Common Standards Monitoring for Designated Sites: First Six Year Report*. Peterborough, JNCC. http://jncc.defra.gov.uk/pdf/CSM_06geology.pdf [Accessed 28.05.2015]

The main findings of arising from the results presented above are summarised below by category:

- **Rock Sequences:** The rock sequences category has the largest number of sites in any of the broad categories studied, with stratigraphic sequences representing the most abundant feature in this assessment (ca. 80%). A high number of sites (ca. 83%) are in favourable condition, and those which are not are principally so due to the feature being obscured. Management agreements are in place for many sites, which include measures to keep features exposed;
- **Fossils:** Williams (2006) accounts for ca. 75% of sites which have fossils indicated as a notified feature, 87% of which are in a favourable condition. Like many geological sites, many are considered unfavourable because features are obscured rather than damage inflicted as a result of fossil collectors;
- **Ice Age Landforms and Sediments:** About 75% of Quaternary features, which includes glacial landforms and sediments, have been accounted for in the JNCC Common Standard Monitoring assessment, 88% of which are reported as being in favourable condition. 1% of features are reporting as having being destroyed in whole or in part, with the remainder being unfavourable or recovering, mostly where sites are obscured;
- **Volcanic Rocks:** Of the 70% coverage of volcanic (igneous) rock sites assessed, 95% were regarded as favourable. Most igneous areas are robust and less likely to be affected by activities which may be damaging to soft rock or sedimentary landscapes. The unfavourable condition of most sites results from being obscured, probably by vegetation cover or scree;
- **Folds, Faults and Rock Movements:** Only 40% of sites in this category were accounted for, and 94% were in favourable condition. Like volcanic rock areas, the robust nature of the rocks and features in this category makes them less susceptible to damage than soft-rock, sedimentary and more dynamic landscapes;
- **Minerals:** Just over 60% of sites are accounted for in the assessment, of which 86% are regarded as in favourable condition. There is a relatively large amount of partially or wholly destroyed sites (7.5%) compared with the other broad geological categories. Apart from being obscured, minerals have been the subject of anthropogenic exploitation and at some sites most or all of the features have been removed; and
- **Active Landforms:** Just over 60% of active landforms (including caves, karst features, fluvial and coastal geomorphology) have been accounted for in the assessment, 86% of which are in favourable condition. The data collected for this category is too sparse to detect any trends in the reasons for the condition of sites. Active landforms are often large and their dynamic, complex nature makes them particularly difficult to monitor.

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 and how it has changed from 1984 to 2007 was calculated by the Office of National Statistics¹⁴² and is shown in **Table 4.6**. 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 4.6 Estimated Area ('000 ha) of Broad Habitats in the UK 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
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

¹⁴² ONS. Land cover account, Great Britain. 2011. <http://www.ons.gov.uk/ons/rel/environmental/environmental-accounts/2011/rftlandcover.xls> [Accessed 15.05.2015]

Land Type	1984	1990	1998	2007	% Change between 1998 and 2007
Other land	n/a	57	107	113	n/a
Unsurveyed land	n/a	522	522	522	n/a
Total³	22514	22632	22601	22627	

Source: Countryside Survey 2007

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 27 years from 18,753 hectares in 1984 to 18,449 hectares in 2013 (a reduction of 1.6%).¹⁴³ 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 25,000 hectares since 1980, equivalent to 1.05% per year. There seems to have been some reduction in the rate of growth from 2000 to 2008 with the net increase in tree cover in this period being about 7,000 hectares per annum (or 0.24%). These recent patterns of woodland expansion continue a very clear upwards trend, which has led to a doubling of the area of UK woodland since World War II.

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 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 1980s.

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

¹⁴³DEFRA. Agricultural Land Use. 2012. <https://www.gov.uk/government/statistical-data-sets/agriculture-in-the-united-kingdom> [Accessed 15.05.2015]

- threat to soil as a cultural resource (e.g. archaeological protection and UK environmental records).

UK soils store around 10 billion tonnes of carbon.¹⁴⁴ A study by the National Soil Inventory (NSI) found that between 1978 and 2003 there had been 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 rich.¹⁴⁵ The loss of this carbon may also have climate change implications.

Compaction may result from a number of activities including intensive mechanised agriculture, poor timing of cultivation, over-stocking and overworking of land¹⁴⁴. 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 erosion. The principle 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
- runoff from urban land surfaces.

Other causes include wind erosion, tillage losses and soil co-extracted with root vegetables.¹⁴⁶

There is still some uncertainty about the intensity and nature of any threats posed by climate change with regard to soil, though the following possibilities have been identified:

- A probable reduction in soil organic matter. Change is most critical in peat and organic-rich soils which are a major carbon store;
- A requirement for new management techniques - soils may become more susceptible to compaction;
- Biomass production may fall due to higher drought duration;
- Soil erosion may increase, particularly in peaty soils, if winters are to become wetter;
- Acidification and nutrient mobility will change with rainfall and temperature; and
- There may be more demand for irrigation, particularly in the south of England. As indicated above, UK soils store a substantial amount of carbon

¹⁴⁴ Defra. Safeguarding our Soils – A Strategy for England. 2009.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69261/pb13297-soil-strategy-090910.pdf [Accessed 28.05.2015]

¹⁴⁵ Bellamy PH, Loveland PJ, Bradley RI, Lark RM and Kirk GJD. Carbon Losses from all Soils across England and Wales 1978-2003. *Nature* 437: 245-248. <http://core.ac.uk/download/pdf/141023.pdf> [Accessed 28.05.2015]

¹⁴⁶ Quine TA Van Oost K, Walling DE and Owens PN. 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. 2006.

http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CClQFiAA&url=http%3A%2F%2Frandd.defra.gov.uk%2FDocument.aspx%3FDocument%3DSP08007_6584_FRA.pdf&ei=mBdnVdaOC4X2UvaVgPgK&usq=AFQjCNEcGiVgzMhyX0jiAa1ghaPkRmpA-Q&bvm=bv.93990622,d.d24 [Accessed 28.05.2015]

(~10 billion tonnes), and land use which allows the release of carbon accounts for ~5% of UK annual greenhouse gas emissions, offset by up to 2% by forestry and farming uptake.

Soil biodiversity is an emerging field of soil science and there is a low level of understanding and few relevant datasets, and it is not known what effects pollutants including metals and pesticides have on soil organisms important for maintaining soil quality¹⁴⁴. Organisms include bacteria, fungi and invertebrates, 100 of which are regarded as BAP species, and like many other facets of the UK's natural environment, soil habitats are host to introduced species such as the predatory New Zealand flatworm.

Contaminated land may be the result of a legacy of old industrial practices or more recent incidents and is regarded as 'contaminated' in legislation (Part 2A of the Environmental Protection Act 1990) where there is a threat to the natural environment or public health. The area of contaminated land in the UK cannot be reliably estimated, though the Environment Agency estimates that ~325,000 sites covering 300,000 hectares (~2% of the area of England and Wales) are affected. The most common pollutants at sites identified by the Environment Agency were heavy metals and inorganic/organic compounds. Other contamination results from pollutant deposition and direct application, leading to acidification and nutrient enrichment.

The soil of the UK has gradually built up since the end of the last Ice Age ~10,000 years ago during the current Holocene warm period, and even before in the case of palaeosols. Soils provide protection for a great deal of the UK's archaeological resource which remains covered, protecting it from redistribution, erosion, and in the case of peat, may provide exceptional preservational contexts. Undisturbed peatlands also preserve the environmental record of areas all over the UK pertaining to the Holocene which can be reconstructed using palaeo-archaeological methods (e.g. plant macrofossil, microfossil, entomological and sedimentary analyses). In many cases the soils themselves are a cultural construct such as the thickened soils of St Kilda^{147, 148}, and the rig-and-furrow formations which are the most abundant archaeological feature in Scotland¹⁴⁹.

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 practices¹⁴⁴. Around 3,000 Scheduled Monuments are actively ploughed, and a third of all sites are on ploughed land, with 2% at high risk¹⁴⁴. In Wales, 15% of Scheduled Monuments have deteriorated due to natural, agricultural and other causes. 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.

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.

¹⁴⁷ Meharg AA, Deacon C, Edwards KJ, Donaldson M, Davidson DA, Spring C, Schrimshaw C, Feldmann J, Raab A, Ellam R (2005). Ancient Manuring Practices Pollutes Arable Soil at the St Kilda World Heritage Site, Scottish North Atlantic. *Chemosphere* 64: 1818-1828.

¹⁴⁸ Donaldson MP, Edwards KJ, Meharg AA, Deacon C and Davidson D (2009). Land Use History of Village Bay, Hirta, St Kilda World Heritage Site: A Palynological Investigation of Plaggen Soils. *Review of Palaeobotany and Palynology* 153: 46-61.

¹⁴⁹ Halliday S. (2003), Rig-and-furrow in Scotland. In: Govan S (ed.) *Medieval or Later Rural Settlement in Scotland: 10 years on. Historic Scotland*, pp.69-81.

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, Soil, 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

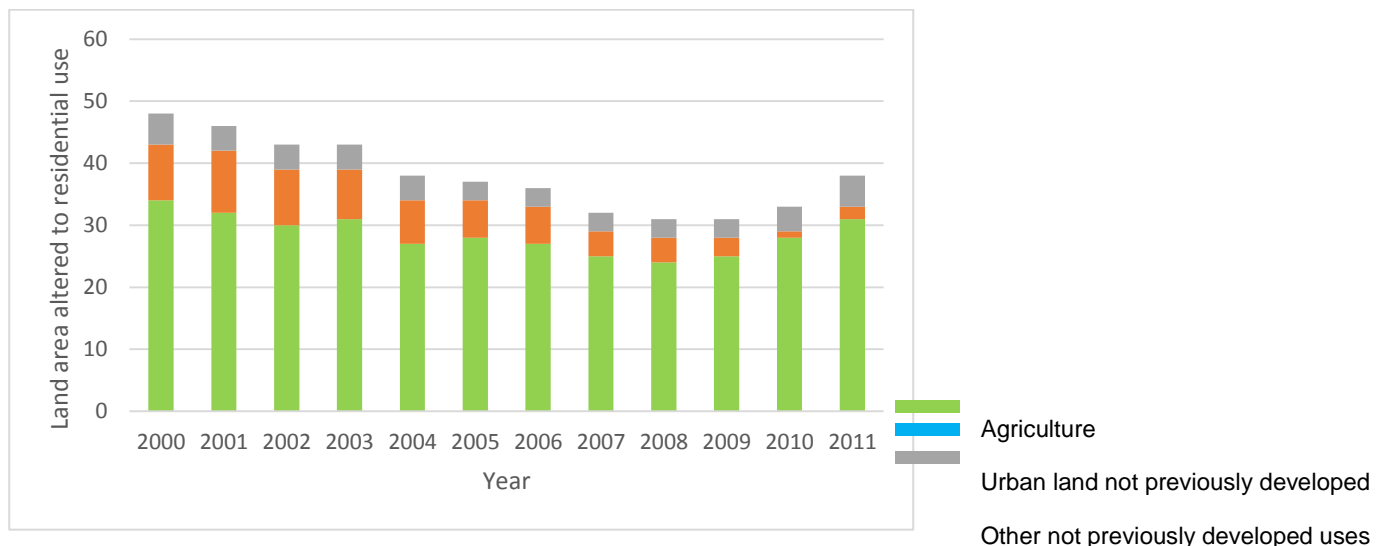
Natural England¹⁵⁰ has identified the following key threats to geology (which are also equally applicable to Scotland and Wales):

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

Land Use and Soils

Figure 4.2 shows the origin and amount of soil lost to development for each year from 1995 to 2011 for England and Wales (for residential use). Overall, the amount of soil lost to development has gradually decreased from nearly 5,800 hectares in 1995 to 2,400 hectares in 2011. There was a noticeable increase in 2003 to over 4,200 hectares. In 2000, 10% of England and Wales was categorised as urban or suburban, predicted to rise to 12% by 2016.

Figure 4.2 Soils Lost to Development (England and Wales)



Source: DCLG. *Live tables on land use change statistics – land use change: residential*. 2013.

<https://www.gov.uk/government/statistical-data-sets/live-tables-on-land-use-change-statistics> [Accessed 28.05.2015]

¹⁵⁰ Natural England. What are the threats to geology?

<http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/threats/default.aspx> [Accessed 28.05.2015]

In 2010, there was an estimated 68,910 hectares of previously developed land in England, up 11% from 61,920 hectares in 2009. An estimated 37,940 hectares of previously developed land were vacant or derelict, 55% of the total. The conversion of previously undeveloped land accounted for an average of 5,188 hectares per annum between 2000 and 2009, although the rate of development on undeveloped land decreased from 7,530 hectares in 2000 to 2,300 hectares in 2009. Of all greenfield land developed in 2009, 51% was for residential uses, 13% for minerals, landfill and defence, 12% for industrial, commercial and related activities, and the remaining 24% for other developed uses including transport and utilities¹⁵¹. Of the 68,910 hectares identified, 27% was currently in use with permission or allocated for redevelopment with a further 18% currently in use with known potential for redevelopment. The remaining 55% was vacant or derelict – 25% consisted of derelict land or building, 23% consisted of previously developed vacant land and 7% consisted of vacant buildings.

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. 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 2007.

The loss of organic matter from soils influences its structure and is linked to erosion and soil compaction, reduced agricultural productivity and soil biota diversity. Surveys in England and Wales as part of a programme for the National Soils Inventory reveal that the loss of organic matter is a serious issue¹⁵² since 1980 there has been an estimated average loss in organic matter 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 land¹⁵³.

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 floodplains¹⁴⁴.

In the 2012 Farm Practices Survey for England¹⁵⁴, 20% of farmers stated that they had experienced soil compaction throughout the soil profile. For the 12 months leading up to

¹⁵¹ Defra. National Land Use Database PDL – Results and Analysis. 2013
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/366838/NLUD_2010_Summary_Headline_Report.doc
 [Accessed 28.05.2015]

¹⁵² Department for Environment, Food and Rural Affairs (2006). Sustainable Farming and Food Strategy – Indicator Data Sheet.
 Headline Indicator H5: Soil Quality – Soil Organic Matter. Department for Food and Rural Affairs

¹⁵³ Defra. Sustainable Farming and Food Strategy – Indicator Data Sheet. Headline Indicator H5: Soil Quality – Soil Organic Matter.
 2006. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69283/pb11649-fiss2006-060411.pdf [Accessed 28.05.2015]

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 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.

Scotland

Geology

No further information has been identified beyond those issues identified in **Section 4.6.2**.

Land Use and Soils

In Scotland, most land is currently being lost to development in the central belt, with development in this area having doubled since the early 1980s and 1990s, though soil sealing in urban areas has not been accurately calculated as gardens, parks and other open spaces have not been accounted for. The total area of agricultural holdings in Scotland was 5.6 million hectares, equating to 73 per cent of Scotland's total land area. Just over half of this comprised rough grazing, with about a quarter taken up by grass, and about ten per cent used for crops or left fallow. The rest consisted of woodland, ponds, yards or other uses. Additionally, almost 0.6 million hectares of land is used for the common grazing of livestock. Amongst the crops grown in Scotland, excluding grass, cereals accounted for 80 per cent of the land area, with nearly three-quarters of that being barley (330,000 hectares). There were also considerable area growing wheat (109,000 hectares), oilseed rape (37,000 hectares) and potatoes (28,500 hectares). Amongst fruit and vegetables, a total of 913 hectares of strawberries were grown, mainly under cover, and was the largest source of income in horticulture.¹⁵⁵

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,

¹⁵⁴ Defra. Farm Practices Survey Autumn 2012 - England. 2012. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/181719/defra-stats-foodfarm-envirom-fps-statsrelease-autumn2012edition-130328.pdf [Accessed 28.05.2015]

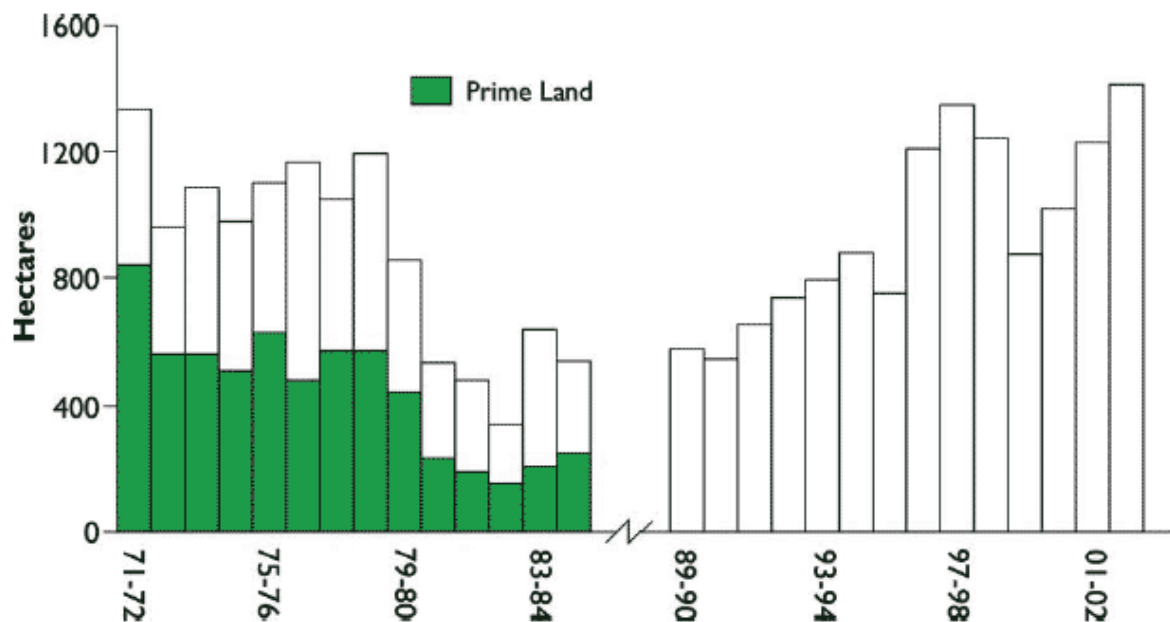
¹⁵⁵ The Scottish Government. Agricultural land use in Scotland. <http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/agritopics/LandUseAll> [Accessed 08.06.2015]

being based on aerial photography interpretation with the last dataset dating to 1988. The principal findings with regard to this section include:

- 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 4.3 indicates the area of agricultural land in Scotland lost to development over the last 30 years, which unlike England and Wales, has been recently increasing.

Figure 4.3 Conversion of Agricultural Land (Scotland)



Source: Towers et al. (2006). <http://www.gov.scot/Publications/2006/09/21115639/11> [Accessed 28.05.2015]

In Scotland, since 2006 there has been a 3% decrease in derelict and urban vacant land, from 11,282 hectares to 10,984 hectares in 2012. Since 2006, an average of 422 hectares of derelict and urban vacant land was brought back into use each year.¹⁵⁶

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

¹⁵⁶The Scottish Government. Scottish Vacant and Derelict Land Survey. 2013. <http://www.scotland.gov.uk/Topics/Statistics/Browse/Planning/Publications/SVDLSTablesCharts> [Accessed 28.05.2015]

agricultural economics, and medium term influences, such as woodland planting and harvesting.

Scotland's Land Use Strategy 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."*

In Scotland, an estimated 27,000 inspections of land with the potential to be contaminated have already been or are in the process of being undertaken (equating to an estimated 40% of all such sites). A total of 807 sites (equivalent to 1,864 hectares) of land that was affected by contamination have been remediated.¹⁵⁷

There is some evidence that soils are becoming slightly less acidic in some areas of Scotland due to reduced acid deposition. Ecological damage to soils caused by run-off from roads and urban areas is likely to increase. Agricultural land is being developed at twice the rate as in the 1990s. This development is likely to have occurred on some of Scotland's versatile and productive soils. There is some evidence that levels of organic matter may be declining.

Studies in Scotland indicate that land-use practices which leave bare soil during the winter months are particularly damaging, especially in lowland sandy/cultivated mineral soils, though single events may be confined to small areas. In the uplands, peat has been shown to be susceptible to erosion which has implications for carbon storage and erosion of any soil has implications for most soil 'functions'.

The Scottish Soil Framework (2009) aims to achieve 13 soil outcomes:

- soil organic matter stock protected and enhanced where appropriate;
- soil erosion reduced and where possible remediated;
- soil structure maintained;
- greenhouse gas emission from soils reduced to optimum balance;
- soil biodiversity, as well as above ground biodiversity, protected;
- soils making a positive contribution to sustainable flood management;
- water quality enhanced through improved soil management;
- soil's productive capacity to produce food, timber and other biomass maintained and enhanced;
- soil contamination reduced;
- reduced pressure on soils by using brownfield sites in preference to greenfield;
- soils with significant historical and cultural features protected;
- knowledge and understanding of soils enhanced, evidence base for policy review and development strengthened; and

¹⁵⁷ Scottish Environment Protection Agency. Dealing with land contamination in Scotland: A review of progress 2000-2008 (2009) <http://www.sepa.org.uk/media/28314/dealing-with-land-contamination-in-scotland.pdf> [Accessed 28.05.2015]

- effective co-ordination of all stakeholders' roles, responsibilities and actions.

Wales

Geology

No further information has been identified beyond those issues identified in **Section 4.6.2**.

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 research.

No baseline data has been identified in relation to previously developed land in Wales and therefore trends could not be established. However, similar to national (UK) trends, it is expected that current trend in land use is generally towards increased development on previously developed land.

In Wales, an estimated 6,500 inspections of land with the potential to be contaminated have been completed between 2000 and 2007.

Included within the Environment Strategy for Wales is the objective to manage soil and to safeguard its ability to support plants and animals, store carbon and provide other important ecosystem services. Changes in soil carbon will be used as an indicator to measure progress of the objective and further indicators are to be selected when the UK Soil Indicator Consortium reports.

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 Geological Disposal NPS proposals are set out in **Table 4.7**, together with reasons for their selection.

Table 4.7 Approach to Assessing the Effects of the Geological Disposal 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.	The SEA Directive 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.

Objective/Guide Question	Reasoning
Will the Geological Disposal NPS have an effect on soil quality/function, variety, extent and/or compaction levels?	Loss of soil quality, variety, extent or an increase in soil compaction will lead to 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 Geological Disposal 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 and Scottish Soil Framework include objectives on reducing/preventing soil pollution and contamination.
Will the Geological Disposal 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 Geological Disposal 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 Geological Disposal NPS affect land stability?	A key challenge is to ensure the correct identification and selection of geological sites, based on a risk assessment of specific geological features.
Will the Geological Disposal NPS change patterns of land use including effects on 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.
Will the Geological Disposal NPS affect induced seismicity?	The potential impacts of the construction of a GDF and deep boreholes on seismicity will need to be considered.

Table 4.8 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the land use, geology and soils objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 4.8 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.

Effect	Description	Illustrative Guidance
-	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.

5. Water Quality

5.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on water quality and water resources. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

Water quality and resources within this context are defined as inland surface freshwater and groundwater resources, and 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 and resources on biodiversity and human health and flood risk.

5.2 Review of Plans and Programmes

International/European

The **Water Framework Directive (WFD) (2000/60/EC)** is the most substantial piece of EC water legislation to date and replaces 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.

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) 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 adopts the 'polluters 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.

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 ***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 establishes 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).

On 27th February 1998, the Commission issued the Urban Waste Water Directive (98/15/EC), which 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. This had the effect of amending Table 2 of Annex I.¹⁵⁸

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. The ***OSPAR Radioactive Substances Strategy (2003)*** aims to prevent pollution of the maritime area covered by the ***OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic)*** from ionising radiation. In particular, the OSPAR objective for 2020 is to reduce discharges to levels where the additional concentrations in the marine environment above historic levels, resulting from such discharges, are close to zero.

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

- **Dangerous Substances Directive 76/464/EEC;**
- **Quality of Shellfish Waters Directive 79/923/EEC;**
- **Directive on Priority Substances 2008/105/EC;**
- **Groundwater Directive 2006/118/EC;**

¹⁵⁸ European Commission. Urban Waste Water Directive. 1991. http://ec.europa.eu/environment/water/water-urbanwaste/legislation/directive_en.htm [Accessed 18.05.2015]

- **Waste Framework Directive 2008/98/EC;**
- **Industrial Emissions Directive 2010/75/EU;**
- **Drinking Water Directive 98/83/EC; and**
- **Integrated Pollution Prevention and Control Directive (2008/1/EC); and**
- **Directive 2013/51/EURATOM laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption.**

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 Department of Energy and Climate Change's (DECC) ***UK Strategy for Radioactive Discharges (2009)*** delivers the UK's obligations under the OSPAR Radioactive

Substances Strategy, in respect of progressive and substantial reductions in radioactive discharges.

England and Wales

Water Quality and Resources

In England, the implementation work related to the WFD is undertaken by the Environment Agency, working in partnership with key partners. 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.

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. It should be noted that an update to the draft river basin management plans was consulted on recently (consultation ended on 10th April 2015)

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 which are designated as 'over-licensed' or 'over-abstracted'. That is, 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).

England

Water Quality and Resources

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 marine plan areas 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) as defined 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. A healthier water environment will also deliver multiple benefits, such as helping to enhance the natural environment generally and adapting to climate change.

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.

It should be noted that a Welsh National Marine Plan (WNMP) that covers Welsh inshore and offshore waters is currently being developed. The Welsh Government is responsible for Marine planning in Wales and it is thought that 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.

Water Quality and Resources

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 7) (2014) 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 will be supported by the Planning (Wales) Bill and Environment (Wales) Bill once they have been given royal assent. The Environment (Wales) Bill will recognise that natural resources, such as water, are amongst the most important assets. The Bill includes features that will ensure that managing these natural resources sustainably will be a core consideration in decision-making.

Scotland

Water Quality and Resources

The ***Water Environment and Water Services (Scotland) Act 2003*** 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 2013/176) 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 (2015)** has recently been adopted by the Scottish Government. The Scottish National Marine Plan (NMP) 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 Scottish Environment Protection Agency's **River Basin Planning Strategy for the Scotland River Basin District (2005)** describes planned actions within three key areas necessary for the development of effective river basin planning, namely: establishing administrative arrangements and working principles to support RBMP production; delivering opportunities for participation and consultation, and integrating and coordinating the RBMP with other plans and planning.

The **River Basin Management Plans for the Solway Tweed River Basin District and Scotland River Basin District (2009)** 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 Executive'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 Executive Scottish Coastal Forum'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.

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.

There are 189 protected areas in UK inshore waters with a marine element, which includes 110 Special Protection Areas (SPAs) with marine habitats for birds¹⁵⁹, 108 Special Areas of Conservation (SACs) with marine habitats or species¹⁶⁰ 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 Greensand. Around 81% of groundwater bodies in England are at risk of failing WFD objectives because of diffuse pollution.

As the majority of data regarding water resources and quality is collected by the Environment Agency (covering both England and Wales) and SEPA, there is little available data on a UK level. For this chapter, the remainder of the baseline is therefore considered by these divisions of administrations.

