

## Appendix 4 – Updated Environmental Baseline Information

### Climate

Carbon dioxide (CO<sub>2</sub>) is the most abundant greenhouse gas, and accounted for about 84% of the total UK greenhouse gas emissions in 2010, the latest year for which final results are available. In 2011, UK net emissions of CO<sub>2</sub> were provisionally estimated to be 456.3 million tonnes. This was 8.0% lower than the 2010 figure of 495.8 million tonnes. Between 2010 and 2011 there were significant decreases in CO<sub>2</sub> emissions from all of the main sectors, which resulted primarily from a significant fall in energy consumption combined with fuel switching from coal to nuclear for electricity generation.<sup>i</sup>

In Lincolnshire there is significant potential to generate energy from renewable sources, and particularly using wind, the tides and biomass. Since 2004, the generation of energy from renewable sources within the county has been increasing steadily.<sup>ii</sup> There are a significant number of wind turbines in the county with many more planned. However the County Council wants to call a halt to the unrestrained invasion of wind turbines across Lincolnshire. Planning applications for wind farms under 50Mw are determined by District Councils, with the County Council as a potential discretionary consultee. Planning applications for wind farms 50Mw and above are determined by the Secretary of State, with the County Council as a statutory consultee. The Council's Executive Members decided on 6 June 2012 to take a stronger position on wind farms, owing to a proliferation of wind farms in recent years. Although supportive of alternative energy supplies for the future, Councillors question the effectiveness of wind farm technology, and are concerned about the visual impact for residents and on tourism in the county. Additionally, there is a project to kick start the use of biomass, which is carbon neutral, to produce energy. Burning biomass can provide a cost effective way of reducing CO<sub>2</sub> emissions.<sup>iii</sup>

In 2009, 4,571 kt of CO<sub>2</sub> emissions were released in Lincolnshire, which represented approximately a 10% (525 kt) decrease on the 5,096 kt that were released in 2007. In 2009, the total emissions in kt CO<sub>2</sub> per sector were as follows<sup>iv</sup>:

- 1,484.0 from domestic sources
- 1,674.7 from industrial and commercial sources
- 1,412.3 from road transport.

Table 1 shows emissions for each local authority in the Plan area between 2007 and 2009.<sup>v</sup>

Table 1- CO<sub>2</sub> Emission for Local Authorities in the Plan Area

| Authority                              | Year | Industry and Commercial kt CO <sub>2</sub> | Domestic kt CO <sub>2</sub> | Road Transport kt CO <sub>2</sub> | Total kt CO <sub>2</sub> | Population ('000s mid-year estimate) | Per Capita Emissions t |
|--|------|--|-----------------------------|-----------------------------------|--------------------------|--------------------------------------|------------------------|
| <b>Boston Borough Council</b>          | 2007 | 173.7                                      | 144.4                       | 134.7                             | 452.8                    | 59.1                                 | 7.7                    |
|  | 2008 | 173.0                                      | 141.4                       | 129.1                             | 443.5                    | 59.1                                 | 7.5                    |
|  | 2009 | 158.5                                      | 127.9                       | 123.7                             | 410.1                    | 59.0                                 | 7.0                    |
| <b>East Lindsey District Council</b>   | 2007 | 326.4                                      | 343.0                       | 314.7                             | 984.0                    | 140.1                                | 7.0                    |
|  | 2008 | 321.7                                      | 338.5                       | 304.0                             | 964.2                    | 140.8                                | 6.9                    |
|  | 2009 | 282.7                                      | 310.0                       | 295.9                             | 888.6                    | 140.8                                | 6.3                    |
| <b>Lincoln City Council</b>            | 2007 | 267.5                                      | 197.9                       | 66.3                              | 531.7                    | 88.2                                 | 6.0                    |
|  | 2008 | 258.7                                      | 195.1                       | 64.6                              | 518.3                    | 88.0                                 | 5.9                    |
|  | 2009 | 217.3                                      | 174.9                       | 61.9                              | 454.1                    | 88.5                                 | 5.1                    |
| <b>North Kesteven District Council</b> | 2007 | 250.4                                      | 241.6                       | 245.6                             | 737.6                    | 103.9                                | 7.1                    |
|  | 2008 | 257.6                                      | 238.2                       | 232.5                             | 728.2                    | 105.0                                | 6.9                    |
|  | 2009 | 227.2                                      | 217.4                       | 221.6                             | 666.2                    | 105.7                                | 6.3                    |
| <b>South Holland District Council</b>  | 2007 | 263.6                                      | 199.0                       | 199.4                             | 662.0                    | 83.1                                 | 8.0                    |
|  | 2008 | 279.0                                      | 194.2                       | 189.8                             | 663.0                    | 83.9                                 | 7.9                    |
|  | 2009 | 246.9                                      | 175.9                       | 180.7                             | 603.5                    | 84.1                                 | 7.2                    |
| <b>South Kesteven District Council</b> | 2007 | 424.4                                      | 305.9                       | 354.4                             | 1084.8                   | 129.7                                | 8.4                    |
|  | 2008 | 415.9                                      | 301.7                       | 334.7                             | 1052.3                   | 130.5                                | 8.1                    |
|  | 2009 | 366.1                                      | 272.0                       | 315.6                             | 956.7                    | 131.2                                | 7.3                    |
| <b>West Lindsey District Council</b>   | 2007 | 193.9                                      | 224.6                       | 225.2                             | 643.7                    | 87.4                                 | 7.4                    |
|  | 2008 | 194.7                                      | 222.6                       | 217.9                             | 635.1                    | 88.3                                 | 7.2                    |
|  | 2009 | 176.0                                      | 205.9                       | 209.9                             | 591.9                    | 88.6                                 | 6.7                    |

Total CO<sub>2</sub> emissions were highest in the South Kesteven District, which accounted for 956.7kt CO<sub>2</sub> of Lincolnshire's total, and the lowest emissions were in Boston Borough with 410.1kt CO<sub>2</sub> of Lincolnshire's total. All local authorities showed reductions in their total emissions between 2007 and 2009.

The highest per capita emissions in 2009 was found to be 7.3t in the South Kesteven District and the lowest per capita emissions was found to be 5.1t in Lincoln City.

### *Climate Change Implications for Lincolnshire*

Climate change is predicted to result in more extreme weather events, increased temperatures and rises in the sea level which will be accompanied by economic, social and environmental impacts. Some of the potential implications of climate change for Lincolnshire are discussed in the following sections and will need to be taken into consideration during the development of policies and strategies within the LJFRDMS.

### *Climate Change & Flooding*

Lincolnshire's coast is low lying, and as a result, has always been vulnerable to flooding from the sea. It is also vulnerable to fluvial flooding. Climate change is likely to result in sea level rises and an increase in severe weather events and storm surges. It will become more difficult to disperse the surface water that accumulates during intense rainfall events and sea level rises will make even moderate coastal sea surges from storms more damaging. These in turn, will increase the risk of flooding and it is predicted that there will be an increased frequency of severe coastal and river floods.

### *Climate Change and Water Resources and Quality*

Hotter drier summers and more extreme rainfall patterns could reduce the amount of water available and affect all stages of the water cycle. This could be particularly noticeable in longer drier summers when the availability of surface water in reservoirs and rivers for abstraction for domestic, industrial and agricultural uses would be reduced. <sup>vi</sup>

An increased likelihood of summer droughts and soil water deficits could lead to an increase in demand for irrigation and livestock may suffer from heat stress, putting more pressure on available water resources in the region.

### *Climate Change and Biodiversity*

Climate change is likely to affect the biodiversity of both the Lincolnshire coastline and the freshwater areas. There are species and habitats of international and national importance along the Lincolnshire coast; The Wash and Humber Estuaries are designated Sites of Special Scientific Interest, Special Areas of Conservation, Special Protection Areas and Ramsar Sites. The Wash is home to approximately 180,000 wading birds, ducks and geese.

Higher sea levels, storm surges and wave action accelerating coastal erosion could lead to a loss of coastal habitats currently used by wildlife. Freshwater habitats may be replaced by saline habitats; there may be an increase in the intertidal flats, or a loss of the east coast mudflats, which are important for wading birds. Species will move to accommodate these changes which will result in changes to species composition. There could therefore be a loss of species that are at the southerly edge of their distribution and an increase in species that are at the northern edge of their distribution. <sup>vi</sup>

The Lincolnshire and Rutland Limestone Natural Area lies within three counties and stretches north from Peterborough to Lincoln. It is dominated by a band of limestone with shallow soils that give rise to some of the richest grasslands in the country. These grasslands can contain 40 species of plant in a square metre of turf including nationally scarce plants such as early gentian and pasque flower, and support butterflies, glow worms, lizards, skylarks and barn owls.

In the 1940s, the Lincolnshire and Rutland Limestone area was recognised as one of the country's hotspots for biodiversity. But changes in agricultural practices and development have resulted in continued losses of this nationally important wildlife habitat. Now, only an estimated 100 hectares of flower-rich grassland remains, confined to small fragmented sites mainly on nature reserves, quarry sites and roadside verges.

Limestone grassland is so scarce and vulnerable that its survival is a conservation priority under national and local Biodiversity Action Plans. Natural England, Leicestershire and Rutland Wildlife Trust and Lincolnshire Wildlife Trust have launched a bold vision for the future of these limestone grasslands. They believe that together with land management advisors, local authorities and quarry operators the limestone grassland, geology and landscape of this Natural Area can be protected and enhanced.

Reduction in summer rainfall and wetter winters could also have a major effect on grassland, an increase in storm frequency or intensity could affect bird populations, and rising river temperatures are likely to result in a decline in fish populations. Furthermore, reductions in the flows in rivers could result in a deterioration of water quality as there could be less water to dilute licensed discharges. Increased numbers of tourists due to warmer weather could also lead to adverse impacts on biodiversity.

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### *Climate Change and Agriculture*

Lincolnshire has some of the best quality agricultural land in the UK and is the most productive county for wheat, oil seed rape, cereals, poultry, horticulture especially field vegetables (leeks, broccoli, cauliflower and cabbages) and bulbs. See section 0..

The increased coastal erosion and flooding that is likely to be associated with climate change has the potential to decrease the quality and availability of agricultural land in the region, with the potential for impacts to the economy and food supply.

It is likely that some crops could no longer be grown in the area. However, there may be opportunities to grow different crops and the longer growing seasons may lead to higher yields and more locally grown produce throughout the year. There may be more opportunities for vineyards and for growing lavender, sweetcorn, grain maize, sunflowers and navy beans. Additionally there may be an increased potential for planting crops for energy production. These changes in crops however will also have implications for biodiversity. <sup>vi</sup>

Additionally, climate change is likely to result in an increased threat of pests and new crop pests such as the Colorado Beetle and the European Corn Borer are anticipated.<sup>vi</sup>

### *Climate Change and Tourism*

Tourism is a significant contributor to Lincolnshire's economy. Climate change may prove beneficial to the tourism industry as summers are likely to be warmer and drier, and winters are expected to be warmer. This has the potential to increase the length of the tourist season with a resultant trend towards an all year round tourism market. This is likely to have major impacts on the economic viability of tourism and tourism related investment in resorts such as Skegness.<sup>vi</sup> Increased flooding may result in negative impacts on tourism.

### *Climate Change & Health*

Flooding can have severe impacts on health due to experience of personal and economic loss and has been linked to stress related illnesses.

Climate change and its impact on health may put additional strain on the UK health care system. It is widely acknowledged that the health impacts of climate change can be minimised by building climate change considerations (both mitigation and adaptation measures) into the UK's health and social care infrastructure. Targeting improvements in health and social services at the most at risk groups – for example by improving social services for elderly people homes – may also help to reduce the potential health impacts of climate change. Such initiatives could form part of a more holistic risk management approach to climate change issues. It is important that the LJFRDMS considers how access to these services may be improved.

### *Climate Change & Historic Environment*

The historic environment represents important cultural, social and economic benefits within Lincolnshire. However, the historic environment is vulnerable to changes in the climate. Many historic assets are potentially at risk from the direct impacts of climate change. For example, rising sea levels, increased extremes of wetting and drying, more frequent intense rainfall, changes in hydrology, and changes in vegetation patterns.

Without action to adapt to climate change and limit anthropologically induced climate change it is possible that historic assets may be damaged irreparably.

### *Transport and Infrastructure*

The East Midlands and Lincolnshire contains a number of important national transport links and ports which could be affected by climate change. Built structures such as bridges, promenades, pylons, roads and railway lines will become more vulnerable to higher winds, flooding, storm events and changes in soil moisture.

Some roads, particularly those near to the coastline and rivers will be particularly susceptible to an increased risk of flooding. Consideration will need to be given to the need to develop the capability of the carriageway to cope with excess water given the likely increase in the frequency of intense rainfall events. Railways will also be susceptible to flooding.

Temperature changes also have the potential to affect roads, by causing more frequent melting of the asphalt road surface, and railways by increasing the risk of buckling on the rail tracks.

Additionally, climate change has the potential to affect emergency services as a result of extreme weather events.

## **Air**

### *Air Quality Management*

Air quality across the county is generally considered to be good.

As part of the National Air Quality Strategy (NAQS), all local authorities are under obligation to establish air quality levels in their area. These air quality levels must meet national air quality objectives which are set by concentrations of airborne pollutants considered to be acceptable for health and the environment. If an area does not meet these objectives Air Quality Management Areas (AQMA) are declared. The authority must then draw up an Air Quality Action Plan to set objectives for improving air quality in problem areas.

There are 6 AQMAs in Lincolnshire, declared primarily as a result of pollution caused by traffic emissions. Lincoln City Council has declared 1 AQMA, Boston Borough Council has declared 2 AQMAs and South Kesteven District Council has declared 2 AQMAs.

## **Biodiversity, flora and fauna**

### *Natural Areas*

Natural England (NE) has divided England into 'Natural Areas' based on characteristic wildlife and natural features. They are used to describe England's wildlife and include all habitats, not just those that are designated. There are eight Natural Areas within Lincolnshire County, which are listed below:

- Lincolnshire Coast and Marshes – A generally flat coastal plain that is largely under arable cultivation. Habitats include meadow and pasture grasslands that are rich in wildlife. Wetlands near the coast support wildfowl and coastal birds.
- Lincolnshire Wolds – Has a rolling landscape that is mostly under arable cultivation. Habitats that are present include meadow and pasture grasslands, calcareous, acidic and neutral grasslands. Many of these habitats are rich in wildlife.

