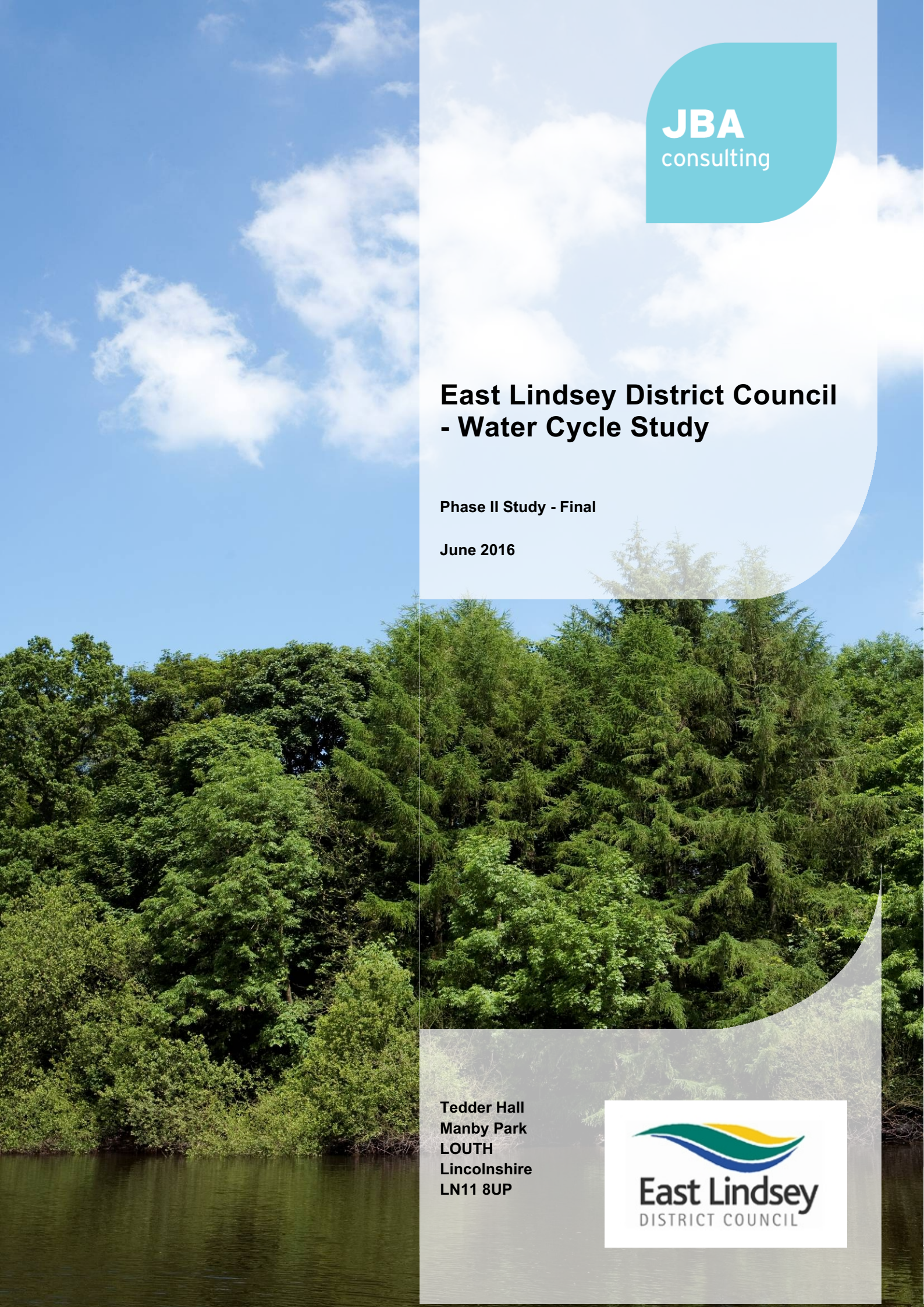

East Lindsey District Council - Water Cycle Study

Phase II Study - Final

June 2016

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Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft v1.0		East Lindsey District Council, Environment Agency, Anglian Water
Final v2.0	Amended following comments from ELDC, EA and AW	East Lindsey District Council, Environment Agency, Anglian Water
Final v3.0	Minor amendments	East Lindsey District Council

Contract

This report describes work commissioned by East Lindsey District Council by an email dated 19/06/2015. East Lindsey's representatives for the contract were Anne Shorland and Alex Murphy. Giovanni Sindoni, Paul Eccleston and Elizabeth Gorton of JBA Consulting carried out this work.

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Purpose

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JBA Consulting has no liability regarding the use of this report except to East Lindsey District Council.

Acknowledgements

JBA Consulting would like to thank East Lindsey District Council, the Environment Agency and Anglian Water Service Limited for assistance in preparing this report.

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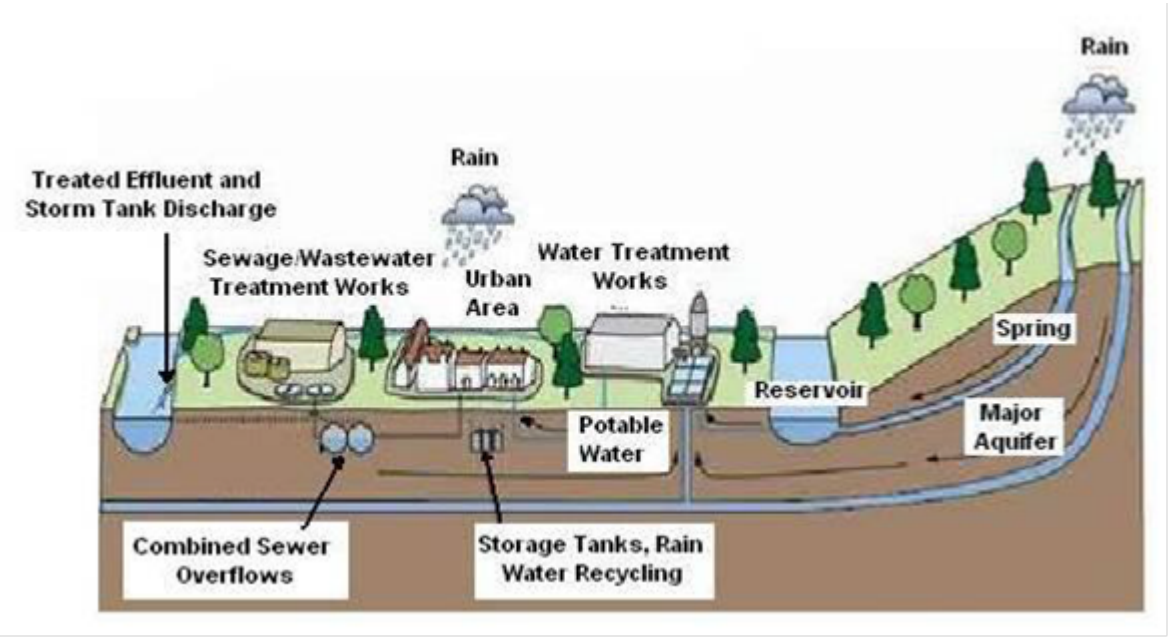
Executive Summary

Introduction

In November 2014 East Lindsey District Council (ELDC) produced a Water Cycle Study scoping study (Phase I study) which highlighted some potential issues relating to water supply, wastewater collection and treatment work infrastructure. As a result in June 2015 JBA Consulting was commissioned to undertake a more detailed Phase II Water Cycle Study (WCS) for ELDC.

New homes require the provision of clean water, safe disposal of wastewater and protection from flooding. It is possible that allocating large numbers of new homes at some locations may result in the capacity of the existing available infrastructure being exceeded. Climate change presents further challenges such as increased intensive rainfall and a higher frequency of drought events that can be expected to put greater pressure on the existing infrastructure. Sustainable planning for water must take this into account. The water cycle can be seen in Figure 1-1 below, and shows how the natural and man-made processes and systems interact to collect, store or transport water in the environment.

Figure 1-1: Water cycle study



*Source: Environment Agency – Water Cycle Study Guidance

ELDC identified 129 potential housing allocation sites within 24 towns and large villages in the District. They also identified five potential housing growth scenarios for each of the 24 towns and large villages which are to be the focus of growth. The sites and housing growth scenarios along with their associated demand for water supply and wastewater services were the key focus of the WCS. Information about all sites assessed is included in Appendix A.

The WCS has been carried out in co-operation with the Environment Agency and Anglian Water. Overall, there are no issues which indicate that the planned scale, location and timing of planned development within the District is unachievable from the perspective of supplying water and wastewater services and preventing deterioration of water quality in receiving waters.