England

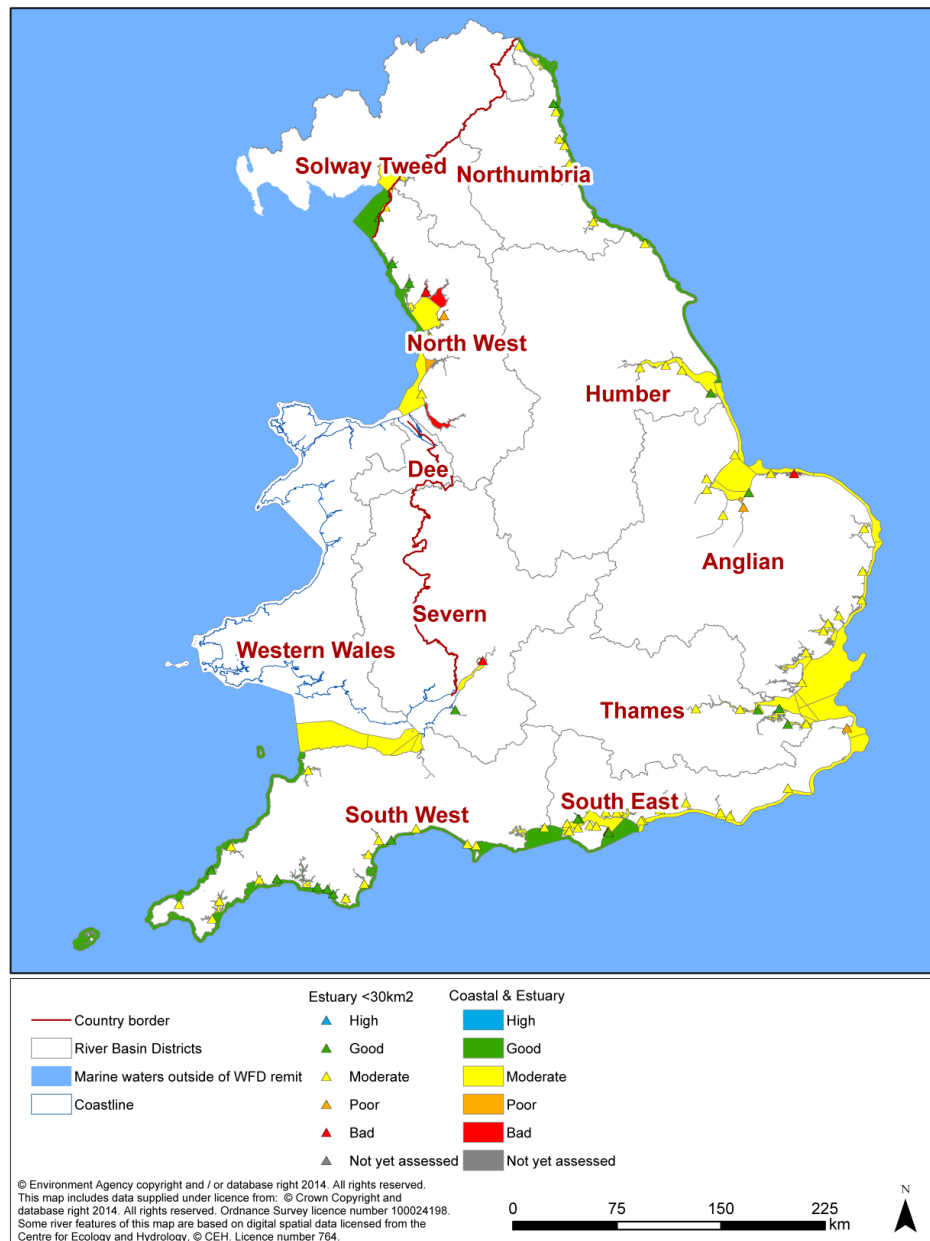
Water Quality

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 5.1**), 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.

¹⁵⁹ Joint Nature Conservation Committee. Spatial and summary data for UK SPAs. 2015. <http://jncc.defra.gov.uk/page-1409> [Accessed 22.05.2015]

¹⁶⁰ Joint Nature Conservation Committee. Spatial / summary data for UK SACs, SCIs and cSACs. 2014. <http://jncc.defra.gov.uk/page-1445> [Accessed 11.06.2015]

Figure 5.1 Ecological Status/Potential of Estuaries and Coastal Waters in England and Wales



Source: *Estuarine and coastal waters national engagement summary*. Environment Agency. 2014. <http://ea.objective.co.uk/file/3078878> [Accessed 22.05.2015]

River water quality in England has been steadily increasing since 1990 and the proportion of rivers at good or high biological quality has shown no significant change between 2009 and 2012. Between 2009 and 2012 the number of assessments classed as high fell from 304 to 253, and the number of assessments classed as bad fell from 189 to 139. The number of assessed rivers that have passed the chemical status criteria has increased from 411 in 2009 to 431 in 2012¹⁶¹.

¹⁶¹ Office for National Statistics. Sustainable Development Indicators. 2014. <http://www.ons.gov.uk/ons/rel/wellbeing/sustainable-development-indicators/july-2014/sustainable-development-indicators.html#tab-Supplementary-Environment--Indicators-26-to-35-> [Accessed 11.06.2015]

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 2000 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. A map which 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?topic=groundwater&layerGroups=default&lang=_e&ep=map&scale=5&x=531453.3095359802&y=179095.4047679901

The Nuclear Sector Plan 2013 Environmental Performance Report (Environment Agency, 2014) highlights that:

- Radioactive discharges to water were 15% higher in 2013 than in 2012.
- Fuel reprocessing produced the highest level of discharges, with an increase of 22% due to increases in discharges of carbon-14. This was because of a significant increase in the amount of Magnox fuel reprocessed in 2013 compared to 2012.
- A dramatic decrease in discharges produced by the fuel fabrication/enrichment sector has occurred from 2006 onwards when Springfields stopped processing uranium ore.
- Since 2007, discharges of radioactivity to water have consistently been less than half the amount discharged in 2000.

Water Resources

Direct abstraction of water from non-tidal surface and groundwater in England and Wales show an increase of 3% on 2012 levels. Total abstractions in 2013 are at the highest levels since 2002 at 14.1 billion cubic metres.¹⁶²

The results from 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.¹⁶³

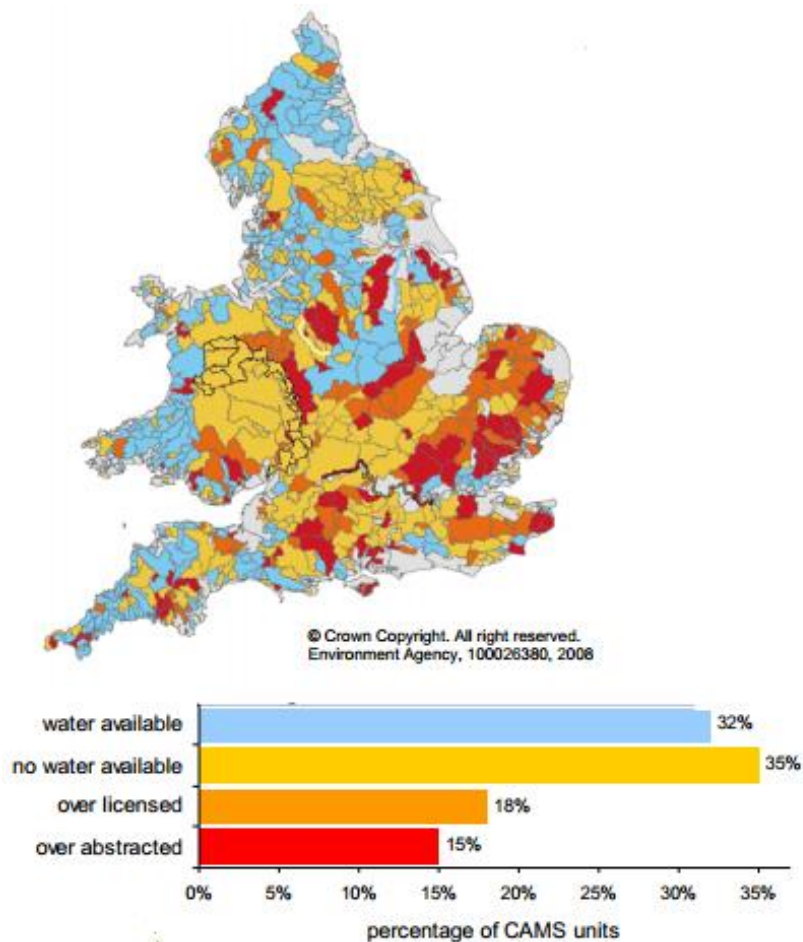
¹⁶² Defra. Water abstraction from non-tidal surface water and groundwater in England and Wales, 200 to 2013.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/422246/Water_Abstractions_release_V1.pdf [Accessed 11.06.2015]

¹⁶³ Defra. Environmental Statistics – Key facts. 2013.

<http://data.defra.gov.uk/env/doc/Environmental%20Statistics%20key%20facts%202012.pdf> [Accessed 18.05.2015]

Figure 5.2 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> [Accessed 22.05.2015]

Overall, water use in the nuclear industry has reduced since 2006. The industry used 4% (600,000m³) less water in 2013 than the previous year. Nearly all subsectors used less, with the defence subsector seeing the greatest saving of 440,000 m³.¹⁶⁴

Bathing Water

In 2014, 80.7% of sites in England were compliant, down from 83.5% in 2013, and they had more stringent standards than previous years. Coastal bathing water quality in England was lower than in other parts of the UK in 2012. Overall, 99.2% of sites met the mandatory standard¹⁶⁵. On a regional level, every region apart from Yorkshire and Wessex achieved 100% compliance, those regions scored 95% and 98% respectively. There was an improvement in compliance compared with 2013 results, from 98.8% to 99.5% complying.

¹⁶⁴ Environment Agency (2014) Nuclear Sector Plan 2013 Environmental Performance Report

¹⁶⁵ Defra. Statistical release 6th November 2014.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/370801/STATS_bathing-water-release-2014v2.pdf [Accessed 18.05.2015]

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 2013.¹⁶⁶ **Figure 5.3** highlights the overall status of surface water in Scotland.

Table 5.1 WFD Classification Results for Water Bodies in Scotland; Percentage of Water Bodies in each Class 2013

Status	High	Good	Moderate	Poor	Bad
Category					
River	6	49	26	16	4
Lochs	18	49	21	10	2
Estuaries	22	65	12	0	0
Coastal Waters	27	68	5	-	-
Groundwater	-	78	-	22	-

Maps and further information are available which show the overall status of surface waters in Scotland and the overall status for groundwater classification for Scotland and Solway Tweed River Basin Districts. The maps can be accessed here:

<http://map.environment.scotland.gov.uk/seweb/map.htm?menutype=0&layers=2>

Water Resources

Between 2002 and 2009, estimated raw water abstractions by Scottish Water decreased by 13% to 2,165 MI/d. Between 2010 and 2013, using improved data and methodology, the volume of raw water abstracted also decreased by 11% to 1,870 MI/d.

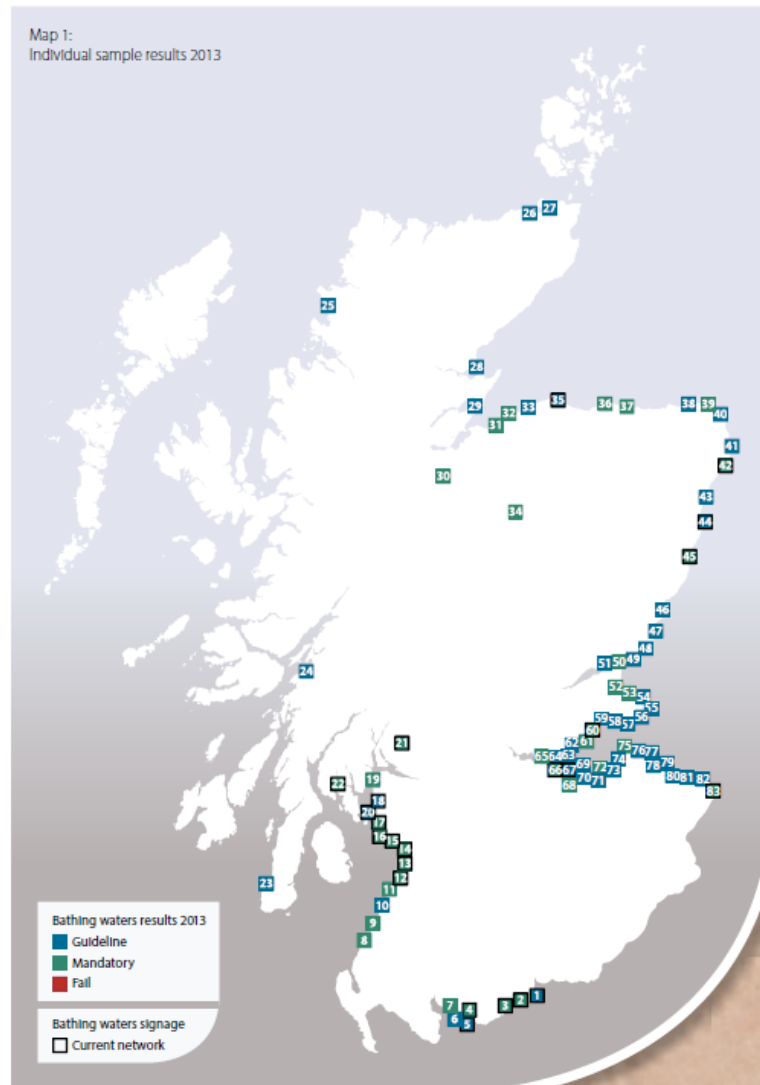
Bathing Water

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

¹⁶⁶ Scottish Environment Protection Agency. Water Ecological Status. 2013.
<http://www.gov.scot/Topics/Environment/Countryside/Landusestrategy/Monitoring/Indicator6> [Accessed 10.06.2015]

stringent guideline standard.¹⁶⁷ **Figure 5.5** shows compliance with the Bathing Water Directive across Scotland for the period 2013 to 2014.

Figure 5.3 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> [Accessed 29.05.2015]

Wales

Water Quality

The percentage of river lengths in Wales of good chemical quality has been consistently above 90% since 1994, and has remained at around 95% for the last three monitored years (2006-08). The percentage of river length in Wales of good biological quality has steadily increased since 2000, peaking at 88% in 2008.¹⁶⁸ In 2012, of the 100 EC-identified bathing waters monitored by Natural Resources Wales, 97% complied with the mandatory

¹⁶⁷ Scottish Environmental Protection Agency. *Scottish Bathing Waters 2013-14*. 2014. <http://www.sepa.org.uk/media/39125/scottish-bathing-waters-report-2013-2014.pdf> [Accessed 29.05.2015]

¹⁶⁸ Welsh Government. *Sustainable Development Indicators for Wales*. 2014. <http://gov.wales/docs/statistics/2014/140821-sustainable-development-indicators-2014-en.pdf> [Accessed 29.05.2015]

standards and 75% passed the tougher guideline standard. Both these figures were down on previous years due to above average rainfall.¹⁶⁹

5.4 Summary of Existing Problems Relevant to the Geological Disposal NPS

The following existing problems for water quality and resources have been identified:

- ▶ There is considerable pressure on water resources in many parts of the UK;
- ▶ 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; and
- ▶ There is a need to ensure that there is sufficient water infrastructure in place to accommodate future growth in the UK.

5.5 Likely Evolution of the Baseline

UK

The current trend in water condition is generally towards increased water quality across natural environments, drinking water and bathing waters. Current climate change predictions indicate 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, increased stress on sensitive hydrological systems and a decrease in dilution potential leading to a failure against water quality targets. Increased flooding and storm events also have the potential to increase runoff of pollutants into controlled waters, thus reducing water quality. Population pressures are predicted to increase in certain parts of Great Britain, for example in the South East. Increased population density will result in an increased pressure on natural resources and could exacerbate current problems or cause new ones.

The Marine and Coastal Access Act 2009 allows for the creation of Marine Conservation Zones (MCZs) in Great Britain (Northern Ireland MCZs will be introduced through separate legislation). MCZs will protect nationally important marine wildlife, habitats, geology and geomorphology. Sites will be selected to protect the range of marine wildlife.¹⁷⁰ This should lead to greater protection and improvement of marine habitats in the future.

In the UK, 98.4% of coastal bathing waters met the mandatory water quality in 2013. This is an increase of 4.7% compared to the previous year. The rate of compliance with the

¹⁶⁹ Environment Agency Wales. Wales Bathing Water Report 2012. 2012. http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/static/documents/EAW_WSR_December_2012.pdf [Accessed 29.05.2015]

¹⁷⁰ Natural England & Joint Nature Conservation Committee. The Marine Conservation Zone Project. 2012. http://jncc.defra.gov.uk/pdf/120718_MCZAP_MCZ%20Project%20Factsheet%20110712.pdf [Accessed 19.05.2015]

guide values increased from 58.8% to 80.5%.¹⁷¹ Under the revised Bathing Water Directive all bathing waters will be required to achieve at least 'sufficient' quality by 2015, which is twice as stringent as the current mandatory standard. The overall quality of bathing waters is therefore likely to increase as water quality is improved to meet the increased standards.¹⁷²

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 runoff 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.

The Environment Agency aims that by 2030, water use per person in England should fall to 130 litres / day, or possibly even 120 litres / day depending on new technological innovation.¹⁷³

The objectives of the RBMPs, required by the WFD and referenced earlier in this section are required to be achieved by 2015. Those objectives are to:

- prevent deterioration, enhance and restore bodies of surface water, achieve good chemical and ecological status of such water and reduce pollution from discharges and emissions of hazardous substances;
- protect, enhance and restore all bodies of groundwater, prevent the pollution and deterioration of groundwater, and ensure a balance between groundwater abstraction and replenishment; and
- preserve protected areas.

Defra aims that by 2030, at the latest, England has improved the quality of our water environment and the ecology which it supports, and continues 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.

¹⁷¹ European Environment Agency. United Kingdom 2013 Bathing Water Results. 2014. <http://www.eea.europa.eu/themes/water/status-and-monitoring/state-of-bathing-water/country-reports-2013-bathing-season/united-kingdom-2013-bathing-water-report/view> [Accessed 29.05.2015.]

¹⁷² European Commission. Bathing Water Quality. 2015. http://ec.europa.eu/environment/water/water-bathing/index_en.html [Accessed 29.05.2015]

¹⁷³ Defra. Future Water - The Government's Water Strategy for England. 2008 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69346/pb13562-future-water-080204.pdf [Accessed 29.05.2015]

The Environment Agency aims to enhance water supply by up to 1,100MI/d above present levels by the improvement of existing schemes and the development of some new resources.¹⁷⁴

Since a new assessment framework was introduced in 2009, there has been no real change 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%.

Scotland

Table 5.2 demonstrates that the overall percentage of water bodies in Scotland which were at good or high status between 2007 and 2013 was broadly similar for all water categories. In most cases the risks to water quality are steady or declining, the exception being estuaries.

Table 5.2 WFD Classification Results for Water Bodies in Scotland; Percentage of Water Bodies in each Class for 2007 and 2013

Status	High	Good	Moderate	Poor	Bad
Category					
River (2007 Classification)	8	40	31	16	5
River (2013 Classification)	6	49	26	16	4
Lochs (2007 Classification)	26	35	15	22	2
Lochs (2013 Classification)	18	49	21	10	2
Estuaries (2007 Classification)	28	16	44	4	8
Estuaries (2013 Classification)	22	65	12	0	0
Coastal Waters (2007 Classification)	57	34	9	0	0
Coastal	27	68	5	0	0

¹⁷⁴Environment Agency. Water for people and the environment – Water resources strategy for England and Wales. 2009. <http://webarchive.nationalarchives.gov.uk/20140328084622/http://publications.environment-agency.gov.uk/pdf/GEHO0309BPKX-E-E.pdf> [Accessed 29.05.2015]

Status	High	Good	Moderate	Poor	Bad
Category					
Waters (2013 Classification)					
Groundwater (2007 Classification)	-	76	-	24	0
Groundwater (2013 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 increasing.¹⁷⁵

The Scotland river basin district objective is to improve water quality such that 98% of surface water bodies and 94% of ground water bodies will be of good or better condition by 2027.¹⁷⁶ By 2027, the objective for the Solway Tweed river basin district is for 92% of surface water bodies and 93% of groundwater bodies to be of good or better quality.¹⁷⁷

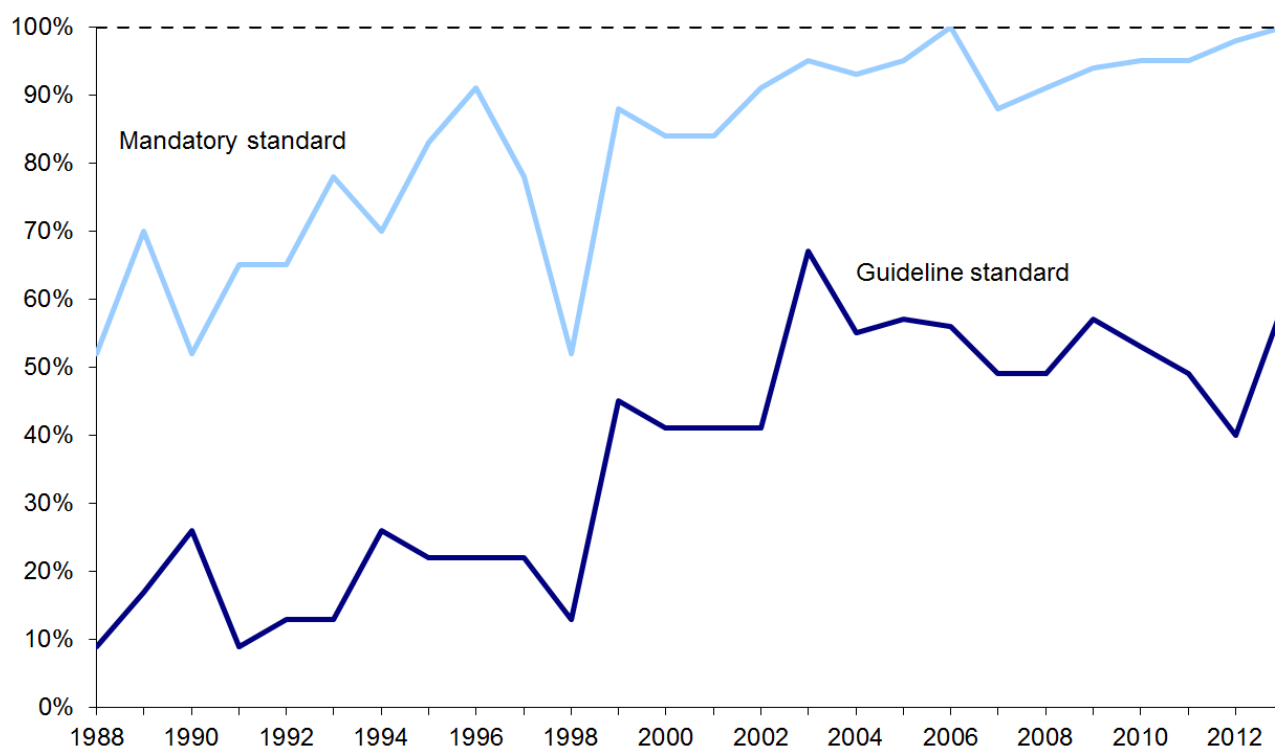
As illustrated in **Figure 5.4**, the quality of bathing water has been improving since 1988. However, the results from recent years suggest that there are still challenges to ensure full compliance with the standards set out in the Bathing Waters Directive. Higher rainfall in summer and more intensive rainfall, as expected in most climate change projections, would be likely to pose significant hurdles to achieve full compliance with the standards.

¹⁷⁵ Scottish Environmental Protection Agency. State of the environment and trends – Scotland – Water. 2013. <http://www.seguidance.org.uk/11/State-of-the-Environment.aspx> [Accessed 29.05.2015]

¹⁷⁶ Scottish Government. The river basin management plan for the Scotland river basin district 2009–2015 – Summary. 2014. http://www.sepa.org.uk/media/37752/scotland_rbmp_summary.pdf [Accessed 29.05.2015]

¹⁷⁷ Scottish Government and Environment Agency. The river basin management plan for the Solway Tweed river basin district 2009–2015 – overview. 2014. http://www.sepa.org.uk/media/37544/rbmp_solwaytweed_overview.pdf [Accessed 29.05.2015]

Figure 5.4 Percentage Compliance of Coastal Waters with the EC Bathing Water Directive 1988- 2013



Source: Scottish Government. *Key Environmental Statistics 2014*. 2014.
<http://www.gov.scot/Resource/0045/00458333.pdf> [Accessed 19.05.2015]

Wales

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. Water companies in Wales expect to increase the overall number of properties that are metered to about 80%, in line with UK trends.

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.

Through the Water Framework Directive objectives, The Environment Agency and Natural Resources Wales aim to develop a single integrated approach which will prevent deterioration in status of water bodies from their current reported status, achieve the objectives for protected areas set by the relative directive under which they were designated and aim to achieve good overall status for surface and ground waters where they are technically feasible and not disproportionately costly.

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 Geological Disposal NPS proposals are set out in **Table 5.3**, together with reasons for their selection.

Table 5.3 Approach to Assessing the Effects of the Geological Disposal NPS Proposals on Water Quality

Objective/Guide Question	Reasoning
Objective: To maximise water efficiency, protect and enhance water quality and help achieve the objectives of the Water Framework Directive.	The SEA Directive 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.
Will the Geological Disposal NPS affect demand for water resources?	The Water Framework Directive 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 abstraction above a sustainable level which could result in water shortages in some areas in the future.
Will the Geological Disposal NPS affect the amount of waste water and surface runoff produced?	Surface runoff and waste water may affect water quality if it reaches water receptors. The Water Framework Directive (England and Wales), 2003 requires all inland, coastal and groundwater to reach a 'good' chemical and ecological status by 2015. Under Water Environment (Controlled Activities) (Scotland) Regulations (2011) authorisation is required for discharges to water.
Will the Geological Disposal NPS protect and enhance the quality of surface, groundwater, estuarine and coastal water quality?	The Water Framework Directive requires all inland, coastal and groundwater to reach a 'good' chemical and ecological status by 2015. 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.

Table 5.4 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the population objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 5.4 Illustrative Guidance for the Assessment of Significance for Water Quality

Effect	Description	Illustrative Guidance
++	Significant Positive	<ul style="list-style-type: none"> 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 significantly decrease the amount of waste water, surface runoff and pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking receptors) would be significantly improved and sustained and water targets (including those relevant to chemical and ecological condition) reached and exceeded.
+	Positive	<ul style="list-style-type: none"> 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 minor decreases in the amount of waste water, surface runoff and/or pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking receptors) may be improved to some level temporarily and some water targets (including those relevant to chemical and ecological condition) would be reached/exceeded.
0	Neutral	<ul style="list-style-type: none"> Option would not significantly affect water demand and abstraction levels would not be altered; Option would not change the amount of waste water, surface runoff and/or pollutant discharges such that the quality of water receptors would not be affected.
-	Negative	<ul style="list-style-type: none"> 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 minor increases in the amount of waste water, surface runoff and/or pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking 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.
--	Significant Negative	<ul style="list-style-type: none"> 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

Effect	Description	Illustrative Guidance
		<p>abstraction is significantly beyond sustainable levels;</p> <ul style="list-style-type: none"> Option would lead to an exceedance of an abstraction license limit; Option would lead to major increases in the amount of waste water, surface runoff and/or pollutant discharges so that the quality of water receptors (including groundwater, surface water, sea water or drinking receptors) would be considerably increased and some or all water targets (including those relevant to chemical and ecological condition) would not be achieved.
?	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.

6. Flood Risk and Coastal Change

6.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on flood risk and coastal change. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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 and climatic factors.

6.2 Review of Plans and Programmes

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 Flood 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.

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 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*** seeks to implement the Marine Strategy Framework Directive (2008) which requires Member States to co-ordinate activities in the marine regions. 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). 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 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 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 marine plan areas 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 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***¹⁷⁸ 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.

To complement the above Strategy, 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 been collated. ***Surface Water Management Plans*** are being developed across England (and Wales), with accompanying technical guidance¹⁷⁹.

¹⁷⁸ Environment Agency. National flood and coastal erosion risk management strategy for England. 2011.

<https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england> [Accessed 29.05.2015]

¹⁷⁹ Defra. Surface Water Management Plan Technical Guidance. 2010.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69342/pb13546-swmp-guidance-100319.pdf [Accessed 29.05.2015]

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 on flood risk published alongside the NPPF sets out how this policy should be implemented, including the Planning Practice Guidance. 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.

Wales

Chapter 13: Minimising and managing environmental risks and pollution of Planning Policy Wales (Edition 7) (2014) 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 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.

The Environment (Wales) Bill will, amongst other items, establish a Flood and Coastal Erosion Committee. This will remove any conflicts in existing legislation so that a wider, advisory role is provided. This will include providing advice on the wider risks and benefits of flood and coastal erosion risk management in Wales across all sources of flooding.

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 guidance.¹⁸⁰

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)*** has recently been adopted by the Scottish Government. The Scottish National Marine Plan (NMP) 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 Scottish Executive Scottish Coastal Forum'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.

The key aims of ***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, SPP 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

¹⁸⁰ The Scottish Government. Surface Water Management Planning Guidance. 2013. <http://www.scotland.gov.uk/Publications/2013/02/7909> [Accessed 29.05.2015]

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.