- North Lincolnshire Edge with Coversands – Two broad lowland plains separated by a watershed. Apart from the Lincolnshire Limestone Edge, most of the Natural Area comprises a fertile clay soil that is extensively farmed. Area includes nationally important heathlands, inland sand dunes and ancient woods including a cluster of small-leaved limewoods near Bardney.
- Lincolnshire and Rutland Limestone – Contains a lot of woodland. Broadleaved woodland, scrub and wood pasture can all be found. Small pockets of calcareous grassland are scattered around the Natural Area. Gravel pits support important populations of breeding birds.
- Trent Valley and Belvoir Vales – Most of the area comprises a geology that produces a fertile soil ideal for agriculture. There are a number of important habitats including neutral grassland, and a number of acidic and calcareous grassland sites associated with local differences of geology.
- The Fens – Low lying, level terrain with little natural or semi-natural habitat remaining. The land is predominantly cultivated. All the fens have artificial water courses essential to drainage.

#### *Internationally Designated sites*

There are six sites of international importance covering three designation types within Lincolnshire; Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and RAMSAR sites (internationally important wetlands). Under the Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations') (SI No. 2010/490) there is a legal requirement to assess whether there are likely significant effects of plans and/ or programmes on Natura 2000 (SACs and SPAs) and Ramsar Sites through a Habitats Regulations Assessment (HRA). HRA runs parallel to the planning approval process.

There are three designated RAMSAR sites:

- The Wash embayment covers an area of 62,044.19ha and is designated as an important wetland area and habitat for winter feeding for waders and wildfowl.
- The Humber is the second-largest coastal plain estuary in the UK covering an area of 36,657.15ha. It regularly supports internationally important numbers of waterfowl in winter and nationally important breeding populations in summer.
- Gibraltar Point consists of an actively accreting sand-dune system, saltmarsh and intertidal flats. The site covers an area of 414.09ha and accommodates large numbers of overwintering birds and significant colonies of breeding terns.

SACs include the Wash and Norfolk Coast, Humber Estuary, Gibraltar Point, Saltfleetby – Theddlethorpe Dunes, Baston Fen, and Grimsthorpe.

The Wash, Humber Estuary and Gibraltar Point are also designated as SPAs.

### *Nationally Designated Sites*

In addition there are a number of nationally designated sites within Lincolnshire. They are Sites of Special Scientific Interest (SSSI), the finest sites for wildlife and natural features in England, supporting many characteristic, rare and endangered species, habitats and natural features; and National Nature Reserves (NNRs) which are a selection of the very best parts of England's SSSIs. Both are designated under the Wildlife and Countryside Act (1981), as amended.

There are 92 SSSIs within Lincolnshire. They are mainly concentrated in the area around the Lincolnshire Wolds Area of Natural Beauty (AONB), The Wash, the area to the east of Spalding, and around Tattersall and Wragby. Within the county 65.67% of the SSSI area is considered to be in a favourable condition, 33.81% of the SSSI area is considered unfavourable but recovering, with only 0.21% of the SSSI area unfavourable condition and declining<sup>vii</sup>.

There are four NNRs within Lincolnshire;

- Donna Nook covers more than 10km of coastline between Grainthorpe Haven in the north and Saltfleet in the south. The reserve is rich in birdlife, with over 250 species recorded in total, 47 species of bird breed regularly. It also has one of the most accessible colonies of breeding grey seals in the UK.
- Saltfleetby – Theddlethorpe Dunes occupies 8.2km of coast between Mablethorpe North End in the south and Saltfleet Haven in the north. The Reserve contains tidal sand and mudflats, salt and freshwater marshes and sand dunes.
- Bardney Limewoods cover an area of 384ha of woodland and are an important example of small leaved limewood in Britain.
- Gibraltar Point NNR covers an area of 429ha, mostly consisting of intertidal flats and saltmarsh. Large numbers of migrant and overwintering birds visit the NNR.

### *Locally Designated Sites*

Local Nature Reserves (LNRs) are places with wildlife or geological features that are of special interest locally. An LNR is a statutory designation made under Section 21 of the National Parks and Access to the Countryside Act 1949 by principal local authorities. Parish and Town Councils can also declare LNRs but they must have the powers to do so delegated to them by a principal local authority.

Local Wildlife Sites (LWS) are non-statutory designations for sites of county significance for wildlife. There are a number of LWSs within Lincolnshire.

Designated sites in Lincolnshire are shown in Figure 1 and Lincolnshire's LWSs are shown in Figure 2, below.

Figure 1 Lincolnshire Designated Sites

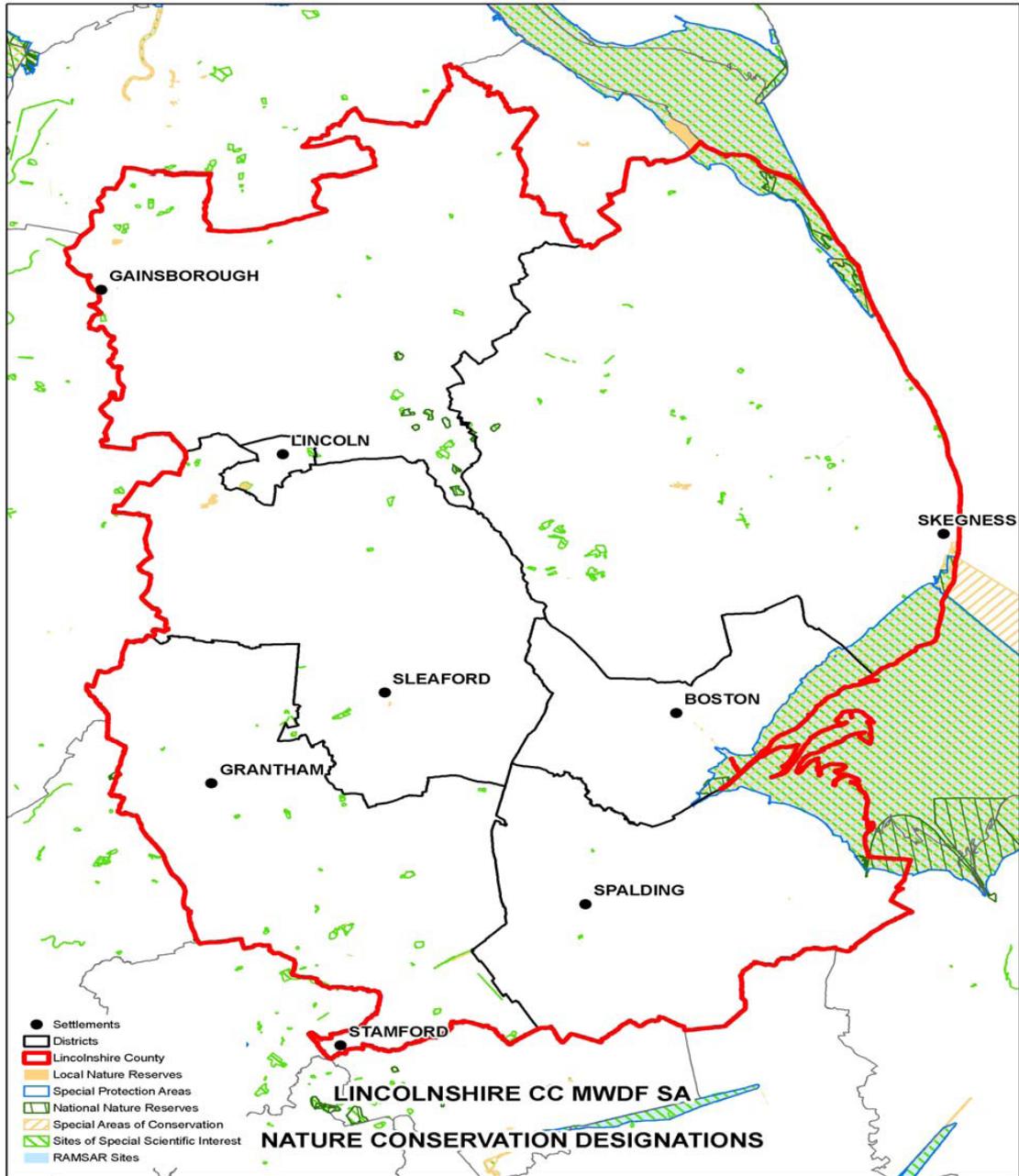
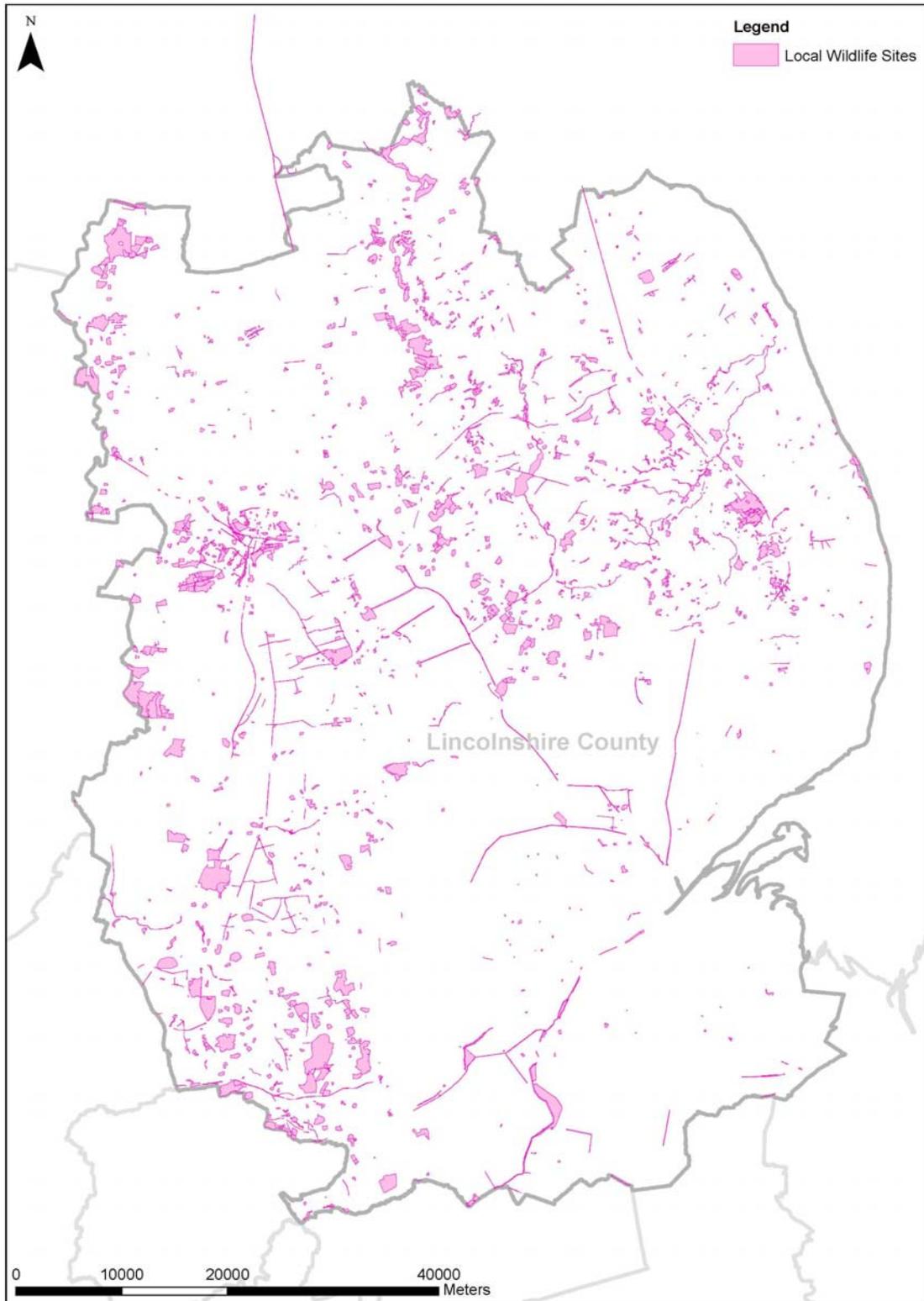


Figure 2 Lincolnshire Local Wildlife Sites



### *BAP Priority Habitats*

The United Kingdom Biodiversity Action Plan (UK BAP) addresses threatened species and habitats and is designed to protect and restore biological systems. It covers not only terrestrial species associated with lands within the UK, but also marine species and migratory birds, which spend a limited time in the UK or its offshore waters.

A number of habitats and species identified by the UK BAP have been subsequently transposed into the Lincolnshire BAP. Many of these habitats within the study area are protected by law. These habitats can be divided up into 3 groups: broad habitat types, local habitats and priority habitats which are under threat and have specific action targets associated with them.

The broad habitat types found within the study area include broadleaved, mixed and yew woodland, rivers and streams, and standing open water and canals.

The local habitat types include churchyards and cemeteries, parks and open spaces and road verges.

There are 41 action plans in total within Lincolnshire, indicating the importance of the habitat variety within this area. These habitats are shown in Table 1.