The WCS has identified whether infrastructure upgrades are expected to be required to accommodate planned growth. Timely planning and provision of infrastructure upgrades will be undertaken through regular engagement between ELDC, AW, the EA and developers.

Development scenarios and policy issues

- The WCS is based on an assessment of the impact of planned development within East Lindsey District.
- An assessment of strategic growth within the District was defined by East Lindsey District Council as five housing growth scenarios for 24 of the large towns and villages in the District where growth was to be focussed up until 2031.

- East Lindsey District Council also had a list of 230 potential housing developments sites within the District at the start of this study which had been promoted by developers and land owners through the Strategic Housing Land Availability Assessment (SHLAA) process. This list of non-discounted sites has been altered since the Phase I WCS. 129 of the 230 sites are within the towns and large villages assessed within this study.
- In addition to the proposed site allocations, the number of houses with planning permission (as of October 2015) but which have not yet been constructed were also collated. The housing growth scenarios do not take these commitments into account (i.e. the housing scenarios quote the total housing numbers required in a settlement until 2031). The scenario growth figures for the water resource and water recycling centre (WRC) assessments use a total potential housing number for the settlements, which includes those sites with existing planning permission. When the original assessments were undertaken for individual planning applications the full capacity assessments included in this study may not have been undertaken. The total volume of additional water Anglian Water will need to supply and treat for the full period 2015-2031 has therefore been considered.
- The potential housing growth figures have been compared with existing commitments for each settlement. The majority of the settlements have enough capacity to meet the potential housing number through the current list of non-discounted SHLAA sites. Binbrook, Grainthorpe, Huttoft and Wainfleet All Saints have a shortfall of capacity within the current list of proposed sites.
- Legal agreements under the Town and Country Planning Act Section 106 agreement, and Community Infrastructure Levy agreements are not intended to be used to obtain funding for water or wastewater infrastructure. It is not therefore necessary for East Lindsey District Council to identify requirements for developers to contribute towards the cost of upgrades in its Local Plan.
- The Water Industry Act sets out arrangements for connections to public sewers and water supply networks, and developers should ensure that they engage at an early stage with Anglian Water to ensure that site specific capacity checks can be undertaken and where necessary additional infrastructure constructed to accommodate the development. Where permitted Anglian Water may seek developer contributions towards infrastructure upgrades. Upgrades to water resources, water treatment works and water recycling centres are funded through the company business plans.

Water resources

- All settlements and sites within East Lindsey District are supplied by Anglian Water. The Water Resource Management Plan (WRMP) makes adequate provision for the forecast growth in housing within East Lindsey District. This is confirmed by Anglian Water's water resource assessment of the five potential housing growth scenarios. Therefore, water resources should not be considered to be a barrier to the planned growth in the District.

Water supply infrastructure

- Anglian Water provided an assessment of the water supply infrastructure to each proposed development site. Anglian Water confirmed that for 48 of the 129 sites capacity was available to serve the proposed growth and for the remaining 81 sites infrastructure upgrades would be required.
- Anglian Water confirmed that there were no major constraints to the provision of infrastructure to serve any of the proposed development sites. Therefore, whilst it is expected that infrastructure upgrades will be required to serve the majority of the proposed sites, there remains adequate time for this infrastructure to be delivered by Anglian Water without restricting the timing, location or scale of planned development.

Wastewater collection

- Anglian Water provided an assessment of the sewerage system capacity for each proposed development sites. Except for a few of the smaller developments (10 houses or fewer) it is anticipated that foul water infrastructure upgrades will be required within the sewerage systems for each site. Exact capacity requirements will be determined by Anglian Water in more detailed analysis.
- Anglian Water's preferred method of surface water disposal is using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.

- Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented following an application for a connection, adoption or requisition from a developer. Early developer engagement with water companies is therefore essential to ensure that sewerage capacity can be provided without delaying development.

Water recycling centres and quality consent assessments

- Anglian Water provided an assessment of the available headroom in the flow and quality consents at their existing water recycling centres to accommodate additional wastewater flows for each of the five housing growth scenarios. In addition, JBA Consulting undertook water quality impact modelling to assess the impact of additional treated effluent on the receiving watercourses.
- Water recycling centres (WRC) at Alford, Binbrook, Friskney, North Cotes, Holton le Clay, Spilsby, Stickney, Tetford, Tetney Newton Marsh, Wainfleet and Wragby are assessed to have capacity available to meet the proposed growth scenarios. Mareham le Fen and North Thoresby WRCs may require some treatment upgrades to serve the proposed growth, whilst there are major constraints identified to meet the proposed growth at Ingoldmells, Coningsby, Manby, Legbourne, Louth, Sibsey and Woodhall Spa WRC. No assessment was provided by AW for Horncastle.

Water recycling centre odour assessment

- An odour screening assessment concluded six sites may be at risk of experiencing odour due to their proximity to the existing WRC. It is recommended that odour impact assessments be undertaken as part of the planning application process. All other sites are unlikely to be impacted by odour from WRCs.

Water quality impact assessment

- All works are currently working below their DWF permits.
- The proposed growth is not predicted to lead to any class deteriorations, or deteriorations of quality of greater than 10% for any determinand.
- For Phosphorus all receiving watercourses at all WRCs fail their targets for the present-day situation:
    - At Coningsby (if BAT for P = 0,5mg/l is considered) and Woodhall, good ecological status could be achieved in the receiving watercourses if these were achieving GES upstream of the works.
    - At Horncastle, Legbourne and Manby even assuming GES upstream, the modelling predicts that it would not be possible to achieve GES in the receiving watercourses.
    - Louth and Sibsey have already GES upstream and it not possible to achieve GES at the receiving watercourses. Note: the reason for the P GES target failure could be due to the fact that by not having any observed data available an assumed discharge value (same for all works) was used.

      Note: for phosphorus an average value provided by the EA based on actual data of around 2000 discharges with no P removal was used for all WRCs.
- For BOD only the receiving watercourses at Horncastle and Sibsey fail GES but targets can be achieved by using BAT.
- For NH4 only the receiving watercourse at Louth fails GES but target can be achieved by using BAT.

Flood risk

- The percentage of each site at risk from fluvial or surface water flooding was calculated. This information may be used to supplement the information presented at the settlement scale in the Strategic Flood Risk Assessment.
- An assessment was carried out to determine whether increased discharges of treated effluent from a WRC due to increased population growth would increase the risk of fluvial flooding from the receiving watercourse. This assessment was carried out for the seven WRCs assessed within the water quality impact assessment and showed that the impact

of increased effluent flows is not predicted to have a significant impact upon flood risk in any of the receiving watercourses.

Surface water drainage

- A desk study exercise was carried out to determine the potential of each site to use sustainable drainage systems (SuDS), in particular the potential to use infiltration drainage techniques. In general, sites in the Lincolnshire Wolds have freely draining soils ideal for infiltration SuDS in contrast to the soils with impeded drainage and high groundwater levels closer the coast and to the west.
- A number of the sites (located within Alford, Binbrook, Holton Le Clay, Louth, Manby, Marshchapel, North Thoresby and Tetney) are within the Environment Agency's Source Protection Zones (SPZ) and the use of infiltration SuDS in these areas may be restricted although the risk of groundwater contamination from SuDS can be effectively managed. SuDS are further encouraged in water scarce regions to improve (or maintain) recharge of an aquifer. The suitability of SuDS will need to be assessed on a site by site basis through a risk assessment which would require approval from LCC as LLFA and the EA.
- Sites were also assessed to determine whether development may increase the surface water flood risk downstream and whether the site may be required to provide "betterment" to reduce existing downstream flood risk. Similarly, sites were identified where there is currently a surface water flood risk to the site which will need to be managed with a local solution (such as SuDS) as part of the overall site design to protect the new developments.

Environmental constraints and opportunities

- GeoPDF maps have been created to allow for a range of notable environmental designations and features to be displayed 'on' or 'off' with the aim of being able to quickly identify the presence of environmental features within or close to the proposed sites. The maps should be used in conjunction with Sustainability Appraisals (SA) and/or Strategic Environmental Assessments (SEAs) when these are available.
- The environmental assessment provides an overview of the wider environment within the District and the potential risks and opportunities associated with the development of the proposed sites.

Climate change

- A qualitative assessment has been undertaken to assess the potential impacts of climate change on the assessments made within this water cycle study. The assessment used a matrix which considers both the potential impact of climate change on the assessment in question, and also the degree to which climate change has been considered in the information used to make the assessments contained within the WCS.
- The capacity of the sewerage system and the water quality of receiving water bodies stand out as two elements of the assessment where the consequences of climate change are expected to be high but no account has been made of climate impacts in the assessment. This is a matter to be addressed at detailed assessment stage.