6.3 Overview of the Baseline

UK

Coastal erosion is occurring along 17% of the UK coastline.¹⁸¹ 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 UK.¹⁸²

England

Flooding is associated with a range of sources: river, coastal, surface water, sewer, groundwater and reservoir.¹⁸³ In 2009, an estimated 2.7 million properties in England and Wales were in areas deemed to be at risk of flooding. Of these, some 580,000 were where the risk of flooding was greater than a 1 in 75 chance in any year ('risk' is the likelihood of flooding occurring given existing flood defences - not the extent to which flooding may cause damage).¹⁸⁴

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, 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 flooding.¹⁸⁵

Coastal erosion is occurring along 30% of England's coastline.¹⁸⁶ 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, South West and East Midland's coastlines whilst 27% and 18% of the North East

¹⁸¹ Marine Climate Change Partnerships, coastal erosion

<http://www.mccip.org.uk/annual-report-card/2007-2008/marineenvironment/coastal-erosion.aspx>

¹⁸² Marine Climate Change Partnerships, sea level, <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/sealevel.aspx>

¹⁸³ Environment Agency. Sources of flooding. <http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/homeandleisure/floods/31652.aspx> [Accessed 29.05.2015]

¹⁸⁴ Defra. Measuring Progress - Sustainable Development Indicators 2010. 2010.

http://webarchive.nationalarchives.gov.uk/20140827110041/http://sd.defra.gov.uk/documents/SDI2010_001.pdf [Accessed 29.05.2015]

¹⁸⁵ Environment Agency. Flooding in England: A National Assessment of Flood Risk. 2009.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292928/geho0609bqds-e-e.pdf [Accessed 18.05.2015]

¹⁸⁶ Marine Climate Change Impact Partnerships. Coastal erosion and coastal geomorphology. 2015. <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/coastal-erosion.aspx> [Accessed 29.05.2015]

and North West coastlines respectively are eroding. The East Midlands has the smallest proportion of coastal length which is eroding at 9% or 21km.¹⁸⁷

Scotland

In Scotland, an estimated 99,000 properties (around 3.9% of all properties) lie in areas at high to medium risk of flooding (i.e. areas where the risk of flooding is greater than a 1 in 200 annual probability) with 26,000 at risk from the sea and 73,000 at risk from rivers.¹⁸⁸ SEPA has mapped a strategic national overview of flood risk in Scotland from rivers and the sea.¹⁸⁹ Coastal erosion is occurring along 12% of Scotland's coastline.¹⁹⁰

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 risk.¹⁹¹

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. Although Cardiff is well defended, if these defences were to be overtopped then the consequences could be severe. 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 Newport.¹⁹² Coastal erosion is occurring along 23% of Wales' coastline.¹⁹³

6.4 Summary of Existing Problems Relevant to the Geological Disposal 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;
- The Flood Directive (2007/60/EC) was transposed into law in England, Wales and Scotland in the form of the Flood and Water Management Act 2010 (England & Wales) and the Flood Risk Management (Scotland) Act 2009. The

¹⁸⁷ Marine Climate Change Impact Partnerships. Impacts of climate change on coastal erosion. 2013. http://www.mccip.org.uk/media/1256/2013arc_sciencereview_09_ce_final.pdf [Accessed 29.05.2015]

¹⁸⁸ The Scottish Government. Responsibilities for managing flood risk in Scotland.2007. <http://www.scotland.gov.uk/Resource/Doc/921/0052798.doc> [Accessed 29.05.2015]

¹⁸⁹ Scottish Environment Protection Agency. Flood Maps. 2015. <http://map.sepa.org.uk/floodmap/map.htm> [Accessed 29.05.2015]

¹⁹⁰ Marine Climate Change Impact Partnerships. Coastal erosion and coastal geomorphology. 2015. <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/coastal-erosion.aspx> [Accessed 29.05.2015]

¹⁹¹ Natural Resources Wales. Flood and Coastal Erosion Risk Management in Wales, 2011-2014. 2014. <http://naturalresources.wales/media/1039/flood-and-coastal-erosion-risk-management-in-wales-2011-2014.pdf> [Accessed 19.05.2015]

¹⁹² Environment Agency Wales. Flooding in Wales: A National Assessment of Flood Risk. 2009. [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) [Accessed 19.05.2015]

¹⁹³ Marine Climate Change Impact Partnerships. Coastal erosion and coastal geomorphology. 2015. <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/coastal-erosion.aspx> [Accessed 29.05.2015]

Directive requires the production of flood hazard maps and flood management plans;

- The Environment Agency has completed Catchment Flood Management Plans (CFMPs) in England and Wales. At the local authority level, Strategic Flood Risk Assessments are being completed;
- 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; and
- 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).

6.5 Likely Evolution of the Baseline

UK

Climate change is likely to exacerbate erosion and coastal flooding as a result of sea level rise together with the potential increase in the intensity, severity and frequency of coastal storms 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 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 emissions.¹⁹⁴

England and Wales

The total number of properties in England and Wales at risk of flooding rose by 23% between 2004 and 2009. However, with improvements to data collection methodology; revisions to modelling techniques; and reduced flood risks resulting from flood management works, year on year changes should be interpreted with caution.

In England and Wales, forecasts suggest that there will be considerable variation in erosion rates, both between and within regions. Many areas will experience little or no erosion of shorelines while others experience erosion of several hundred metres. Future erosion will be consistently severe on the east coast and major estuaries such as the Severn, Thames and Humber. As the erosion rates will (to first order) depend on the climate, although the national value of built assets directly at risk from coastal erosion is substantially lower than those at risk from coastal flooding, coastal flood risk is itself heavily influenced by the rate of coastal change.¹⁹⁵

Almost two-thirds of the intertidal profiles in England and Wales have steepened over the past hundred years, a process which is particularly prevalent on coasts protected by hard engineering structures (this represents 46% of England's coastline; 28% of Wales; and 7% Scotland). Both coastal erosion and steepening of intertidal profiles effects are expected to increase in the future due to the effects of climate change, especially sea-level rise and changes to the wave conditions.¹⁹⁶

The Environment Agency estimates that 700 properties could be lost to coastal erosion over the next 20 years, and about 2,000 could be lost in the next 50 years. These estimates take into account the interventions proposed in SMPs. Without the interventions, these figures could increase to about 5,000 properties within 20 years and about 28,000 in 50 years.¹⁹⁷

Scotland

Until recent years, the risk posed by coastal flooding has attracted less attention in Scotland compared to other parts of the UK. In part this was because it was thought to be relatively low risk and unlikely to generate significant economic losses. As a result records of coastal change and flood risk are less well established in Scotland than England and Wales. However, as the frequency and severity of coastal flooding appears to be increasing, risks associated with coastal flooding are beginning to attract similar levels of interest as river based and pluvial flooding in cities. For example, Scottish Natural

¹⁹⁴ UK Climate projections. Maps and key findings. <http://ukclimateprojections.defra.gov.uk/21708#key> [Accessed 28.05.2015]

¹⁹⁵ Government Office for Science (2004) Future of flood and coastal defence <https://www.gov.uk/government/collections/flood-and-coastal-defence>

¹⁹⁶ Marine Climate Change Impact Partnerships. Coastal erosion and coastal geomorphology. 2015. <http://www.mccip.org.uk/annual-report-card/2007-2008/marine-environment/coastal-erosion.aspx> [Accessed 29.05.2015]

¹⁹⁷ Environment Agency (2014) Managing flood and coastal erosion risks in England, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/356341/S18_report_2013_14_Final_v2.pdf

Heritage is undertaking various research projects into coastal climate change, many of which will consider relative sea-level rise and its impacts.¹⁹⁸

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 increase.¹⁹⁹

As noted in **Section 6.2** above, 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.

6.6 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 Geological Disposal NPS proposals are set out in **Table 6.1**, together with reasons for their selection.

Table 6.1 Approach to Assessing the Effects of the Geological Disposal 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 requires that the likely significant effects on the environment, which includes their integration in the interests of promoting sustainable development, should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.
Will the Geological Disposal 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 environmental and planning policy seeks to ensure that new development does not exacerbate risks.

¹⁹⁸ See <http://www.snh.gov.uk/about-scotlands-nature/rocks-soils-and-landforms/coasts/climate-change/>

¹⁹⁹ SNIFFER (2008)

<http://www.sniffer.org.uk/Webcontrol/Secure/ClientSpecific/ResourceManagement/UploadedFiles/FRM10%20final%20030908%20with%20security.pdf>

Objective/Guide Question	Reasoning
Will the Geological Disposal 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.

Table 6.2 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the flood risk and coastal change objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 6.2 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 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.

Effect	Description	Illustrative Guidance
?	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.

7. Air

7.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on air quality. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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.

7.2 Review of Plans and Programmes

International/European

The ***Air Quality Framework Directive (96/62/EC)*** and its Daughter Directives set a framework for monitoring and reporting levels of air pollutants across European Union (EU) Member States, setting limits or reductions for certain air pollutants.

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 made law 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 sets 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)).

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.

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 includes a new ***Clean Air Programme for Europe (2013)***, which sets 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 ***EU Thematic Strategy on Air Quality (2005)*** identifies that despite significant improvements in air quality across the EU, a number of serious air quality issues still persist. The Strategy promotes an approach which focuses upon the most serious pollutants and integrates environmental concerns into other policies and programmes. The objective of the Strategy is to attain levels of air quality that do not give rise to significant negative impacts on, and risks to, human health and the environment. The Strategy emphasises the need for a shift towards less polluting modes of transport and the better use of natural resources to help reduce harmful emissions.

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 ***National Emissions Ceilings Directive (2001/81/EC)*** came into force in 2001, and Member States were required to transpose it into their national legislation by November 2002. This Directive sets 'ceilings' (maximum values to be achieved by 2010) for total national emissions of four pollutants: sulphur dioxide; oxides of nitrogen; volatile organic compounds; and ammonia. These four pollutants contribute to acidification, eutrophication, and formation of ground level ozone.

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) and transpose 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, PM₁₀, sulphur dioxide and PM₂₅.

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.

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 Quality 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 regard 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.

Air Quality and Land Use Planning (2004) outlines some of the main ways in which land use planning can help deliver air quality objectives. It builds on the detailed advice contained in the relevant NPPGs/SPPs and PAN51, but is not intended to serve as a replacement for them. If the planning system is to continue to improving air quality, then the links between air quality and land use planning need to be understood.

Wales

Planning Policy Wales (Edition 7) (2014) 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.

Following royal assent, the ***Environment (Wales) Bill*** will support the ***Well-being of Future Generations (Wales) Act 2015*** the latter including indicators relating to air quality.

7.3 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 and the 1979 United Nations Economic Commission for Europe (UNECE) Geneva Convention on Long Range Transboundary Air Pollution (Geneva Convention). The Geneva Convention agreed a number of protocols including the Gothenburg Protocol (amended in May 2012, and partially in force). The UNECE Gothenburg Protocol now sets national emission reduction targets, including for fine particulate matter, to be achieved by 2020. The UK meets European air quality standards for nearly all pollutants. The main challenge is in meeting nitrogen dioxide limits alongside roads in cities and towns. The EU Directives include: the Ambient Air Quality Directive (2008/50/EC) and Directive 2004/107/EC which sets limits for concentrations of pollutants in outdoor air for the protection of health and ecosystems; and the EU National Emissions Ceilings Directive (2001/81/EC), which sets limits on total annual emissions of important air pollutants for all member states to help reduce 'transboundary air pollution'.

Air quality in the UK is generally good. In 2014 urban background particulate levels averaged 17 micrograms per cubic metre ($\mu\text{g m}^3$) (Air Quality Strategy Objective and EU Limit Value is $40\mu\text{g m}^3$); roadside particulate levels averaged $19\mu\text{g m}^3$; urban background ozone levels averaged $61\mu\text{g m}^3$; and rural ozone levels averaged $70\mu\text{g m}^3$.²⁰⁰

The annual per capita radiation dose to people in the UK from nuclear power station atmospheric discharges was $0.11\mu\text{Sv}$. In the UK between 1985 and 2005 radioactive emissions to air fell by 83%. The Nuclear Sector Plan 2013 Environmental Report (Environment Agency, 2014) highlights that discharges to air have continued to fall since 2005. Whilst discharges increased by 9% in 2013 compared to 2012, they were still very low compared with 2005 levels.

In 2010, 234 Local Authorities in the UK (58% of all UK authorities) had declared Air Quality Management Areas (AQMAs), 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 air.²⁰¹ AQMAs are predominantly in urban areas along busy and congested road networks and are generally related to nitrogen dioxide (NO₂) (in 93% of cases) and particulates (PM₁₀) (in 33% of cases). Transport is identified as the main source of pollution in 92% of all AQMAs.

²⁰⁰ Defra. National Statistics Release: Air quality statistics in the UK, 1987 to 2014. 2015.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/423353/National_Statistic_on_Air_Quality_2014.pdf [Accessed 11.06.2015]

²⁰¹ Defra. Review of local air quality management. 2009.

<http://webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/environment/quality/air/airquality/local/documents/laqm-report.pdf> [Accessed 11.06.2015]

In 1990 UK emissions of Nitrogen Oxide (NO_x) (as NO₂) were 2.7 Mt. These have reduced to 1.1 Mt in 2011, largely 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 abatement.²⁰²

In the UK 26 days of moderate or high air pollution were recorded in urban areas, and 45 days of moderate or high air pollution were recorded in rural areas respectively in 2008.

England

England is divided into 31 zones and agglomerations for ambient air quality reporting. In 2013, all zones and agglomerations complied with the limit values for 1-hour mean and 24-hour mean SO₂ concentration. One area (Greater London Urban Area) had locations which failed the short term limit for NO₂. Only in two areas of England (Blackpool Urban Area and Preston Urban Area) did all the measurement locations in the area meet the annual limit for NO₂. All areas in England complied with the annual limit for PM₁₀. All zones and agglomerations complied with the short term limit or PM₁₀.²⁰³

There were 222 local authorities in England with Air Quality Management Areas (AQMA), 33 of which were within London. Most AQMAs 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 AQMAs declared for NO₂; only a few have been declared as a result of other sources, such as industrial or domestic emissions.

Scotland

The Scottish Air Quality Database contains monitoring data for a total of 91 sites. The data captured by these monitoring stations in 2013 suggests that air quality is generally good in Scotland, save for some urban locations.²⁰⁴

Four sites exceeded the Air Quality Strategy (AQS) objective of not more than 18 exceedences of 200 µg m⁻³ for the hourly mean for NO₂. A further 15 sites exceeded the AQS objective for NO₂ mean (40 µg m⁻³). Similarly, 17 sites failed to reach the annual objective for PM₁₀ and two failed to reach the daily objective. None of the sites failed to meet the AQS objective for number of exceedences of the 15 minute mean for SO₂.

By the end of 2013, there were a total of 34 AQMAs in 13 local authorities in Scotland.

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.

²⁰² Defra - AQPI Summary Report: Emissions of Air Quality Pollutants – 1970-2011.

²⁰³ Defra. Air Pollution in the UK 2013. 2014. http://uk-air.defra.gov.uk/assets/documents/annualreport/air_pollution_uk_2013_issue_1.pdf [Accessed 29.05.2015]

²⁰⁴ Scottish Government. Scottish Air Quality Database Annual Report 2013. 2014. http://www.scottishairquality.co.uk/assets/documents/technical%20reports/SAQD-annual_report_2013-Issue_1.pdf [Accessed 29.05/2015]

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. The main cause of pollution in rural areas is the variation in ozone levels, which is affected by the weather. Five Welsh monitoring sites (Neath Cymra Road, Caerphilly Hafodyrynys, Newport M4 junction 25, Rhondda Pontypridd Gelliwastad Road and Swansea Hafod) exceeded the annual mean objective of 40 µg m⁻³ for NO₂. Of these, one (Caerphilly Hafodyrynys) also exceeded the AQS objective for hourly mean NO₂ concentration on more than the permitted 18 occasions in 2013. Eight sites 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. These were: Aston Hill, Cwmbran, Marchlyn Mawr, Swansea Cwm Level Park, Swansea Hafod DOAS, Swansea St Thomas DOAS and Vale of Glamorgan Fonmon. No monitoring sites in Wales exceeded the EU target values for arsenic, cadmium or benzo(a)pyrene. However, one site (Pontardawe Tawe Terrace), which is in an industrial area, exceeded the EU target value for nickel in 2013.²⁰⁵

As of 2012, there were 34 AQMAs in Wales.²⁰⁶ There are 26,353 people living in AQMAs in Wales. This represents 0.9% of the total population of Wales.

7.4 Summary of Existing Problems Relevant to the Geological Disposal 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; and
- 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 nitrogen.²⁰⁷

7.5 Likely Evolution of the Baseline

UK

The emissions of ammonia were 307kt in 2005 and 284kt in 2010. Emissions are projected to decrease in the middle of the next decade and return to 284kt in 2020 a decline since 2005 of 8%. Emissions are projected to increase thereafter to 294kt in 2030. Emissions of nitrogen oxides were 1580kt in 2005. Emissions in 2010 were 1106 kt. Emissions are

²⁰⁵ Welsh Assembly Government & Welsh Air Quality Forum. Air pollution in Wales 2009. 2010. http://www.welshairquality.co.uk/documents/reports/471141002_AQ_wales_2013_Final_in_English.pdf [Accessed 29.05.2015]

²⁰⁶ Welsh Government. State of the Environment Report. 2012. <http://wales.gov.uk/docs/statistics/2012/120725stateofenvironment12en.pdf> [Accessed 29.05.2015]

²⁰⁷ Joint Nature Conservation Committee. Air Pollution Bulletin. 2014 http://jncc.defra.gov.uk/pdf/Air_pollution_bulletin2_2014.pdf [Accessed 29.05.2015]

projected to decrease to 708kt in 2020 a decline of 55%. Emissions are projected to decline further to 589kt in 2030.²⁰⁸

The emissions of PM₁₀ (particles with aerodynamic diameters below 10µm) are predicted to decline from 135kt in 2005 and 114kt in 2010 to 106kt in 2020 a decline of 22%. Emissions will then increase slightly to 108kt in 2030. Emissions of particles with aerodynamic diameters below 2.5µm were 81kt in 2005 and 67kt in 2010. They are predicted to decline to 57kt in 2020 a reduction since 2005 of 30%. Emissions are projected to increase slightly thereafter to 59kt in 2030.

The emissions of sulphur dioxide were 706kt in 2005 and 406kt in 2010. Emissions are projected to decrease to 287kt in 2020 a decline of 59% from 2005. Emissions are projected to decline further to 242kt in 2030. Emissions of non-methane volatile organic compounds (NMVOC) were 1080kt in 2005. Emissions in 2010 were 789 kt. Emissions are projected to decrease to 705kt in 2020 a decline of 35% from 2005. Emissions are projected to increase towards 2030 reaching 725kt.

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 baseline.²⁰⁹

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. By 2015, 1,331km of main urban road is predicted to be in exceedance of the annual mean objective of 40µg m⁻³, this is an 80.2% decrease compared to the 2003 baseline.

Scotland

There is a downward trend in air pollution in Scotland in recent years. For instance.²¹⁰

- Scotland's NO_x emissions have declined by 65% since 1990 and currently account for 10% of the UK total.
- Power generation is a very significant source of NO_x emissions, accounting for 25% of the Scotland total in 2011; although emissions from this source have reduced by 71% since 1990.
- Scotland's PM₁₀ emissions have declined by 58% since 1990 and account for 11% of the UK total.
- 17% of PM₁₀ emissions in Scotland come from transport sources (down by 32% since 1990), whilst 38% stem from commercial, domestic and agricultural

²⁰⁸ National Atmospheric Emissions Inventory. UK Emission Projections of Air Quality Pollutants to 2030. 2012. http://uk-air.defra.gov.uk/assets/documents/reports/cat07/1211071420_UEP43_%282009%29_Projections_Final.pdf [Accessed 11.06.2015]

²⁰⁹ Defra. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Volume 2. 2007. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69337/pb12670-air-quality-strategy-vol2-070712.pdf [Accessed 29.05.2015]

²¹⁰ Scottish Government. Scottish Air Quality Database Annual Report 2013. 2014. http://www.scottishairquality.co.uk/assets/documents/technical%20reports/SAQD-annual_report_2013-Issue_1.pdf [Accessed 29/05/2015]

combustion (down by 52% since 1990, mostly due to a decline in coal and solid fuels).

- Emissions from power generation were 25% of the Scotland total emission in 1990, but have been reduced to 8% of the Scotland total in 2011.

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.

7.6 Assessing Significance

The objectives and guide questions related to air quality which have been identified for use in the appraisal of the effects of Geological Disposal 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 Geological Disposal NPS on Air

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.	The SEA Directive 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.
Will the Geological Disposal NPS affect air quality?	The Ambient Air Quality and Cleaner Air for Europe Directives aim 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.
Will the Geological Disposal 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 7.2 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the air quality objective. It should not be

viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 7.2 Illustrative Guidance for the Assessment of Significance for Air

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.
-	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 increase 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.

8. Noise

8.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on noise. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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.

8.2 Review of Plans and Programmes

International

The World Health Organisation (WHO) document ***Guidelines for Community Noise 1999*** makes recognition that in comparison to many other environmental problems, noise pollution levels continue to increase, coupled with an increasing number of complaints from affected individuals. It 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, WHO 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 ***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 ***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), addresses 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**.

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) / IoA document **Guidelines for Noise Impact Assessment (Draft)** was published on 6th October 2014. The guidelines are applicable to noise impact assessment for any scale of development proposal.

The British Standards Institution (BSI) document **BS 8233: 1999; 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)** 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. **Planning Practice Guidance: Noise (2014)** advises on how planning can manage potential noise impacts in new development.

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 (SI 2006/2238), 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:

- Edinburgh Agglomeration;
- Glasgow Agglomeration;
- Dundee Agglomeration;
- Aberdeen Agglomeration;
- Transportation;
- Aberdeen Airport;
- Edinburgh Airport; and
- Glasgow Airport.

Policies in ***Scottish Planning Policy (SPP) (2014)*** stress the role of noise impact assessments in developments where noise is likely to be considerable, and emphasise 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 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: Chapter 13 – Minimising and Managing Environmental Risks and Pollution (July 2014) 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.

8.3 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)** has two principle objectives:

- 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
- To 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.

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’).

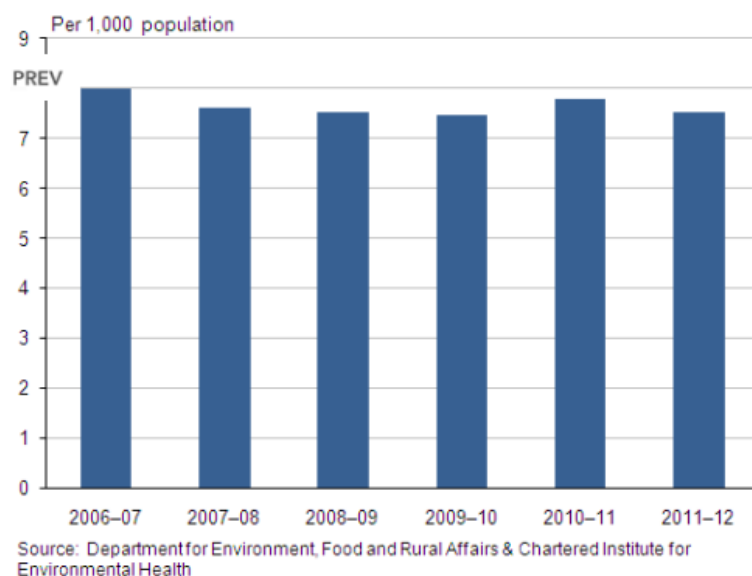
Between 2000 and 2012 there was a decrease of between 10% and 16% (depending on the noise source) in the proportion of people surveyed who felt that they were not at all adversely affected by the four most commonly heard sources of noise (‘road traffic’, ‘neighbours and/or other people nearby’, ‘aircraft, airports and airfields’ and ‘building, construction, demolition, renovation and road works’). It is suggested that the population may be less tolerant of noise than in 2000.

The proportion of those reporting themselves as being significantly adversely affected had remained broadly the same, 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 8.1. below shows the proportion of people making noise complaints in England.

Figure 8.1 Noise complaints per 1,000 population²¹¹



Under the terms of the END, Defra has prepared a Noise Action Plan; underpinned by the results of a strategic mapping exercise, that is 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. Interactive noise maps of certain cities and large urban areas in England can be generated from Defra's noise map for England.²¹² 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 8.1** below:

Table 8.1 Estimated number of people in agglomerations above various noise levels due to noise from roads, L_{den}

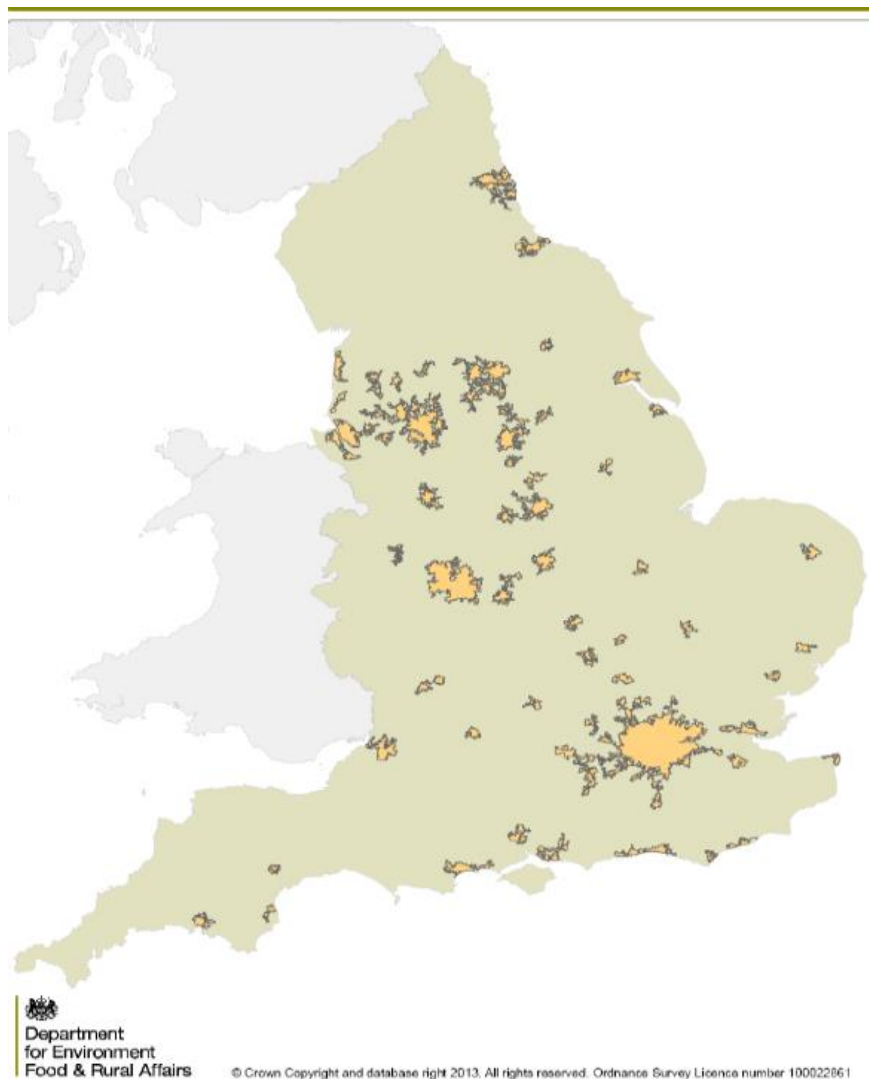
Noise Level (L_{den}) (dB)	Number of People
≥55	7,401,000
≥60	3,717,000
≥65	2,325,000
≥70	1,122,000
≥75	135,000

²¹¹ <http://www.ons.gov.uk/ons/rel/wellbeing/sustainable-development-indicators/july-2014/sustainable-development-indicators.html#tab-Supplementary-Society-Indicators-19-to-25->

²¹² See <http://services.defra.gov.uk/wps/portal/noise>.

Defra has identified a number of “Important Areas” or “noise hotspots” through 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. This is expected to correspond to just under 2,700 Important Areas. The Environmental Noise Directive 2002/49/EC regulations require that Action Plans should apply in particular to the most important areas as established by the strategic noise maps. Action plans are designed to manage environmental noise and its effects, including noise reduction if necessary.

Figure 8.2 Map showing the approximate location of END agglomerations



Scotland

Interactive noise maps can be generated from the Scottish Government’s Scottish Noise Mapping facility.²¹³ They indicate that road traffic is the most dominant noise exposure source.

²¹³ See <http://www.scottishnoisemapping.org/default.aspx>

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 Government's website.²¹⁴ Based on these maps a total of 220 priority areas for road noise and 27 for railway noise have been identified.²¹⁵

8.4 Summary of Existing Problems Relevant to the Geological Disposal 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.

8.5 Likely Evolution of the Baseline

The OECD (1991)²¹⁶ identifies unsustainable trends in noise pollution. The following factors are considered to be of increasing importance in the future:

- increasingly powerful sources of noise;
- wider geographical spread of noise sources coupled with greater individual mobility and the spread of leisure activities;
- the increasing invasion of noise particularly early mornings, evenings and weekends; and
- increasing public expectations that are closely linked to increases in income and educational levels.

The WHO document 'Guidelines for Community Noise' estimates that about half of the European citizens live in zones that do not ensure acoustical comfort to residents.

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

²¹⁴ See <http://data.wales.gov.uk/apps/noise/>

²¹⁵ See <http://gov.wales/topics/environmentcountryside/epq/noiseandnuisance/environmentalnoise/noisemonitoringmapping/priority-areas/?lang=en>

²¹⁶ OECD 1991 Fighting Noise in the 1990's. Organisation for Economic Co-operation and Development, Paris, France.