*Table 1 BAP action plans in Lincolnshire*

|                               |  |
|-------------------------------|--|
| <b>Common themes</b>          | Biodiversity information and monitoring  |
|                               | Policy, planning and resource management |
|                               | Awareness and involvement                |
| <b>Coastal and marine</b>     | Coastal sand dunes                       |
|                               | Peat and clay exposures                  |
|                               | <i>Sabellaria spinulosa</i> reefs        |
|                               | Saline lagoons                           |
|                               | Saltmarsh                                |
| <b>Farmland and grassland</b> | Arable field margins                     |
|                               | Grazing marsh                            |
|                               | Hedgerows and hedgerow trees             |
|                               | Lowland calcareous grassland             |
|                               | Lowland meadows                          |
| <b>Urban</b>                  | Brownfield                               |
|                               | Churchyards and cemeteries               |
|                               | Gardens and allotments                   |
|                               | Parks and open spaces                    |
| <b>Species</b>                | Bats                                     |

|                               |                                  |
|-------------------------------|----------------------------------|
|                               | Commercial fish (marine)         |
|                               | Farmland birds                   |
|                               | Freshwater fish                  |
|                               | Greater water-parsnip            |
|                               | Natterjack toad                  |
|                               | Newts                            |
|                               | Seals                            |
|                               | Urban birds                      |
|                               | Water vole                       |
|                               | White-clawed crayfish            |
|                               | Invasive non-native species      |
| <b>Rivers and wetlands</b>    | Chalk streams and blow wells     |
|                               | Fens                             |
|                               | Ponds, lakes and reservoirs      |
|                               | Reedbeds and bittern             |
|                               | Rivers, canals and drains        |
|                               | Springs and flushes              |
| <b>Trees and woodland</b>     | Lowland mixed deciduous woodland |
|                               | Traditional orchards             |
|                               | Wet woodland                     |
|                               | Wood-pasture and parkland        |
| <b>Heathland and peatland</b> | Heathland and peatland           |
|                               | Lowland dry acid grassland       |

Due to the fertility of its soils Lincolnshire is a principally agricultural county, dominated by intensive arable cultivation in large fields, frequently without connecting hedgerows, and subsequently the historic loss of biodiversity in Lincolnshire has been more significant than in the rest of the UK<sup>viii</sup> .

## Soil, Geology and Geomorphology

### *Soils*

Lincolnshire contains a wide variety of soils including alluvium (clay, silt and sand) along coastal regions, Till (Diamicton), River Terrace deposits (Sand and Gravel), blown sand, peat, glacial sand and gravel. The type of soil and underlying geology influence the likelihood of surface and groundwater flooding in an area.

Lincolnshire soils vary in thickness from a few centimetres to over a metre in response to the underlying geology, location in the landscape and agricultural

practices. The thinnest soils tend to occur over chalk and limestone escarpments and on valley side, with the deepest soils in the Fenlands.

### *Geology and Geomorphology*

Lincolnshire's bedrocks form a simple pattern of north-south stripes at the surface. There are older Triassic rocks in the west, overlain progressively by marine Jurassic rocks and the younger Cretaceous rocks in the east. At the surface they have been subjected to weathering and erosion under a range of climates including glacial and periglacial during the last 2 million years.

The superficial geology of the county is blanketed with a covering of Quarternary superficial deposits that formed within the last two million years. The Quarternary deposits includes glacial and fluvioglacial deposits along with younger Flandrian silts, peat, sands and alluvium that cover the Fenlands, the coastal plains east of the Wolds, much of the Humber coast and the Isle of Axholme.

## **Water**

### *Shoreline Management Plans*

There are two Shoreline Management Plans (SMPs) in place that cover the coast of Lincolnshire. One covers the coastline between Flamborough Head in East Yorkshire to Gibraltar Point. This is known as HECAG SMP2. A second SMP covers the coast between Gibraltar Point and Hunstanton in Norfolk and is known as The Wash SMP2. These were published for consultation in 2010 and 2009 respectively and both have now been signed off by the Environment Agency's Regional Director.

The purpose of the SMPs is to identify the management options and techniques that will be adopted especially with regard to the management of coastal flooding. The purpose of the LJFRDMS is to sit alongside these SMPs to manage and mitigate the risk of flooding from both fluvial and coastal sources.

### *Bathing Water Quality*

The coastline in Lincolnshire stretches from Haile Sand Fort near North Cotes in East Lindsey to Gedney Drove End in South Holland District. There are a number of popular tourist resorts including Skegness and Mablethorpe where wide sandy beaches provide opportunities for bathers.

The EA is responsible for monitoring bathing water quality across England and Wales to assess whether it complies with the standards of the current Bathing Water Directive (76/160/EEC, revised by Directive 2006/7/EC). The Directive (2006) will be implemented in stages between now and 2015 and uses two parameters to assess water quality, *Escherichia coli* and intestinal *enterococci*, over a four year data cycle that sets much tighter standards than the original directive.

Water samples are collected and graded as being 'Excellent' (approximately twice as stringent as the current guideline standard); 'Good' (similar to the current guideline; 'Sufficient' (approximately twice as stringent as the current mandatory standard) and 'Poor', for waters which do not comply with the Directive's standards. The EA is to begin monitoring to the parameters of the revised Directive in 2012; currently they produce annual results under the original directive parameters and a four year data set (2008-2011) to project the expected compliance rate under the new Directive.

There are eight EA bathing water monitoring locations along the Lincolnshire coast, all are in the East Lindsey District. Table 2 below, shows the monitored bathing water quality against the current directive and projected against the new directive from results for the 4 year cycle period, 2008-2011.

*Table 2 Bathing water quality of monitored locations in Lincolnshire*

| Monitoring Location       | Bathing Water Quality - Current monitoring parameters | Projected revised Bathing Water Directive classifications using 2008-2011 monitoring data |
|---------------------------|---|---|
| <b>Mablethorpe Town</b>   | Higher (Since 2001)                                   | Excellent   |
| <b>Sutton on Sea</b>      | Higher (Since 1996)                                   | Excellent   |
| <b>Moggs Eye</b>          | Higher (Since 1997)                                   | Excellent   |
| <b>Anderby</b>            | Higher (Since 1998)                                   | Excellent   |
| <b>Chapel St Leonards</b> | Higher (Since 2001)                                   | Excellent   |
| <b>Ingoldmells South</b>  | Higher (Since 2008)                                   | Excellent   |
| <b>Skegness</b>           | Higher (Since 2006)                                   | Good  |

*Source:* Environment Agency, 2012.

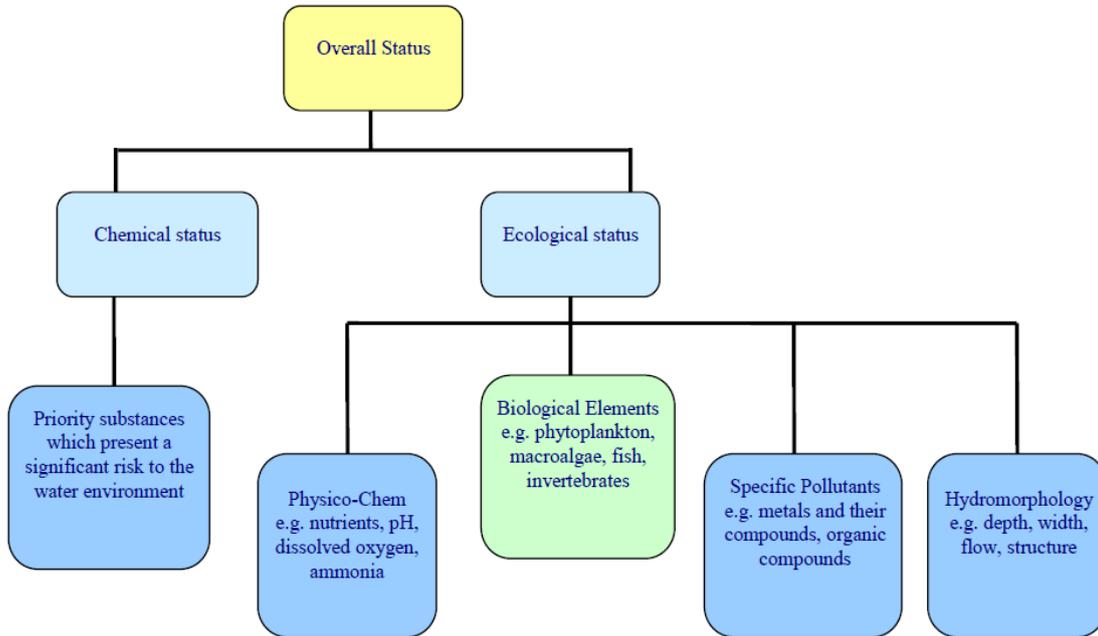
The high standards in Lincolnshire, 100% of monitoring locations achieving the 'higher' standard, reflect the high standards within the Anglian region as a whole, with 36 of the 40 (90%) monitored locations achieving the higher guideline standard. In the UK 76.9% of monitored locations achieve the 'higher' standard<sup>ix</sup>

Lincolnshire's high standard of bathing water quality is highlighted again when compared with expected compliance rate against the revised Directive, 7 of the 8 (87.5%) of the monitored locations achieving. In England 53.5% would be expected to achieve an 'excellent' classification with 23.8% achieving 'good'<sup>x</sup>.

### *Surface Water Quality*

The Water Framework Directive (WFD) sets an objective of aiming to achieve at least 'good status' in all water bodies by 2015. For surface waters, good status is a statement of 'overall status', and has an ecological and chemical component. It is measured on the scale 'high', 'good', 'moderate', 'poor' and 'bad'. The factors contributing to quality are shown in Figure 3 below.

Figure 3 The components of overall status of surface water bodies



Source: Environment Agency, 2009; *Humber River Basin Management Plan*.

Under the WFD the EA has divided England into River Basin Districts (RBD). Lincolnshire extends into the Anglian RBD (82.4%) and the Humber RBD (17.6%). The Anglian and Humber River Basin Districts are shown in the context of Lincolnshire in Figure 4 below.

Figure 4 Anglian and Humber River Basin District Boundaries



Source: Lincolnshire County Council, 2011; *Preliminary Flood Risk Assessment Report*.

Rivers comprise the majority of water bodies within the Anglian Region, there are 758 rivers and canals and 49 lakes and reservoirs. The ecological and biological status of water bodies in the Anglian and Humber regions are shown in Table 3 below.

Table 3 Ecological status/ potential and biological status of surface water bodies in the Anglian and Humber RBDs

| Classification Status | Anglian RBD                  |                   | Humber RBD                   |                   |
|-----------------------|------------------------------|-------------------|------------------------------|-------------------|
|                       | Ecological status/ potential | Biological status | Ecological status/ potential | Biological status |
| High                  | 0%                           | 6%                | 0%                           | 5%                |
| Good                  | 18%                          | 27%               | 18%                          | 22%               |
| Moderate              | 72%                          | 34%               | 66%                          | 36%               |
| Poor                  | 9%                           | 29%               | 13%                          | 29%               |
| Bad                   | 1%                           | 5%                | 3%                           | 8%                |

Source: Environment Agency, 2009; *River Basin Management Plan - Anglian River Basin District*.

On a local scale Lincolnshire is covered by six river catchments that are set either wholly or partially within the boundaries. The catchments covering Lincolnshire are listed below and shown in Figure 5.

25: Grimsby and Ancholme

51: River Wellend

32: Louth Coastal

52: River Witham

50: River Nene

67: Trent

Figure 5 Lincolnshire River Catchments



Source: Lincolnshire County Council, 2012; *Lincolnshire Joint Flood Risk and Drainage Management Strategy (DRAFT)*

The majority of surface water resources are fully committed within Lincolnshire, and there are no additional resources available in most water resource management units.

A major river catchment contained wholly within Lincolnshire is the Witham Catchment. The River Witham rises south of Grantham, passing through Lincoln and draining into the Wash at Boston. Other significant rivers in the catchment include the Rivers Till, Slea and Brant and the extensive network of drainage systems in the East and West Fens north of Boston. There are 125 river water bodies in the catchment and 3 lakes.

Compared with rivers in the Anglian Region, the Witham Catchment achieves slightly higher surface water quality results with 23% of rivers and lake water bodies assessed achieving a good ecological status and 38% achieving at least a good biological status<sup>xi</sup>.

Under the Nitrates Directive, implemented through the Nitrate Pollution Prevention Regulations 2008 (as amended) in England, areas of land that drain into waters polluted by nitrates are required to be designated as Nitrate Vulnerable Zones (NVZs). Farmers in NVZs have to follow mandatory rules to tackle nitrate loss from agriculture. NVZs now cover 62% of England, the whole of Lincolnshire is designated as a surface water NVZ.

### *Flooding*

Due to the topography of Lincolnshire from the rolling hills and steep valleys of the Lincolnshire Wolds to the low lying coastal fringes and fenland areas around the Wash; many communities are at a potential risk of flooding from heavy rainfall and surface water. Significant historic flooding has occurred in Lincoln, Louth, Horncastle, Grantham and Sleaford.

The Flood Risk Regulations (2009) implement the requirements of the European Floods Directive (2007) which aims to provide a consistent approach to managing flood risk across Europe. The EA is responsible for managing flood risk from main rivers, the sea and reservoirs. LLFAs are responsible for local sources of flood risk.