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Abbreviations

ALC ....Agricultural Land Classification

ALS....Abstraction Licensing Strategy

AMP....Asset Management Plan

AONB ....Area of Outstanding Natural Beauty

AP....Assessment Point

ASNW....Ancient Semi-Natural Woodland

AW....Anglian Water

BOD....Biochemical Oxygen Demand

BREEAM ....Building Research Establishment Environmental Assessment Methodology

CAMS ....Catchment Abstraction Management Strategies

CAPEX ....Capital Expenditure

CfSH....Code for Sustainable Homes

CSO....Combined Sewer Overflow

DWI ....Drinking Water Inspectorate

DYAA....Dry Year Annual Average

EA....Environment Agency

EFI....Ecological Flow Indicator

ELDC.....East Lindsey District Council
EP.....Environmental Permit
FWMA .....Flood and Water Management Act
FZ.....Flood Zone
GES.....Good Ecological Status
GIS .....Geographic Information Systems
HOF.....Hands-Off Flow
IDB .....Internal Drainage Board
IDP .....Infrastructure Delivery Plan
JBA.....Jeremy Benn Associates
LCC .....Lincolnshire County Council
LDE .....Level Dependent Environments
LLFA.....Lead Local Flood Authority
LPA.....Local Planning Authority
l/p/d.....Litres per person per day
LWS.....Local Wildlife Site
Ml/d.....Million litres per day
NNR.....National Nature Reserve
NPPF.....National Planning Policy Framework
OfWAT.....Water Service Regulation Authority
OPEX .....Operational Expenditure
OS .....Ordnance Survey
PE.....Population Equivalent
p/h .....Person per house
PPS .....Planning Policy Statement
PR .....Price Review
R/A/G.....Red / Amber / Green assessment
RBD.....River Basin District
RBMP.....River Basin Management Plan
RMA .....Rick Management Authority
RQP.....River Quality Planning tool
RSS .....Regional Spatial Strategy
RZ.....Resource Zone
TWA .....Trent Witham Ancholme Water Transfer Scheme
SA.....Sustainability Appraisals
SAB .....SuDS Approving Body
SAC .....Special Area of Conservation
SDS .....Strategic Direction Statements
SEA .....Strategic Environmental Assessment
SEPA.....Scottish Environmental Protection Agency

SFRA.....Strategic Flood Risk Assessment
SHLAA.....Strategic Housing Land Availability Assessment
SINC.....Site of Importance for Nature Conservation
SNCI.....Site of Nature Conservation Interest
SPA .....Special Protection Area
SPZ .....Source Protection Zone
SSSI .....Site of Special Scientific Interest
SU .....Sewerage Undertaker
SuDS .....Sustainable Drainage Systems
uFMfSW .....Updated Flood Map for Surface Water
UWWTD .....Urban Waste Water Treatment Directive
WaSC.....Water and Sewerage Company
WCS.....Water Cycle Study
WFD .....Water Framework Directive
WRC.....Water Recycling Centre
WRMP.....Water Resource Management Plan
WRZ .....Water Resource Zone
WQA.....Water Quality Assessment
WSZ .....Water Supply Zone
WTW .....Water Treatment Works
WwTW.....Wastewater Treatment Works

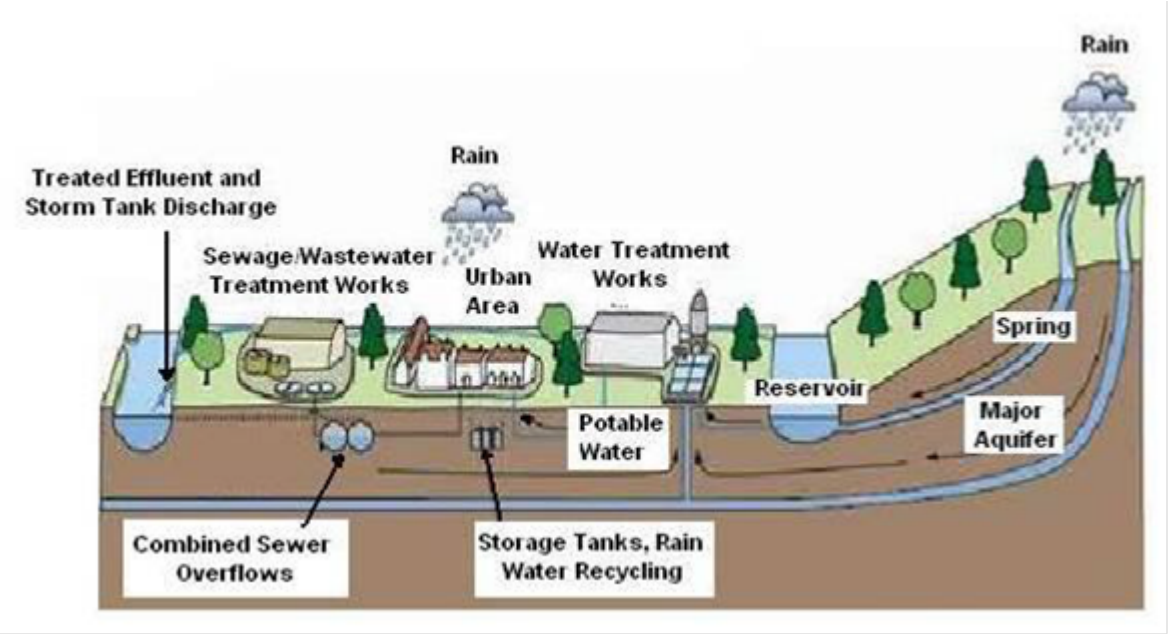
1 Introduction

1.1 Background

In November 2014 East Lindsey District Council (ELDC) produced a Water Cycle Study scoping study[1] (Phase I study) which highlighted some potential issues relating to water supply, wastewater collection and treatment work infrastructure. As a result, in June 2015 JBA Consulting was commissioned to undertake a more detailed Phase II Water Cycle Study (WCS) for ELDC.

New homes require the provision of clean water, safe disposal of wastewater and protection from flooding. It is possible that allocating large numbers of new homes at some locations may result in the capacity of the existing available infrastructure being exceeded. This situation could potentially lead to service failures to water and wastewater customers, adverse impacts to the environment or high costs for the upgrade of water and wastewater assets being passed on to bill payers. Climate change presents further challenges such as increased intensive rainfall and a higher frequency of drought events that can be expected to put greater pressure on the existing infrastructure. Sustainable planning for water must take this into account. The water cycle can be seen in Figure 1-1 below, and shows how the natural and man-made processes and systems interact to collect, store or transport water in the environment.

Figure 1-1: Water cycle study



*Source: Environment Agency – Water Cycle Study Guidance

This study will assist the council to select and develop sustainable development allocations where there is minimal impact on the environment, water quality, water resources, infrastructure and flood risk. This has been achieved by identifying areas where there may be conflict between any proposed development and the requirements of the environment and by recommending potential solutions.

The Water Cycle Study should be treated as a "dynamic document" that is periodically reviewed as further information becomes available. This will provide a better understanding of the impact of the developments on the water supply and wastewater infrastructure and water quality.

1.2 Objectives of the Water Cycle Study

ELDC are in the process of identifying draft site allocations to meet their targets for housing and employment provision to 2031.

The Phase I Water Cycle Study identified some potential issues relating to water supply, wastewater collection and treatment work infrastructure that without appropriate intervention and

1 East Lindsey District Council (November 2014) Water Cycle Study Draft

investment may either present a constraint to the development of the district or lead to significant environmental impacts. The Phase I study highlighted six settlements in particular which may have significant constraints on growth due to issues of wastewater capacity. These six settlements are Alford, Binbrook, Legbourne, Manby, Sibsey and Woodhall Spa.

The Phase I scoping study did not include any modelling or detailed assessment of the impact of the future increases in sewerage effluent discharges on the receiving watercourses, and the subsequent ability of the watercourses to meet Good Ecological Status (GES) under the Water Framework Directive (WFD). The Local Planning Authority (LPA) is required to have regard to meeting GES in its Local Plan.

Although water resources were not identified as a significant constraint to growth in the Phase I study, Anglian Region has the lowest average annual rainfall in the UK and East Lindsey's average is 600mm per year, below the UK average. This makes groundwater the main source of water supply with minimum input from rivers and reservoirs. Water optimisation is therefore an important aspect to consider for future developments.

A Phase II WCS is required in order to assess in more detail the constraints and requirements that arise from the proposed growth on the District's water environment, including flood risk, surface water drainage, water resources, wastewater infrastructure, water quality and ecology issues, with particular attention at the six settlements mentioned above.