Environmental Noise Regulations and associated action plans may result in the reduction of noise in priority areas over time.

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.

8.6 Assessing Significance

The objectives and guide questions related to cultural heritage which have been identified for use in the appraisal of the effects of Geological Disposal NPS proposals are set out in **Table 8.2**, together with reasons for their selection.

Table 8.2 Approach to Assessing the Effects of the Geological Disposal 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. As such, the issues are important to the AoS Report in respect of human health, in particular.
Will the Geological Disposal NPS help to minimise noise and vibration effects from construction and operational activities on residential amenity and effects 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 a GDF. This could include local strategies based on general principles and practical measures for noise and vibration avoidance and limitation.

Table 8.3 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the cultural heritage objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 8.3 Illustrative Guidance for the Assessment of Significance for Noise

Effect	Description	Illustrative Guidance
++	Significant	• Option would significantly improve the ambient noise

Effect	Description	Illustrative Guidance
	Positive	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.

9. Climatic Factors

9.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on climate change. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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, human health, flood risk, traffic and transport and air quality.

9.2 Review of Plans and Programmes

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 **Kyoto Protocol**, adopted in 1997, is the key international mechanism agreed to reduce emissions of greenhouse gases. The Kyoto Protocol set binding targets for 37 industrialised countries and the European Community for reducing greenhouse gas emissions. 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 commits them to doing so through greenhouse gas reductions. Countries must meet their targets primarily through national measures however, the Kyoto Protocol offers them an additional means of meeting their targets by way of three market-based mechanisms: 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. Governments of Parties to the Kyoto Protocol also made amendments to the Protocol, among others, the range of greenhouse gases covered. A major outcome was the establishment of the Durban Platform for Enhanced Action, which spelt out a path to negotiate a new legal and universal emission reduction agreement by 2015, to be adopted by 2020.

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. Since carbon dioxide (CO₂) is the principal greenhouse gas, this is often described as a carbon market or trading in carbon; the total amount of carbon emissions within the trading scheme being limited, and reduced over time. **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 wellbeing 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 complete 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%.

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.

In 2010, the **Cancun Adaptation Framework** was adopted, and it was agreed that adaptation must be given the same priority as mitigation. The Framework calls for further action on adaptation including reducing vulnerability and increasing resilience in developing country Parties.

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

On the 23rd June 2011, DECC introduced 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**).

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 first **Climate Change Risk Assessment** was published in 2012. Government will be required to publish and regularly update a programme setting out how the UK will address these likely impacts, based on the principles of sustainable development, thereby ensuring that environmental, economic and social issues are all fully considered. The Climate Change Act 2008 also introduced powers for Government to require public bodies and statutory undertakers (in this context these are utilities companies which provide a public service) to carry out their own risk assessments and make plans to address those risks.

The **Low Carbon Transition Plan (2009)** plots how the UK will meet the 34% cut in emissions on 1990 levels by 2020 and the **Renewables Strategy (2009)** sets out the path for the UK to meet the legally-binding target to ensure 15% of energy to come from renewable sources by 2020. The **UK Renewable Energy Roadmap Update 2013** provides analysis on achievements and changes that have taken place in 2013. It includes energy demand and technology cost projections, as well as a 'bottom up' review of projects that could well come forward.

The **Carbon Plan: Delivering our low carbon future (2011)** sets out how the UK will achieve decarbonisation within the framework of energy policy: to make the transition to a low carbon economy while maintaining energy security, and minimising costs to consumers, particularly those in poorer households. It includes proposals for energy efficiency, heating, transport and industry.

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.

The **Nuclear Sector Plan (Issue 3) (Environment Agency, 2013)** sets out the main environmental issues facing the nuclear industry over the next few years and identifies ways that the industry can work with the Environment Agency to address them. The Plan sets out the following environmental objectives for the nuclear sector:

- Minimise resource consumption and carbon footprint.
- Minimise discharges to air and water.
- Promote use of the waste hierarchy.
- Demonstrate environmental management and leadership.
- Progress decommissioning and manage land quality.
- Maintain or improve a very high level of regulatory compliance.
- Further implement better regulation.

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.

Planning Practice Guidance (2015) on 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.

Scotland

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. This covers the basket of six greenhouse gases recognised by the UNFCCC, and includes Scotland's share of emissions from international aviation and international shipping.

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 ambitious 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 our target of 11% renewable heat.

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;
- 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, confirm their commitments and the areas where they will act, and where they will work with their partners to reduce greenhouse gas (GHC) emissions and enable effective adaptation in Wales.

Following royal assent, the ***Environment (Wales) Bill*** will set out the approach for the sustainable management of natural resources in Wales, which will help to mitigate for and adapt to the impacts of climate change. This will include strengthening the health of our natural resources to reduce the impacts of climate change on them, considered the services that natural resources provide and identifying opportunities to provide green growth. This new approach will also enable resilience to be considered as part of the decision making process for activities from the outset.

Planning Policy Wales (Edition 7, 2014) (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.

PPW is supported by the following Technical Advice Notes (TANs) that are particularly relevant to climate change:

- TAN 8: Renewable Energy;
- TAN12: Design;
- TAN 15: Development and Flood Risk; and
- TAN 22: Sustainable Buildings.

9.3 Overview of the Baseline

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.

All areas of the UK are getting warmer, and the warming is greater in summer than in winter²¹⁷. 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

²¹⁷ 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
 [Accessed 26.05.2015]

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 year.²¹⁸ Central England's temperature has risen by about 0.7°C over the last century, with 2006 being the warmest on record⁴. 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.

According to UKCIP, average UK temperature has risen since the mid-20th Century, as have average sea level and sea surface temperature around the UK coast. Over the same time period, trends in precipitation are harder to identify. 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;

²¹⁸ UK Climate Projections. The climate of the UK and recent trends. 2009.

<http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87933&filetype=pdf> [Accessed 26.05.2015] [Accessed 26.05.2015]

- 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 is only statistically significant in northern England and Scotland where increases of 30-65% have been experienced; and
- 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%.

Energy

In 2013, UK energy production was down 6.3% on a year earlier, due to record low coal output following mine closures. Oil and gas output was also down as production facilities were affected by maintenance issues, alongside longer term decline. Imports in 2013 were at a record high level, with exports at their lowest level since 1980. Net imports increased and accounted for 47% of energy used in the UK. In 2013, the UK became a net importer of petroleum products for the first time since 1973, largely due to the closure of the Coryton refinery in 2012.²¹⁹

Primary energy consumption was down 0.6%; and on a temperature adjusted basis primary energy consumption was down 1.9% continuing the downward trend of the last eight years. In 2013 the average UK temperature was 9.7 degrees Celsius, with colder winter weather compared to 2012. Fossil fuels remain the dominant source of energy supply, accounting for 86.2%, through this is a record low level. Supply from renewables increased, with its contributions accounting for 5.2% of final consumption on the EU agreed basis.

In 2013, there was a switch in the main sources of electricity generation away from the fossil fuels of coal and gas to more low carbon generation. Generation from coal fell by 8.7%, as a number of plants closed or switched to burning biomass; gas fell by 4.5% due to high gas prices; with overall renewables share of generation up by 30% to a record 14.9% share of generation.

In 2014, nuclear generation fell 9.7% from 70.6 TWh to 63.7 TWh. The share of generation from nuclear in 2014 as a whole decreased from 19.7% to 19.0%. In 2014 Q4, nuclear generation fell 22.6% from 18.2 TWh to 14.1TWh, due to planned and unplanned outages affecting four EDF nuclear stations. The share of generation from nuclear decreased from 19.3% in 2013 Q4 to 15.8% in 2014 Q4.

The current trend in energy use is generally towards increased consumption; however, there have been some slight declines in recent years associated with mild winters. Since 1980, UK energy consumption by individual sectors has changed substantially: there have been rises of 68% for transport, 10% for the domestic sector and 3% for the service sector, whilst consumption by industry has fallen by 34%. However, in recent years there has been an overall decrease in the total energy consumed on a national level. In the UK in 2008 total energy use had decreased by 7.6% to 1,604,618 GWH compared to 2005 levels of 1,738,031 GWH.

Overall, the nuclear industry used 0.8% more energy (approximately 56,000 MWh) in 2013 than in 2012. It used more energy to generate electricity, fabricate and reprocess fuel and

²¹⁹ DECC. Digest of UK Energy Statistics (DUKES) 2014.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/337552/chapter_1.pdf [Accessed 16.06.2015]

to manage waste. However, the research, defence and medical and bioscience subsectors used less energy.²²⁰

Greenhouse Gas (GHG) Emissions²²¹

The GHG inventory covers the six direct greenhouse gases under the Kyoto Protocol:

- Carbon dioxide (CO₂);
- Methane (CH₄);
- Nitrous oxide (N₂O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Sulphur hexafluoride (SF₆).

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.

In 2013, UK emissions of the basket of six greenhouse gases covered by the Kyoto Protocol were estimated to be 568.3 million tonnes carbon dioxide equivalent (MtCO₂e). This was 2.4% lower than the 2012 figure of 582.2 million tonnes. CO₂ accounted for about 82% of total UK greenhouse gas emissions in 2013, the latest year for which results are available. In 2013, UK net emissions of CO₂ were provisionally estimated to be 467.5 million tonnes (Mt). This was 1.8% lower than the 2012 figure of 476.3 Mt.

The energy supply sector was responsible for 33 percent of UK greenhouse gas emissions in 2013. The main source of emissions from this sector was the use of coal and natural gas in electricity generation from power stations. However, since 1990 there has been a 32% reduction in greenhouse gas emissions from the energy supply sector. This decrease has resulted mainly from changes in the mix of fuels being used for electricity generation, including the growth of renewables, together with greater efficiency resulting from improvements in technology. Between 2012 and 2013, the largest decreases were experienced in the energy supply sector, down 6.5% (12.5 MtCO₂e). The second largest source of greenhouse gases in the UK was the transport sector at up to 21% of total emissions. Emissions from this sector arise predominantly from CO₂ (20%). The main source of emissions from this sector is the use of petrol and diesel in road transport. Since 1990, there has been relatively little overall change in the level of greenhouse gas emissions from the transport sector (emissions were around 3% lower in 2013 than in 1990).

The business sector makes up the third largest source of greenhouse gases in the UK, contributing to up to 16% of the national total. Emissions of CO₂ and fluorinated gases occur from this sector. Emissions from this sector primarily relate to fossil fuel combustion

²²⁰ Environment Agency (2014) Nuclear Sector Plan 2013 Environmental Performance Report

²²¹ DECC. 2013 UK Greenhouse Gas Emissions, Final Figures. Statistical Release. February 2015

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407432/20150203_2013_Final_Emissions_statistics.pdf
[Accessed 26.05.2015]

in industry and commerce, although emissions of F-gases from the use of fluorinated compounds in certain applications, particularly refrigeration and air-conditioning, are also significant. The business sector is responsible for the majority of emissions from F-gases. 2013 emissions from the business sector were 21% lower than 1990 emissions. The main driver of the decrease in emissions since 1990 is a reduction in emissions from industrial combustion (including iron and steel) which has led to a reduction in CO₂ emissions of 33% since 1990.

The Land Use, Land Use Change and Forestry (LULUCF) sector contains absorbers (sinks) as well as sources of CO₂ emissions. LULUCF has been a net sink since 2001 and there has also been some reduction in emissions since 1990 due to less intensive agricultural practices. Emissions from this source occur for CO₂, N₂O and CH₄ from clearing of forests and vegetation, flooding of land and from application of fertilizers and lime.

Emissions from the nuclear industry have fluctuated since 2006 although there has been an overall increase. However, emissions fell in most nuclear industry subsectors in 2013 and overall they were 13% lower than 2012. The largest contributors were the fuel fabrication and enrichment, defence and fuel reprocessing subsectors. Together, these three subsectors produced 87% of the gross emissions, although each subsector produced fewer emissions in 2013, saving a total of 100,000 tonnes of CO₂.²²²

England

Greenhouse Gas inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2012 (2014) 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 has a 77% share of total net GHG emissions in 2012. That said, it has seen a decrease of 28% in greenhouse gas emissions between 1990 and 2012. However, emissions between 2011 and 2012 have increased slightly (by 3.8%). This increase of emissions is predominantly driven by a shift from natural gas to coal (which has a higher carbon content per unit of energy) in the power generation sector due to the impact of changes in global fuel prices, and an increase in the consumption of natural gas in the residential sector due to colder average temperatures. Greenhouse gas (GHG) emissions for England in 2012 are 441,778 ktCO₂e with 33% of emissions in 2012 from energy supply, 14% from residential, 15% from business and 22% from transport sources.

Energy supply sector emissions have decreased by 31% between 1990 and 2012. There was an increase in overall emissions between 2011 and 2012. This 6% increase (8,198 ktCO₂e) was mainly due to a shift from natural gas to coal in power stations due to global fuel prices. Residential sector emissions have, generally, decreased since 1990. Emissions between 2011 and 2012, however, increased by 13% (7,298 ktCO₂e) due to an increase in natural gas consumption for the sector. This increase in gas use reflects the colder average daily temperatures of 2012 (9.8 degrees C) compared to 2011 (10.7 degrees C). Business sector emissions have reduced by 24% since 1990. Emissions have, however, increased by 3% (1,876.97 ktCO₂e) between 2011 and 2012 caused

²²² Environment Agency (2014) Nuclear Sector Plan 2013 Environmental Performance Report

mainly by an increase in the iron and steel sector as the Teesside plant resumed production in 2012.

Waste management sector emissions have significantly declined, by 54%, since 1990, largely due to the progressive introduction of methane capture and oxidation systems within landfill management. Emissions decreased by 5% (849 ktCO₂e) between 2011 and 2012 in line with this decline. Agriculture sector emissions have reduced by 22% since 1990 mainly due to a decrease in livestock numbers. There was a small decrease of 1% (533 ktCO₂e) in emissions from 2011 to 2012 mainly due to a reduction in the production of wheat and the resulting reduction in emissions from crop residues and fertilizer. Transport sector emissions have decreased by 4% between 1990 and 2012 due to strong growth in transport demand over the period coupled with improvements in efficiency of transport vehicles. Emissions between 2011 and 2012 decreased by less than 1% (473 ktCO₂e).

Public sector emissions have reduced by 21% since 1990. This is due to increased energy efficiency measures and the switch to gas-fired heating. However, emissions between 2011 and 2012 increased by 4% (324 ktCO₂e) due mainly to an increase in natural gas consumption in 2012 in response to the colder average daily temperatures of 2012 compared to 2011. Land Use, Land Use Change and Forestry (LULUCF) sector was a source of emissions between 1990 and 2003 after which the LULUCF sector was a sink. The sink reduced by 16% between 2011 and 2012 (199 ktCO₂e). Industrial Process emissions have decreased significantly since 1990 (85%). Emissions slightly decreased by 0.1% between 2011 and 2012 (4.8 ktCO₂e) due to a significant increase in emissions from iron and steel (due to the reopening of the Teesside Steel works) offset emission reductions due to plant closures in the aluminium industry and lower cement clinker production from kilns in England.

Scotland

A report by the Scottish Government²²³ sets out the following observations on the current state of greenhouse gas emissions in the country.

In 2012, Scottish emissions of the basket of six greenhouse gases were estimated to be 52.9 MtCO₂e. This is 0.8% higher than the 2011 figure of 52.5 MtCO₂e (a 0.4 MtCO₂e increase). Between 1990 and 2012, there was an overall 29.9% reduction in emissions.

When emissions are adjusted to take into account trading in the EU ETS, emissions increased by 0.5% between 2011 and 2012 (from 55.4 MtCO₂e to 55.7 MtCO₂e). Compared with the 1990 base year, emissions in 2012 (after taking account of trading in the EU ETS) were 26.4% lower. The annual target for 2012, as published in the Climate Change (Annual Targets) (Scotland) Order 2012, is 53.226 MtCO₂e. The target is assessed using the adjusted emissions.

Between 2011 and 2012, there were increases in greenhouse gas emissions in the residential and energy supply sectors, of 0.7 and 0.2 MtCO₂e respectively (increases of 11.1 and 1.4%). Residential emissions are partly generated by space-heating homes and thus are related to external temperatures. Mean annual temperatures in 2012 were 0.7°C lower than in 2011. As a result of this relationship to external temperature, residential

²²³ The Scottish Government. Scottish Greenhouse Gas Emissions 2012. 2012. <http://www.gov.scot/Resource/0045/00452084.pdf> [Accessed 28.05.2015]

emissions can exhibit some large annual fluctuations. The increase in energy supply emissions is largely driven by changes in the fuel mix for electricity production.

Between 2011 and 2012, there was very little change in the size of carbon sink from forestry. There were increases in emissions of 0.6% from the business and industrial process sector (0.1 MtCO₂e) while the public sector saw a 4.3% rise (0.1 MtCO₂e). International aviation and shipping showed the largest per cent reduction in emissions at 8.7% (down 0.2 MtCO₂e). Net emissions from agriculture and related land uses and waste management decreased by 2.8% and 5.3% respectively (0.3 MtCO₂e and 0.2 MtCO₂e respectively), while transport (excluding international aviation and shipping) and development emissions both increased by 0.5% and 1.8% respectively (0.1 MtCO₂e and 0.01 MtCO₂e respectively).

Since 1990, emissions from transport (excluding international aviation and shipping) have decreased by 0.2 MtCO₂e (1.2%). Residential emissions also saw a decrease of 0.9 MtCO₂e, a 10.8% decrease since 1990. The largest absolute reduction was for energy supply at 5.3 MtCO₂e, a 23.5% reduction. Other sectors with significant reductions are business and industrial process (down 5.0 MtCO₂e (37%)), waste management (down 3.9 MtCO₂e (58.6%)), agriculture and related land uses (down 4.1 MtCO₂e (26.7%)), and public sector (down 0.3 MtCO₂e (17.8%)). Development emissions decreased by 0.1 MtCO₂e (3.4%) and emissions from international aviation and shipping reduced by 0.2 MtCO₂e (6.4%). Net removals from forestry increased by 2.9 MtCO₂e; 41.9% more than removed in 1990.

CO₂ is the main greenhouse gas, accounting for around 75.2% of Scottish greenhouse gas emissions in 2012 (equating to 39.8 MtCO₂). This was 1.02 MtCO₂e higher than the 2011 figure of 39.1 MtCO₂. Since 1990, emissions of CO₂ have fallen by 28.4% and emissions of the other greenhouse gases (methane, nitrous oxide and F-gases) have fallen by 28.5%.

Wales

A report by the Welsh Government sets out the following observations on the current state of greenhouse gas emissions in the country.

As a Government, the two key overarching targets for reducing greenhouse gas emissions in Wales are firstly to reduce emissions by 3% annually in areas of devolved competence and secondly to reduce overall emissions by 40% by 2020.

The baseline for the 3% target is 32.53 MtCO₂e²²⁴. In 2012, the emissions of greenhouse gases were 30.16 MtCO₂e which equates to a decrease from the baseline of 10.0%. That said, annual emissions for 2012 rose in comparison with those reported from 2011 – by 3.3%. This increase was predominantly driven by a shift from natural gas back to coal in the energy sector due to the impact of changes in global fuel prices. Provisional emission estimates for 2013 show that emissions are likely to decrease in comparison with those for 2012. This reduction is largely driven by a decrease in coal use for electricity generation and an associated reduction in the emissions associated with end-use electricity consumption.

²²⁴ Welsh Government. Climate Change Annual Report. 2014. <http://gov.wales/docs/desh/publications/141222-climate-change-annual-report-2014-en.pdf> [Accessed 28.05.2015]

With regard to the 3% annual reduction for the devolved sectors, as of 2012 there was an overall reduction of 10% but the sector reductions range from 1.2% to 20.4%. Compared to the 2006-10 baseline, emissions from the transport sector reduced by 8.2%, residential sector emissions by 7.6% and business sector emissions by 16.7%. The agriculture and land use sector reduced by 1.2%, the resource efficiency and waste sector by 20.4% and the public sector have by 3.1%.

The residential sector was responsible for 24% of emissions, with a baseline of 7.69 MtCO_{2e}. In comparison with 2011, 2012 emissions increased by 10.6% largely due to the return of colder winter temperatures in 2012 and a consequential increase in natural gas consumption compared with 2011. The transport sector is responsible for approximately a fifth (19%) of emissions, with the baseline average emissions level of 6.28 MtCO_{2e}. Between 2011 and 2012, there was a 1.3% reduction in emissions from this sector.

The business sector accounts for 31% of emissions, with a baseline of 11.27 MtCO_{2e}. Business sector emissions increased by 2.0% in comparison with 2011, largely due to end-use electricity consumption emissions which were associated with the shift to increased coal use in electricity generation. End-use electricity consumption accounts for 58% of sector emissions and is primarily for heating, lighting and operating equipment in the business sector.

The agriculture and land use sector accounts for 20% of emissions with a baseline of 6.00 MtCO_{2e}. In comparison with 2011, emissions increased by 3.0% in 2012. This is a result of both a reduction in the land-use carbon sink of 22% between 2011 and 2012 and an increase of agricultural emissions by 1% driven by changes in sheep and cattle numbers.

The resource efficiency and waste sector emissions account for 3.8%, with a baseline of 1.43 MtCO_{2e}. In comparison with 2011, the sector's emissions decreased by 4.9% in 2012. This reduction in emissions follows the introduction of improved management systems, which reduce methane emissions from landfill and from a reduction in methane emissions from industrial and municipal waste water treatment.

The devolved public sector in Wales accounts for 2.7% of emissions, with a baseline of 0.85 MtCO_{2e}. In comparison with 2011, emissions increased by 8.2% in 2012 due to an increase in natural gas consumption as a consequence of a return to colder winter temperatures and a 9.5% increase in emissions associated with end-use electricity consumption.

9.4 Summary of Existing Problems Relevant to the Geological Disposal 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; and

- Changes in temperature and rainfall patterns, along with more frequent extreme weather events creates the situation where a greater degree of resilience will have to be incorporated into plans and proposals.

9.5 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% probability:²²⁵

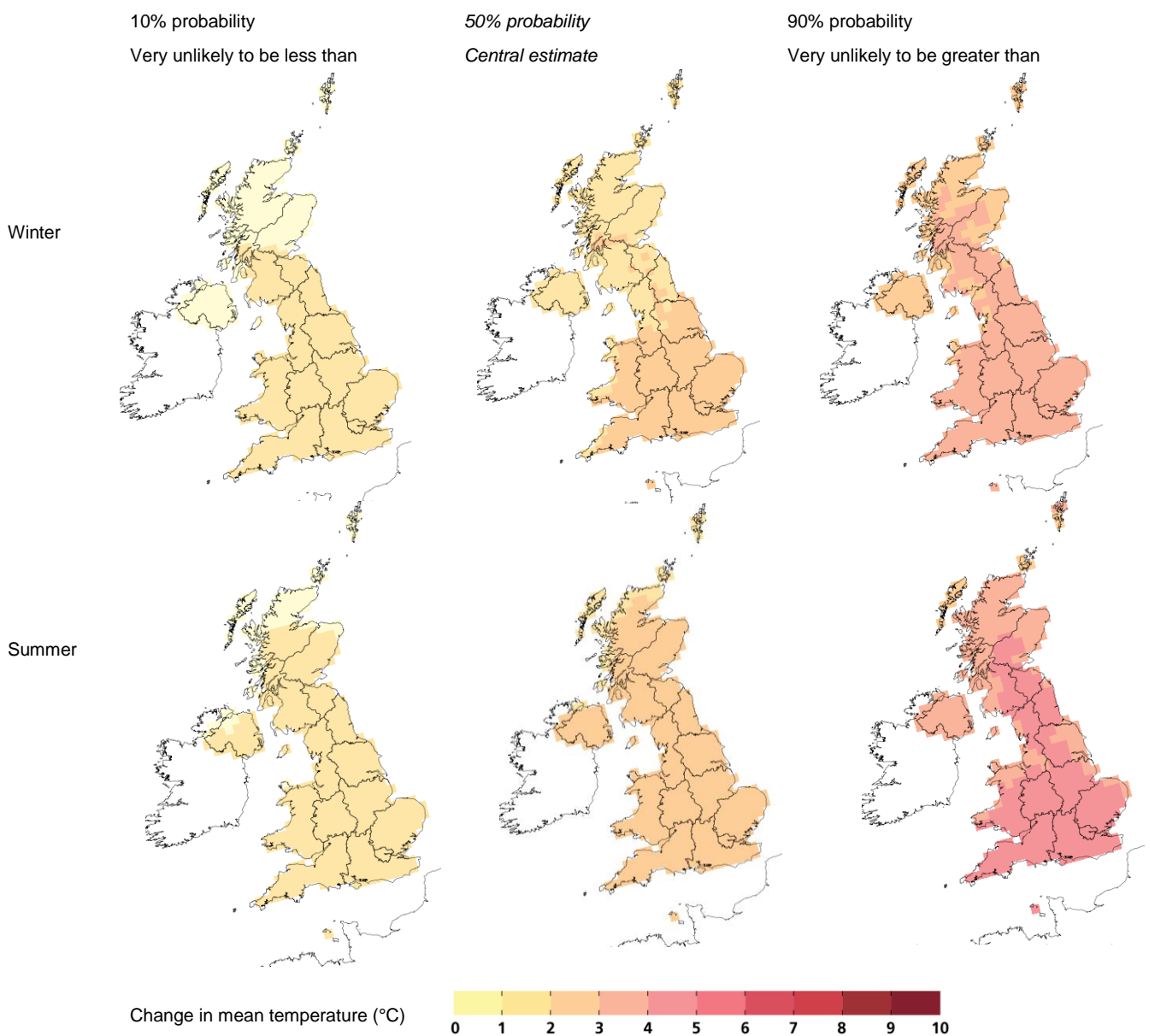
- **2080 mean winter temperature:** the central estimates of change are projected to be generally between 2 and 3°C across most of the country, with slightly larger changes in the south-east and slightly smaller in the north-west of Britain;
- **2080 mean summer temperature:** a more pronounced south 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;

²²⁵ UK Climate projections. Maps and key findings. <http://ukclimateprojections.defra.gov.uk/21708#key> [Accessed 28.05.2015]

- 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 $+5$ cm. Changes in the annual maxima are projected to be between -1.5 and $+1$ m.

Figure 9.1, Figure 9.2 and **Table 9.1** 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 website²²⁶ for more information.