To assess flood risk for England the EA has produced flood maps. These identify areas on floodplains that would naturally be affected by flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas. The classification of flood zones is listed below:

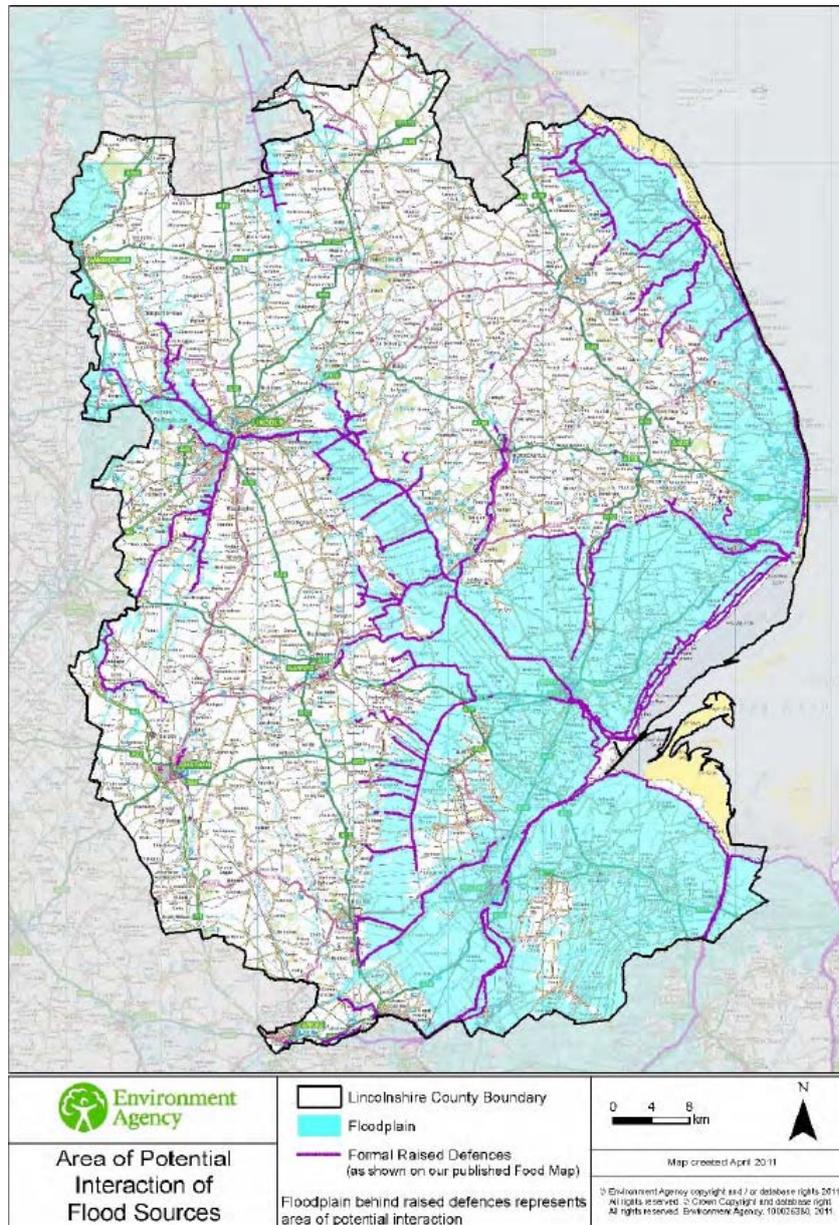
- Flood zone 1 – These are areas outside the floodplain where there is a less than 1 in 1000 years (0.1%) chance of flooding from either river sources or from the sea in any one year.
- Flood zone 2 – Covers all land where there is between a 1 in 100 (1%) and 1 in 1000 (0.1%) chance of flooding from rivers in any one year and between a 1 in



In addition to coastal flooding, parts of the Lincolnshire are vulnerable to fluvial and surface water flooding. Recent flooding events include the June/ July 2007 flood event, where approximately 2000 properties were flooded across the county.<sup>xii</sup>

On a local scale there is the potential for interaction of flooding sources (fluvial, coastal, surface and groundwater sources). These may occur behind raised fluvial and coastal flood defences, as shown in Figure 7 below, which highlights the areas where there is the potential for local sources of flooding to interact.

Figure 7 Flood Map showing potential for interaction with local sources of flooding



Source: Lincolnshire County Council, 2011; *Preliminary Flood Risk Assessment Report*.

On a national scale no significant Local Flood Risk Areas have been identified in Lincolnshire.

### *Groundwater*

Groundwater comes from rainfall that has filtered down through the ground and is stored in permeable rocks, known as aquifers. This can be abstracted for public supply, industry, farming and small private supplies from springs, wells and boreholes. All public water supplies in Lincolnshire come from groundwater sources and it is also an important resource for direct abstraction for local use by farmers.

The Groundwater Directive (80/68/EEC) aims to protect groundwater, the directive is implemented through the Environmental Permitting Regulations (2010). The EA monitors the quality of nearly 3,500 groundwater sites across England and Wales and subsequently classifies ground water bodies as of either 'good' or 'poor' status, there is a quantitative and a chemical component.

On a national scale Groundwater has deteriorated in quality over the last 50 years. Pollution from diffuse sources is the main cause of pollution to groundwater with around 81% of groundwater bodies at risk of failing WFD objectives. Nitrate is one of the most common groundwater pollutants with more than two thirds of the nitrate in groundwater coming from past and present agricultural, mostly chemical fertilisers and organic materials<sup>xiii</sup>.

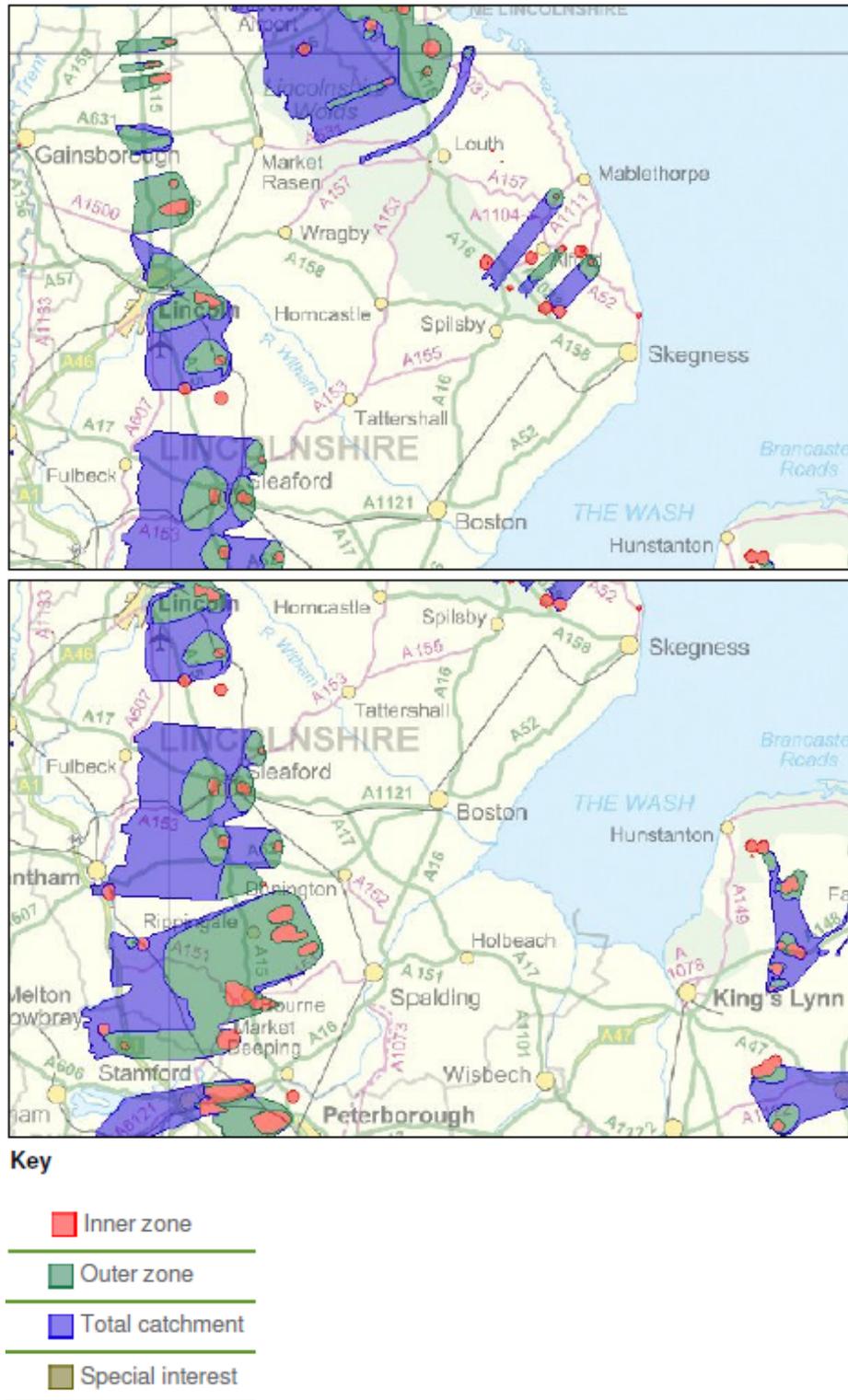
The EA has defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs. These zones show the risk of contamination from any activities that might cause pollution in the area. The shape and size of a zone depends on the condition of the ground, how the ground water is removed and other environmental factors.<sup>xiv</sup>

The EA divides groundwater SPZs into three zones, listed below:

- SPZ1 (Inner protection zone) – Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being in SPZ1.
- SPZ2 (Outer protection zone) – Defined by a 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction.
- SPZ3 (Source catchment protection zone) – Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.

Figure 8 below outlines the groundwater SPZs in Lincolnshire.

Figure 8 Lincolnshire Ground Water Protection Zones



Source: Environment Agency, 2012

On a regional level there are 31 groundwater bodies in the river basin district. 65% are currently at a good quantitative status and 65% at good for chemical status. The EA does not expect these to change by 2015<sup>xi</sup>.

Within the study area the most significant groundwater resource is the Lincolnshire Limestone, which runs broadly north-south through the county. Other major aquifers include the Lincolnshire Chalk which forms the Wolds and stretches from the Humber Estuary in the north to Skegness in the south, the Spilsby Sandstone which outcrops to the west of the Wolds from Grasby to the Wash, and the Bain Gravels a locally important source of water around the lower River Bain<sup>xv</sup>

## Population and Human Health

### *Population Statistics and Structure*

Population density and structure varies across Lincolnshire. The area consists of both rural and urban areas. At the time of the 1991 census assessed as 584,538, figures indicate that Lincolnshire's population has increased by 83,400 (16%) since 1971. The population of Lincolnshire continues to increase. The rate of increase has fallen slightly from 8.9% between 1971 and 1981 to 6.9% between 1981 and 1991. The County Council records show that population density stands at around one person per ha, making Lincolnshire a sparsely populated County compared to the UK average of 2.4 or the East Midlands Region with 2.5 persons per ha.

The District of East Lindsey has increased their rate of population growth in the two periods, while the other five districts have experienced a decline in the rate of growth or are experiencing actual population decline. The growth in the number of residents of pensionable age is likely to continue in line with national trends, and has implications with regard to healthcare facilities, housing provision and transport issues. The growth in car ownership levels in the County reflects a national trend which is forecast to continue.

The Office of National Statistics (ONS) mid-year 2010 population estimates, released in June 2011, show that Lincolnshire's population increased by 5,100 people, from 697,000 in 2009 to 703,000 in 2010.<sup>xvi</sup> This represents a 0.7% increase compared to 2009, slightly lower than the national changes of 0.8% but in line with the regional changes of 0.7%. This rate of population growth is more than double the rate of increase in the county population between 2008 and 2009 partly reflecting recent changes in the numbers of people migrating to and from the county.

During the period 2009 to 2010, Lincoln had the largest percentage growth in population at 1.4%. This figure is more than double the rate in the period between 2008 and 2009. Boston's population remains unchanged according to the estimates. Over the 10 years from 2000 to 2010, the population of Lincolnshire has had an average annual percentage increase above that of the East Midlands' and the national average. Over this period, the districts of North Kesteven, South Holland and West Lindsey have all had an average annual population growth rate at least double that of the national rate. Table 4 summarises the estimated population change from mid 2009 – mid 2010.

The 2010 population estimates show that 21% of Lincolnshire's population is of retirement age. This figure is much higher than the national and regional averages

currently estimated at 16% and 17% respectively. The number of people within the retirement age group is also projected to increase to 31% of the county's population by 2033, compared to only 23% nationally. This demonstrates the ageing profile of the county's population.

Over the last 10 years, the greatest fall in the number of persons has been those aged between 25 and 39. However one of the larger increases in population has been in the 20-24 age group. Between 2000 and 2010, this group increased by 41% or 12,300 people.

*Table 4 Summary of Population Change Mid 2009 - Mid 2010*

| Area           | Mid 2009 Population Estimate | Mid 2010 Population Estimate | Change (persons) | Change (%) | Average Annual Change 2000 - 2010 (%) |
|----------------|------------------------------|------------------------------|------------------|------------|---------------------------------------|
| Boston         | 59,000                       | 59,000                       | 0                | 0.0        | 0.7                                   |
| East Lindsey   | 140,800                      | 141,600                      | 800              | 0.6        | 1.0                                   |
| Lincoln        | 88,500                       | 89,700                       | 1,200            | 1.4        | 0.6                                   |
| North Kesteven | 105,700                      | 106,400                      | 700              | 0.7        | 1.5                                   |
| South Holland  | 84,100                       | 84,600                       | 500              | 0.6        | 1.2                                   |
| South Kesteven | 131,200                      | 132,300                      | 1,100            | 0.8        | 0.7                                   |
| West Lindsey   | 88,600                       | 89,400                       | 800              | 0.9        | 1.4                                   |
| Lincolnshire   | 697,900                      | 703,000                      | 5,100            | 0.7        | 1.0                                   |
| East Midlands  | 4,451,200                    | 4,481,400                    | 30,200           | 0.7        | 0.8                                   |
| England        | 51,809,700                   | 52,234,000                   | 424,300          | 0.8        | 0.6                                   |

The population increase within Lincolnshire County along with the age structure has implications for the LJFRDMS, with a growing ageing population in the rural areas; the LJFRDMS will need to consider how flood alleviation measures, with specific focus on rural areas will impact upon the ageing population as well as on children and young people.

### *Health*

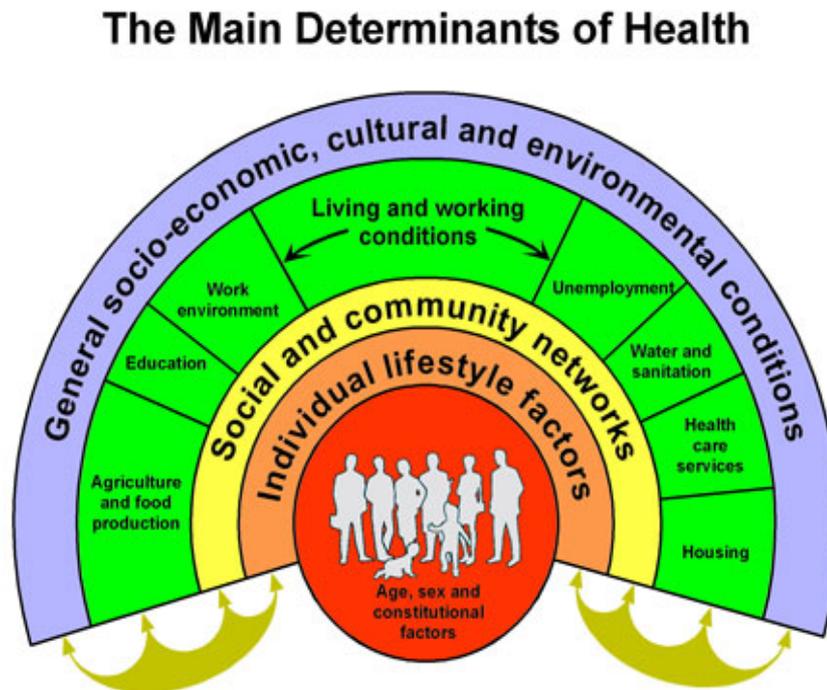
Health Determinants include:

- The social and economic environment;
- The physical environment, and
- The person's individual characteristics and behaviours.