The overall objective of the Water Cycle Study is to understand the environmental and physical demands of the planned development and identify opportunities for more sustainable planning and improvements that may be required so that proposals don't exceed the existing water cycle capacity. This is assessed by considering the following issues:

- Water Resources;
- Water Supply;
- Wastewater Collection and Treatment;
- Water Quality and the Environment;
- Demand Management;
- Flood Risk, and
- Climate Change

This report focuses upon the proposed site allocations provided by the council. The report outlines the current status of the environment and infrastructure, identifies the possible constraints to the development, the impacts and demands of the development, and gives recommendations as to any improvements or mitigation.

1.3 Phase I and Phase II Water Cycle Study scope

The Environment Agency's Water Cycle Study Guidance[2] sets out the purpose and scope of the different stages of a WCS.

The scoping study aims to highlight areas where development is likely to either impact on the water environment, or is likely to require significant investment in water infrastructure to service new development. A scoping study should clarify the objectives of further Water Cycle Studies.

The following issues are scoped into the Phase I WCS:

- *Will there be enough water?*
- *Will there be a water quality impact?*
- *Can development be accommodated without increasing flood risk?*
- *Are there other location specific environmental risks that need to be considered, for example relating to biodiversity or conservation requirements?*
- *What constraints are there on increasing capacity of wastewater treatment and water supply?*
- *Are there outstanding concerns about infrastructure provision that need to be addressed in a detailed WCS?*

2 Environment Agency Water Cycle Study Guidance. Accessed online at http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/geho0109bpff-e-e.pdf on 09/12/2015.

The aim of a detailed study is to resolve areas of uncertainty that have arisen from previous stages of Water Cycle Studies. The study will identify if updated infrastructure is required and if so what are the timescales, where it is required and who is responsible.

We recommend the following issues are scoped into the Phase II WCS:

Water Resources and Water Supply

Environmental capacity

- *Is there capacity in existing licenses for development?*
- *Will existing license remain valid?*
- *Can we reduce abstraction by better management practices?*

Infrastructure capacity

- *If new major infrastructure (reservoirs, water treatment works, boreholes) are needed, can they be provided in time, can they be funded, and are they sustainable?*

Wastewater Collection and Treatment

Environmental capacity

- *Is there volumetric capacity in existing effluent discharge consent for growth?*
- *Will discharge consent be valid to meet future standard (e.g. WFD)?*
- *Will additional discharge be allowed if there is no additional environmental capacity to assimilate it?*

Infrastructure capacity

- *If new major infrastructure (wastewater treatment works, major pumping mains or sewer mains) are needed, can they be provided in time, and can they be funded?*

Environmental Opportunities

- *Are we making the most of our new development?*
- *Are there multi-use options that will provide water resources, flood risk management and water quality benefits?*
- *Examples:*
    - *Green roofs and permeable road surfaces for new developments*
    - *SuDS designed to provide green infrastructure and biodiversity benefits as well as surface water flood risk and water quality management*

1.4 Structure of this report

Table 1-1: Report structure

Chapter	Description
1. Introduction	This chapter provides the background, the objective and the scope of the project.
2. Development Scenarios and Key Developments	This chapter illustrates the scale and locations of the planned developments that were assessed in this study.
3. Legislation and Policy Framework	This chapter introduces the policy and legislative framework which drives the management of development and the water environment in England at local, national and European level.
4. Water Resources and Water Supply	This chapter looks at the availability of water resources to cover the future demand. It also covers the impact of the planned development on the existing capacity of the water supply infrastructure and highlights where upgrades or new infrastructure might be needed.
5. Wastewater Collection and Treatment	This chapter covers the impact of the planned development on the existing capacity of the sewerage system infrastructure and water recycling centres and highlights where upgrades or new infrastructure might be needed. It also looks at the potential

	impact of odour from the water recycling centres on new developments. Finally it covers the water quality impact assessment of discharges from future water recycling centres into the receiving watercourses.
6. Flood Risk Management	This chapter considers the flood risk to the potential site allocations as well as the potential risk of increased flood flows in watercourses due to additional flows of sewage effluent.
7. Environmental Constraints and Opportunities	This chapter looks at the environmental risks and opportunities associated with the allocation sites.
8. Climate Change Impact Assessment	This chapter illustrates the qualitative assessment undertaken to assess the potential impacts of Climate Change on the assessments made in this water cycle study.
9. Summary and Recommendations	This chapter outlines whether the required upgrades and solutions for all the assessments covered by this study can be delivered where a Red status is scored. This chapter also summarises all the recommendations provided in each chapter.

Where applicable the assessments in this report uses a simple Red / Amber / Green (R/A/G) assessment to identify the degree to which development in a site or settlement may be constrained. Each assessment uses a specific R/A/G definition that is defined in each chapter. An example is shown below from the water supply infrastructure assessment:

Capacity available to serve the proposed growth	Infrastructure and/or treatment upgrades required to serve proposed growth or diversion of assets may be required	Major constraints to provision of infrastructure and/or treatement to serve proposed growth

Each chapter details the methodology, data collected, results and conclusions of the assessment as well as including relevant recommendations.

Chapter 9 outlines whether the required upgrades and solutions for all the assessments covered by this study can be delivered where a Red status is scored and also summaries the recommendations provided in each chapter.

1.5 Stakeholders and consultation

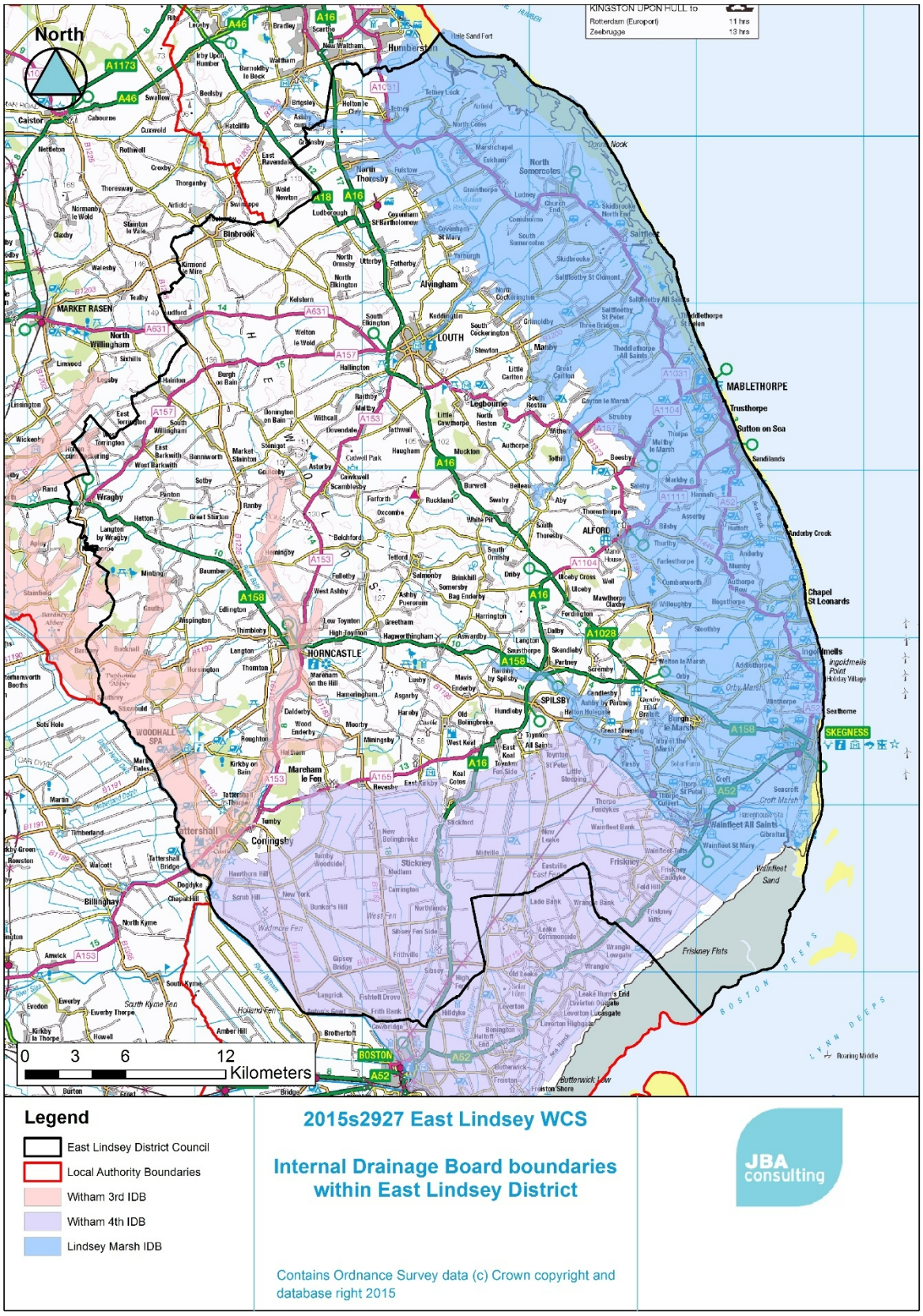
It is important that a Water Cycle Study brings together all partners and stakeholders knowledge, understanding and skills to help to understand the environmental and physical constraints to development.