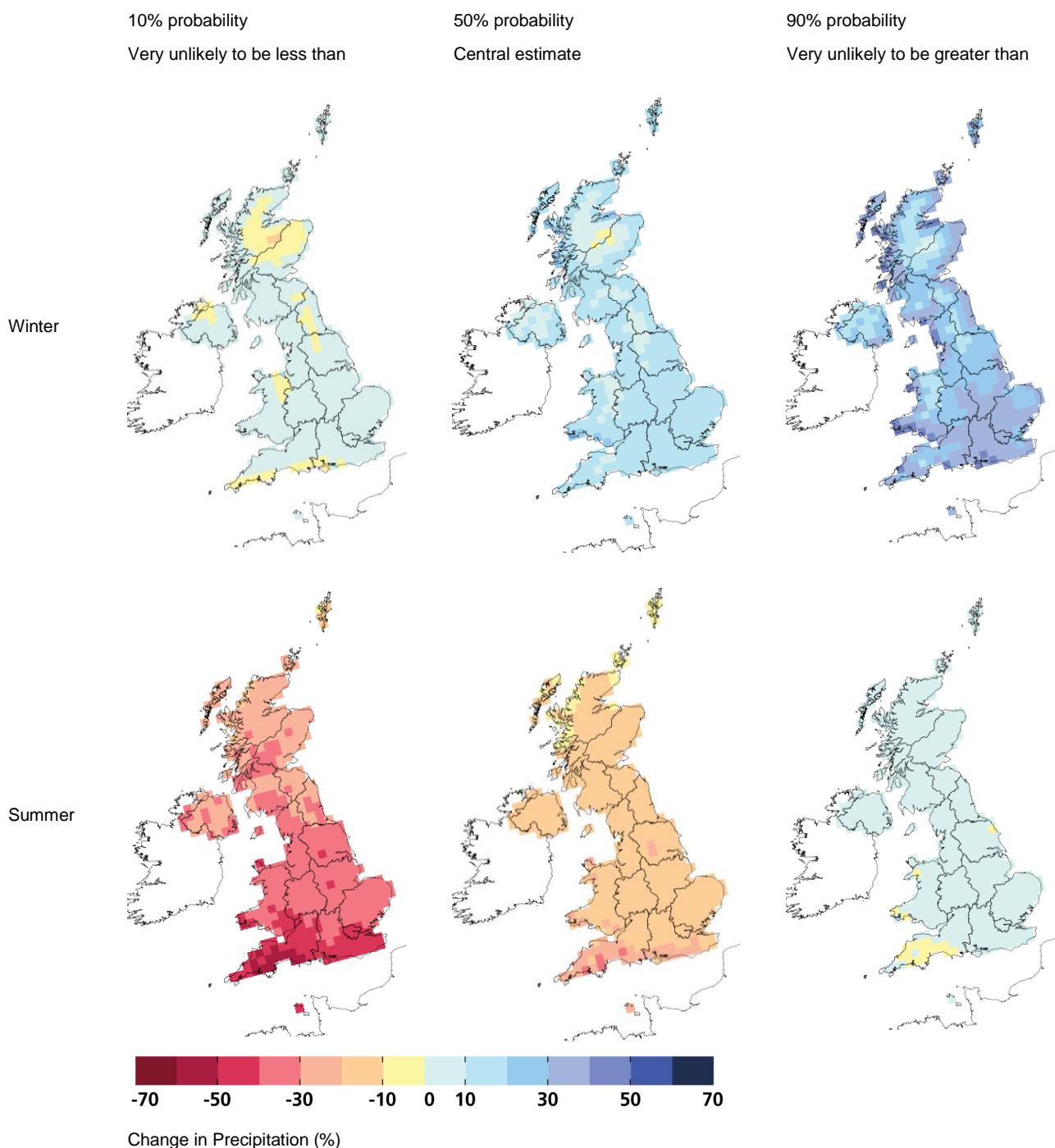
Figure 9.1 Mean Seasonal Probabilistic Temperature Projections for the 2050s, based on the Medium Emissions Scenario



Source: UK Climate Projections 2009 (<http://ukclimateprojections-ui.defra.gov.uk/ui/>)

²²⁶ <http://ukclimateprojections.defra.gov.uk/>

Figure 9.2 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/>)

Table 9.1 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
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Probability level (%)	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	1.9	3	1.1	2.4	3.8	5	15	28	-26	-12	1
NE England	1	2	3.1	1.2	2.5	4.1	1	11	24	-29	-14	1
NW England	1	2	3	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	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/>)

The nuclear industry continually reviews how best to manage its own operations to adapt to the impacts of climate change, including how to respond to extreme events. In the aftermath of the 2011 Fukushima disaster, operators of all licenced nuclear sites in the UK have carried out safety investigations at their sites to determine their resilience to extreme natural events and are making improvements where necessary.²²⁷

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

²²⁷ Environment Agency 2012: Nuclear Sector Plan, 2012 environmental performance report

(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. Included within the **Fourth Carbon Budget is the recommendation for an indicative 2030 target to reduce emissions by 60% relative to 1990 levels (46% relative to 2009 levels).**²²⁸

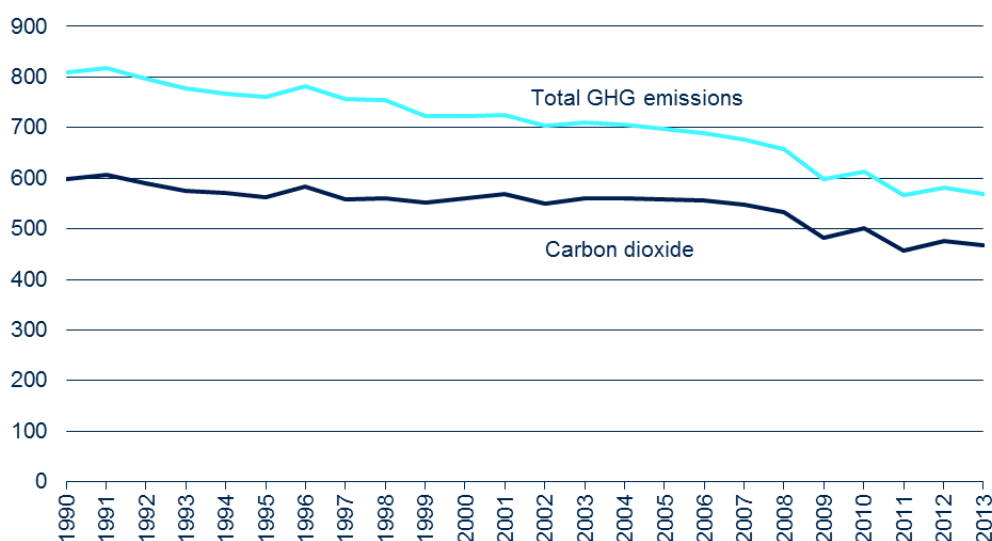
The Carbon Plan 2011 explains that if the UK is to cut emissions by 80% by 2050, there will have to be major changes in how energy is generated and used. In particular:

- 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);
- 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, the UK is committed to delivering 15% of its energy from renewable sources by 2020.

Since 1990, there has been a decrease in UK CO₂ of around 19% (see **Figure 9.3**). In 2013, UK emissions of the basket of seven greenhouse gases covered by the Kyoto protocol were estimated to be 568.3 million tonnes carbon dioxide equivalent (MtCO₂e). This was 2.4% lower than the 2012 figure of 582.2 million tonnes. Between 2012 and 2013, the largest decreases were experienced in the energy supply sector, down 6.8 percent (13.8 MtCO₂e) due to a decrease in the use of coal and gas for electricity generation, and the waste management sector, down by 14.1 percent (3.7 MtCO₂e) due to a reduction in emissions from landfill waste. Carbon dioxide (CO₂) is the main greenhouse gas, accounting for 82 percent of total UK greenhouse gas emissions in 2013. In 2013, UK net emissions of carbon dioxide were estimated to be 467.5 million tonnes (Mt). This was around 1.8 percent lower than the 2012 figure of 476.3 Mt.

²²⁸ Committee on Climate Change. Fourth Carbon Budget – Part 2. 2010. <http://www.theccc.org.uk/reports/fourth-carbon-budget> [Accessed 30/05/2015]

Figure 9.3 Emissions of Greenhouse Gases, 1990 - 2013

Source:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407432/20150203_2013_Final_Emissions_statistics.pdf

According to 2012 data,²²⁹ the UK's CO₂ footprint reached its peak in 2004 at 852 Mt CO₂ and since then has fallen 15% to 722 Mt CO₂, with a notably large dip occurring in 2009. The carbon footprint refers to emissions that are associated with the spending of UK residents on goods and services, wherever in the world these emissions arise along the supply chain, and those which are directly generated by UK households through private motoring, etc. These emissions are often referred to as 'consumption emissions' to distinguish them from estimates relating to the emissions 'produced' within a country's territory or economic sphere. The UK's CO₂ footprint can be separated into a number of components: those emissions relating to goods and services produced by UK business, those generated by UK households through heating and private motoring, and those emissions relating to imported goods and services, broken down into imports from China, imports from the EU and imports from the Rest of the World. These are often referred to as emissions that are 'embedded' in imports.

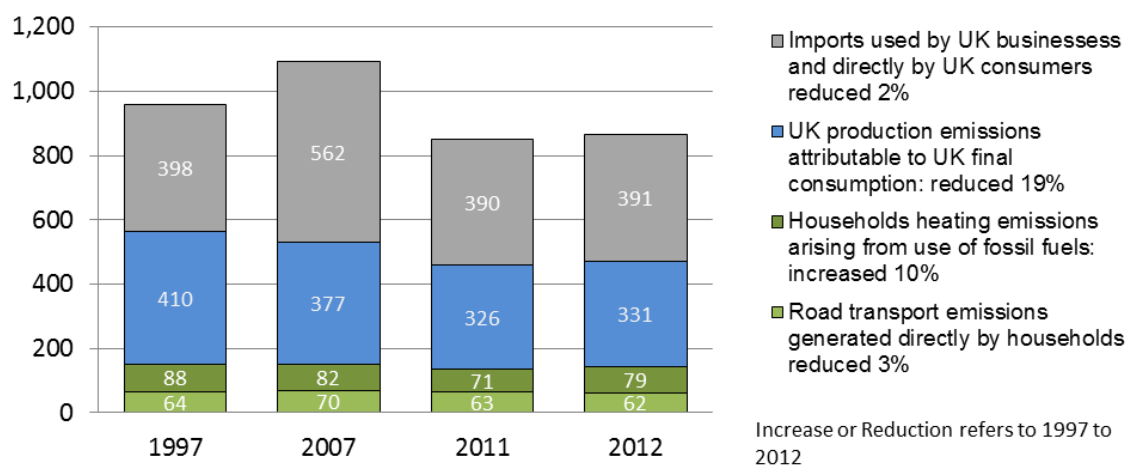
In 2012, total greenhouse gas emissions associated with UK consumption were 10% lower than in 1997. **Figure 9.4** sets out the changes in each of four main activities that make up the total, including the peak in 2007. Emissions associated with UK production were 19% lower than 1997 levels in 2012. These emissions accounted for 38% of the total greenhouse gas footprint in 2012. UK production emissions were 331 MtCO₂e in 2012, an increase on the 2011 level of 326 MtCO₂e.

The level of emissions generated directly by households had remained broadly constant at around 140 – 160 MtCO₂e but dropped in 2011 to 134 MtCO₂e before rising to 142 MtCO₂e in 2012. Within the category, emissions from heating have fluctuated around 80 – 90 MtCO₂e depending largely upon the severity of the winter. In 2011, emissions from heating dropped 20 MtCO₂e to 2010, but rose slightly in 2012 to 79 MtCO₂e. This was due to 2012 being a colder year on average than 2011. Embedded emissions from imports increased by 41% from 1997 to 200 when they reached a peak. In 2012 they were 391 MtCO₂e which was 30% lower than the peak.

²²⁹ DEFRA. UK's Carbon Footprint 1997 – 2012. 2012.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/85869/release-carbon-footprint-dec2012.pdf [Accessed 28.05.2015]

Figure 9.4 Comparison of Consumption based CO₂ Emissions in 1997, 2007, 2011 and 2012



Source:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/414180/Consumption_emissions_Mar15_Final.pdf

DECC updates projections of energy demand, supply and greenhouse gas emissions annually. These projections are an important way of assessing whether current and planned policies are consistent with achieving UK carbon budgets in future years. The last full set was published in September 2013. The latest report updates those figures and extends the projections to 2035. The UK met its first carbon budget by 36 MtCO₂e. The government has a suite of policies to meet carbon budgets two and three. Projections for 2013 to 2022 suggest that the UK will meet both. The projected margin for carbon budget two is less than projected last year (by 3 MtCO₂e), whilst that for budget three is greater (by 38 MtCO₂e). Table i and figure i summarise progress against the budgets. The projections for the fourth budget period, from 2023-27, and afterwards give expectations in the absence of any additional policy effort, i.e. no new policies. They show that there is a shortfall of 133 MtCO₂e (82 MtCO₂e less than projected last year). The Carbon Plan sets out scenarios for how the UK might achieve the fourth carbon budget.

Carbon Dioxide Emissions by Sector²³⁰

CO₂ accounted for about 82% of the UK's anthropogenic (man-made) greenhouse gas emissions in 2013. In 2014, an estimated 36% of CO₂ emissions were from the energy supply sector, 28% from transport, 17% from business and 15% from the residential sector. Between 2013 and 2014, provisional estimates indicate that CO₂ emissions decreased by 15.3% (27.6 Mt) in the energy supply sector, 16.6% (12.4 Mt) in the residential sector and 7.2% (5.5 Mt) in the business sector. Emissions from the transport sector were down by 1.1% (1.2 Mt) from 2013.

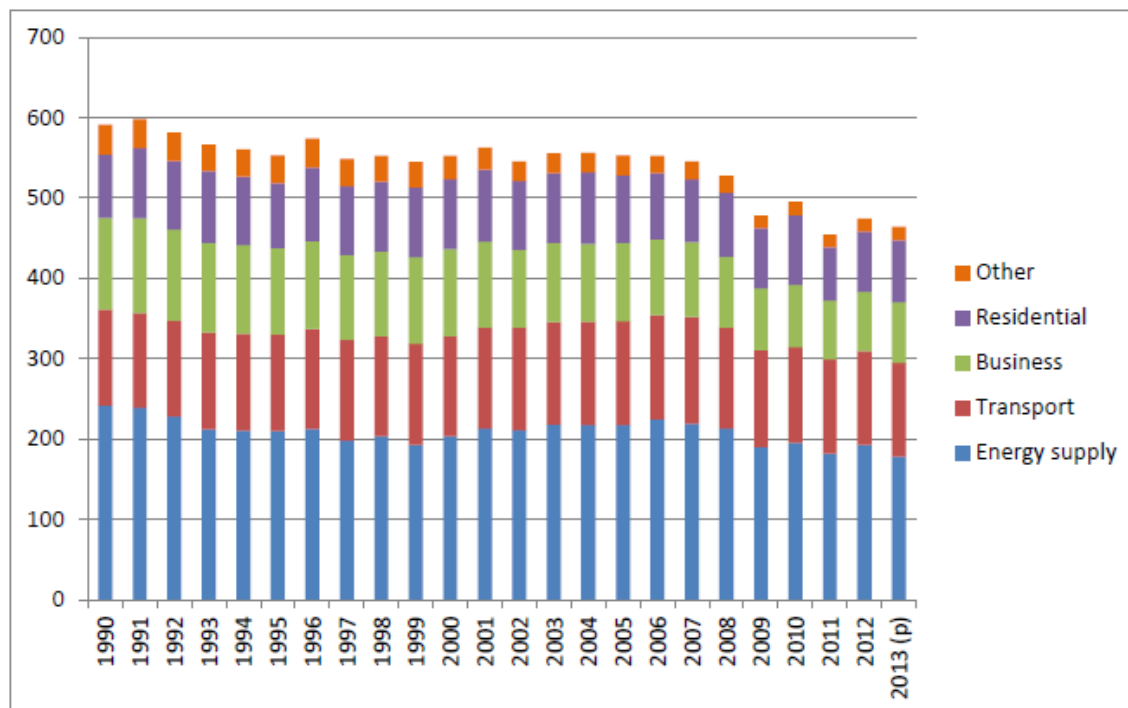
Since 1990, there has been a decrease in UK CO₂ emissions of around 29%. This fall in emissions has coincided with a decrease in overall energy consumption over the period of around 10%. If this figure is adjusted to allow for the effect of temperature, energy consumption has fallen by around 11% between 1990 and 2014. This decrease has resulted mainly from changes in the mix of fuels being used for electricity generation, including the growth of renewables, together with greater efficiency resulting from

²³⁰ DECC. 2014 UK Greenhouse Gas Emissions, Provisional Figures. 2014.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/416810/2014_stats_release.pdf [Accessed 28.05.2015]

improvements in technology and a decline in the relative importance of energy intensive industries (see **Figure 9.5**).

Figure 9.5 Carbon Dioxide Emissions by Source, 1990-2013 (provisional) (Mt)



Source:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/295968/20140327_2013_UK_Greenhouse_Gas_Emissions_Provisional_Figures.pdf

Renewable Energy Generation Trends²³¹

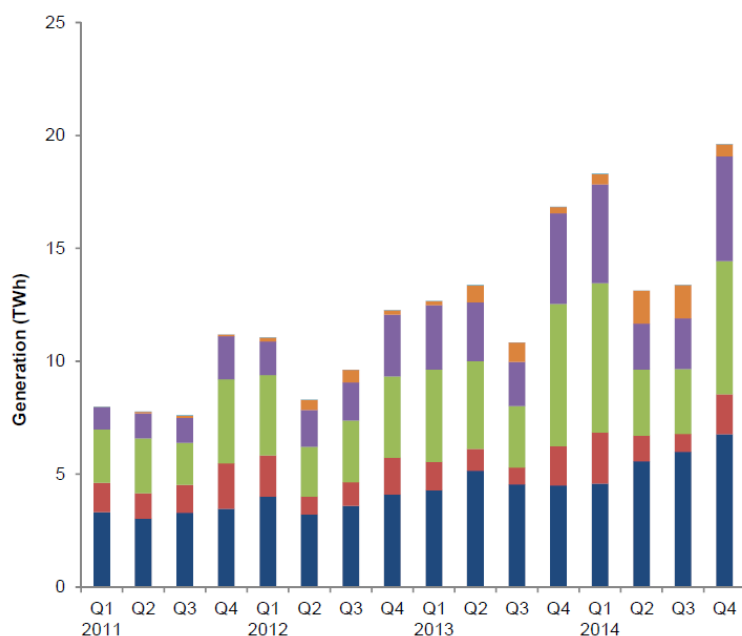
In 2014, generation from offshore wind increased by 16 per cent, from 11.4 TWh in 2013 to 13.3 TWh. Onshore wind generation rose by 8 per cent, from 17.0 TWh to 18.3 TWh. Both increases were mainly due to increased capacity; average wind speeds were similar for both years. Hydro generation increased by 26 per cent on a year earlier, from 4.7 TWh to a record 5.9 TWh, with rainfall levels (in the main hydro areas) in 2014 16 per cent higher than those of 2013, and the highest for three years. In 2014, generation from bioenergy increased by 24 per cent, from 18.5 TWh in 2013 to a record 22.9 TWh. Within this figure, generation from plant biomass increased from 8.9 TWh in 2013 to 13.1 in 2014 (47 per cent) due to a second conversion at Drax Power Station to biomass; however, as a result of the conversion, generation from co-firing fell by 56 per cent.

In 2014, 36 per cent of renewables generation was from bioenergy, 29 per cent from onshore wind, 21 per cent from offshore wind, and 9 per cent from hydro. In 2014, solar PV accounted for 6.1 per cent of renewable generation compared to 3.8 per cent in 2013; this increase is due to a large increase in capacity.

²³¹ DECC. Digest of United Kingdom Energy Statistics 2014. 2014.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415998/renewables.pdf [Accessed 28.05.2015]

Figure 9.6 Energy Generated from Renewable Sources 2011 – 2014



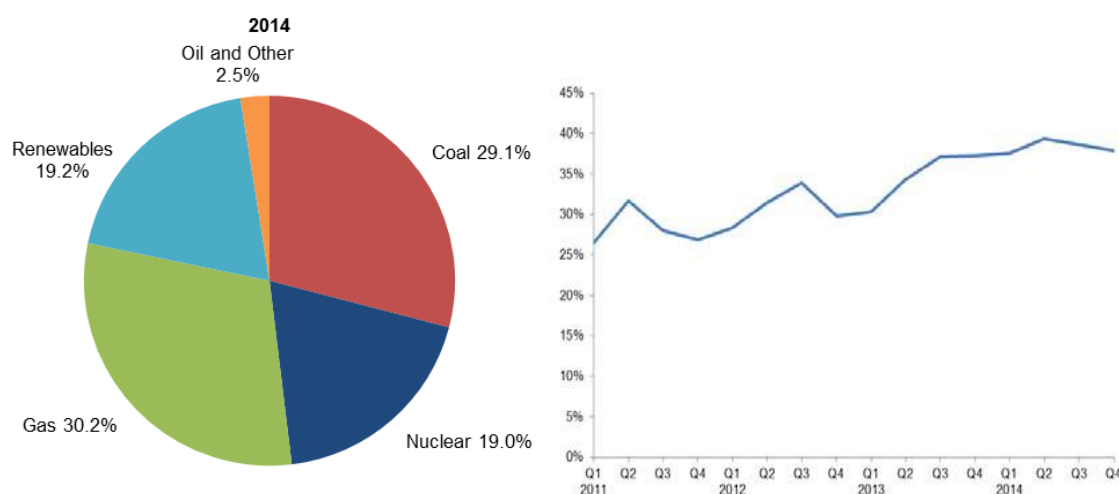
Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415998/renewables.pdf

The share of generation²³² from coal decreased from 36.4% in 2013 to 29.1% in 2014, a record low generation of 97.3 TWh due to plant closures and conversions. Gas's share of generation rose from 26.6% in 2013 to 30.2% in 2014, due to lower wholesale gas prices between June and August and a shortfall in generation caused by nuclear outages in the second half of the year. The share of nuclear generation fell from 19.7% in 2013 to 19.0% in 2014. The share of renewables (hydro, wind and bioenergy) increased from 14.9% in 2013 to 19.2% in 2014, a record high due to increased wind, solar and hydro generation capacity. Low carbon electricity's share of generation increased from 34.6% in 2013 to 38.3% in 2014, a record high due to higher renewables generation.

²³² DECC. Energy Trends. 2015.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415976/ET_Mar_15.PDF [Accessed 28.05.2015]

Figure 9.7 Renewable Electricity Generated as a Percentage of Total Electricity, 2009 - 2014



Source: DECC digest of UK Energy Statistics Webpages

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415976/ET_Mar_15.PDF

Renewables plants are projected to generate approximately 112 TWh of electricity by 2020, rising to 148 TWh by 2030. The 2030 renewables projection is lower than last year's figures by 8 TWh. This is because overall electricity demand is lower by approximately 27 TWh. Fossil fuel CHP generation follows a similar trend to the growth in its capacity, increasing from 17 TWh in 2014 to 19 TWh 2020. After 2020, there is expected to be a slow decline in generation to 11 TWh by 2035. The effect of greater CHP and renewables generation coupled with declining demand in the medium term mean that projected MPP generation will decline rapidly up until the mid-2020s. After Hinkley Point C comes on line in 2023 we project nuclear generation will follow the same trend as capacity growth.²³³

The recent trend of gas being displaced in favour of coal for generating electricity is expected to continue up until 2015. This is despite the closure of some coal plants in the intervening years and is primarily due to changes in the price of coal relative to gas and the CPS cap. Projected coal generation falls substantially in the 2020s, declining rapidly to zero by 2027. This is because the changing price differential between gas and coal makes coal plants relatively less profitable. The Industrial Emissions Directive comes into force in 2016. This limits particle emissions and requires the closure of some coal plants by 2023.

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.

²³³ DECC. Updated energy and emissions projections 2014. 2014. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/368021/Updated_energy_and_emissions_projections2014.pdf [Accessed 16.06.2015]

- 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.

Greenhouse Gas Emissions

England shares the same targets related to climate change and energy use as the rest of the UK.

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. This covers the basket of six greenhouse gases recognised by the UNFCCC, and includes Scotland's share of emissions from international aviation and international shipping. The Scottish Greenhouse Gas Emissions Annual Target 2012 is the third report under the Climate Change (Scotland) Act 2009 and sets out that Scotland had mixed success with regard to its annual target for 2012.

In 2012, the NSEA figure, after adjustment for EU ETS allowances, was 55,665,180 tCO₂e. This means that the statutory 2012 target, as expressed under the terms of the Climate Change (Scotland) Act 2009, to reduce greenhouse gas emissions to 53,226,000 tCO₂e in 2012 was missed by 2,439,180 tCO₂e. However, it is worth noting that actual, or source emissions recorded in the same year were 52,895,245 tCO₂e, or 330,755 tCO₂e better than the target.

When taking emissions trading into account, Scotland's emissions rose by 0.5 per cent in 2012 on the previous year. The longer term trend to date shows a substantial emissions reduction of 26.4 per cent from the 1990 baseline (1995 for the F-gases). This compares with a 24.2 per cent reduction assumed when the 2012 target was set based on the 1990-2008 greenhouse gas inventory. This percentage reduction demonstrates that the Scottish Government is over half way to achieving its Climate Change Act target of reducing emissions by 42 per cent by 2020.

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

The Welsh Government intends to achieve at least a 40% reduction by 2020 compared to figures from 1990. This target will be 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.

The Climate Change Annual Report (2014) sets out that the Welsh Government have once again met their 3% annual emissions target and provisional data indicates that they are also on course to meet the target for 2013. In terms of progress against the wider 40% target by 2020 however, the report shows that in contrast their total emissions have decreased by 17.9% against the 1990 baseline.

In setting out the contribution to the 3% target from each of the key sectors, the report shows that all sectors have reduced their emissions in comparison with the baseline, the reductions for each sector being as follows: Transport Sector (-8.2%), Residential Sector (-7.6%), Business Sector (-16.7%), Agriculture and Land-use sector (-1.2%), Resource Efficiency and Waste Sector (-20.4%) and the Devolved Public Sector (-3.1%).

9.6 Assessing Significance

The objectives and guide questions related to climate change which have been identified for use in the appraisal of the effects of Geological Disposal NPS proposals are set out in **Table 9.2**, together with reasons for their selection.

Table 9.2 Approach to Assessing the Effects of the Geological Disposal 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.	The SEA Directive requires that the likely significant effects on the environment, which includes their integration in the interests of promoting sustainable development, should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.
Will the Geological Disposal NPS help to ensure a low carbon design solution to the disposal of higher activity radioactive wastes, at both construction and operation phases?	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 Geological Disposal 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.
Objective: To minimise greenhouse gas emissions as a contribution to climate change and ensure resilience to any consequences of climate change.	The SEA Directive requires that the likely significant effects on the environment, which includes their integration in the interests of promoting sustainable development, should be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.

Table 9.3 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the Climate Change objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 9.3 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 increase resilience/decrease vulnerability to climate change in the 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 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 in a way that 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 wider environment.
--	Significant Negative	<ul style="list-style-type: none"> Option would significantly increase carbon and other greenhouse gas emissions; Option would decrease resilience/increase vulnerability to climate change in the 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.

10. Waste and Resource Use

10.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on waste and resource use. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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.

10.2 Review of Plans and Programmes

International/European

The **Waste Framework Directive (75/442/EEC)** as amended by **91/156/EEC**, **91/92/EEC** and **2008/98/EC** provides the overarching framework for waste management at the EU level. It relates to waste disposal and the protection of the environment from harmful effects caused by the collection, transport, treatment, storage and tipping of waste. In particular, 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 stipulates waste management options based on their desirability. In order, these 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:

- by 2020, requiring Member States to recycle 50% of their household waste and 70% of their non-hazardous construction and demolition waste;
- 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;
- by 2020, the preparing for re-use and recycling of waste materials (such as paper, metal, plastic and glass) from households shall be increased to a minimum of overall 50% by weight;
- 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 the Decision 2000/532/EC establishing a List of Wastes as last amended by 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 agencies²³⁴.

The Directive was transposed into English/Welsh legislation through the ***Waste (England and Wales) Regulations 2011*** (SI 2011/988).

A compromise agreement was reached between the Council of Environment Ministers and the European Parliament in June 2008 on revisions to the Waste Framework Directive. The main changes included EU-wide targets for reuse and recycling 50% of household waste by 2020, and for reuse, recycling and recovery of 70% of construction and demolition waste by 2020.

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 ***Mineral 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.

²³⁴ SEPA, NIEA, NRW, EA (2015) Guidance on the classification and assessment of waste: Technical Guidance WM3. Available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf [Accessed October 2015].

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.

The **European Sustainable Development Strategy (2006)** includes sustainable consumption & production and conservation & management of natural resources as key challenge areas.

The **Review of the EU Sustainable Development Strategy (2009)** responds to the request of the European Council to measure progress of mainstreaming the objective of sustainable development into a broad range of policies.

Initially created to coordinate the Member States' research programmes for the peaceful use of nuclear energy, the **Euratom Treaty (1957)** today helps to pool knowledge, infrastructure and funding of nuclear energy. It ensures the security of atomic energy supply within the framework of a centralised monitoring system.

The International Atomic Energy Agency (IAEA) (1994) **Convention on Nuclear Safety** aims to legally commit participating States operating land based nuclear power stations to maintain a high level of safety by setting international benchmarks. The IAEA (1997) **Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management**, meanwhile, was the first legal instrument aimed to address issues of safely managing spent fuel and radioactive waste on a global scale. The objectives of the Joint Convention are

- To achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste management;
- To ensure there are effective defences against potential hazards so that individuals, society and the environment are protected now and in the future;
- To prevent accidents with radiological consequences and to mitigate their consequences should they occur.

The main objective of the **Shipments of Radioactive Waste and Spent Fuel (2006/117/EURATOM)** is to establish a system of control and prior authorisation for shipments of radioactive waste, to protect the health of workers and the general public and to avoid illicit traffic of such materials.

Council Directive 2003/122/Euratom on the control of high-activity sealed radioactive sources and orphan sources (HASS) aims to prevent exposure to ionising radiation arising from inadequate control of high-activity sealed radioactive sources and to harmonise controls in EU countries.

Council Directive 2011/70/Euratom establishes a Community framework for the responsible and safe management of spent fuel and radioactive waste. The Directive requires national policies on radioactive waste and spent fuel to be based on the following principles:

- the amounts generated must be kept as low as possible;
- all steps in generation and management are interdependent;
- safety as a priority;
- generators must bear the full cost of all safety requirements; and
- all decision-making processes must be documented.

Each EU country is responsible for managing its own radioactive waste and spent fuel and must implement a national legislative, regulatory and organisational framework for such material. Radioactive waste must be disposed of in the country where it was generated, unless there are agreements with other countries. If waste is shipped to a country outside the EU, responsibility for safety still rests with the EU country that generated it.

UK

The UK Government's ***Sustainable Development Strategy: Securing the Future (2005)*** and the ***UK's Shared Framework for Sustainable Development, One Future - Different Paths (2005)*** 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.