Many factors combine together to affect the health of individuals and communities. Whether people are healthy or not, is determined by their circumstances and environment. To a large extent, factors such as where we live, the state of our environment, genetics, our income and education level, and our relationships with friends and family all have considerable impacts on health, whereas the more

commonly considered factors such as access and use of health care services often have less of an impact. See Figure 9. <sup>xvii</sup>

Figure 9 The Main Determinants of Health



Source: Dahlgren and Whitehead, 1993

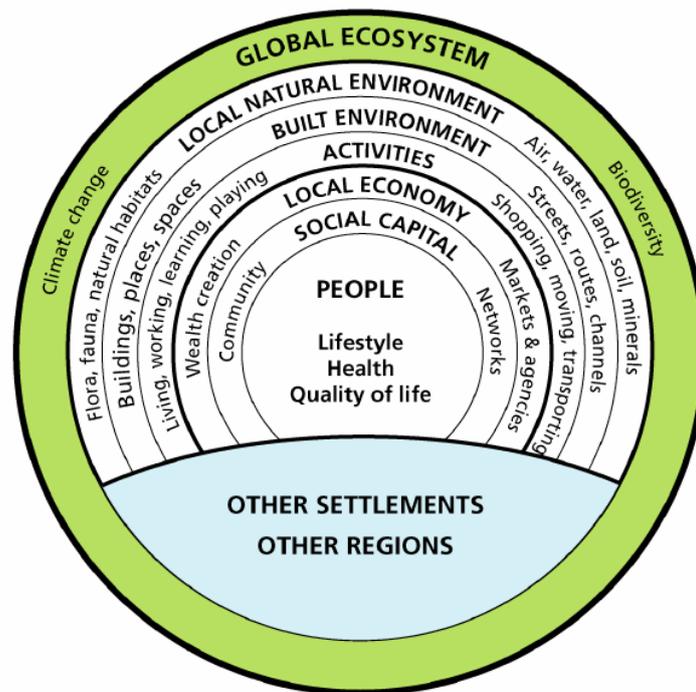
Barton and Grant (2006) have developed the Dahlgren and Whitehead model to produce the health map for the local human habitat Figure 10. The map continues to place people at the centre, but sets them within the global ecosystem which includes:

- the natural environment;
- the built environment;
- activities – such as working, shopping, playing and learning;
- the local economy – includes wealth creation and markets;
- community – social capital and networks; and
- lifestyle.

The health map illustrates why the social determinants are of such relevance to local government. The majority of local government services impact upon or can influence the conditions in which people live and work and, to a certain extent, the life chances of individuals. <sup>xviii</sup>

Looking at the social determinants of health challenges the notion that health is the domain of the NHS and brings it squarely into the arena of local government.

Figure 10 Health map for the local human habitat



### Lincolnshire Health Profile

The Association of Public Health Observatories (APHO) and Department of Health have produced a 2011 Health Profile for Lincolnshire, which identifies some key health related facts:

- The health of people in Lincolnshire is mixed compared to the England average. Deprivation is lower than average, however 22,730 children live in poverty.
- Life expectancy is 7 years lower for men and 4.6 years lower for women in the most deprived areas of Lincolnshire than in the least deprived areas. Generally, life expectancy for women is lower than the England average.
- Over the last 10 years early death rates from cancer, heart disease and stroke have improved and remain similar to the England average.
- About 19.5% of Year 6 children are classified as obese. A high percentage than average of pupils spend at least 3 hours each week on school sport. However, the health of Children in Lincolnshire is significantly better than the England average.

- It is estimated that 22.2% of adults smoke and 25.0% are obese. The rate of road injuries and deaths is higher than average.
- Prior to 2011 the Lincolnshire Local Area Agreement prioritised tackling issues relating to alcohol, tobacco and obesity.

The impact upon health as a result of flooding will need to be considered in the LJRFDMs.

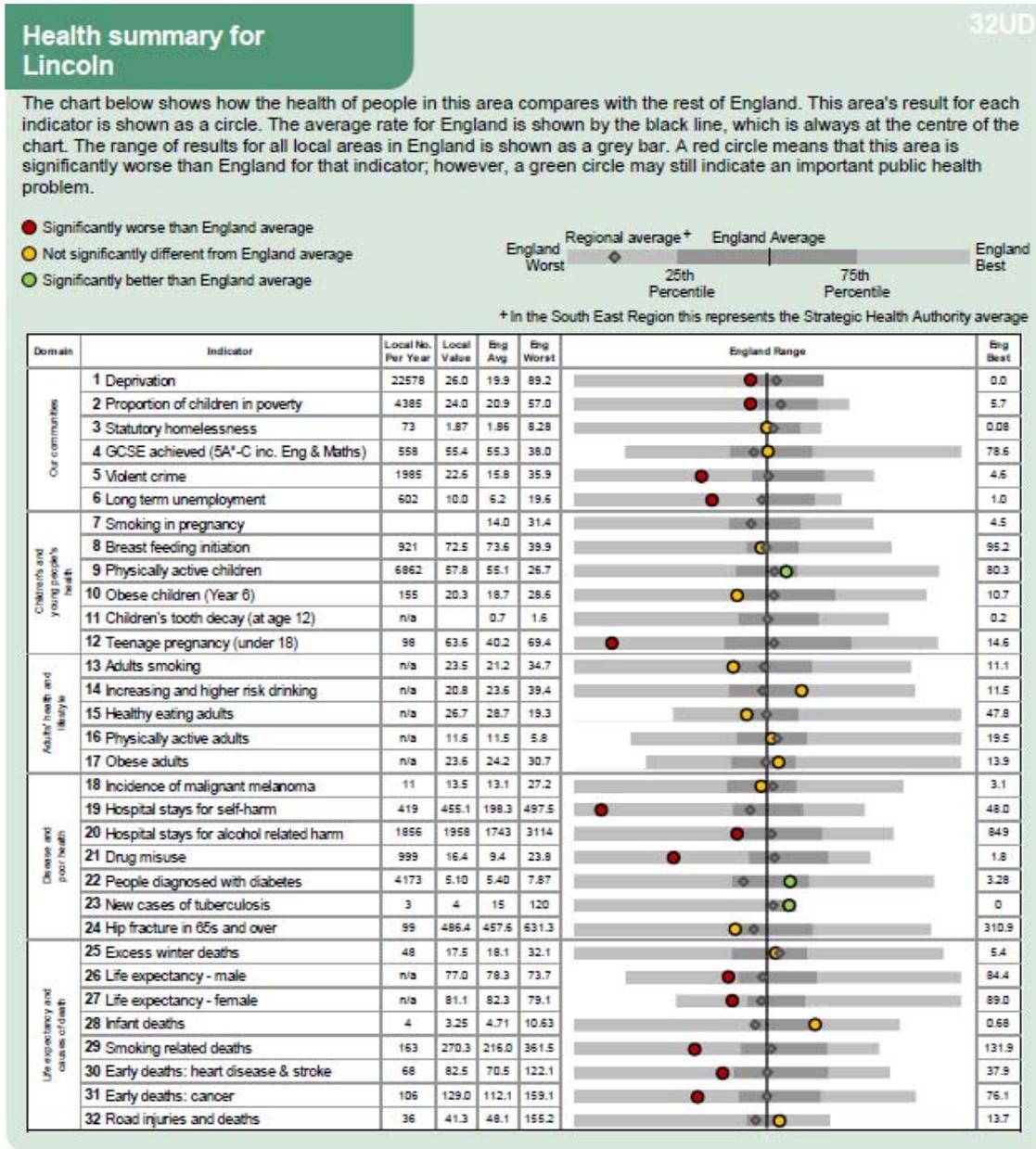
### *Lincoln Health Profile*

The APHO and Department of Health 2011 Health Profile for Lincoln have identified some key health related facts:

- The health of people living in Lincoln is mixed compared to the England average. Deprivation is higher than average and 4,385 children live in poverty. Life expectancy for both men and women is lower than the England average.
- Life expectancy is 11.9 years lower for men and 6.9 years lower for women in the most deprived areas of Lincoln than in the least deprived areas.
- Over the last 10 years, rates of deaths from all causes and early deaths from heart disease and stroke have improved but remain higher than the average for England.
- Approximately 20.3% of Year 6 children are classified as obese. A higher percentage than average of pupils spend at least three hours each week on school sport. Levels of teenage pregnancy are also worse than the England average.
- It is estimated that 23.5% of adults smoke and 23.6% are obese. The rate of road injuries and deaths is higher than average.
- The Lincolnshire Local Area Agreement has prioritised tackling issues relating to alcohol, tobacco and obesity.

Table 5<sup>xix</sup> shows how people's health in Lincoln compares to the rest of England. The local result for each indicator is shown as a circle, against the range of results for England which is shown as a bar. A green circle may still indicate an important public health problem.

Table 5 Lincoln's Health Profile



**Indicator Notes**

1 % of people in this area living in 20% most deprived areas in England 2007 2 % children in families receiving means-tested benefits & low income 2008 3 Crude rate per 1,000 households 2009/10 4 % at Key Stage 4 2009/10 5 Recorded violence against the person crimes crude rate per 1,000 population 2009/10 6 Crude rate per 1,000 population aged 16-64, 2010 7 % of mothers smoking in pregnancy where status is known 2009/10 8 % of mothers initiating breastfeeding where status is known 2009/10 9 % of year 1-13 pupils who spend at least 3 hours per week on high quality PE and school sport 2009/10 10 % of school children in Year 6, 2009/10 11 Weighted mean number of decayed, missing or filled teeth in 12-year-olds, 2008/09 12 Under-18 conception rate per 1,000 females aged 15-17 (crude rate) 2007-2009 (provisional) 13 % adults aged 18+, 2009/10 14 % aged 16+ in the resident population, 2008 15 % adults, modelled estimate using Health Survey for England 2006-2008 (revised) 16 % aged 16+ 2009/10 17 % adults, modelled estimate using Health Survey for England 2006-2008 (revised) 18 Directly age standardised rate per 100,000 population under 75, 2005-2007 19 Directly age and sex standardised rate per 100,000 population 2009/10 20 Directly age and sex standardised rate per 100,000 population, 2009/10 21 Estimated problem drug users using crack and/or opiates aged 15-64 per 1,000 resident population, 2008/09 22 % of people on GP registers with a recorded diagnosis of diabetes 2009/10 23 Crude rate per 100,000 population 2007-2009 24 Directly age and sex standardised rate for emergency admission 65+, 2009/10 25 Ratio of excess winter deaths (observed winter deaths minus expected deaths based on non-winter deaths) to average non-winter deaths 1.08.06-31.07.09 26 At birth, 2007-2009 27 At birth, 2007-2009 28 Rate per 1,000 live births 2007-2009 29 Per 100,000 population aged 35+, directly age standardised rate 2007-2009 30 Directly age standardised rate per 100,000 population under 75, 2007-2009 31 Directly age standardised rate per 100,000 population under 75, 2007-2009 32 Rate per 100,000 population 2007-2009

For links to health intelligence support in your area see [www.healthprofiles.info](http://www.healthprofiles.info) More indicator information is available online in The Indicator Guide.

**Ethnic Diversity**

Lincolnshire is less ethnically diverse than England and the East Midlands with 93% of its total population being White British. Using the Mid-2001 – mid 2009 Population

Estimates by Ethnic Group, the resulting statistics show that in England, 82.8% of the total population are of “White British” ethnicity and 87.0% are of the same background in the East Midlands with the remaining population comprised of black and minority ethnic (BME) group.<sup>xx</sup> Figures for the Districts and Boroughs ranged from 90.4% to 94.6%. Lincoln is at the bottom range being more ethnically diverse than West Lindsey which is top of the range and least ethnically diverse.<sup>xxi</sup>

### *Indices of Deprivation*

In the 2010 Indices of Multiple Deprivation (IMD) published by the Department for Communities and Local Government (DCLG), Lincolnshire’s district councils all ranked as being slightly more deprived than in the 2007 published IMD data. The 2010 IMD results also indicate that 12% of Lincolnshire’s population currently live in areas categorised within England’s 20% most deprived areas, an increase of 1% on the 2007 published data.<sup>xxii</sup>

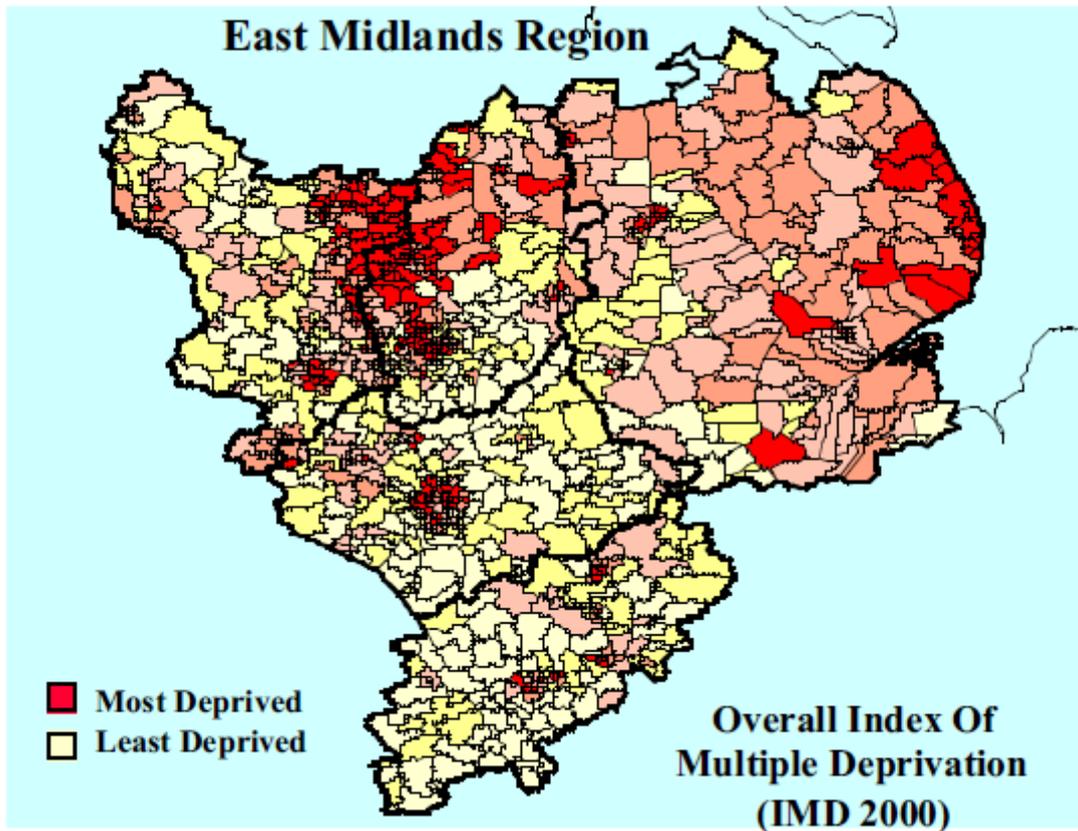
The area around Moorland Avenue in Lincoln is ranked as the most deprived Lower Super Output Area (LSOA) in the county. This area has consistently featured as the most deprived area in the county since 2004. It has risen to the 132<sup>nd</sup> rank out of the 32,482 LSOAs in England. In Lincolnshire County, the least deprived area is currently around the Royal Air Force College Cranwell.