The Phase I WCS set up a steering group to prepare the scoping study. The steering group consisted of representatives from East Lindsey District Council, Environment Agency and Anglian Water Services Limited. In addition, a wider group of stakeholders were identified for future studies.

As well as the initial steering group, the following stakeholders were consulted during this Water Cycle Study and have provided data for use within the study:

- East Lindsey District Council (ELDC)
- Anglian Water Services Ltd (AW)
- Environment Agency (EA)
- Lindsey Marsh Internal Drainage Board
- Witham Third Internal Drainage Board
- Witham Fourth Internal Drainage Board

Figure 1-2: Internal Drainage Boards within East Lindsey District



1.5.1 Internal Drainage Board consultation

During the preparation of the WCS the IDBs were consulted to understand their individual procedures and requirements with regards to development.

The Flood and Water Act 2010 confirms IDBs as one of the key Risk Management Authorities (RMAs). Local planning authorities should consult the IDB on planning matters so the Board can comment accordingly. The Boards are also consulted by Lincolnshire County Council with respect to flood and drainage matters (including SuDS) as part of the planning consultation process. As a result of the consultation process the Boards are able to inform developers of IDB's requirements in respect to Land Drainage Act and Byelaw issues. The Act and Byelaws give protection to the Board's assets in respect to work in, over, under and near to watercourses as well as discharge to watercourses

Section 23 of the Land Drainage Act 1991 sets out the powers Internal Drainage Boards have over works on or near a Board maintained watercourse. Within 9m of the riparian watercourse bank top (8m for Lindsey Marsh Drainage Board) the Internal Drainage Board's bylaws apply and any works within this distance must obtain the Board's prior written consent.

Any structure built within a watercourse should be designed such that it can withstand the frequent passage of machinery or the channel being maintained by mechanical plant. The issuing of consent also allows the Board to record who will be responsible for the long-term maintenance of the structure and who to approach should it not be maintained or fail. This is important to the Boards as many surface water flooding issues are caused or exacerbated by a lack of maintenance and lack of access to the watercourse.

The Board's consent is also required to increase flows into any watercourse within the District (except Main Rivers which are controlled by the Environment Agency). In line with government directives, the Boards generally expect developers to implement sustainable drainage solutions to ensure post development surface water run-off rates do not exceed a certain flow rate. This varies for each Board:

- For Lindsey Marsh IDB surface water runoff is set at 1.4 litres per second (which is the flow rate the IDB systems have historically been designed for).
- For Witham 3rd generally up to 5 litres per second for small developments is allowed even if this is larger than Greenfield, however for larger developments discharge rate is restricted to Greenfield runoff.
- For Witham 4th, surface water discharge rates allowed can vary from full un-restricted discharge to flow attenuated to 1.4 litres per second per hectare for impermeable area connected to the system.

Discussion in respect to acceptable discharge for larger developments generally occurs at the pre-application stage of a development.

Generally, all Board maintained watercourses have sufficient capacity to cater for the predevelopment runoff rates of 1.4 litres per second. However, within Witham 4th there are a number of small watercourses that receive flows from developments on the edge of the Lincolnshire Wolds and also overland flows from this steep catchment. These overland flows have caused flooding to property in the past. None of the watercourses in this area can accept flows greater than 1.4 l/sec/ha. Existing villages (such as Friskney) served by Board's watercourses would also be subject to the same restriction however systems can be improved with contribution from developers (in some circumstances). Within Witham 3rd IDB, a number of the watercourses which received urbanised runoff are also considered to have some degree of flood risk.

Lindsey Marsh and Witham 3rd IDBs do not have any plans in place to provide additional volumetric storage capacity within the receiving watercourses. This is due to the general presumption in favour of site level sustainable systems whereby surface water run-off rates are limited to predevelopment runoff rates. Witham 4th IDB has no specific plans within East Lindsey however the Board is looking at its long term pumping station replacement plan (15 - 20 year) which will bring benefits to areas of East Lindsey as well as Boston Borough. Witham 4th will also consider adoption of watercourses that serve development or areas of growth.

1.6 Study area

The study area is the district of East Lindsey within the county of Lincolnshire. The District is largely rural and sparsely populated. The main towns in the District are Skegness, Louth, Mablethorpe, Horncastle, Spilsby, Alford, Coningsby and Tattershall. See Figure 1-3 below.

There are three different Internal Drainage Boards within the district: Witham Third, Lindsey Marsh and Witham Fourth.

The main transport links in the district include the A16, A52 and A158.

Figure 1-3: East Lindsey study area

2 Development Scenarios and Key Developments

2.1 Introduction

East Lindsey District Council are in the process of developing their Local Plan to 2031. In order to assist ELDC to understand the capacity for growth within the District, this Phase II WCS tests five housing growth scenarios at 24 locations (5 towns and 19 large villages) within the District to measure their likely impact upon water resources, wastewater services and the water environment. The chosen locations are those where growth in the District is most likely to be concentrated and the selection incorporates all inland towns and large villages in the District.

The baseline potential housing numbers and the four other housing growth scenarios are shown in Table 2-1. Scenario 4, the high housing numbers are the same as those used within the Phase I WCS, which were based on the 2008 headship rate data. The current housing targets in East Lindsey District have been revised and are somewhat lower than the previous growth figures (Scenario 1 housing figures).

As well as housing growth scenarios, ELDC had a list of 230 potential housing developments sites within the District at the start of this study which had been promoted by developers and land owners through the SHLAA process. This list of non-discounted sites has been altered since the Phase I WCS. 129 of the 230 sites are within the towns and large villages (listed in Table 2-1) to be assessed within this study. As with the Phase I study it was expected that assessing the possible housing sites as well as high level growth figures would provide a more detailed picture and therefore all 129 sites will be assessed within this Phase II study

As a result of the housing targets and SHLAA sites within East Lindsey District being revised since the Phase I WCS as well as Anglian Water's previous assessments having been carried out within a different AMP period it was felt necessary from all the partners from the start of the project that the AW R/A/G assessments carried out within the Phase I study would need to be redone to ensure they were up to date.

2.2 Growth scenarios

To assess the headroom capacity of the water recycling centres and water resource to each location it was necessary to consider the total proposed housing figures in each settlement.

ELDC provided five housing growth scenarios, shown in Table 2-1, for each of the towns and larger villages in the District. Scenario 1 is the most recent figures ELDC have for housing need over the next 15 years. Scenario 2 is the proposed housing numbers in Scenario 1 plus a 20% increase. Scenario 3 are the proposed housing numbers in Scenario 1 plus an adjustment for the existing coastal allocation commitment. The numbers in bold in the Scenario 3 column of the table show which settlements have an increase in housing numbers compared to Scenario 1.

Scenario 4 are the high level housing numbers. These were the figures used within the Phase I WCS and are based on the 2008 headship rate data. These are considered the "worst case" figures as far as stress-testing the water and wastewater systems. Scenario 5 is equal to the Scenario 3 housing numbers except for a further 100 homes to be located in Burgh le Marsh.

None of these housing scenario figures consider commitments, they simply outline how many houses are required in a location over the next 15 years.

Table 2-1: Location growth scenarios for towns and large villages within East Lindsey

Location	Scenario 1: Potential housing numbers	Scenario 2: Scenario 1 +20%	Scenario 3: Scenario 1 +coastal housing adjustment	Scenario 4: High level housing numbers	Scenario 5: Scenario 3 except change for Burgh le Marsh
Alford	289	347	**603**	693	603
Binbrook	82	98	82	114	82
Burgh le Marsh	213	256	**257**	295	**357**
Coningsby & Tattershall	486	583	486	991	486
Friskney	50	60	**94**	128	94

Grainthorpe	59	71	**103**	67	103
Grimoldby & Manby	140	168	**184**	194	184
Hogsthorpe	78	94	**122**	115	122
Holton le Clay	302	362	**346**	406	346
Horncastle	605	726	605	1411	605
Huttoft	47	56	**91**	68	91
Legbourne	54	65	**98**	72	98
Louth	1434	1721	**1748**	3347	1748
Mareham le Fen	84	101	**128**	101	128
Marshchapel	60	72	**104**	82	104
North Thoresby	93	112	**137**	137	137
Sibsey	168	202	**212**	231	212
Spilsby	266	319	**580**	634	580
Stickney	85	102	**129**	113	129
Tetford	39	47	39	46	39
Tetney	137	164	**181**	186	181
Wainfleet All Saints	160	192	160	184	160
Woodhall Spa	347	416	**391**	473	391
Wragby	153	184	**197**	212	197
Total	**5431**	**6517**	**7077**	**10300**	**7177**

The numbers in bold in the Scenario 3 column shows which settlements have an increase in housing numbers compared to Scenario 1. Scenario 5 is equal to the Scenario 3 housing numbers except for a further 100 homes to be located in Burgh le Marsh.