Strategy for the management of Naturally Occurring Radioactive Material (NORM) in the UK (July 2014) aims to facilitate the sustainable and efficient management of Low Level Radioactive Waste in line with the 'waste hierarchy' principle.

UK Strategy for Radioactive Discharges (July 2009) is a revised strategy that updates Government policy and describes how the UK will continue to implement the agreements reached at the 1998 OSPAR (Oslo and Paris Convention on the Protection of the Marine Environment of the North East Atlantic) Ministerial meeting, and subsequent OSPAR meetings on radioactive substances, particularly the Radioactive Substances Strategy (RSS). This Strategy expands on the scope of the initial UK Strategy, published in 2002, to include aerial, as well as liquid discharges, from decommissioning as well as operational activities, and from the non-nuclear as well as the nuclear sectors.

In February 2011, the UK Government published its vision for sustainable development and a package of measures to deliver it through the green economy, action to tackle climate change, protecting and enhancing the natural environment, fairness and wellbeing and building a Big Society. ***Mainstreaming Sustainable Development (2011)*** is a refreshed vision and builds on commitments and principles that underpinned the UK's

2005 Sustainable Development Strategy by recognising the needs of the economy, society and the natural environment, alongside the use of good governance and sound science. Much progress has been made in mainstreaming sustainable development since the launch of the vision in 2011. **Government Progress in Mainstreaming Sustainable Development (2013)** sets out the progress made towards the achievement of this vision which is thought can be seen in the range of policies being developed by Departments and the work to drive improvements across estates and procurement.

Radioactive substances, including non-nuclear waste, must be handled in accordance with the **Radioactive Substances Act 1993**. In April 2010, the Act was repealed and the provisions included in schedule 23 of the **Environmental Permitting (England and Wales) Regulations 2010** (SI 2010/675) to allow radioactive substance regulation to be brought in to the Environmental Permitting regime. The **High Activity Sealed Radioactive Sources and Orphan Sources Regulations 2005** (SI 2005/2686) specify how high-activity sealed radioactive sources should be registered, kept, used or disposed of. The **Ionising Radiations Regulations 1999** (SI 1999/3232) require employers to protect employees and other people against ionising radiation arising from work with radioactive substances and other sources of ionising radiation.

The **United Kingdom Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry strategy (2010)**, produced by the Nuclear Decommissioning Authority (NDA), provides a framework for continued capability and capacity for the safe, secure and environmentally responsible management and disposal of LLW in the UK.

England

Defra carried out a **National Review of Waste Policy in England** in June 2011, looking 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.

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, brickclay, 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.

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) Minerals provides guidance on the planning for mineral extraction in plan making and the application process.

Planning Practice Guidance (October 2014) Waste provides further information in support of the implementation of waste planning policy.

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 **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. The 2014 White Paper **Implementing Geological Disposal** published by the Department of Energy and Climate Change (DECC) sets out the UK Government's policy framework for managing higher activity radioactive waste in the long term through geological disposal. It includes a number of initial actions that will be undertaken by the UK Government and by the developer to help implement geological disposal. It also sets out a number of key principles and commitments that will shape the subsequent process of working with communities to identify and assess potential sites. In this context, the White Paper details the Government's intention to amend the **Planning Act 2008** to bring Geological Disposal Facilities (GDFs) in England within the definition of Nationally Significant Infrastructure Projects (NSIPs), and to designate a NPS in support of this approach. In consequence, the **Infrastructure Planning (Radioactive Waste**

Geological Disposal Facilities) Order 2015, which came into force on the 27th March 2015, amended the Planning Act 2008 to extend the categories of NSIPs to include development relating to a GDF.

Scotland

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. In 2015, the Scottish Government published the **Government Economic Strategy** which reaffirmed its commitment to delivering increased sustainable economic growth.

Safeguarding Scotland's Resources – Blueprint for a More Resource Efficient and Circular Economy 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: 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.

The Radioactive Substances Act 1993: The HASS (Scotland) Directions 2005 are made by the Scottish Ministers to SEPA, requiring compliance with the provisions of Council Directive 2003/122/EURATOM (“the HASS Directive”) on the control of high-activity sealed radioactive sources and orphan sources in the exercise of existing regulatory powers. These Directions supplement the **High-activity Sealed Radioactive Sources and Orphan Sources Regulations 2005** (SI 2005/2686).

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 framework recognises that some of Scotland's coal and nuclear power stations are nearing the end of their current life. Moreover, there will be no nuclear new build in Scotland, but the possibility of extending the operating life of Scotland's existing nuclear power stations at Hunterston B and Torness, is not ruled out.

Site decommissioning is progressing at former nuclear generation sites at Dounreay in Caithness, Hunterston A in Ayrshire and Chapelcross in Dumfries and Galloway, as are plans for an economically sustainable future for those sites and their wider areas. Similar challenges are considered to arise for areas around Hunterston B and Torness, following future decommissioning.

Scottish Planning Policy (2014) sets out policies for (inter alia) the extraction of resources. It stipulates that the planning system should:

- 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 Policy (2010), the SPP 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.

Planning and Waste Management Advice (July 2015) complements the National Planning Framework 3, Scottish Planning Policy and Scotland's Zero Waste Plan. It reiterates Scottish Government Policy published in January 2011 that the long-term management of higher activity radioactive waste should be in near-surface facilities.

Scotland's **Higher Activity Radioactive Waste Policy (2011)** provides the framework for the long term management of higher activity radioactive waste arising Scotland. The Scottish Government's policy for higher activity radioactive waste is to support long-term near surface, near site storage and disposal facilities so that the waste can be monitored and is retrievable and the need for transporting it over long distances is minimised. The aim of the Policy is to ensure that all activities for the long-term management of the waste are made in a way that protects the health and interests of people and the integrity of the environment now and in the future. The Scottish Government is currently consulting on an Implementation Strategy for the Policy on Higher Activity Radioactive Waste. The Strategy does not address site-specific issues nor is it prescriptive about which management solutions should be used in specific circumstances. The Strategy instead sets out the key stages for the effective implementation of the 2011 Policy and outlines key actions that are required from the NDA and the Scottish Government during those phases.

Wales

Planning Policy Wales: Chapter 12 Infrastructure and Services (July 2014) 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*".

Technical Advice Note (TAN) 21: Waste (2014) provides advice on the role of land use planning in the management and control of waste.

The **One Wales: One Planet, A New Sustainable Development Scheme for Wales Sustainable Development Scheme (2009)** sets out the Welsh Government's vision of a sustainable Wales and describes specific outcomes that it will seek to achieve through its main policies and programmes and processes that it will put in place to ensure its work coherently reflects the goals of sustainable development.

The **Wales Spatial Plan (2006)** was further updated to be in keeping with the One Wales, One Planet principles 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.

Towards Zero Waste (2010) establishes the Welsh Government's long-term aim of zero waste by 2050 and a medium term aim of achieving a high recycling society by 2025. This is supported by a range of recycling and other waste management targets including in relation to commercial and industrial waste and which are to be delivered through specific sector plans.

The Welsh Government has 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)***. The 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
- communications, engagement and knowledge sharing.

Part 1 of the ***Environment (Wales) Bill*** (to receive assent in 2016) is intended to provide a modern legislation for managing Wales' natural resources that helps to tackle the challenges faced and is focused on the opportunities Wales' resources provide. Part 4 of the Bill, meanwhile, concerns the improvement of waste management processes by achieving higher levels of business waste recycling, better food waste treatment and increased energy recovery.

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 Planning Policy Wales (2001) sets out planning policy guidance in relation to minerals extraction and related development in Wales, which includes all minerals and substances in, on or under land extracted either by underground or surface mining. The overriding objective is to provide a sustainable pattern of minerals extraction including by providing mineral resources to meet society's needs and to safeguard resources from sterilisation. Similarly, the main objective of ***Minerals Technical Advice Note (MTAN) Wales 1: Aggregates (March 2004)*** is to provide aggregate resources in a sustainable way to meet society's needs in respect of aggregates related development.

The ***Welsh Government Policy on the Management and Disposal of Higher Activity Radioactive Waste (2015)*** sets out that the Welsh Government has adopted a policy of geological disposal for the long-term, safe and secure management of higher activity radioactive waste. It states that a GDF will only be deliverable in Wales on the basis of a

voluntary partnership with interested local communities willing to enter into discussions about potentially hosting a GDF and the successful conclusion of those discussions.

10.3 Overview of the Baseline

UK

Radioactive Waste

Higher activity radioactive waste comprises a number of categories of radioactive waste – high level waste (HLW), intermediate level waste (ILW), and low level waste (LLW) – that is not suitable for near-surface disposal in current facilities. Higher activity radioactive wastes are produced as a result of the generation of electricity in nuclear power stations, from the associated production and reprocessing of the nuclear fuel, from the use of radioactive materials in industry, medicine and research, and from defence-related nuclear programmes.

HLW is defined as waste in which the temperature may rise significantly as a result of its radioactivity, such that this factor has to be taken into account in designing storage or disposal facilities. HLW arises in the UK initially as a liquid that is a by-product from the reprocessing of spent nuclear fuel. HLW is being converted into solid glass form using a treatment process called 'vitrification'. Current plans are that this solid glass waste will be stored for a number of decades, to allow a significant proportion of the radioactivity to reduce through a natural decay process, and for the waste to become cooler, so as to make it easier to transport and dispose of.

ILW is defined as waste with radioactivity levels exceeding the upper boundaries for low-level wastes, but which does not require heat to be taken into account in the design of storage or disposal facilities. ILW arises mainly from the reprocessing of spent fuel and from general operations and maintenance at nuclear sites, and can include solid metal items such as fuel cladding and reactor components, and sludges from the treatment of radioactive liquid effluents. As decommissioning and clean-up of nuclear sites proceeds, more ILW will arise. Typically, ILW is treated in solid form and packaged in purpose-designed containers, manufactured from stainless steel, iron or concrete.

LLW is the lowest activity category of radioactive waste. LLW currently being generated in the UK consists largely of paper, plastics and scrap metal items that have been used in hospitals, research establishments and the nuclear industry. Although LLW makes up more than 90% of the UK's radioactive waste legacy by volume, it contains less than one-tenth of 1% of the total radioactivity. Most operational low level waste in the UK is sent to the national LLW repository near the village of Drigg in west Cumbria, where it is encapsulated in cement and packaged in large steel containers, which are then placed in an engineered vault a few metres below the surface. A small fraction of the total volume of LLW cannot be disposed of in this way, due principally to the concentration of specific radionuclides and so will need to be disposed of in a GDF. A sub-category of LLW is Very Low Level Waste (VLLW). This comprises small volumes principally from hospitals and universities that can be safely disposed of with municipal, commercial or industrial waste (either directly or after incineration), and larger volumes from nuclear sites that can be disposed of to appropriately permitted landfill facilities.

As a pioneer of nuclear technology, the UK has accumulated a legacy of higher activity radioactive waste and material. Some of this has already arisen as waste and is being

stored on an interim basis at nuclear sites across the UK. More will arise as existing facilities reach the end of their lifetime and are decommissioned and cleaned up, and through the operation and decommissioning of any new nuclear power stations.

The NDA (2014) 2013 UK Radioactive Waste & Materials Inventory (the Inventory) provides comprehensive and up-to-date information on radioactive waste and materials in stock (as at 1 April 2013) and estimated to arise in future. **Table 10.1** shows the total volume of radioactive waste by type.

Table 10.1 Volume of Radioactive Waste by Type in the UK

Waste Type	Total Cubic Metres	% of Total Waste
VLLW	2,800,000	63.2%
LLW	1,400,000	30.4%
ILW	290,000	6.4%
HLW	1,100	0.02%
Total	4,500,000	

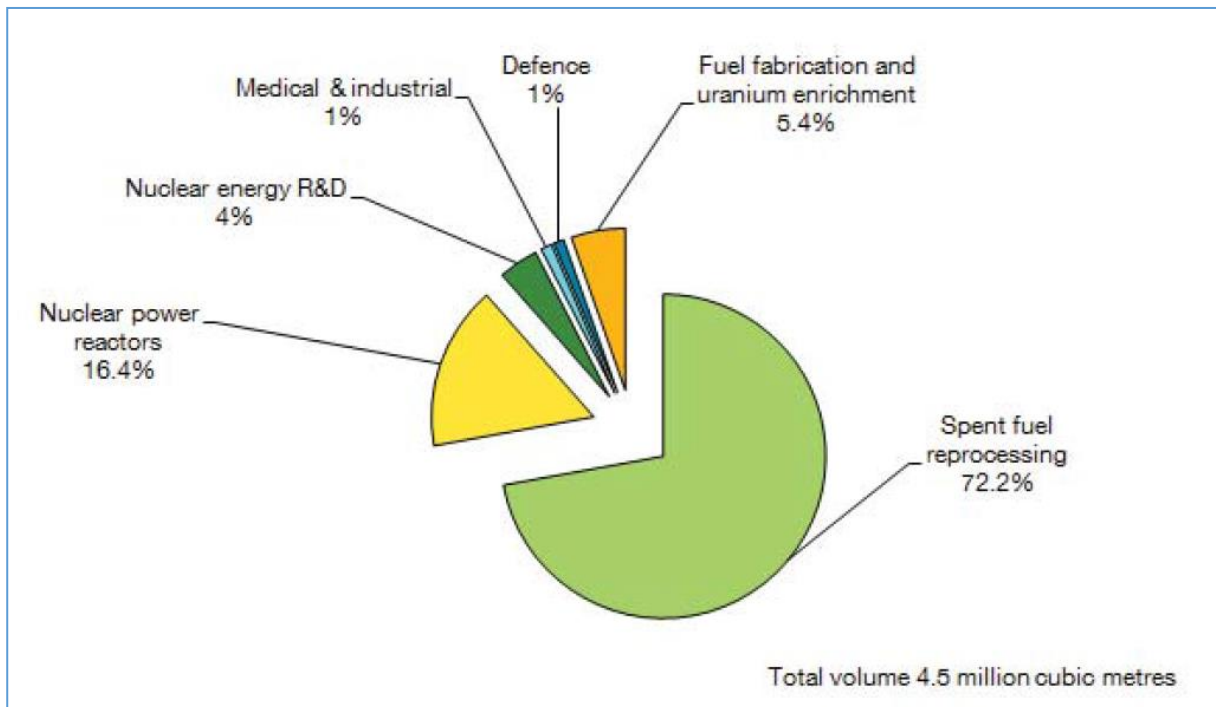
Source: NDA (2014) 2013 UK Radioactive Waste & Materials Inventory

Approximately 94% (4.2 million cubic metres) of radioactive waste falls into the LLW and VLLW categories. According to the Inventory, about 3.9 million cubic metres of this volume are from the dismantling and demolition of nuclear facilities and the clearance of contaminated ground at nuclear sites.

About 6% (about 290,000 cubic metres) of radioactive waste is in the ILW category, and less than 0.1% (1,100 cubic metres) is in the HLW category. The Inventory highlights that although the volume of HLW is relatively small, it contains around 95% of all radioactivity in radioactive wastes (LLW contains less than 0.01% of the total radioactivity). These percentage values will change gradually over future time as radioactivity decays.

Figure 10.1 highlights the relevant contribution of radioactive waste arising from activities at existing facilities in the UK.

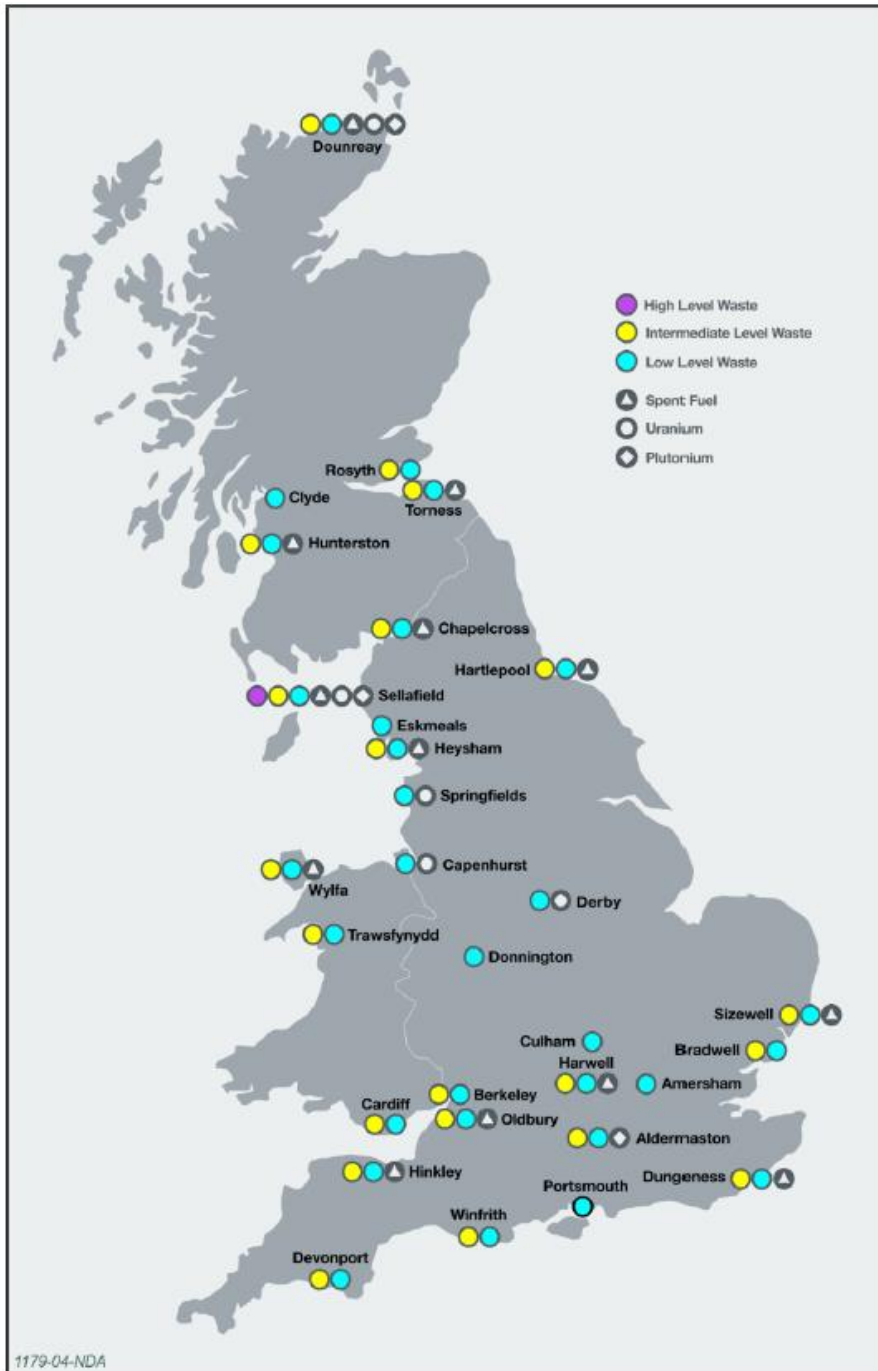
Figure 10.1 Sources of Radioactive Waste



Source: NDA (2014) 2013 UK Radioactive Waste & Materials Inventory

Figure 10.2 shows sites where radioactive waste and materials are currently stored in the UK. There are three LLW disposal sites within Great Britain; the main national repository is the LLW Depository near Drigg, in England. Further LLW disposal sites are at Dounreay and Clifton Marsh. At present there are no facilities in the UK for disposing of LLW not suitable for near-surface disposal, ILW and HLW – and these wastes are currently stored.

Figure 10.2 Sites Where Radioactive Waste and Materials are Currently Stored



Source: DECC (2014) Implementing Geological Disposal: A Framework for the long-term management of higher activity radioactive waste.

The Inventory sets out that approximately 96% (4.3 million cubic metres) of the total volume of radioactive waste has already been produced. Some has been processed, and is being held in stores, but most is contained within existing nuclear facilities, including reprocessing plants and nuclear reactors, and will not be processed until these are shut down and dismantled. This waste is the legacy of past and current civil and military nuclear programmes.

About 4% (160,000 cubic metres) of the radioactive waste total has yet to be produced. This waste is that forecast from the future planned operations of the existing nuclear power

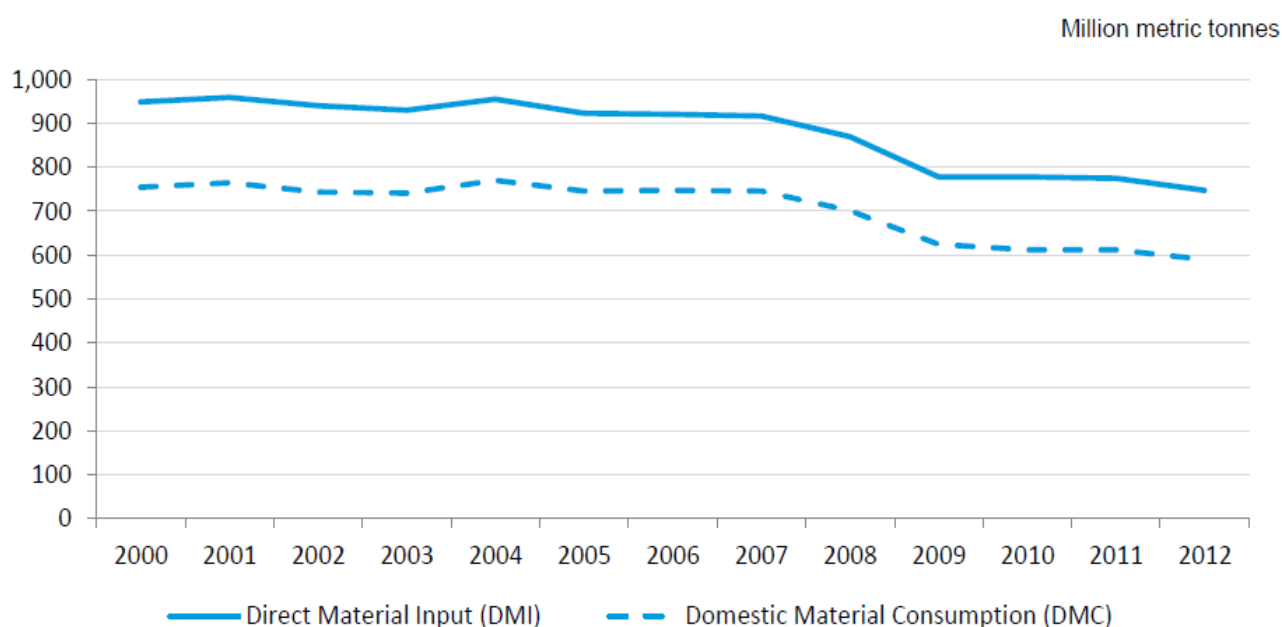
industry, from ongoing defence programmes and from the continued use of radioactivity for medical and industrial purposes.

The Inventory does not include nuclear material that is not currently classified as waste but could be at some point in the future, if it is deemed to have no further use. This could include spent fuels arising in the reactors of the operational nuclear power stations in the UK, plutonium produced during the irradiation of fuel in nuclear reactors and uranium which typically arises from either fuel manufacture, enrichment processes or from reprocessing spent fuel after irradiation in a nuclear reactor.

Resource Use and Minerals

According to Defra Resource Statistics (2015)²³⁵, in 2012, the Domestic Material Consumption (DMC) was 590 million tonnes, and Direct Material Input (DMI) was 747 million tonnes – the lowest levels recorded on its records (See **Figure 10.3**)

Figure 10.3 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 – 2015 Edition

Table 10.2 summarises totals for extractors' sales of material for agricultural and industrial uses for 2013 for different mineral types.²³⁶

²³⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/422618/Digest_of_waste_England_-_finalv2.pdf

²³⁶ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407761/Mineral_extraction_in_Great_Britain_2013.pdf

Table 10.2 Summary of totals for extractors' sales of material for agricultural and industrial 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	56,626
Industrial Sand	3,961
Sand and Gravel	51,925
Sandstone	8,682
Igneous Rock	35,096
Peat	1,254
Crushed Rock	82,433
Clay & Shale	6,464
Chalk*	3,528
Fireclay	105

*NB only those parts of GB producing chalk are identified.

Source: DCLG: Mineral Extraction in Great Britain 2013, Business Monitor PA1007 (February 2015)

England

Waste

The Waste Review 2011 estimated that the total arisings of waste in England in 2008 were 165.1 million tonnes from households, commercial and industrial businesses and the construction sector. The Review reported a decline in waste arisings in 2008 and which the Waste Management Plan for England reports has continued. The largest contributing sector was construction, demolition and excavation which generated 81.4Mt of waste.²³⁷

In 2013/14, household waste generation was 22.97 million tonnes, having fallen 11% since 2006/7. This amounts to 389kg of waste per person per year.²³⁸ Some 43.5% of household waste was recycled. Although this is the highest recycling rate recorded for

²³⁷ Government Review of Waste Policy in England 2011

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69401/pb13540-waste-policy-review110614.pdf

²³⁸ <https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables>

England, the rate of increase has been levelling off, with 2012-13 being the lowest year on year increase for ten years²³⁹

Local authority managed waste going to landfill fell by 36% in 2013/14 over a ten year period, to 7.9 million tonnes. The implementation of the Landfill Directive and the introduction of Landfill Tax have been key drivers for local authorities to reduce waste to landfill. But also to an extent, wider issues like the slowdown in economic growth during the recession are attributable to the reduction in waste to landfill diversion totals.

A total of 38.9 million tonnes of commercial and industrial (C&I) waste were generated in England in 2012, a decrease from 67.9 million tonnes in 2002-03. C&I waste was roughly evenly split between the commercial and industrial sectors.

During 2011 in England and Wales over 4.3 million tonnes of hazardous waste were managed, generated from nearly 160,000 businesses and industry, with:

- 21% landfilled;
- 22% transferred, before final disposal or recovery;
- 27% treated;
- 30% recycled, recovered or re-used; and
- 7% incinerated.

This total amount of hazardous waste managed in 2011 was almost 15% less than in 2000.²⁴⁰

Radioactive Waste

According to the 2013 UK Radioactive Waste & Materials Inventory, approximately 91% by volume of all radioactive wastes in the UK are produced in England with the most waste produced at Sellafield and the nuclear power stations. The main national repository is the LLW Repository near Drigg, in England.

Minerals

Over 46 different minerals were extracted in England in 2012. The main minerals are outlined in **Table 10.3**.

Table 10.3 Minerals Production in England 2012

Mineral	Thousand Tonnes
Coal (deep-mined)	6,031
Coal (opencast)	2,956
Clay and Shale	5,298

²³⁹ Defra (2012) Local Authority Collected Waste Management Statistics for England- Final Annual Results 2011/12, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/85918/mwb201112_statsrelease.pdf

²⁴⁰ Environment Agency (2011) Waste Management Key Facts <http://www.environment-agency.gov.uk/research/library/data/142511.aspx>

Mineral	Thousand Tonnes
Igneous Rock	15,646
Limestone & Dolomite	46,976
Sand and Gravel (land)	33,229
Sand and Gravel (marine)	14,227
Salt	6,152
Sandstone	4,451

Source: British Geological Survey (2014) United Kingdom Minerals Yearbook 2013

Scotland

Waste

In 2012, the total amount of waste generated in Scotland was 11.36 million tonnes - a decline from the 13.38 million tonnes recorded for 2011. In 2011, Scotland produced approximately 13.2 million tonnes of controlled waste.²⁴¹ The majority of the controlled waste was from the construction and demolition industry (46%), with the remainder generated from businesses, households and other industry. A small percentage of the total (approximately 4.6%) was classed as hazardous waste.

In 2013, 2.41 million tonnes of household waste was generated in 2013, compared with 2.5 million tonnes in 2012.²⁴²

The amount of controlled waste in Scotland had fallen during the period 2005 to 2012 from approximately 22 million tonnes to 13 million tonnes. This is attributed to mainly reductions in the amount of commercial and industrial waste, rather than the amount of household waste. The slowdown in economic growth is also considered a likely causal factor.

In 2011/12, there were 3.06 million tonnes municipal solid waste arising in Scotland; a decrease of 3% from 2010/11. The percentage of local authority collected municipal waste recycled or composted rose from 38.2% to 41.2% during the 2010-11 to 2011/12 period.

Of the local authorities in Scotland:

- 17 recycled or composted more than 40% of their waste;
- 11 recycled or composted more than 30%;
- 2 recycled or more than 20%; and
- 2 recycled less than 20%.

²⁴¹ <http://www.environment.scotland.gov.uk/get-informed/people-and-the-environment/waste/>

²⁴² <http://www.gov.scot/Topics/Statistics/Browse/Environment/TrendHouseholdWaste>

Radioactive Waste

According to the 2013 UK Radioactive Waste & Materials Inventory, approximately 6% by volume of radioactive wastes in the UK are produced in Scotland with the most waste produced at Dounreay and the nuclear power stations. Radioactive waste is managed at 7 sites and a new LLW disposal facility opened at Dounreay in 2015 which is intended to support the decommissioning of redundant facilities at the site.