An additional 5 LSOAs in Lincolnshire are now ranked in England’s top 20% most deprived areas. Two each in both Lincoln and East Lindsey and one in West Lindsey. The area to the south of Louth is the LSOA in East Lindsey which has deteriorated the most in ranking; dropping 5000 places in England and 77 places in Lincolnshire. On the other hand, the LSOA comprising South Hykeham, Thurlby and Witham St Hughs improved by 4500 places in the England ranking and 81 places in Lincolnshire.

Urban areas contain pockets of social problems that are on a par with larger conurbations, such as Earlsfield in South Kesteven. There are envelopes of less visible deprivation in rural areas, where travel time and cost of accessing employment and services can make the plight of the rurally excluded different, but as severe, as their urban counterparts.

Figure 11 illustrates the level of deprivation in the East Midlands region as measured using the Government’s Index of Multiple Deprivation.<sup>xxiii</sup>

Figure 11 Index of Multiple Deprivation East Midlands Region



The indices of deprivation are based on income; employment; health and disability; education, skills and training; barriers to housing and services; living environment and crime. Deprivation therefore is a result of environmental factors, socio-economic factors and health factors.

The SEA process provides an opportunity to guide the LJRFDMs towards policies preventing flooding in already deprived areas.

Figure 12 Index of Multiple Deprivation Lincolnshire

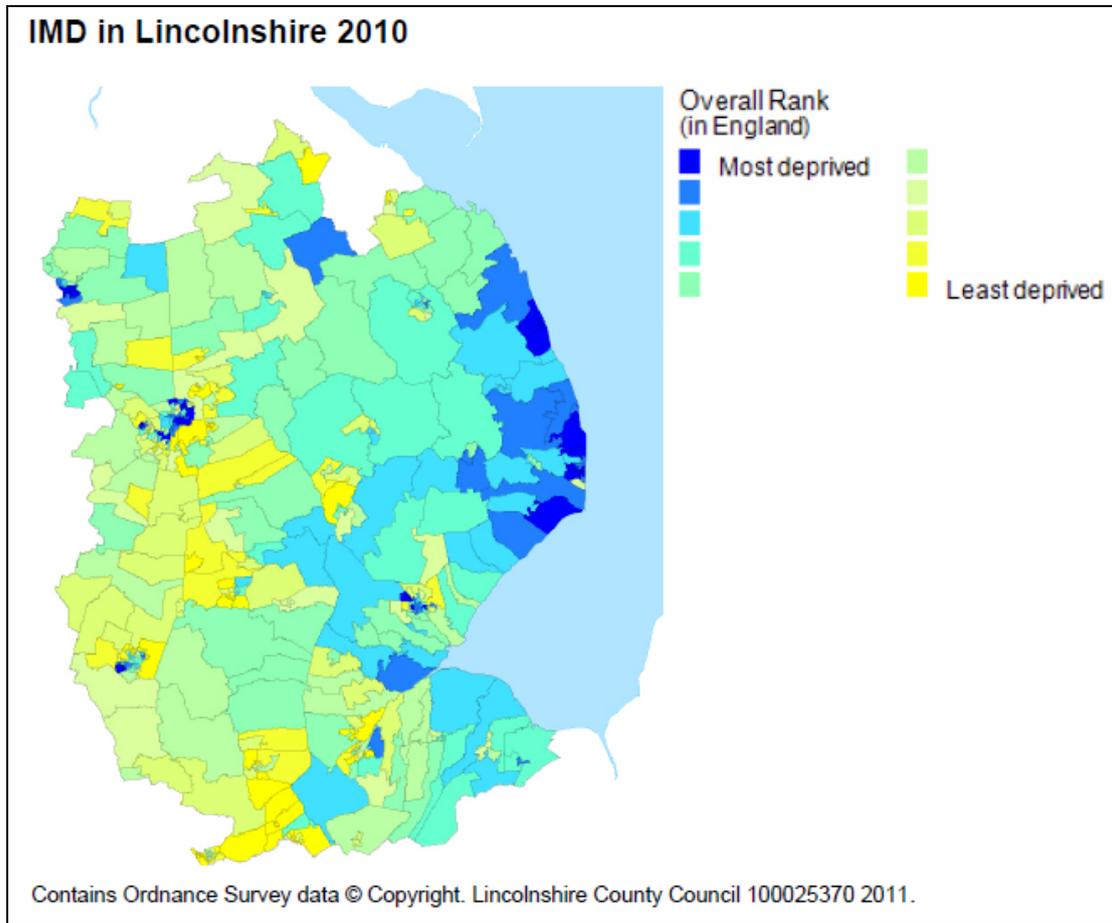


Figure 13 District Rankings 2007 - 2010

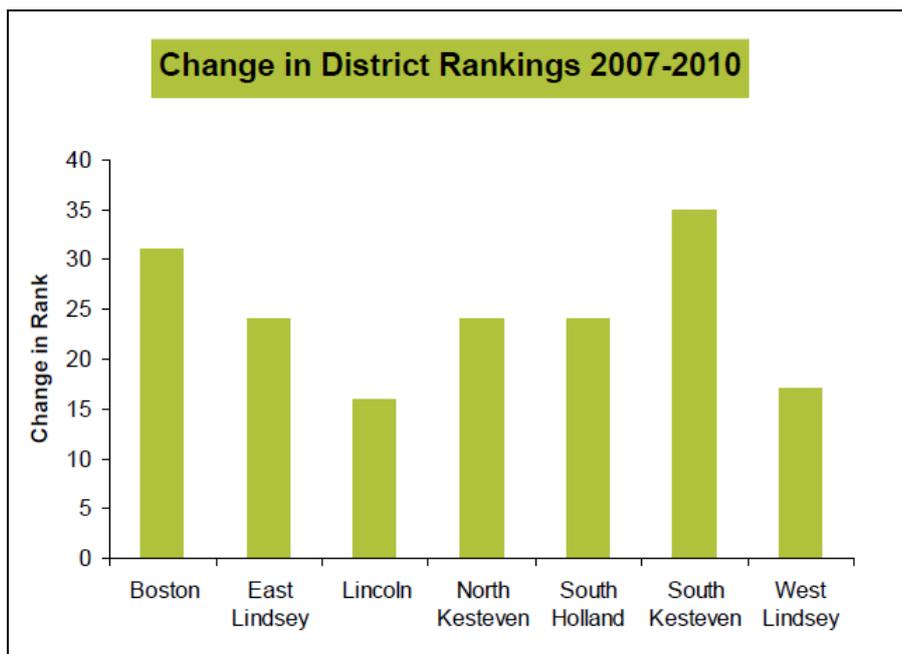


Figure 13 shows changes in the average district rankings since 2007.<sup>xxiv</sup> A rise indicates that a district has become more deprived against other districts in England. Consequently, South Kesteven has seen the biggest rise in ranking, while other districts have become more deprived. Lincoln has seen the smallest change and traded places with East Lindsey which has become the most deprived district in Lincolnshire. It is the 58<sup>th</sup> most deprived district council area in the country out of a total of 326.

## Transport

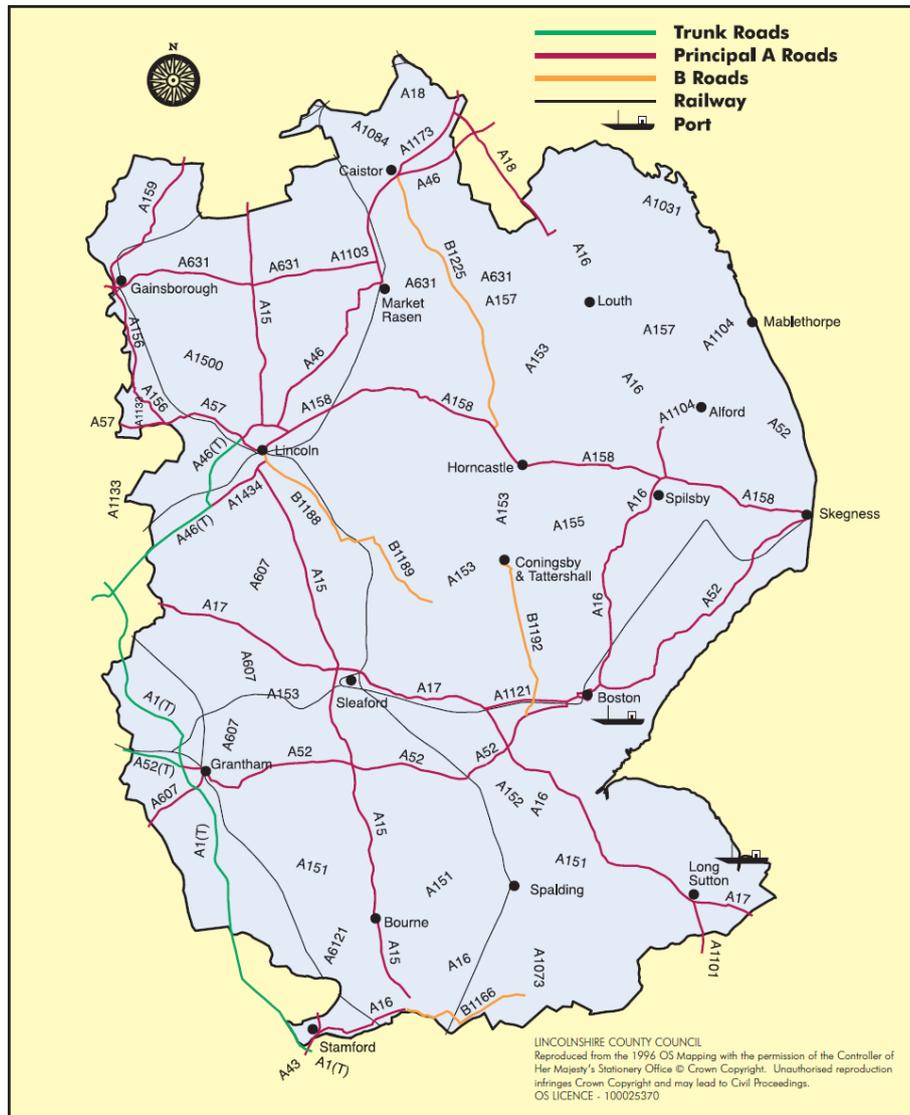
Lincolnshire is a predominantly rural shire county covering some 5921 square kilometres (2286 square miles) or 5% of England. As a consequence of the size of the county, the highway network is extensive totalling some 9018 kilometres (5605 miles) – the 5th longest of any English highway authority. The County Council is responsible for over 8,718km of roads and 3,263km of footways across the network. The County Council is the Highway Authority for all public roads except trunk roads. Within this network there is no motorway and just 66km of dual carriageway of which the A1 and the recently upgraded A46 between Newark and Lincoln form the vast majority (48km) (see Table 6).

In recent years, the length of trunk road in the county has been dramatically reduced from some 311 km to just 58 km following the ‘detrunking’ of the A15, A16, A17, A43, A46 (in part) and A57. Much of the network for which the County Council is responsible comprises narrow, tortuous roads and country lanes, with 80% being C class or unclassified roads. The majority of the Strategic Road Network (see Figure 14) falls well below current design standards with consequential low speeds and safety problems.