2.3 Key developments

At the start of this study ELDC had a list of 230 non-discounted potential housing development sites within the District which were promoted through the Strategic Housing and Land Availability Assessment (SHLAA). 129 of these sites are within the towns and large villages being assessed in this WCS. Some or all of these sites will make up ELDC housing allocations with this WCS being part of the process of deciding on the housing allocations.

To help identify if there were any constraints to growth at any of these sites all 129 sites within the towns and large villages where ELDC plan to focus growth would be assessed. Whilst some of the sites in this list are the same as those assessed in the Phase I study, some sites from the Phase I study have been removed whilst other sites have been added.

Table 2-2 lists the sites assessed within this study.

Table 2-2: List of SHLAA sites assessed

Site Ref	Parish	Site location	Potential housing number	Site Area (Ha.)
AL036	Alford	Land adjacent to 9 Chauntry Road	3	0.1
AL042	Alford	Land adjacent to Peachcroft, Farlesthorpe Road.	10	0.4
AL302	Alford	Land off Spendluffe Avenue	90	6.8
AL303	Alford	Land east of Tothby Lane	43	4.2
AL304	Alford	Land to rear of Hunt's Depot	22	1.3
AL312	Alford	Land off Tothby Lane	150	9.8
AL316	Alford	Land at Farlesthorpe Road	37	1.4
AL325	Alford	Land off Chauntry Road	90	8.7
BIN306	Binbrook	Land north of Louth Road	21	2.3
BIN307	Binbrook	High Street	20	2.1
BIN309	Binbrook	Rear of Binbrook Mews,Market Place	1	0.0
BLM309	Burgh le Marsh	Land south of Hall Lane	94	5.5
BLM310	Burgh le Marsh	Wildshed Lane	52	2.8
BLM313	Burgh le Marsh	Land south of Wildshed Lane	31	3.7
BLM318	Burgh le Marsh	Station Road	8	0.5
C&T305	Coningsby	Land off Park Lane	160	8.8
C&T306	Coningsby	Leagate Road	57	2.2

Site Ref	Parish	Site location	Potential housing number	Site Area (Ha.)
C&T311	Coningsby	Tumby Road	54	2.1
C&T313	Coningsby	Leagate Farm	96	3.7
FRIS301	Friskney	Land adj Beech Cottage, Church Road	63	3.4
FRIS306	Friskney	Land Adj Fendale, Low Gate	10	1.0
FRIS311	Friskney	Church Lane/Yawling Gate	15	0.8
FRIS316	Friskney	Low Road / The Avenue	3	0.2
FRIS317	Friskney	Church End	2	0.1
FRIS321	Friskney	Burgh Road	20	1.6
GRA209	Grainthorpe	Poors End, Grainthorpe	9	0.5
GRA211	Grainthorpe	Land north of Staples Garth, Grainthorpe	9	1.2
GRA312	Grainthorpe	Land at Garth House, Main Road	1	0.1
HLC206	Holton le Clay	r/o 1 Louth Road, Holton le Clay	19	1.0
HLC301	Holton le Clay	Land Opp Jug and Bottle	337	17.7
HLC302	Holton le Clay	Land off Church Lane	32	1.7
HLC303	Holton le Clay	Land east of Louth Road	292	15.4
HLC304	Holton le Clay	Land north of Tetney Road	19	1.0
HLC305	Holton le Clay	Land north of Louth Road	91	4.8
HOG306	Hogsthorpe	Land off West End	89	4.7
HOG309	Hogsthorpe	Land off Thames Street	11	2.1
HOR050	Horncastle	Land at The Wong	12	0.5
HOR063	Horncastle	Land adjacent to Greystones, Lincoln Road	12	0.3
HOR301	Horncastle	Land east of Lincoln Road	500	26.0
HOR303	Horncastle	Land east of Elmhirst Road	16	1.9
HOR308	Horncastle	Land off Station Lane/The Sidings	25	2.2
HOR312	Horncastle	Linpac Site, Mareham Road	49	5.3
HOR314	Horncastle	Land south of Banovallum Gardens	146	6.1
HOR315	Horncastle	Land south of Spilsby Road	60	2.6
HOR320	Horncastle	Highways Depot, Hemingby Lane	43	1.7
HOR324	Horncastle	Land off Lincoln Road	24	0.9
HOR327	Horncastle	Land on Lincoln Road	7	0.2
HOR330	Horncastle	Land off Mareham Road	230	9.9
HOR333	Horncastle	Land to the west of Churchill Avenue	124	10.3
HUT206	Huttoft	Adj Hemingby House, Mumby Road, Huttoft	3	0.2
HUT306	Huttoft	Adjacent Hemingby House, Mumby Road	13	0.6
LEG303	Legbourne	Extension of Househams Lane, Legbourne	66	3.5
LEG307	Legbourne	Station Road	3	0.7
LEG313	Legbourne	Land off Station Road	1	0.1
LO044	Louth	Land off St Marys Lane (Close to Grimsby Rd end)	4	0.3
LO096	Louth	Land to rear of property off Hortons Yard, Kidgate	5	0.1
LO099	Louth	Land to rear of The Kings Head PH, Mercer Row	2	0.0
LO143	Louth	Land between Spire View Road & Pleasant Avenue	16	0.6
LO154	Louth	Land to rear of 87-107 Eastfield Road	5	0.2
LO155	Louth	Land to rear of 119-155 Eastfield Road	8	0.3
LO301	Louth	Land east of A16	30	2.3
LO305	Louth	Land adjoining Greenways, Brackenborough Road	129	5.0
LO306	Louth	Land between Keddington Road and Brackenborough Road	400	22.0
LO311	Louth	Land adjacent to Louth United Football Ground	396	12.0
LO312	Louth	Wallis House, Birch Road	38	1.4
LO313	Louth	Land to NE of Legbourne Road	240	33.9

Site Ref	Parish	Site location	Potential housing number	Site Area (Ha.)
LO324	Louth	Adj Shangri-la, Stewton Lane	1	0.2
LO325	Louth	Land off Shearwater Close	54	2.1
LO326	Louth	Land south of Eastfield Road	76	4.7
LO329	Louth	Land at Legbourne Road	89	3.4
LO331	Louth	Land off Stewton Lane	1	0.2
LO339	Louth	Land at Legbourne Road	55	2.1
LO341	Louth	Bluestone Rise (extension of)	5	0.6
LO344	Louth	Louth Garden Centre, Legbourne Road	45	2.1
LO462	Louth	Land at Louth Golf Course	30	6.8
MAN314	Manby	Land at Carlton Road	50	4.9
MAN316	Manby	Former Caravan Site	27	1.4
MAN330	Manby	Redundant RAF Hangers, Manby Park	142	8.6
MAN332	Manby	Land at Manby Middlegate	4	0.5
MAR217	Marshchapel	End of Mill Lane, Marshchapel	34	2.5
MAR226	Marshchapel	Land adj Chain Terrace, Seadyke Way, Marshchapel	15	0.6
MAR300	Marshchapel	R/O Seadyke Way	15	0.9
MAR304	Marshchapel	Land off Mill Lane	20	1.2
MLF021	Mareham le Fen	Land at the garage, Main Street	3	0.2
MLF305	Mareham le Fen	Moat Farmyard, Watery Lane	35	2.3
MLF328	Mareham le Fen	Land off Main Street	32	2.0
NTH301	North Thoresby	Station Road	33	2.4
NTH307	North Thoresby	Off High Street	10	0.5
NTH308	North Thoresby	East of A16	130	10.8
NTH313	North Thoresby	Land off High Street	20	1.1
NTH317	North Thoresby	Land adj to Quidi Vidi	1	0.1
SIB302	Sibsey	Land to the west of A16	101	11.0
SIB303	Sibsey	Land to rear of Sibsey House	320	24.3
SIB304	Sibsey	Land to R/O Tregarthen House, Main Road	5	2.1
SIB406	Sibsey	Land to the rear of Page Close	34	1.8
SPY008	Spilsby	Land adjacent to Shades Hotel, Church Street	1	0.0
SPY301	Spilsby	Post Office Lane	67	2.6
SPY302	Spilsby	Land fronting and rear of 55 Ashby Road	35	1.8
SPY303	Spilsby	East of Ashby Road	100	7.8
SPY304	Spilsby	North of Halton Road	30	1.2
SPY305	Spilsby	Land adj to Halton Road	129	5.0
SPY306	Spilsby	Land off Halton Road	70	2.7
SPY307	Spilsby	Land adjacent to 1 Ashby Meadows	1	0.1
STK304	Stickney	Land north of Halls Lane	50	0.5
STK312	Stickney	West of Main Road	39	3.9
STK013	Stickney	Land at Station Bridge Bungalow, Main Road	10	2.1
STK314	Stickney	Adj Lynwood, Main Road	1	0.1
STK315	Stickney	Land to the rear of Main Road	20	1.8
STK319	Stickney	Land adjacent to a depot, Main Road	15	0.8
TEF302	Tetford	Land at South Road	38	2.0
TEF303	Tetford	South Road	12	0.6
TNY308	Tetney	Land west of Hoop End, Tetney	10	1.6
TNY311	Tetney	Humberstone Road, Tetney	32	1.7
TNY313	Tetney	Humberston Road	97	11.8
TNY316	Tetney	Land at Tetney Golf Club, Station Road	183	11.0
WAI305	Wainfleet All Saints	Land south of Matt Pits Lane	35	1.9
WAI308	Wainfleet All Saints	Land off Church Walk	7	0.4
WAI308B	Wainfleet All Saints	Land off Station Road	9	0.5
WAI401	Wainfleet All Saints	Land off Matt Pitts Lane	11	0.7
WAI405	Wainfleet All Saints	Land at Brewster Lane	3	0.2
WRA024	Wragby	Land to rear of Thornfield, Louth Road	32	1.9