Minerals

Mineral production in Scotland for 2012 is outlined in **Table 10.4**.

Table 10.4 Minerals Production in Scotland 2012

Mineral	Thousand Tonnes
Coal (opencast)	4,823
Igneous Rock	17,383
Limestone & Dolomite	1,120
Sand and Gravel (land)	5,772
Sandstone	1,564
Silica Sand	440
Peat (000m ³)	146

Source: British Geological Survey (2014 United Kingdom Minerals Yearbook 2013)

Wales

Waste

Total municipal waste produced in Wales in 2013-14 was 1,557,229 tonnes²⁴³. 87% of all municipal waste produced was household waste.²⁴⁴

The amount of waste disposed of in landfill continued to fall with less than 0.6 million tonnes sent to landfill in 2013-14, accounting for 41% of all waste. This is considered to be largely due to an increase in the amount of waste recycling and composting rates, which together, accounted for 56% of local authority municipal waste management in 2013-14.

The percentage of local authority municipal waste (excluding abandoned vehicles) that was reused, recycled or composted in Wales has seen a continued increase since 2000-01, reaching 54.3% in 2013-14.

The most recent figures for Industrial and Commercial Waste in Wales date back to 2007. Key results from this survey include:

²⁴³ <https://stats.wales.gov.uk/Catalogue/Environment-and-Countryside/Waste-Management/Local-Authority-Municipal-Waste/Annual/wastemanaged-by-management-year>

²⁴⁴ Welsh Government (2014) Local Authority Municipal Waste Management Report 2013-14

- Welsh industrial and commercial sectors generated an estimated 3.6 million tonnes of waste, with 53% from industrial companies and 47% from commercial companies; and
- in addition, 1.8 million tonnes of 'non-wastes' were produced, specifically blast furnace slag and virgin timber.²⁴⁵

Radioactive Waste

According to the 2013 UK Radioactive Waste & Materials Inventory, approximately 3% by volume of radioactive wastes in the UK are produced in Wales with the most waste produced at the nuclear power stations. Radioactive waste is managed at 3 sites in Wales, the NDA Magnox reactor station sites at Trawsfynydd and Wylfa – the former is shut down and being decommissioned, the latter is operational (though due to be decommissioned shortly) and a new power station is proposed; and GE Healthcare's Maynard Centre at Cardiff.

At present there are no facilities in Wales for disposing of LLW and ILW – these wastes are currently stored and transported to the repository in Drigg, England.

Minerals

Mineral production in Wales for 2012 is outlined in **Table 10.5**.

Table 10.5 Mineral Production in Wales 2006-2012

Mineral	Thousand Tonnes
Coal (deep-mined)	139
Coal (opencast)	2,408
Igneous Rock	1,769
Limestone & Dolomite	7,938
Sand and Gravel (land)	751
Sand and Gravel (marine)	613
Sandstone	2,701

Source: British Geological Survey (2014) United Kingdom Minerals Yearbook 2013

10.4 Summary of Existing Problems Relevant to the Geological Disposal 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;

²⁴⁵ Environment Agency (2007) Survey of Industrial and Commercial Waste Arisings in Wales

- The consumption of non-renewable sources will deplete overall stocks and result in a scarcity of resources for future generations; and
- Facilities for disposing of higher activity wastes, which include LLW not suitable for near-surface disposal, ILW and HLW, have yet to be developed in the UK.

10.5 Likely Evolution of the Baseline

UK

Non-radioactive waste management in the UK is moving towards greater reuse and recycling and less landfill. In 2012, 186.2 million tonnes of waste entered final treatment. Of this amount, the proportion that went to landfill was 26.1%. The Environment Agency reports a decrease in hazardous waste production in England and Wales from 2007 to 2009 by 31%. The total amount of hazardous waste sent to landfill is reported to have decreased since 2000, totalling 0.56mt in 2009²⁴⁶.

When compared with the previous NDA 2010 UK Radioactive Waste & Materials Inventory, there is 220,000 cubic metres less radioactive waste in the 2013 Inventory. The volume of LLW and VLLW has decreased by about 220,000 cubic metres, the volume of ILW has decreased by about 900 cubic metres and the volume of HLW has increased by 60 cubic metres. The main reason for the lower total volume has been a change in the assumptions underpinning a reassessment of waste from decommissioning activities at Sellafield.

The wastes that will be disposed of in a GDF are referred to in the White Paper as the 'inventory for disposal'. The specific types of higher activity radioactive waste (and nuclear materials that could be declared as waste) which would comprise the inventory for disposal in a GDF are:

- HLW arising from the reprocessing of spent nuclear fuel at Sellafield;
- ILW arising from existing nuclear licensed sites, and defence, medical, industrial, research and educational activities;
- The small proportion of LLW that is not suitable for disposal in the national LLW Repository;
- Spent fuel from existing commercial reactors (yet to be declared waste) and research reactors that is not reprocessed;
- Spent fuel (yet to be declared waste) and ILW from a new build programme up to a defined amount;
- Plutonium stocks - residual plutonium not re-used in new fuel manufacture (yet to be declared waste);
- Uranium stocks – including that arising from enrichment and fuel fabrication activities (yet to be declared waste);
- Irradiated fuel and nuclear materials (yet to be declared waste) from the UK defence programme.

²⁴⁶ <http://webarchive.nationalarchives.gov.uk/20130123162956/http://www.defra.gov.uk/statistics/files/20110617-waste-data-overview.pdf>

Based on Radioactive Waste Management's (RWM) (2015) Geological Disposal: The 2013 Derived Inventory²⁴⁷, the current estimated volume of all the waste and materials to be disposed of in a GDF is 656,000 cubic metres. **Table 10.6** provides a breakdown of this inventory for disposal by waste stream/group.

Table 10.6 Inventory for Disposal

Waste Group	Packaged Volume (m ³)
Legacy Shielded Intermediated Level Waste (SILW) / Shielded Low Level Waste (SLLW)	93,000
Legacy Unshielded Intermediate-level Waste (UILW) / Unshielded Low Level Waste (ULLW)	327,000
New Build UILW	22,100
New Build SILW	18,900
Depleted, Natural and Low-enriched Uranium (DNLEU)	109,000
Robust Shielded ILW Containers	7,280
HLW	9,290
Legacy Spent Fuel (SF) (Advanced Gas-Cooled Reactor)	9,160
Legacy SF (Pressurised Water Reactor)	2,160
Legacy SF (metallic)	3,390
New build SFs	39,400
Mixed Oxide SF	11,900
Highly Enriched Uranium	2,470
Plutonium	620
Total	656,000

Source: RWM (2015) Geological Disposal: The 2013 Derived Inventory

England

In England, household waste arisings have fallen from 23.7 million tonnes in 2009-10 to 22.9 million in 2011-12. In 2009, commercial and industrial waste arisings were 47.9 million tonnes. The municipal component of this C&I waste is estimated to be 24.7 million tonnes. Both C&I and household waste had larger decreases in waste arisings than

²⁴⁷ Available from <http://www.nda.gov.uk/publication/2013-derived-inventory/> [Accessed October 2015].

forecast in a previous analysis for 2008-09²⁴⁸; with an estimate of approximately 56.3 million tonnes, which constitutes approximately 27.6 million tonnes of municipal C&I waste.

A 2009 survey²⁴⁹ estimated that 52% of commercial and industrial waste was recycled or reused in 2009 and 24% was sent to landfill.

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.

On the basis of an evaluation of the development of waste streams in the future set out in the WMPE (2013), commercial and industrial waste arisings are predicted to fall to 43.9 million tonnes by 2020.

Scotland

In Scotland, approximately 20 million tonnes of waste was produced in 2008.²⁵⁰ Household waste arisings in 2013 totalled 2,412,706 tonnes of which 1,018,208 was recycled/ composted. This is a decrease by 88,130 tonnes in 2012. Commercial and industrial waste arisings in 2012 totalled 4,091,566 tonnes. The total amount of Scottish waste sent to landfill decreased from 7,814,879 tonnes to 6,112,198 tonnes over the same four year period.²⁵¹

The quantity of hazardous waste in Scotland reduced from 109,995 tonnes in 2006 to 104,001 tonnes in 2009, a decrease of 5.4%.²⁵²

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 2025.²⁵³

The Scottish Government is not a sponsor of the programme for implementing geological disposal, but does remain committed to dealing responsibly with radioactive waste arising in Scotland. On 20 January 2011, the Scottish Government published Scotland's Higher Activity Waste Policy 12. Scottish Government policy is that the long-term management of higher activity radioactive waste should be in near-surface facilities. Facilities should be located as near to the sites where the waste is produced as possible. While the Scottish Government does not support deep geological disposal, it continues, along with the UK Government and other devolved administrations, to support a robust programme of interim storage and an ongoing programme of research and development.

²⁴⁸ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/251567/pb13883-forecasting-2020-waste-arisings-131017.pdf

²⁴⁹ 2009 'Commercial and Industrial Waste Generation and Management Survey

²⁵⁰ <http://www.gov.scot/Resource/0045/00458945.pdf>

²⁵¹ Scotland's Zero Waste Plan Data, Scottish Environment Protection Agency, June 2010, http://www.sepa.org.uk/waste/waste_data/zero_waste_plan_data.aspx

²⁵² Environment Agency Waste Trends, <http://www.environment-agency.gov.uk/research/library/data/123472.aspx>

²⁵³ Scotland's Zero Waste Plan Data, Scottish Environment Protection Agency, June 2010, http://www.sepa.org.uk/waste/waste_data/zero_waste_plan_data.aspx

Wales

In Wales, the landfilling of all wastes has decreased by 1,409,000 tonnes between 1998/99 (4,377,000 tonnes) and 2007 (2,968,000 tonnes).²⁵⁴ There has been a year on year decrease in waste arisings since 2004/05 and a marked increase in the amount of municipal waste being reused, recycled and composted. A target set to landfill less than 0.710 million tonnes of biodegradable municipal waste by 2010 was met two years ahead of target, in 2008.

The waste prevention targets for the commercial and industrial waste stream set out in Towards Zero Waste suggest that there will be an 85.6% in the period 2015/16 from total arisings in 2006 and a further reduction to 77.9% in the period 2020-21.

With regard to commercial wastes, Towards Zero Waste 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.

The Welsh Government has participated in the Managing Radioactive Waste Safely (MRWS) programme since its inception in 2001. The Welsh Government is committed to securing the long-term safety of radioactive wastes and to the implementation of a disposal framework appropriate to the needs of Wales and will continue to play an active part in the MRWS programme to promote the interests of the people of Wales.

As highlighted in **Section 10.2**, the Welsh Government has adopted a policy of geological disposal for the long-term, safe and secure management of higher activity radioactive waste. It states that a GDF will only be deliverable in Wales on the basis of a voluntary partnership with interested local communities willing to enter into discussions about potentially hosting a GDF and the successful conclusion of those discussions.

10.6 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 Geological Disposal NPS proposals are set out in **Table 10.7**, together with reasons for their selection.

Table 10.7 Approach to Assessing the Effects of the Geological Disposal NPS on Waste and Resource Use

Objective/guide question	Reasoning
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.	The SEA Directive requires likely significant effects on resources be taken into account in the Environmental Report, which for the purposes of the AoS is incorporated within the AoS Report.

²⁵⁴ Towards Zero Waste: and Waste Strategy Progress Report 2002- 2008, Welsh Government, June 2010, <http://wales.gov.uk/docs/desh/publications/100730wasteprogresen.pdf>

Objective/guide question	Reasoning
Will the Geological Disposal NPS affect the amount of hazardous and non-hazardous wastes produced?	The Waste Framework Directive promotes a hierarchical approach to waste management with waste prevention at the top of the hierarchy. This is supported through national strategies such as the Waste Management Plan for England. In addition, the Basel Convention promotes minimisation of generation of quantities of hazardous waste in order to prevent against problems and challenges posed by hazardous waste.
Will the Geological Disposal NPS affect the capacity of existing waste management systems, both nationally and locally?	The UK currently has no specific facility or capacity for the disposal of Higher Activity Waste. The 2014 White Paper sets out the types of radioactive waste to be managed, and a proposed way forward through the creation of a GDF. As such, the proposals will help to create the required capacity to accommodate this particular waste stream.
Will the Geological Disposal 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 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 include targets for recycling rates.</p>
Will the Geological Disposal 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 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 Geological Disposal NPS increase the burden on limited natural resources?	<p>Conservation of resources and living within environmental limits are underlying objectives of several 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 Geological Disposal 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 10.8 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the resource use and waste objectives. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 10.8 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.
-	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

Effect	Description	Illustrative Guidance
		<p>national targets for minimising, recovering and recycling waste;</p> <ul style="list-style-type: none"> • 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.

11. Traffic and Transport

11.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on 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

11.2 Review of Plans and Programmes

International/European

The European Commission White Paper ***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 no more conventionally-fuelled cars in cities, 40% use of sustainable low carbon fuels in aviation and a 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport, all of which will contribute to a 60% cut in transport emissions by 2050.

The ***International Maritime Dangerous Goods Code (2012)*** sets out a uniform code for the transport of dangerous goods by sea covering such matters as packing, container traffic and stowage, with particular reference to the segregation of incompatible substances. The Code regulates sea transport of hazardous materials to ensure the safe transportation of dangerous goods and to prevent marine pollution.

The ***European Agreement Concerning the International Carriage of Dangerous Goods by Road (the ADR Regulations) (2015)*** (ECE/TRANS/242, Vol. I and II (ADR 2015)) sets out high level aims, duties and provisions for the carriage of dangerous goods in Europe.

The main objective of the ***Shipments of Radioactive Waste and Spent Fuel (2006/117/EURATOM)*** is to establish a system of control and prior authorisation for shipments of radioactive waste, to protect the health of workers and the general public and to avoid illicit traffic of such materials.

UK

The ***Transport Act 2000*** made 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.

The ***Local Transport Act 2008*** empowers local authorities to take appropriate steps to meet local transport needs in the light of local circumstances.

The ***Aviation Policy Framework (2013)*** replaces the 2003 Air Transport White Paper as the Government's policy on aviation, alongside any decisions Government makes following the recommendations of the independent Airports Commission. One of the Government's main aviation objectives is to ensure that the UK's air links continue to make it one of the best connected countries in the world. This includes increasing links to emerging markets so that the UK can compete successfully for economic growth opportunities. To achieve this objective, the Framework supports the maintenance of the UK's aviation hub capability and the development of links from airports which provide point-to-point services.

The ***Road Safety Act 2006*** makes provision about road traffic, registration plates, vehicle and driver information, hackney carriages and private hire vehicles, and trunk road picnic areas. The ***Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (2009) as amended*** (SI 2009/1348) sets out measures to regulate the carriage of dangerous goods by road and rail in Great Britain.

The transport of dangerous goods by air is governed by the ***Air Navigation (Dangerous Goods) Regulations 2002*** (SI 2002/2786). The transport of dangerous goods by sea, meanwhile, is governed by the ***Merchant Shipping (Dangerous Goods and Marine Pollutant) Regulations 1997*** (SI 1997/2367) and the ***Merchant Shipping (Vessel Traffic Monitoring and Reporting Requirements) Regulations 2004*** (SI 2004/2110).

The ***NDA Geological Disposal Transport Safety Strategy (2014)*** presents the NDA's strategy and outlines the documents to be prepared for understanding, assessing and ensuring the safety of transport associated with the lifecycle of a GDF. The Strategy sets out the following transport-specific priorities:

- Responsibility for demonstrating transport safety;
- Assessment of all safety impacts of transport.

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.

Door to Door- A Strategy for Improving Sustainable Transport Integration (DfT, 2013) focuses on four key areas to enable people to be confident in choosing sustainable transport these include:

- accurate, accessible and reliable information about the different transport options for their journeys;
- convenient and affordable tickets, for an entire journey;
- regular and straightforward connections at all stages of the journey and between different modes of transport; and
- safe, comfortable transport facilities.

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 Policy Statement for National Networks (NN NPS) (Department for Transport (DfT), 2013)*** sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects (NSIPs) on the national road and rail networks in England. The NN NPS identifies the following vision and objectives for national networks:

“The Government will deliver national networks that meet the country’s longterm needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:

- *Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs.*
- *Networks which support and improve journey quality, reliability and safety.*
- *Networks which support the delivery of environmental goals and the move to a low carbon economy.*
- *Networks which join up our communities and link effectively to each other.”*

The ***National Policy Statement for Ports (DfT, 2012)*** provides the framework for decisions on proposals for new port development. The NPS sets out that the Government seeks to:

- encourage sustainable port development to cater for long-term forecast growth in volumes of imports and exports by sea with a competitive and efficient port industry capable of meeting the needs of importers and exporters cost effectively and in a timely manner, thus contributing to
- long-term economic growth and prosperity;
- allow judgments about when and where new developments might be proposed to be made on the basis of commercial factors by the port industry or port developers operating within a free market environment; and

- ensure all proposed developments satisfy the relevant legal, environmental and social constraints and objectives, including those in the relevant European Directives and corresponding national regulations.

Scotland

Scotland's National Transport Strategy (2006) aims to connect people to jobs, education, services and recreation. The Strategy focuses on three key strategic outcomes, which include:

- 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.

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.

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 Welsh Government is currently consulting on its **Draft National Transport Plan (2015)** that, once approved, will replace the existing adopted Transport Plan. This focuses on key priorities which include economic growth, access to employment, tackling poverty, sustainable travel and safety and access to services.

Planning Policy Wales (Edition 7) (2014) 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.

11.3 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 245.8 thousand miles, the majority of which is made up of minor roads (87.3%).²⁵⁵

Between 1994 and 2014, the distance travelled by motor vehicles increased by 18.8%. In 2014, a total of 311.0 billion miles were travelled by all motor vehicles in the UK, an increase of 7.3 billion miles since 2013. This suggests that traffic volumes are returning to the pre-recession peak of 314.1 billion miles in 2007.²⁵⁶ In Great Britain, overall there has been a steady increase in domestic road freight with 74.4% of freight goods being moved by road in 2013. In total, 151 billion tonnes km of freight was moved in 2013.²⁵⁷

Congestion in the UK is a well-documented issue for road traffic and data shows that motor vehicle traffic increased from 261,935 million vehicle miles in 1994 to 311,010

²⁵⁵ Department for Transport, Road Lengths in Great Britain 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/428857/road-lengths-in-great-britain-2014.pdf

²⁵⁶ Department for Transport, Roads and Traffic 2014 <https://www.gov.uk/government/statistical-data-sets/tsgb07>

²⁵⁷ Department for Transport, Domestic freight transport: by mode: 1953-2013 <https://www.gov.uk/government/statistical-data-sets/road-freight-statistical-tables-index>

million vehicle miles in 2014, an increase of 19%.²⁵⁸ Over the last ten years, on a national scale, traffic growth has been fastest in Scotland and slowest in England with 2014 figures 4.6% and 0.9% higher than in 2004 respectively.²⁵⁹

In 2013, the number of reported road fatalities decreased by 2% to 1,713 compared to 2012. This figure is the lowest since records began in 1926.²⁶⁰

Rail

Across the UK, the number of passenger journeys by rail has more than doubled since privatisation, from 735 million passengers in 1994/95 to 1,589 million in 2013/14. The amount of route kilometres open to passengers has also increased, from 14,359 km to 14,504 km over the same period.²⁶¹

In recent years, 8 to 9% of freight moved in Great Britain has been moved by rail. Freight traffic is measured in net tonne kilometres (NTKm), taking into account the weight of the goods and the distance they travel. In 2013/14 the amount of freight moved by rail was 23 billion NTKm. 36% of freight moved was coal, the highest proportion for any commodity, 27% was domestic intermodal freight and 2% was international freight.²⁶²

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, Gatwick²⁶³. Air traffic in the UK has been rising steadily. In 1953 there were 195,000 air traffic movements, by 2013 this figure was 2,031,000. In this time, both the number of passengers flying and the amount of freight transported has risen dramatically to 228,382,000 passengers and 2,262,000 tonnes respectively. This has put increased pressure on the UK's airports.²⁶⁴

Water

Major UK sea ports include: Sullom Voe; Forth; Tees and Hartlepool; Hull; Grimsby and Immingham; Felixstowe; Harwich; London; Ramsgate; Dover; Portsmouth; Southampton; Milford Haven; Holyhead; and Liverpool. In the UK, the total amount of domestic freight movements by water fell by 19% to 28.5 billion tonne-km between 2012 and 2013. This decline can be largely attributed to the amount of goods moved around the coast. Since 2011, coastwise traffic has decreased by 38% from 31.3 to 19.4 billion tonne. The total goods moved is now less than half the level of 2003.²⁶⁵

²⁵⁸ Department for Transport, Traffic by Local Authority <https://www.gov.uk/government/statistical-data-sets/tra89-traffic-by-local-authority>

²⁵⁹ Department for Transport Road Traffic Estimates: Great Britain 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/428671/annual-road-traffic-estimates-2014.pdf

²⁶⁰ Department for Transport, Transport Statistics Great Britain 2014 – Road accidents and casualties https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389592/tsqb-2014.pdf

²⁶¹ Department for Transport, Length of National Railway Route at the year end - annual from 1990 <https://www.gov.uk/government/statistical-data-sets/rai01-length-of-route-distance-travelled-age-of-stock>

²⁶² Rail Executive (2014) Rail Trends, Great Britain 2013/14, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/363718/rail-trends-factsheet-2014.pdf

²⁶³ Department for Transport, Transport Statistics Great Britain 2014 – Aviation https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389592/tsqb-2014.pdf

²⁶⁴ Department for Transport Air traffic at UK airports <https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport>

²⁶⁵ Department for Transport, Domestic Waterborne Freight, 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384456/dwf-2013.pdf

Movement of Radioactive Materials

At least half a million packages of radioactive materials are shipped within the UK each year. Transport of radioactive materials is associated with a number of activities and industries, for example electricity generation, healthcare, university research and education, with the nuclear industry making up only a small proportion of these movements. Transport is seen as a key issue for local stakeholders in respect of decisions about the management of wastes from nuclear sites. This local concern is usually focussed on two key issues:

- Disturbance to local communities as a result of transport;
- The safety of radioactive materials during transport²⁶⁶

England

Road

England has a road infrastructure network of 187,838 miles (as at 2014), comprising 21,979 miles of major roads and 165,858 miles of minor roads.²⁶⁷ The average speed during the weekday morning peak (7:00-10:00) on local authority managed 'A' roads in England was 24.3mph in the year ending September 2014, a 2.4% decrease on the year ending September 2013. Average speeds have continued to fall over the last two and a half years indicating that congestion is increasing.²⁶⁸

Rail²⁶⁹

In 2013/14, 70% of Great Britain rail journeys were made with London & South East operators whilst 66% journeys in the South East and 76% in the East of England started or finished in London. In the north of England, the North West had the highest number of rail journeys, with 9% of all journeys in Great Britain starting or finishing in the region.

Aviation²⁷⁰

Heathrow is the busiest airport in the UK with 72.3 million passengers in 2013. In 2013, Heathrow handled 27.1% of the UK's total air transport movements, 34.6% of terminal passengers and 64.2% of freight. The other major airports in London are Gatwick, Luton, Stansted and London City.

Gatwick and Manchester airports are the next busiest airports in England following Heathrow at 35.4 and 20.7 million passengers respectively in 2013.

Other major airports in England include Birmingham, Bristol, Newcastle, East Midlands International and Liverpool (John Lennon).

²⁶⁶ NDA (2014) Geological Disposal Generic Environmental Assessment

²⁶⁷ Department for Transport Statistical Release - Road Lengths in Great Britain 2014 <https://www.gov.uk/government/statistical-data-sets/tsqb07#table-tsqb0713-rdl0102>

²⁶⁸ Department for Transport Congestion on local authority managed 'A' roads, England https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389592/tsqb-2014.pdf

²⁶⁹ ²⁶⁹ Rail Executive (2014) Rail Trends, Great Britain 2013/14, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/363718/rail-trends-factsheet-2014.pdf

²⁷⁰ Department for Transport Aviation <https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport>

Water

Dover is the largest ferry port in England and the UK and handled over 13 million passengers in 2013.²⁷¹ Dover to Calais is by far the busiest UK ferry route carrying 10.8 million passengers in 2014.²⁷²

English ports accounted for 69% of total freight tonnage through UK ports in 2013. Grimsby & Immingham is largest UK port in terms of tonnage and in 2013 handled 12% of total UK tonnage.

Modes of Transport

In 2013, 64% of all trips were made by car or van, with 22% walking and 14% by rail, bus or other 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 follows:²⁷³

- 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)
- Not in employment 35.3% (13,718,653 persons)

The average distance travelled to work increased by 12.2% between 2001 and 2011 to 15.1km.²⁷⁴

Scotland

Road

Scotland has a road infrastructure network of 36,914 miles (as of 2014), comprising 6,667.9 miles of major roads and 30,246.3 miles of minor roads. Scottish Ministers are responsible for the trunk road network, which comprises the motorways and some, but not all, of the main 'A' roads. This accounts for 6% of the total length of the public road

²⁷¹ Department for Transport UK international sea passengers <https://www.gov.uk/government/statistical-data-sets/spas01-uk-international-sea-passengers>

²⁷² Department for Transport Provisional Sea Passenger Statistics: 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/406807/provisional-sea-passenger-statistics-2014.pdf

²⁷³ ONS Method of Travel to Work in England and Wales – 2011 <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>

²⁷⁴ ONS Average Distance Travelled to Work Summary Table, England and Wales, 2001 and 2011

network, but carried over a third of all the traffic.²⁷⁵ Local authorities are responsible for the rest of the public road network.

Unclassified roads accounted for almost half of the road network – 16,383 miles. There were 22,512 miles of roads with a speed limit of over 40mph – about two thirds of the road network. The length of motorway (excluding slip roads) has risen from 230 miles in 1999 to 283 miles in 2014.²⁷⁶

Rail

In 2013/14, 7% of all Great Britain rail journeys started or finished in Scotland. Scot Rail passenger numbers totalled 83.8 million in 2012/13, an increase of 2.7% from the previous year, and a 30% rise since 2004/5. Rail freight has increased slightly from the mid-1990s “all time low”, to around 7-14 million tonnes in recent years. When measured in ‘tonne-kilometres’, which take account of the distance that the freight is carried, rail is about 3 billion. In the 2012 Scottish Household Survey (SHS), 92% of respondents agreed that trains were on time, 89% agreed that services were stable and not regularly changing, and 51% agreed that the fares were good value.

Aviation

There were 22.2 million air terminal passengers in 2012, around 0.1 million (1%) more than the previous year. There has been almost continuous growth from 1.2 million in 1960, with increases in all but eight of the years since then. In 2012, more than half the passengers who used Scottish airports were travelling to or from other UK airports – principally London Heathrow (2.7 million), Gatwick (1.8 million) and Stanstead (0.7 million). International passenger numbers were greatest for flights to/from Amsterdam (1.2 million), Dublin (0.7 million) and Paris, Charles de Gaulle (0.5 million).

Water

In 2012, about 5 million passengers were carried on subsidised ferry services. The most heavily-used routes were: Wemyss Bay – Rothesay (690,000); Largs – Cumbrae (695,000); and Ardorossan – Brodick (689,000). Subsidised services also carried just over 1 million cars, the number on the specified routes noted previously being: 150,000; 134,000; and 127,000 respectively.

There were 1.8 million passenger journeys between Scotland and Northern Ireland in 2012: 1.1 million on the Cairnryan – Belfast route, 524,000 on Cairnryan – Larne and 169,000 on Troon – Larne. The service between Troon and Belfast was withdrawn in December 2004 and the service between Stranraer and Belfast was replaced by Cairnryan to Belfast in 2011. The numbers of cars carried on these routes (in 2012) were: 239,000 for Stranraer - Belfast; 126,000 for Cairnryan – Larne and 47,000 for Troon – Larne.

The tonnages lifted in Scotland by coastal shipping has fluctuated over the past 20 years, and is currently around 25 – 31 million tonnes per year. Inland waterway freight has remained fairly stable at around 10-12 million tonnes. When measured in “tonne-kilometres” (which take account of the distance that the freight is carried, and are unaffected by freight being lifted several times en route), shipping is around 14-17 billion, and inland waterway a quarter of a billion.