Table 6 Network Length by Category of Road

| <b>Classification</b>      | <b>Length<br/>(kilometres)</b> | <b>Length<br/>(miles)</b> |
|----------------------------|--------------------------------|---------------------------|
| <i>Trunk Roads</i>         | 58                             | 36                        |
| <i>Principal (A) Roads</i> | 1042                           | 648                       |
| <i>B Roads</i>             | 786                            | 489                       |
| <i>C Roads</i>             | 2916                           | 1812                      |
| <i>Unclassified Roads</i>  | 4216                           | 2620                      |
| <b>Total</b>               | <b>9018</b>                    | <b>5605</b>               |

Figure 14 Trunk Roads, Principle A Roads, B Roads, Railway, Ports



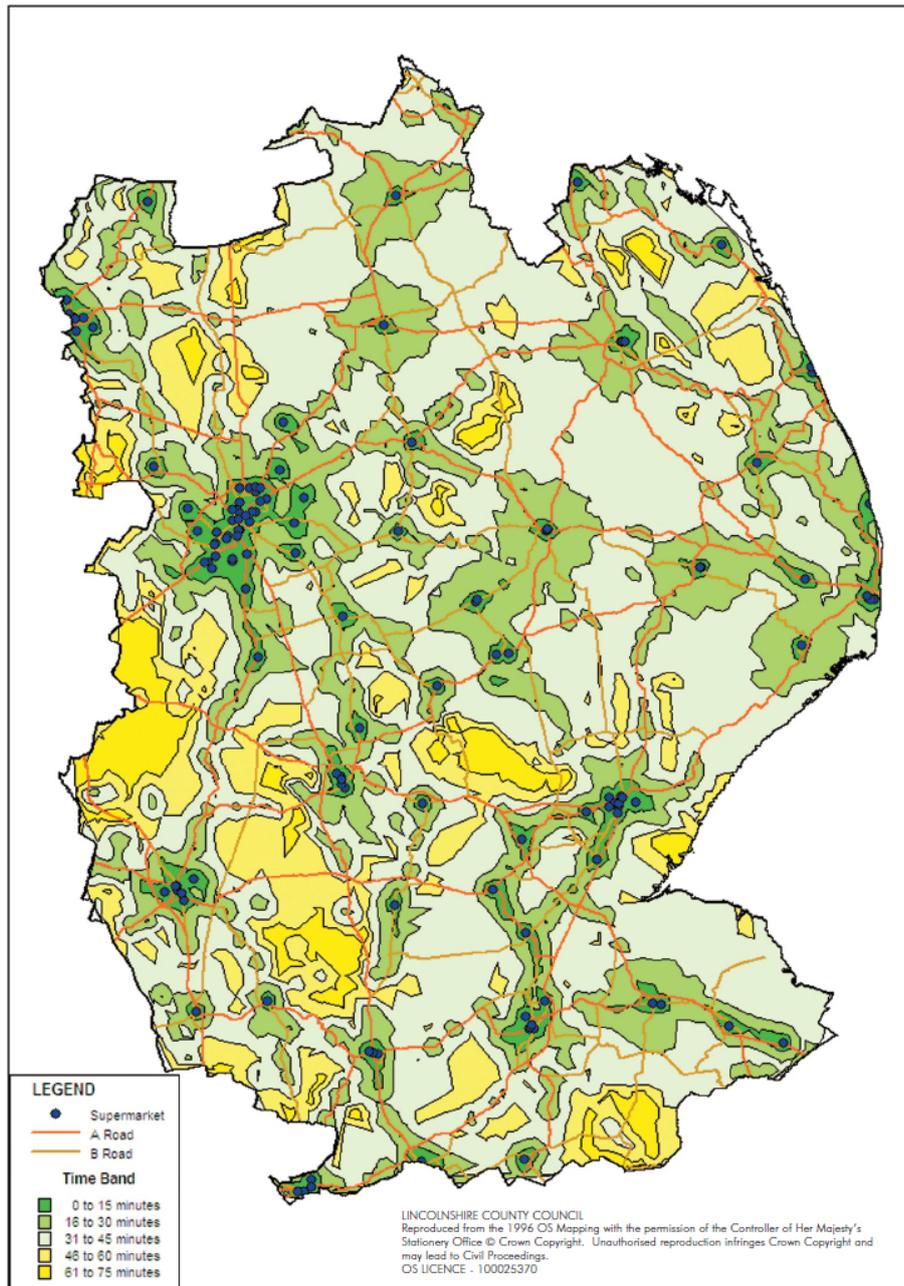
### Access to Services

Accessibility is central to the safeguarding of sustainable communities, in particular people's ability to reach services by available, affordable and accessible public and community transport. In rural areas of Lincolnshire, access to facilities and services is limited and has been compounded by the gradual loss or centralisation of services. Improvement to the transport system has a key role in improving access to services across the County.

Many parts of Lincolnshire suffer some degree of deprivation. In the deeply rural parts of the county, social exclusion remains a problem, particularly access to important services such as health facilities, shopping and employment opportunities. This has been compounded in the recent past by the gradual loss or centralisation of many of these facilities (e.g. village shops, post offices, health facilities). The problem is most acute within East Lindsey. However, as Figure 15 shows, this is not just a rural problem. In the urban areas, particularly Lincoln, Grantham, Boston and

Gainsborough, there are also pockets of deprivation. Both Lincoln and East Lindsey rank among the top 100 most deprived district authorities in England, with Lincoln receiving support through the government's Neighbourhood Renewal Fund. The LJFRDMS will need to consider the potential loss of services from flood alleviation measures.

Figure 15 - Access to Supermarkets and Service Centres



## Public Rights of Way

There are no national trails within Lincolnshire. The Viking Way is a long distance footpath which runs for 235km from the Humber Bridge at Barton-upon-Humber to Oakham in Rutland. There are a number of national cycle routes within the county including national route 1 which runs through Boston, Lincolnshire, and Market Rasen. There are other schemes including a cycleway from Newark to Lincoln and a town centre scheme in Grantham. There is a network of over 4000km of public rights of way in Lincolnshire, including public footpaths, bridleways and byways; these should be protected from flood risk where possible.

## Tourism

Tourism is an important industry in Lincolnshire, particularly along the coast, in and around the Lincolnshire Wolds and in the historic settlements. Attractions in the county include:

- Magic World of Fantasy Island (East Lindsey)
- Skegness Water Leisure Paradise (East Lindsey)
- Hartsholme Country Park (Lincoln)
- Gibraltar Point National Nature Reserve (East Lindsey)
- Lincoln Castle (Lincoln)
- Belton House Park and Garden (South Kesteven)
- All Saints Steam Brewery Museum (South Kesteven)
- Lincoln Cathedral (Lincoln).

In addition, Lincolnshire hosts the Lincolnshire Show, Burghley horse trials, RAF Waddington air show, Lincoln Christmas Market and Market Rasen Racecourse. <sup>xxv</sup>.

In 2003, Lincolnshire hosted 3,058,800 staying tourism trips, of which 5% were from overseas visitors. In total, 11 million tourist nights were spent in the county and the average trip length was 3.61 days. Holidays accounted for approximately 68% of trips, social visits for 21% and business trips for 10%. In addition to staying trips, there were almost 19 million day trips. <sup>ii</sup>

Tourism is a very significant source of employment and revenue in Lincolnshire, particularly in East Lindsey (EMRA, 2009). The total visitor spend was estimated at over £961 million, of which tourists staying overnight spent £412 million and day trippers spent £550 million (Geoff Broom Associates, 2005). The number of Full Time Equivalent jobs is estimated at 15,576, although jobs tend to be seasonal, with just under a third of tourist trips during the summer months. <sup>xxv</sup>

Flood management is essential to promote and maintain tourism in Lincolnshire.

## **Economy**

From April 2010, all unitary authorities and county councils have a statutory duty to carry out an assessment of the economic conditions of their area through a Local Economic Assessment (LEA). This will provide local authorities and other stakeholders with a robust analysis of the local economy which will inform their economic policies and interventions.

Lincolnshire is one of the largest and most sparsely populated areas of England and presents a distinctive range of challenges for organisations concerned with the socio-economic well-being of a low wage area experiencing sustained population growth. This section outlines the characteristics, which frame regeneration activities in Lincolnshire.

Distinct economic and geographical areas: Lincolnshire contains five distinct economic and geographical areas each with their own characteristics. These areas are:

- The expanding Greater Lincoln area - including Gainsborough - which is increasingly prosperous and is consolidating as a regional centre.
- The coastal strip - has significant levels of deprivation due to peripherality and seasonal employment.
- The Fenland area of the south east - has a strong and successful food and horticultural identity.
- The A1 corridor - is experiencing private sector led economic growth and still has significant untapped potential.
- The large central and traditional rural area - has a network of market towns in a historic agricultural setting.

Each area presents a different set of issues, and with the exception of greater Lincoln, the most distinctive characteristic is a commonality of rural issues.

Slow and low economic growth: Gross Value Added (GVA) is a very broad barometer of economic vitality and is used locally, regionally and internationally to make comparisons between areas. The consequences of a low-wage economy are a low GVA. Lincolnshire has one of the lowest GVAs in the country despite the local economy growing by 1% pa in recent years.<sup>xxvi</sup>

## *Employment*

The population structure of Lincolnshire shows that it has a higher than the national average of persons of retirement age, therefore the percentage of persons of

working age in Lincolnshire is only 61.8% of the total population. The economic activity rate of those of working age is 77.7 % which is higher than the national average of 76.1%. The employment rate of those of working age is 77%; also higher than the national average of 74.2%.<sup>xxvii</sup>

### *Earnings*

In Lincolnshire, residence average annual earnings (earnings of people who live in the area but don't work in the area) for full time workers are higher than work place earnings (people who live and work in the area). This is due to people living in Lincolnshire and commuting for work outside the area.

The difference in residence average annual earnings for part time workers in Lincolnshire is also higher than the work place earnings. The part time data is only applicable to Lincoln and South Kesteven as the rest of the districts and boroughs show no statistics for part time working. This may be a reflection of the rural nature and the predominant agricultural work prominent in these areas.

## **Material Assets**

### *Waste*

Lincolnshire disposes of a range of waste streams: municipal waste; waste generated by industry, commerce and business; waste from construction and demolition activities; and other more specific waste types such as hazardous waste, agricultural waste, waste water and sewage sludge. Over 3 million tonnes of waste is produced each year and a large percentage of this ends up in landfill.<sup>xxviii</sup>

Lincolnshire is in the process of producing their Minerals and Waste Development Framework, which is a new set of documents to replace the existing Mineral and Waste plans which will address future waste activities in the County.<sup>xxix</sup> A Joint Municipal Waste Management Strategy has also been developed by the Lincolnshire Waste Partnership (Lincolnshire County Council, the seven local authorities and the Environment Agency) to provide a structure that will enable the municipal waste produced in the county to be effectively managed.

Waste collection and disposal results in a substantial number of lorry movements into and out of the County to transport waste to recycling facilities, energy from waste facilities or landfill sites. Regular collections are required from households and with the number of households increasing, the amount of waste increasing and smaller household sizes; there will inevitably be an impact on transport.

Flood management is essential to insure infrastructure such as roads and waste facilities are protected across the county.

### *Minerals*

The most significant minerals produced in Lincolnshire are sand and gravel, limestone (crushed rock) and chalk. Oil and gas are also produced. Additionally, there are reserves of ironstone, silica sand, coal and clay, but these reserves are not currently exploited.

The core strategy of the emerging Minerals and Waste Development Framework will strive to ensure that minerals are available at the right time and in the right locations to support levels of growth. Mineral extraction operations within the county will result in substantial lorry movements to transport materials, therefore infrastructure needs to be protected against flood risk.

### *Housing and Homes*

The issues of affordable housing will be addressed by the Local Planning Authorities, Local Development Framework Core Strategies and Site Allocations Development Plan Documents (DPD). Within these DPDs, new housing locations will be identified as will new employment sites, it is essential that the LJRFDMs is integrated with the LDFs to ensure that development is located in areas that are not incompatible with flood risk.

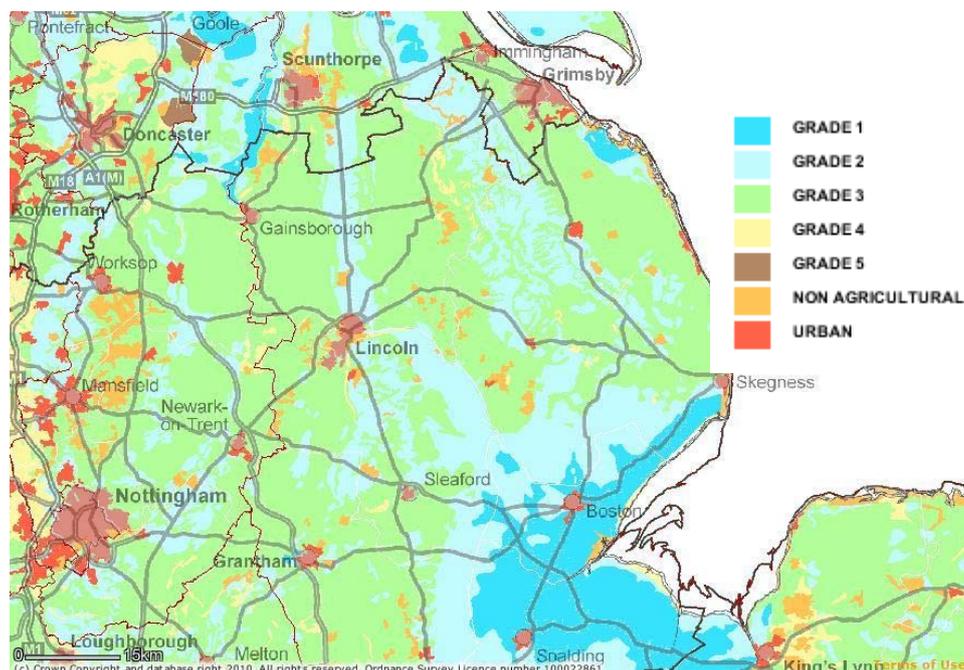
The LJRFDMs must ensure access to services is a high priority for new housing development within Lincolnshire, the SEA process provides an opportunity to ensure that these issues are fully addressed at the strategy options/alternatives appraisal stage.

### *Agriculture*

The East Midlands is a very productive area for agriculture and contains a significant percentage of the total national resource of the best and most versatile agricultural land. The proportion of Grade 1, 2 and 3a agricultural land, i.e. the best and most versatile land, in the East Midlands is 47% compared to 39% across England. The East Midlands also contains a significant percentage (34%) of the total national resource of Grade 1 agricultural land. Within the region, over 1.2 million hectares of land is in agricultural use and the industry employs over 39,000 people across some 18,500 farms.

Farming is a major industry in Lincolnshire, with a farmed area of 500,994ha, a total of 7,191 holdings and a labour force of 15,286 in 2009.<sup>xxx</sup> Some of the highest grade agricultural land in the country is found in the south and east of the county, with 44% of the agricultural land in Lincolnshire being Grade 1 or Grade 2. Figure 16<sup>xxxi</sup> below shows the agricultural land quality across Lincolnshire.

Figure 16 Agricultural land in Lincolnshire being Grade 1 or Grade 2



Lincolnshire is the largest producer of wheat in the UK; contributes over 10% of total national wheat production and over 50% to regional production. The split in produce on Lincolnshire's farms is shown in Table 7. xxxii

The JFRMS needs to consider protection of agriculture and the infrastructure required for transportation.