Site Ref	Parish	Site location	Potential housing number	Site Area (Ha.)
WRA301	Wragby	Land off Victoria Street	79	4.2
WRA304	Wragby	Land off Bardney Road	42	2.2
WRA306	Wragby	South of Wire Hill Lane	7	0.5
WRA313	Wragby	Land on Bardney Road	79	4.2
WSP304	Woodhall Spa	Land adj to St Hughs School	100	5.5
WSP310	Woodhall Spa	Land off Clinton Way	18	1.2
WSP314	Woodhall Spa	Land off Witham Road	228	13.8
WSP315	Woodhall Spa	196/198 Witham Road	13	0.7

2.4 Commitments

The number of houses with planning permission, but which have yet to be constructed, have been collated for the towns and large villages within East Lindsey (see Table 2-3). The housing growth scenarios in Table 2-1 do not take these commitments into account, i.e. the housing scenarios simply quote the total housing numbers required in a settlement until 2031. The scenario growth figures for the water resource and wastewater treatment work assessments use a total potential housing number for the settlements, which includes those sites with existing planning permission. When the original assessments were undertaken for individual planning applications the full capacity assessments included in this study may not have been undertaken. The total volume of additional water Anglian Water will need to supply and treat for the full period 2015-2031 has therefore been considered.

Table 2-3 shows the true number houses that are likely to be required going forward.

The sites with planning permission have not been included in the environment and flood risk assessments on the basis these issues were appropriately addressed when the respective planning permissions were granted.

Table 2-3: Commitments within East Lindsey

Location	Scenario 1: Potential housing numbers	Commitments as of October 2015	Scenario 1 minus commitments	Total capacity of all suitable SHLAA sites	Shortfall
Alford	289	156	133	445	
Binbrook	82	9	73	42	31
Burgh le Marsh	213	67	146	185	
Coningsby & Tattershall	486	164	322	367	
Friskney	50	3	47	113	
Grainthorpe	59	3	56	19	37
Grimoldby & Manby	140	138	2	223	
Hogsthorpe	78	21	57	100	
Holton le Clay	302	7	295	790	
Horncastle	605	659	-54	1248	
Huttoft	47	3	44	16	28
Legbourne	54	39	15	70	
Louth	1434	485	949	1629	
Mareham le Fen	84	42	42	70	
Marshchapel	60	4	56	84	
North Thoresby	93	16	77	194	
Sibsey	168	17	151	460	
Spilsby	266	72	194	433	
Stickney	85	58	27	135	
Tetford	39	5	34	50	
Tetney	137	88	49	322	
Wainfleet All Saints	160	22	138	65	73
Woodhall Spa	347	60	287	359	

Location	Scenario 1: Potential housing numbers	Commitments as of October 2015	Scenario 1 minus commitments	Total capacity of all suitable SHLAA sites	Shortfall
Wragby	153	124	29	239	

3 Legislative and Policy Framework

This section introduces the policy and legislative framework which drives the management of development and the water environment in England.

3.1 National Planning and Sustainable Development Policy

3.1.1 National Planning Policy Framework (NPPF) and Practice Guidance

The National Planning Policy Framework (NPPF)[3] was published on 27th March 2012, as part of reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. The main NPPF provides guidance to planning authorities to take account of flood risk and water and wastewater infrastructure delivery in their Local Plans:

- Paragraph 100 of the NPPF states “Local Plans should be supported by a strategic flood risk assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as Lead Local Flood Authorities and Internal Drainage Boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change".
- Paragraph 156 of the NPPF states: “Local planning authorities should set out the strategic priorities for the area in the Local Plan. This should include strategic policies to deliver...the provision of infrastructure for transport, telecommunications, waste management, water supply, wastewater, flood risk and coastal changes management, and the provision of minerals and energy”.

In March 2014, the Planning Practice Guidance was issued by Department for Communities and Local Government, with the intention of providing guidance on the application of the NPPF in England. Of relevance to this study;

- Flood Risk and Coastal Change[4]
- Water Supply, Wastewater and Water Quality[5].

3.1.2 Planning Practice Guidance: Flood Risk and Coastal Change

Diagram 1 in the Planning Practice Guidance sets out how flood risk should be taken into account in the preparation of Local Plans (see Figure 3-1). These requirements are addressed principally in the Council's Strategic Flood Risk Assessment (SFRA)[6].

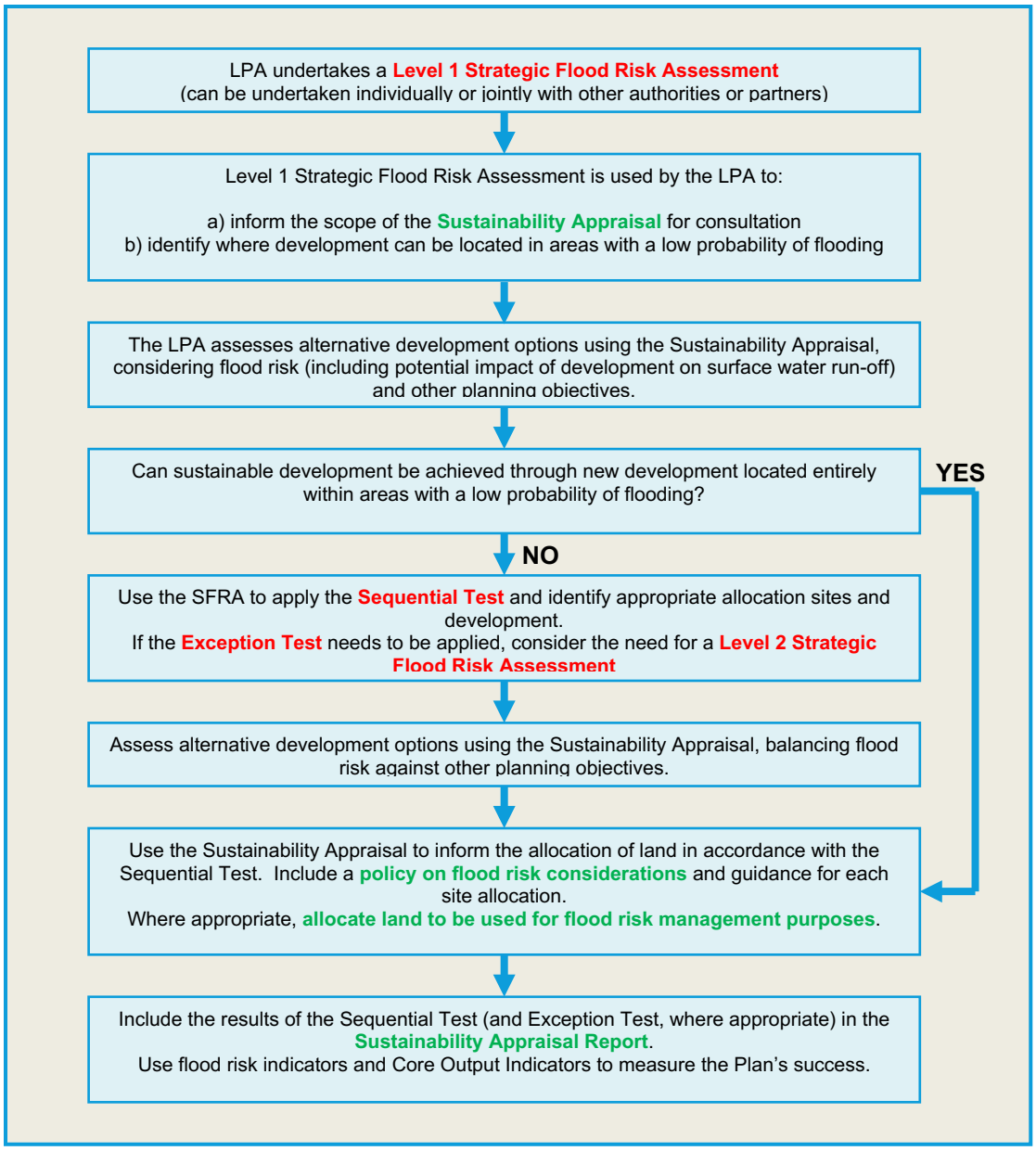
3 Department for Communities and Local Government (2012) National Planning Policy Framework