²⁷⁵ Transport Scotland. Statistical trends. 2014. <http://www.transportscotland.gov.uk/statistics/high-level-summary-statistics-trends-0> [Accessed 17.06.2015]

²⁷⁶ Department for Transport. Road lengths (miles). 2015. <https://www.gov.uk/government/statistical-data-sets/rdl01-road-lengths-miles> [Accessed 17.06.2015]

Modes of Transport

In terms of the method of travel to work or study in Scotland, the breakdown is as follows:²⁷⁷

- Work mainly at or from home - 11.3% (383,490 persons)
- Underground, metro, light rail or tram - 0.3% (9,830 persons)
- Train - 3.4% (118,241 persons)
- Bus, minibus or coach - 13.4% (454,981 persons)
- Taxi or minicab - 0.7% (23,678 persons)
- Driving a car or van - 40.1% (1,390,214 persons)
- Passenger in a car or van – 9.0% (305,949 persons)
- Motorcycle, scooter or moped – 0.2% (7,544 persons)
- Bicycle – 1.3% (44,193 persons)
- Walking -1.9% (627,855)
- Other method of travel to work – 0.9% (31,232 persons)

Wales

Road

The total road length in Wales in 2014 was 21,411.83 miles. Unclassified minor surfaced roads contribute approximately half the total road length in Wales. The local authority of Powys covers the largest land area out of all the local authorities in Wales and accounts for the highest proportion of all A trunk roads (27%), B and C roads (21%) and minor surfaced roads (12%), resulting in an overall 16% of the total road length of Wales. The greatest length of motorway is in Newport, which accounts for 19% of the total motorway in Wales. Just over one third (34%) of the road length of Wales is classed as being in built – up areas.²⁷⁸

UK registered HGVs carried 42 million tonnes of road freight within Wales in 2014; 23 million tonnes to Wales from the rest of the UK; and 24 million tonnes from Wales to the rest of the UK. Over three quarters of the freight from Wales goes to the North West, the South West and the West Midlands; they also account for 72% of the road freight moving into Wales from the rest of the UK.²⁷⁹

Rail

There were approximately 28 million rail passenger journeys which either started or ended in Wales in 2012-13, an increase of 1% compared to the previous year. Over two-thirds (68%) of these journeys were within Wales. During 2012-13, stations within the Cardiff

²⁷⁷ Scotland's Census 2011- Method of Travel to Work or Study <http://www.scotlandscensus.gov.uk/ods-analyser/jsf/tableView/tableView.xhtml>

²⁷⁸ Welsh Government Road Lengths and Conditions 2014 <http://gov.wales/statistics-and-research/road-lengths-conditions/?lang=en>

²⁷⁹ Welsh Government. Road Freight. 2014. <http://gov.wales/statistics-and-research/road-freight/?lang=en> [Accessed 17.06.2015]

local authority area were the destination of almost two fifths (39%) of rail passenger journeys within Wales.²⁸⁰

Aviation

The total number of passengers using Cardiff International Airport reduced by 48,000 (4%) in 2014 compared to 2013, to a little over 1,000,000. The majority (83%) of these terminal passengers were for international flights. In 2014, there were 858,000 international air passengers using Cardiff International Airport, an increase of 2,000 from the previous year. There was an increase in passengers to and from EU destinations, up 4%, and a fall in passengers going beyond the EU, down 21%. Most of the international traffic was by chartered airlines rather than scheduled airlines. With regard to domestic flights, in 2014 there were 171,000 domestic terminal passengers using Cardiff International Airport, down by 40,000 (19%) since 2013. In contrast to the international traffic, most of these passengers, 167,000, used scheduled services.²⁸¹

Water

In Wales during 2013 there was total freight traffic through Welsh ports of 58.9 million tonnes (Mt). Of this, 39.1 Mt were good inwards and 19.8 Mt were goods outwards. Welsh ports accounted for 12% of the total UK port traffic of 503.0 Mt.²⁸²

Welsh ports also act as the gateway between the Republic of Ireland and the rest of Europe with, for example, nearly three quarters of goods carried on HGVs between Ireland and Europe passing through Wales.

Modes of Transport

In terms of the method of travel to work in Wales, the breakdown is as follows:

- Working mainly at or from home – 3.3 % (73,140 persons)
- Underground, metro, light rail, tram – 0.1% (1,175 persons)
- Train – 1.2% (27,341 persons)
- Bus, minibus or coach – 2.8% (62,903 persons)
- Taxi – 0.3% (6,523 persons)
- Motorcycle, scooter or moped – 0.3% (7,694 persons)
- Driving a car or van – 40.9% (918,645 persons)
- Passenger in a car or van -4.1% (92,727 persons)
- Bicycle – 0.9% (19,659 persons)
- Walking – 6.5% (145,135 persons)
- Other method of travel to work – 0.4% (8,673 persons)
- Not in employment 39.3% (881,551 persons)

²⁸⁰ Welsh Government. Rail Transport. 2014. <http://gov.wales/statistics-and-research/rail-transport/?lang=en> [Accessed 17.06.2015]

²⁸¹ Welsh Government. Air Transport. 2015. <http://gov.wales/statistics-and-research/air-travel/?lang=en> [Accessed 17.06.2015]

²⁸² Welsh Government. Sea Transport. 2015. <http://gov.wales/statistics-and-research/sea-transport/?lang=en> [Accessed 17.06.2015]

The average distance travelled to work increased by 12.6% between 2001 and 2011 to 16.7km.²⁸³

11.4 Summary of Existing Problems Relevant to the Geological Disposal 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;
- The transport of radiological materials by road and rail in the UK is controlled by the Office for Nuclear Regulation and the Department for Transport. Nevertheless, there is a need to ensure the safe transportation of such materials and minimise adverse effects of transport movements on local communities.

11.5 Likely Evolution of the Baseline

UK

Road

Compared to 2013, traffic has increased in all regions of Great Britain: Wales and the East of England have seen the largest percentage increases; London and the South West of England have seen the smallest increases. Over the last ten years, on a national scale traffic growth has been fastest in Scotland and slowest in England, with 2014 figures 4.6% and 0.9% higher than in 2004 respectively.

Rail

Despite stagnating throughout most of the second half of the twentieth century, passenger numbers on the UK's railways have grown strongly since 1995. Demand is now growing at around 5-6% per year.²⁸⁴ The NPS for National Networks (DfT, 2014) 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. Report of the Inquiry into Britain's Rail Capacity highlights that if the current growth rate of demand continued for a sustained

²⁸³ ONS Average Distance Travelled to Work Summary Table, England and Wales, 2001 and 2011

²⁸⁴ All-Party Parliamentary Group for High-Speed Rail. Report of the Inquiry into Britain's Rail Capacity. 2012.

<http://www.appghsr.co.uk/upload/APPG%20for%20High-Speed%20Rail%20Inquiry%20Report.pdf> [Accessed 17.06.2015]

period, current infrastructure would be overwhelmed and incremental upgrades such as those suggested by Rail Package 2 (RP2) and 51m's 'Optimised Alternative' would not be sufficient. 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.

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 decades.²⁸⁵

The central forecast, 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. 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

In their assessment of future port demand, MDS Transmodal identified three forecasting scenarios for unitised traffic. These can be summarised as:

- Central Forecast: import growth dictates the overall growth of unit loads moving through the ports because those units will be 're-exported' whether loaded or empty. Import volumes are based upon the evidence of long run trends and relationships based upon GDP growth and exchange rate change, independently of trends in export growth. The implication is that export volumes will grow to meet any long run balance of payments deficits that might emerge.
- Low Case: growth in imports implied in the Central Forecast inhibited by the slower rate of growth of unit load exports over the last 5 years, implying that for imports to grow faster would lead to an unacceptable long run balance of payments deficit.
- High Case: growth in imports based upon the higher rates of unit load import growth over the last 5 years, implying that there will be a rapid growth in exports of goods and (particularly) services to avoid a long run balance of payments deficit.²⁸⁶

²⁸⁵ Department for Transport. UK Aviation Forecasts. 2013. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223839/aviation-forecasts.pdf [Accessed 17.06.2015]

²⁸⁶ MDS Transmodal Ltd. UK Port demand forecasts to 2030. 2006. <http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/consultations/archive/2006/ppr/ukportdemandforecaststo2030.pdf> [Accessed 17.06.2015]

The overall conclusion is that between 2004 and 2030 container traffic is expected to grow by 178% & 112% with regard to TEU (Twenty-foot equivalent) and HGV (Heavy Goods Vehicle) respectively. Bulk traffics are forecast to grow by just 8% overall. Total port tonnes for the UK are forecast to grow by 37%. Unit load cargoes are forecast to grow from about 27% of total UK port tonnes (including Eurotunnel) in 2004 to about 43% in 2030.

England

Forecasts conducted by the DfT predict that compared to the 2010 baseline (and under a central scenario), road traffic will be 44% higher by 2035. Despite this increase in traffic, CO₂ emissions are forecast to decline by around 9% from 2010 levels, reflecting fleet fuel efficiency improvement and the use of biofuels (this reflects the central scenario, the low traffic scenario forecasts 23% lower, whilst high traffic forecasts 9% higher).²⁸⁷

DfT road traffic forecasts indicate that national road traffic will increase to 2040 but that the size of growth will be dependent on the number and types of journeys that people make, the effect of rising incomes on car ownership and car use, and future trends in income growth and fuel prices. The range in DfT's forecasts is for 19% to 55% growth in road traffic between 2010 and 2040.²⁸⁸

Scotland

There has been a large rise in the distance travelled, with most of the increase being due to travel by car. Over about 20 years, the average distance travelled per person per year in Scotland increased by 2,509 miles, of which 2,246 were by car.

The total number of motor vehicles licensed in Scotland was 2.7 million at the end of 2012 and has increased steadily with rises of 17% since 2002 and 3% since 2007. However, there were fewer vehicles per 100 population in Scotland (51) than in Great Britain (56) in 2012. Traffic volume on Scotland's roads has tended to increase steadily – an overall increase of 15% since 1996. The volume of traffic on Motorways has grown by 43% since 1996, in part due to the expansion of the Motorway network.

The Scottish Government Infrastructure Investment Plan 2011: Progress report for 2014 outlines why the Government needs to invest, how they will invest and in what strategic, large-scale investments they intend to take forward within each sector over the next 10 to 20 years. With regards to transport, the largest noted investment is the Forth Replacement Crossing at a value of between £1.35-1.4 billion.

Wales

It is estimated that the volume of motor vehicle traffic on all roads in Wales in 2010 had decreased since 2009, by 1.9 per cent. The volume of traffic had, however, grown by just over 10 per cent since 2000.

²⁸⁷ Department for Transport. Road Transport Forecasts 2011. 2012.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4243/road-transport-forecasts-2011-results.pdf [Accessed 17.06.2015]

²⁸⁸ Department for Transport. Road Traffic Forecasts 2015. 2015.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/411471/road-traffic-forecasts-2015.pdf [Accessed 17.06.2015]

The Wales Infrastructure Investment Plan for Growth and Jobs: Project Pipeline Update 2014 provides a clear picture of infrastructure investment in Wales and helps to inform strategic investment decisions across both the public and private sector. With regard to transport there are a number of projects currently in the pipeline, the largest of which is the M4 Corridor around Newport at an estimated total scheme value of £1 billion.

11.6 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 Geological Disposal NPS proposals are set out in **Table 11.1**, together with reasons for their selection.

Table 11.1 Approach to Assessing the Effects of the Geological Disposal NPS on Traffic and Transport

Objective/Guide Question	Reasoning
Objective: To minimise the volume of traffic and promote more sustainable transport choices.	Whilst traffic and transport is not specifically referred to in the SEA Directive, the issue is a significant one in the case of the GDF given the character of construction and operation.
Will the Geological Disposal 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 Geological Disposal NPS help to minimise the direct effects of transport such as noise and vibration, severance 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 Geological Disposal 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.

Table 11.2 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the traffic and transport objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 11.2 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 the GDF.
+	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 the GDF.
0	Neutral	<ul style="list-style-type: none"> Option would not have any significant effects on traffic and transport.
-	Negative	<ul style="list-style-type: none"> Option would have minor, short term effects associated with the direct and indirect impacts of traffic and transport associated with the GDF.
--	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 the GDF.
?	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. Cultural Heritage

12.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on cultural heritage. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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.

12.2 Review of Plans and Programmes

International/European

The **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. 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 **UNESCO Convention for the Protection of the Archaeological Heritage of Europe (revised) (1992)** 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 (1972)** 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.

The ***European Convention on the Protection of the Archaeological Heritage (1992)*** made a number of important agreements including setting the definition of 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*”.

UK

The Department for Culture, Media and Sport White Paper ***Heritage Protection for the 21st Century (2007)*** set out a strategy for protecting the historic environment in England and Wales, based on three core principles: developing a unified approach to the historic environment; maximising opportunities for inclusion and involvement; and supporting sustainable communities by putting the historic environment at the heart of an effective planning system.

Set out below, are recent changes in the planning system and in the specialised heritage protection system that will affect heritage protection:²⁸⁹

- 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.

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).

²⁸⁹ <https://www.historicengland.org.uk/advice/hpg/HP>

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 value²⁹⁰; 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.

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 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.

National Planning Practice Guidance on 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, has published a number of guidance documents for the protection of the historic environment, including ***Climate Change and the Historic Environment (2005)*** (currently being revised to reflect changes resulting from the NPPF and other Government initiatives and to incorporate new information, research and advice on climate change and its relationship with the historic environment), ***Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (2008)*** and Good Practice Advice Notes on ***Managing Significance in Decision-Taking in the Historic Environment (2015)*** and ***The Setting of Heritage Assets (2015)***.

²⁹⁰ 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.

Scotland

The **National Planning Framework 3 (2014)** recognises the value of Scotland's historic environment and its world-renowned built heritage as a key asset.²⁹¹

The **Natural Heritage (Scotland) Act 1991** established a body to be known as Scottish Natural Heritage (SNH) whose general aims and purposes are to secure the conservation and enhancement of the natural heritage of Scotland and to foster understanding and enjoyment of this heritage.

The **Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997** outlines the level of protection received by listed buildings and buildings within conservation areas in Scotland.

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
- 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.

Scotland's Culture (2006) sets out the Scottish Minister's vision for the strategic direction of future cultural policy and identifies key initiatives, legislation, investment and infrastructure changes needed to implement those decisions. The policy aims to: provide support nationally for talent and excellence in culture and enable more people to enjoy culture; and encourage more people to enjoy cultural activities locally by asking local authorities to develop cultural 'entitlements' for their area and to undertake cultural planning.

²⁹¹ <http://www.gov.scot/Topics/Built-Environment/planning/National-Planning-Framework>

Policies in **Scottish Planning Policy (SPP) (2014)** reflect the value of the historic environment as a key part of Scotland's cultural heritage. SPP 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.

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.

Wales

The **Historic Environment (Wales) Bill** was introduced 1st May 2015 to improve the protection and sustainable management of Wales' unique and precious historic environment. Specifically, the Bill is intended to give more effective protection to listed buildings and scheduled monuments; to improve the sustainable management of the historic environment; and to introduce greater transparency and accountability into decisions taken on the historic environment. The existing 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
- The Planning (Listed Buildings and Conservation Areas) Act 1990.

Historic Environment Strategy for Wales (May 2013) seeks to summarise the areas which the Welsh Government will prioritise for action over the next three and a half years. The main objective of the Strategy is to protect Wales' heritage, whilst encouraging public access, enjoyment and participation.

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 (7th Edition 2014) 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 (2014) sets out the Welsh Government's policy and advice in respect of the design of new development, including sustaining or enhancing local character.

12.3 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.

National

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. Nearly 19,446 sites have been assessed by Historic England as being 'at risk'.

Historic England has identified the following proportions of heritage sites as at risk within England in 2014:

- 6% of listed places of worship;
- 6.1% of conservation areas (from those that were included within the report);
- 15.2% of scheduled monuments;
- 5.7.% of registered parks and gardens;
- 13% of registered battlefields; and
- 4 protected wreck sites²⁹².

A nationwide survey of conservation areas, conducted by Historic England and the 75% of England's local planning authorities who responded, indicates that approximately 1 in 7 is at risk from neglect, decay or unsympathetic change.²⁹³ The main threats identified were:

- unsympathetic replacement doors and windows (83% of conservation areas);
- poorly maintained roads and pavements (60%);
- the amount of street clutter (45%);

²⁹² Historic England, Heritage at Risk 2014 <https://www.historicengland.org.uk/advice/heritage-at-risk/findings/>

- loss of boundary walls, fences or hedges (43%);
- unsightly satellite dishes (38%);
- the effects of traffic calming or traffic management (36%);
- alterations to front elevations, roofs and chimneys (34%);
- unsympathetic new extensions (31%);
- the impact of advertisements (23%); and
- neglected green spaces (18%).

The density of shipwreck remains in the English territorial sea is considered amongst the highest in the world due to the combined effects of historically high volumes of shipping traffic, a long history of seafaring and an often hazardous coastline.²⁹⁴

Scotland

In Scotland there are approximately 8,193 scheduled monuments²⁹⁵ in excess of 47,000 listed buildings,²⁹⁶ 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 Areas and 39 Inventory Battlefields.

Wales

In Wales there are approximately 4,111 scheduled monuments²⁹⁷ 29,889 listed buildings, 519 conservation areas, 3 World Heritage Sites, 370 historic parks and gardens, and 6 designated historic wrecks. There are currently 127 monuments in state care in Wales.²⁹⁸

Since 2011, the percentage of buildings 'at risk' or in vulnerable condition has decreased from 9.22% to 8.92%.

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.

12.4 Summary of Existing Problems Relevant to the Geological Disposal NPS

The following existing problems for cultural heritage have been identified:

- ▶ Scheduled monuments in rural areas are at risk from intensive grazing practices and unrestricted plant, scrub or tree growth;

²⁹⁴ Historic England, <https://www.historicengland.org.uk/advice/hpg/has/protectedwrecks/>

²⁹⁵ Historic Environment Scotland, <http://data.historic-scotland.gov.uk/pls/htmldb/f?p=2300:30:0::::>

²⁹⁶ Scottish Government, 2010, Land Use Strategy, Strategic Environmental Assessment Screening and Scoping Report, <http://www.scotland.gov.uk/Resource/Doc/1051/0095735.pdf>

²⁹⁷ Powys County Council: Built Heritage Strategy (October 2010) http://built-heritage.powys.gov.uk/uploads/media/Built_Heritage_Strategy_Web_en.pdf

²⁹⁸ Powys County Council: Built Heritage Strategy (October 2010 – September 2015) http://built-heritage.powys.gov.uk/uploads/media/Built_Heritage_Strategy_Web_en.pdf

- ▶ Challenging economic conditions are reducing the funds available to conserve and manage heritage assets; and
- ▶ The settings of heritage assets are at risk from new development.

12.5 Likely Evolution of the Baseline

England

From 2000 to 2007 there was a steady decrease in the number of buildings identified at risk. This trend was interrupted in 2007 as there was a rise in the number of entries on the Buildings at Risk Register. The 2014 Heritage at Risk National Summary Report²⁹⁹ identifies some positive trends, such as:

- Buildings at risk: 575 entries have been removed from the 2013 Register because their futures have been secured. Of the 14,775 listed places of worship in England, 888 (6%) are at risk and have as such been added onto the 2013 Register;
- Scheduled monuments: 1.3% of scheduled monuments have been removed from the 2013 Register for positive reasons;
- Registered parks and gardens: 0.5% of sites have been removed from the 2013 Register;
- Protected wrecks: four sites have been added to the 2013 Register;
- Conservation areas: 497 (6.1%) of sites have been added to the 2013 Register for positive reasons.

Scotland

Despite the difficult economic climate, there was a reduction in the percentage of A-listed entries (Buildings of national or international importance, either architectural or historic, or fine little-altered examples of some particular period, style or building type) on the Buildings at Risk Register in Scotland from 8.7% in 2009 to 8.2% in 2011.³⁰⁰ Almost 40% of all A-listed entries were in the 'Critical' or 'High' category of risk which suggests that a high proportion of these buildings are in such a condition that unless remedial action is carried out, the building's condition will sharply deteriorate.

Wales

A 2013 report for Cadw found that the number of listed buildings reported as 'at risk' fell from 9.22% in 2011 to 8.92% in 2013. Those classed as 'vulnerable' fell from 15.31% to 13.81%; and those classed as 'not at risk' increased slightly from 75.47% to 77.27%.³⁰¹

²⁹⁹ English Heritage (2014) Heritage at Risk 2014 National Summary Leaflet

³⁰⁰ Historic Environment Scotland (2011) Buildings at Risk Register (BARR): survey of A-Listed entries in Scotland National Report 2011 (<http://www.historic-scotland.gov.uk/barrnationalreport2011.pdf>)

³⁰¹ <http://cadw.gov.wales/docs/cadw/publications/141008cadwconditionsurveyen.pdf>

12.6 Assessing Significance

The objectives and guide questions related to cultural heritage which have been identified for use in the appraisal of the effects of Geological Disposal 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 Geological Disposal NPS on Cultural Heritage

Objective/Guide Question	Reasoning
Objective: To protect and where appropriate enhance the historic environment including cultural heritage resources, historic buildings and archaeological features and their settings.	The SEA Directive 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.
Will the Geological Disposal NPS affect designated or locally-important archaeological features or 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 and Planning (Listed Buildings and Conservation Areas) Act.
Will the Geological Disposal NPS affect the fabric and setting of historic buildings, places or spaces that contribute to local distinctiveness, character and appearances?	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.

Table 12.2 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the cultural heritage objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 12.2 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

Effect	Description	Illustrative Guidance
		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 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 bring minor 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 designated sites, 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.

13. Landscape and Townscape

13.1 Introduction

The overview of plans and programmes and baseline information contained in this section provides the context for the assessment of potential effects of the National Policy Statement for Geological Disposal of Radioactive Waste (hereafter referred to as the Geological Disposal NPS) on landscape and townscape. Information is presented for the UK as a whole as well as for England, Scotland and Wales.

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.

13.2 Review of Plans and Programmes

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, 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 (with numerous revisions) 1986*** 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*** implements key elements of the Government's ***Rural Strategy*** published by Defra in July 2004. 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 townscapes 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 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.

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

Planning Policy Wales (Edition 7) (2014) 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 (2014) sets out the Welsh Government's policy and advice in respect of the design of new development, including sustaining or enhancing local character.

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. This act will be supported by the Planning (Wales) Bill and Environment (Wales) Bill once they have been given royal assent.

13.3 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.

Many of the UK's nuclear facilities are situated in relatively rural locations. The general scale of the buildings associated with existing nuclear facilities has a relatively significant effect on the landscape and are, as such, relatively noticeable features. A number of existing nuclear facilities are also located within, or in close proximity, to designated landscape areas, such as National Parks, AONB and Heritage Coasts.³⁰²

England

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 areas.³⁰³

There are 34 AONBs in England, one of which straddles England and Wales (the Wye Valley AONB). AONBs cover 18% of England and Wales.³⁰⁴ 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 England.³⁰⁵ 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 alone.³⁰⁶

A national record of nearly 1,650 Registered Historic Parks and Gardens³⁰⁷ 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 Blenheim Palace, the most recent of these to be recognised was inscribed by UNESCO in 2009.³⁰⁸

³⁰² GDA (2014) Geological Disposal: Generic Environmental Assessment

³⁰³ National park facts and figures. <http://www.nationalparks.gov.uk/learningabout/whatisanationalpark/factsandfigures> [Accessed 26.05.2015]

³⁰⁴ Areas of Outstanding Natural Beauty <http://www.landscapesforlife.org.uk/> [Accessed 26.05.2015]

³⁰⁵ National Character Area profiles: data for local decision making. 2014.

<http://www.naturalengland.org.uk/ourwork/landscape/englands/character/areas/default.aspx> [Accessed 28.05.2015]

³⁰⁶ Review and evaluation of heritage coasts in England. 2006.

<http://publications.naturalengland.org.uk/publication/4594438590431232?category=56001> [Accessed 26.05.2015]

³⁰⁷ Historic England. The National Heritage List for England. 2015. <http://list.historicengland.org.uk/results.aspx>

³⁰⁸ World Heritage List. <http://whc.unesco.org/en/list/> [Accessed 28.05.2015]

Scotland

Scotland has been assessed as having 365 types of distinctive landscape character which are divided into 52 groupings.³⁰⁹

Scotland has 40 National Scenic Areas (NSAs) covering more than one million hectares (12.7% of Scotland).³¹⁰ Other areas designated for their landscape include two National Parks and three Regional Parks together with a number of Special (local) Landscape Areas.³¹¹

There are five World Heritage Sites in Scotland: St. Kilda; Old and New Towns of Edinburgh; the Frontiers of the Roman Empire; Heart of Neolithic Orkney; and New Lanark.

Scottish National Heritage has produced a map which illustrates 'wild land' in Scotland. '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).³¹² Other areas designated for their landscape include three National Parks covering 20% of Wales (Brecon Beacons, Snowdonia and Pembrokeshire Coast National Park); 495km of Heritage Coast, and 58 landscapes of outstanding/special historic interest.

There are three World Heritage Sites in Wales; Castles and Town Walls of King Edward in Gwynedd, Blaenavon Industrial Landscape and Pontcysyllte Aqueduct & Canal.

The Landscape Map of Wales recognises 49 sub-regional Landscape Character Areas across Wales.

13.4 Summary of Existing Problems Relevant to the Geological Disposal NPS

The following existing problems for landscape have been identified:

- Over the last century the following landscape character trends have been experienced in the UK:³¹³
 - 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;

³⁰⁹ Scottish Natural Heritage. Natural Heritage Zones: A national assessment of Scotland's landscapes. 2002.

<http://www.snh.gov.uk/docs/B464892.pdf> [Accessed 28.05.2015]

³¹⁰ Scottish Government, 2010, Land Use Strategy, Strategic Environmental Assessment Screening and Scoping Report, <http://www.scotland.gov.uk/Resource/Doc/1051/0095735.pdf> [Accessed 28.05.2015]

³¹¹ The term used for such local landscape designations varies from one local authority to another. For example, they are 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).

³¹² Areas of Outstanding Natural Beauty <http://www.ccg.gov.uk/landscape--wildlife/protecting-our-landscape/special-landscapes--sites/protected-landscape/aonbs.aspx> [Accessed 28.05.2015]

³¹³ Natural England. State of the Natural Environment 2008. <http://www.naturalengland.org.uk/publications/sones/sections.aspx> [Accessed 28.05.2015]

- 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.
- As part of the most recent Countryside Quality Counts (2007) survey, 29% of National Character Areas in England were identified as having a changing landscape character, many of which were altering in a direction which could be regarded as inconsistent with the traditional landscape vernacular of the area. A similar study of landscape change is not available for Scotland or Wales, though changes have undoubtedly taken place in areas relevant to the AoS in these countries also;
 - 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; and
 - 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 processes⁶ Wind energy development is placing a pressure on landscape character, in particular in Southern Scotland where there are 83 windfarms installed or approved.

13.5 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;

- **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

Forestry Commission Scotland aimed to see Scotland's woodlands increase from 17.1% of land area to about 25% and bring 80% of the special features on Scotland's nationally important nature sites into favourable condition by March 2008.³¹⁴

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.³¹⁵

³¹⁴ The Scottish Forestry Strategy. 2006 <http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/forestry-strategy> [Accessed 26.05.2015]

³¹⁵ Countryside Council for Wales. Strategic Environmental Assessment. Guidance for practitioners. SEA Topic: Landscape. 2008. <http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&cad=rja&uact=8&ved=0CCEQFjAA&url=http%3A%2F%2Fwww.ccw.gov.uk%2FLandscape--wildlife%2Fmanaging-land-and-sea%2Fenvironmental-assessment%2Fidoc.ashx%3Fdocid%3De0082b5b-19a7-45cd-97fb-5deac1e100bc%26version%3D-1&ei=dupmVc-JLsW1UZmglAM&usq=AFQjCNGI0YMqVSTp-oYVld4xQB7cVC0gA> [Accessed 28.05.2015]

13.6 Assessing Significance

The objectives and guide questions related to landscape which have been identified for use in the appraisal of the effects of Geological Disposal NPS proposals and alternatives are set out in **Table 13.1**, together with reasons for their selection.

Table 13.1 Approach to Assessing the Effects of the Geological Disposal NPS Landscape and Townscape

Objective/Guide Question	Reasoning
Objective: To protect and enhance landscape and townscape quality and visual amenity.	The SEA Directive 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.
Will the Geological Disposal NPS have significant visual impacts (including those at night)?	Visual impacts can influence how people perceive a landscape or townscape and can decrease the character and intrinsic value.
Will the Geological Disposal 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 Geological Disposal 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 Geological Disposal 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 Geological Disposal NPS affect public access to open spaces or the countryside?	<i>National Parks and Access to the Countryside Act 1949</i> and <i>Countryside and Rights of Way Act 2000</i> 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 13.2 sets out guidance that will be utilised during the assessment to help determine the relative significance of potential effects on the landscape objective. It should not be viewed as definitive or prescriptive; merely illustrative of the factors that may be considered as part of the assessment process.

Table 13.2 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 townscapes and/or their setting; Option would affect the visual amenity of local communities; Option would temporarily 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;

Effect	Description	Illustrative Guidance
		<ul style="list-style-type: none">• 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.