Table 7 Farming Produce

| Type         | Area / Number | Includes  |
|--------------|---------------|---|
| Arable       | 383,729 ha    | Cereals 2,328ha; potatoes 13,650ha; sugar beet 19,971ha; field beans 19,826ha, peas 5,290ha, oilseed rape 62,412ha, linseed 3,695ha, root crops 1,375ha |
| Horticulture | 32,480ha      | Peas and beans 11,329ha; other veg and salad 19,067ha; fruit 152ha; bulbs and flowers 1,620ha   |
| Livestock    | 3,227,858 No. | Cattle 87,814; pigs 174,722; sheep 144,789; goats 1,024; horses 4,760; poultry 12,945,060   |

### Cultural Heritage

Lincolnshire's historic landscape and built environment reflects local topography, land use and the availability of building materials, and more recently changes in social conditions and technological advances. One of the county's assets is the combination of styles and materials which represent the economic and aesthetic influences of different periods of history. This is reflected in the high historic and cultural value of the cores of Lincoln City and surrounding towns.

There is also a significant archaeological resource within Lincolnshire with some of the earliest archaeological remains including evidence of Palaeolithic inhabitation. Other features include the prehistoric burial mounds of the Wolds, the waterlogged landscape of the Witham Valley, medieval castles and monasteries and the industrial and agri-industrial buildings of the towns and World War II sites and defences.

The Heritage at Risk (HAR) programme was launched in 2008 by English Heritage, it identifies nationally designated sites including grade I and II\* listed buildings, listed places of worship, Scheduled Monuments, Registered Parks and Gardens, Registered Battlefields and protected wreck sites. Locally designated Conservation Areas are also featured on the Register.

Within Lincolnshire there are currently 162 heritage sites on the HAR; 19 of these sites are classified as priority category A *'Immediate risk of further rapid deterioration or loss of fabric; no solution agreed'*, these are the highest prioritised HARs. The East Midlands Heritage at Risk Register (2012) identifies the Boston Conservation Area, former maltings of Bass Industrial (Sleaford) grade II\* listed building, and Harlaxton Manor Registered Park and Garden as priority HARs in the East Midlands Region. HARs by district are listed below:

- Boston – there are 10 sites at risk; two grade I listed buildings, two grade II\* listed buildings, three listed places of worship, two scheduled monument and four conservation areas (not mutually exclusive).
- East Lindsey – there are 44 sites at risk; three grade I listed buildings, five grade II\* listed buildings, four listed places of worship, 28 scheduled monuments, one Registered Park and Gardens and nine conservation areas (not mutually exclusive).
- Lincoln – there are nine sites at risk; two grade I listed buildings, two listed places of worship, one scheduled monument and eight conservation areas (not mutually exclusive).
- North Kesteven – there are 18 sites at risk; one grade I listed building, two grade II\* listed buildings, seven listed places of worship, nine scheduled monuments and six conservation areas (not mutually exclusive).
- South Holland – there are 16 sites at risk; one grade I listed buildings, two grade II\* listed buildings, five listed places of worship, four scheduled monuments and six conservation areas (not mutually exclusive).
- South Kesteven – there are 26 sites at risk; six grade I listed buildings, two grade II\* listed buildings, 12 scheduled monuments, listed places of worship, seven Registered Park and Gardens and seven conservation areas (not mutually exclusive).
- West Lindsey – there are 36 sites at risk; six grade I listed buildings, five grade II\* listed buildings, seven listed places of worship, 14 scheduled monuments, six Registered Park and Gardens and six conservation areas (not mutually exclusive).

### *Nationally Designated Sites*

Heritage Assets are statutorily protected through national designations.

Lincolnshire's designated heritage assets are listed below:

- There are 478 scheduled monuments in Lincolnshire. There is a wide variety in the types of scheduled monuments, from those visible above ground to those that are not. They range from prehistoric settlements to medieval crosses and 19<sup>th</sup> century cast iron foot bridges.
- There 6954 listed buildings; includes 388 Grade I, 535 Grade II\* and 6031 Grade II Listed Buildings.
- 29 Registered Parks and Gardens; of which three are Grade I, three Grade II\* and 23 Grade II.
- One Registered Historic Battlefield; the battle of Winceby.

### *Locally Designated Sites*

Conservation areas are designated for their special architectural and historic interest. For Lincolnshire as a whole there are 162 Conservation Areas. The designation of Stamford Conservation Area in 1967 was England's first Conservation Area. The Conservation Areas vary greatly in nature and character. For instance, the historic centres of villages and towns, former industrial areas such as Gainsborough Riverside, and small estate villages such as Aswarby near Sleaford.

As well as locally designated sites, there are significant areas of undesignated but nationally important archaeology in Lincolnshire. For example, Witham Valley is significant given good preservation of archaeological and environmental remains and the concentration of prestigious artefacts and monuments of death, burial and religion, dating from the Neolithic period through to the Middle Ages. Indeed a Witham Valley Archaeological Research Committee has been established to guide further research and projects in the area.

A Historic Landscape Characterisation project has been undertaken in Lincolnshire; this helps people to interpret the modern environment with reference to how it has developed and what is historically important about particular landscapes. The project identified 42 Historic Character Zones within 10 broad Historic Landscape Types; these comprised:

- The Confluence
- The Northern Cliff
- The Northern Marshes
- The Wolds
- The Clay Vale
- The Trent Valley
- The Southern Cliff

- The Grazing Marshes
- The Fens
- The Wash

A complete list of the Historic Character Zones is available from English Heritage document 'The Historic Character of The County of Lincolnshire'.<sup>xxxiii</sup>

There are a number of grant schemes supported by Lincolnshire County Council which aim to repair historic buildings; these schemes include Townscape Heritage Initiative in Boston, Heritage Economic Regeneration Scheme in Burgh le Marsh, Tattershall, Woodhall Spa and Wragby, and Historic Buildings Grant Schemes throughout the county.

Cultural Heritage assets can be damaged through flooding; the LJFRDMS will provide protection measures designed to reduce flood risk. The LJFRDMS could have an impact on the setting of heritage assets including both the visual impact from permanent structures, and impacts from maintenance and construction activities such as noise, dust and vibration. As outlined in the National Planning Policy Framework, the more important the asset the greater the weight should be given to the asset's conservation.

## Landscape and Visual Amenity

### *Nationally Designated Sites*

An Area of Outstanding Natural Beauty (AONB) is an area of countryside considered to have significant landscape value in England, Wales or Northern Ireland. AONBs are designated under the National Parks and Countryside Act, 1949 and given added protection through the Countryside Rights of Way Act, 2000. Their primary purpose is to conserve and enhance natural beauty while taking into account the economic and social needs of the area.

Within Lincolnshire there is one AONB, Lincolnshire Wolds, please see Figure 17 below. This area contains remnant chalk grasslands which are very fragmented, and the hedgerows and rivers form an important feature of the landscape providing connections between adjacent habitats. The coastal plains which rise to meet the Wolds have historically been threatened by conversion to arable land uses and associated drainage with a consequent decline in wildlife interest. Current management practises focus on regenerating and maintaining grassland, inter-tidal and riverside habitats.

Figure 17- Lincolnshire AONB Boundary



County of Lincolnshire  
 AONB Boundary

MAP © Lincolnshire and South Humberside  
 Tourist Cartography by Lovell Johns Ltd. Oxford 1993

### National Character Areas

Natural England has identified 159 National Character Areas (NCAs) that recognise areas of similar landscape character at the highest tier in the assessment hierarchy in England. They provide a picture of landscape character at the national scale. Lincolnshire is covered wholly or partially by eight NCAs. The key characteristics of the eight character areas are described below:

- Character Area 42: Lincolnshire Coast and Marshes – Flat coastal plain and undulating foothills, with dispersed settlement pattern concentrated near to the coast, the landscape is influenced by land drainage and navigation systems.
- Character Area 43: Lincolnshire Wolds – Rolling upland arable landscape (only 4% wooded), sparse settlements (only 1.5% urban) and archaeologically rich.
- Character Area 44: Central Lincolnshire Vale – Broad low lying arable vale divided into two parts by a central watershed. Rural landscape (only 2.5% urban).
- Character Area 45: North Lincolnshire Edge with Coversands – The area comprises a large scale upland arable farmland with sparse settlement, active and redundant airfields, Roman roads and ancient trackways.
- Character Area 46: The Fens – Reclaimed from the sea, the Fens is a large scale, open and flat landscape. It is a very rural Character Area and, agriculturally very productive. Almost 97% is open countryside with 91% of that land cultivated. Only 3% of the landscape is urban.
- Character Area 47: Southern Lincolnshire Edge – The area comprises a large scale upland arable farmland with sparse settlement (11% urban), active and redundant airfields, Roman roads and ancient trackways.
- Character Area 48: Trent and Belvoir Vales – This area has a gently undulating landform with pastoral and wooded farmland and open arable land. There are large market towns and historic centres with dwellings built of redbrick (7% urban).
- Character Area 75: Kesteven Uplands – This area is dominated by mixed farmland; it is archaeologically rich with historic houses and parkland. Rural landscape with dispersed settlements (2.6% urban).

### *Regional Landscape Character*

An East Midlands Regional Landscape Character Assessment (EMRLCA) was undertaken in 2010 to provide a detailed and comprehensive examination of the region's landscape and seascape landscape. The EMRLCA was produced in consultation with a wide number of stakeholders including Lincolnshire County Council and Natural England.

The East Midlands Region is noted for its agricultural productivity, recreational value, cultural associations and heritage, geodiversity and biodiversity assets, and contains a diverse landscape resource. The Assessment defines 31 Regional Landscape Character Types ranging from open sea, coastal sea marshes and low lying drained fenland farmlands in Lincolnshire to upland moorland landscape of the Peak District.

The EMRLCA identifies likely/ potential '*forces for change*' acting on the various landscape character types in the region. Common forces identified include agricultural intensification and diversification, minerals extraction and development on settlement margins.

### *Local Character Areas*

At a local level several detailed district and protected landscape assessments have been undertaken. They present landscape character at a more refined scale and as such provide information which is more suitable for local planning decisions.

There are a number of high value urban landscapes that are included in the designated Conservation Areas. Townscape Assessments have been undertaken for a number of urban landscapes e.g. the Lincoln Townscape Assessment.

As detailed in the Cultural Heritage chapter a Historic Landscape Characterisation project has been undertaken within Lincolnshire, dividing the county into 10 broad historic landscapes. It is important to have an understanding of past landscapes that have shaped the character of a zone, their surviving elements and impact on subsequent landscape features.

### *Landscape Trends*

The Countryside Quality Counts (CQC) project sponsored by Natural England in partnership with Defra and English Heritage measured landscape change between 1999 and 2003. The assessment showed that existing landscape character is being maintained in 51% of England's landscapes (NCAs), 20% of our landscapes are showing signs of neglect and a further 10% of existing character is being enhanced<sup>xxxiv</sup>.

Table 8 below outlines the overall changes in character of Lincolnshire's landscape character areas over the period 1999 to 2003.

Assessment is one of four categories: If the Character Area is assessed as being 'Consistent with the Vision' it can either be scored as maintained (stable) or enhancing (changing). If the character is assessed as being 'inconsistent with the vision' it is either scored as neglected (stable) or diverging (changing).

Table 8 Countryside Quality Counts Assessment 1999 - 2003

| Landscape Character Area   | Description   | Settlement and development score | Historic features | Overall Assessment |
|--|---|----------------------------------|-------------------|--------------------|
| <b>Character Area 42:<br/>Lincolnshire Coast and Marshes</b>             | Overall rates of development are moderate. It is significant along the coastal strip, continuing to transform the area. An overall assessment of diverging is mainly based on changes in agriculture and settlement which continue to transform the character of the area.  | Diverging                        | Neglected         | Diverging          |
| <b>Character Area 43:<br/>Lincolnshire Wolds</b>                         | Development Pressure is low, in terms of overall rate of change to urban and development outside urban and fringe areas. Changes in agriculture have lessened, and the uptake of management agreements for boundary and woodland elements has probably maintained or strengthened their character. Although development has impacted locally, overall character has probably been maintained. | Maintained                       | Maintained        | Maintained         |
| <b>Character Area 44:<br/>Central Lincolnshire Vale</b>                  | Moderately high rate of build outside urban and fringe areas. Development pressures continue to transform this area. Woodland character has been strengthened, the changes in agriculture and development, coupled with the weakened character of boundaries, suggest that the overall character of the area remains weakened.  | Diverging                        | Maintained        | Neglected          |
| <b>Character Area 45:<br/>Northern Lincolnshire Edge with Coversands</b> | Although average rate of urbanisation and development outside urban and fringe is low, development is concentrated and significant locally. Thus development continues to transform the area locally.<br><br>Although woodland character has been strengthened, changes in agriculture and development continue to transform the character of the area overall.                               | Diverging                        | Not Classified    | Diverging          |
| <b>Character Area 46:<br/>The Fens</b>                                   | Shows the highest rate of build outside urban and fringe areas. Character of settlement and development continues to transform. Although development continues to transform the character of the area locally, enhancements in woodland, agriculture, coastal and other aspects of character suggest that overall character of the area has been strengthened.                                | Diverging                        | Not Classified    | Enhancing          |

| Landscape Character Area                             | Description   | Settlement and development score | Historic features | Overall Assessment |
|--|---|----------------------------------|-------------------|--------------------|
| <b>Character Area 47: Southern Lincolnshire Edge</b> | Moderately high rates of change to urban and development outside urban and fringe areas. Development pressures continue to transform character of the area. Despite the development pressure that is significant locally, the character of the agricultural landscape appears to be stable.                   | Diverging                        | Enhancing         | Maintained         |
| <b>Character Area 48: Trent and Belvoir Vales</b>    | High rate of expansion outside urban and fringe areas. Development pressure continues to transform the character of the area. Changes in agriculture suggest that, overall, the area is diverging from the vision suggested for the area. Development is also transforming the character of the area locally. | Diverging                        | Neglected         | Diverging          |
| <b>Character Area 75: Kesteven Uplands</b>           | Moderately high rate of development outside urban and fringe, but development is scattered and has little overall impact. The overall character of the area has been maintained.  | Maintained                       | Neglected         | Maintained         |

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