4 Department for Communities and Local Government (2014) Planning Practice Guidance: Flood Risk and Coastal Change (2014). Accessed online at http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/ on 15/04/2014.

5 Department for Communities and Local Government (2014) Planning Practice Guidance: Water supply, wastewater and water quality. Accessed online at http://planningguidance.planningportal.gov.uk/blog/guidance/ on 15/04/2014

6 East Lindsey District Council (2012) Draft Strategic Flood Risk Assessment. Accessed online at http://www.e-lindsey.gov.uk/article/2202/Strategic-Flood-Risk-Assessment on 15/12/2015.

Figure 3-1: Flood risk and the preparation of Local Plans



Based on Diagram 1 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-021-20140306) March 2014

3.1.3 Planning Practice Guidance: Water Supply, Wastewater and Water Quality

Under the previous system of Planning Policy Statements (PPSs) which were in place before implementation of the NPPF in 2011, there was no equivalent guidance document for planners, although there was some relevant guidance contained in PPS1[7]. Since the introduction of NPPF there had not been any other specific guidance issued on planning for water supply, wastewater and water quality issues.

The Planning Practice Guidance sets out a framework of linked guidance and documents:

7 Department for Communities and Local Government (2005) Planning Policy Statement 1: Delivering Sustainable Development

- Local Planning Authorities (LPAs) must have regard for Water Framework Directive as implemented in the Environment Agency's River Basin Management Plans[8,9].
- The National Policy Statement for Waste Water. This sets out Government policy for the provision of major waste water infrastructure to construct a new wastewater treatment plan or increase the capacity of an existing plant to a population equivalent of more than 500,000. None of the proposed developments within the study area would fall into this category.
- Water Cycle Studies (WCS). These are identified as voluntary studies that assist the EA, LPAs and Water and Sewerage Companies (WaSCs) to work together. The EA's Water Cycle Study advice is referenced.
- Planners should consider the contribution that the catchment-based approach can make, for example by improving farming and land management practices to improve water quality, offsetting the need to implement more advanced water or water recycling centres. The Defra catchment-based approach guidance is referenced[10].
- The Environment Agency and OfWAT Drainage Strategy Framework[11] guidance is referenced. It is expected that public facing drainage strategies will become an integral part of WaSC business plans. However as yet there are none in place for this study area.
- LPAs are advised to discuss growth plans at an early stage with WaSCs, to enable growth to be allowed for in the company's five-yearly business plans. Water recycling centres are classified as waste developments, so in a 2-tier area the district and county authorities must co-operate.
- Local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems.
- Specific guidance on how infrastructure, water supply, wastewater and water quality considerations should be accounted for in both plan-making and planning applications is summarised below in Table 3-1.

8 Environment Agency (Dec 2009) River Basin Management Plan for the Humber River Basin District. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297488/gene0910bsqr-e-e.pdf on 29/03/2016.

9 Environment Agency (Dec 2009) River Basin Management Plan for the Anglian River Basin District. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/309814/River_Basin_Management_Plan.pdf on 15/12/2015.

10 Department for Environment, Food and Rural Affairs (2013) Catchment Based Approach: Improving the quality of our water environment. Accessed online at https://www.gov.uk/government/publications/catchment-based-approach-improving-the-quality-of-our-water-environment on 15/12/2015

11 Environment Agency / OfWAT (2013) Drainage Strategy Framework. Accessed online at http://webarchive.nationalarchives.gov.uk/20150624091829/https://www.ofwat.gov.uk/future/sustainable/drainage/rpt_com201305drainagestrategy.pdf on 15/12/2015 .

Table 3-1: Planning practice guidance: Water supply, wastewater and water quality considerations for plan making and planning applications

	Plan-making		Planning applications
Infrastructure	Identification of suitable sites for new or enhanced infrastructure. Consider whether new development is appropriate near to water and wastewater infrastructure. Phasing new development so that water and wastewater infrastructure will be in place when needed.	→	Wastewater considerations include: first presumption is to provide a system of foul drainage discharging into a public sewer. Phasing of development and infrastructure. Circumstances where package sewage treatment plants or septic tanks are applicable.
Water supply		↘	Planning for the necessary water supply would normally be addressed through the Local Plan ... exceptions might include: large developments not identified in Local Plans; where a Local Plan requires enhanced water efficiency in new developments.
Water quality	How to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage. The type or location of new development where an assessment of the potential impacts on water bodies may be required. Expectations relating to sustainable drainage systems.	→	Water quality is only likely to be a significant planning concern when a proposal would: involve physical modifications to a water body; indirectly affect water bodies, for example as a result of new development such as the redevelopment of land that may be affected by contamination etc. or through a lack of adequate infrastructure to deal with wastewater.
Wastewater	The sufficiency and capacity of wastewater infrastructure. The circumstances where wastewater from new development would not be expected to drain to a public sewer.	→	If there are concerns arising from a planning application about the capacity of wastewater infrastructure, applicants will be asked to provide information about how the proposed development will be drained and wastewater dealt with.
Cross-boundary concerns	Water supply and water quality concerns often cross local authority boundaries and can be best considered on a catchment basis. Recommends liaison from the outset.	→	No specific guidance (relevant to some developments).
SEA and Sustainability Appraisal	Water supply and quality are considerations in strategic environmental assessment and sustainability appraisal ... sustainability appraisal objectives could include preventing deterioration of current water body status, taking climate change into account and seeking opportunities to improve water bodies.	→	No specific guidance (should be considered in applications).

Planning Practice Guidance: Housing - Optional Technical Standards

This guidance, updated in March 2015, advises planning authorities on how to gather evidence to set optional requirements, including for water efficiency. It states that *"all new homes already have to meet the mandatory national standard set out in the Building Regulations (of 125 litres/person/day). Where there is a clear local need, local planning authorities can set out Local*

Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day." Planning authorities are advised to consult with the EA and water companies to determine where there is a clear local need, and also to consider the impact of setting this optional standard on housing viability. A 2011 study[12] into the cost of implementing sustainability measures in housing found that meeting a standard of 110 litres per person per day would add only £250 to the cost of a 3-bed semi (see Table 3-2).

Table 3-2: Extra-over costs to meet Code for Sustainable Homes water consumption standards

Code Level	Water consumption (l/person/day)	Extra-over costs for a 3-bed semi (£)
1	120	£ 200.00
2	110	£ 250.00
3	105	£ 250.00
4	90	£ 250.00
5	80	£ 4,750.00
6	80	£ 4,750.00

The cost saving to the customer of using lower consumption can be calculated thus:

Water saved per day (compared to standard fittings) 15 litres/person/day

Average household occupancy 2.3 persons/dwelling

Metered cost (combined water and sewerage) £1.6195 /cubic metre[13]

Annual cost saving = (15/1000)*2.3*365*£1.6195 = £20.39

Therefore the additional cost of using low consumption fittings would, on average, be paid back over 12 years.

3.1.4 Building Regulations and Code for Sustainable Homes

The Building Regulations (2010) Part G[14] were amended in early 2015 to require that all new dwellings must ensure that the potential water consumption must not exceed 125l/person/day, or 110 l/person/day where required under planning conditions. The regulations include advice on how to calculate this.

The Code for Sustainable Homes (CfSH) was, from 2007 to March 2015, the Government's optional national standard for new housing. It became effective in England in April 2007 and a Code rating for new homes became mandatory in May 2008. The Code included six levels of water efficiency for new homes (see Table 3-2). Seeking to simplify the various building codes that house builders have to adhere to, the Government withdrew CfSH in March 2015, with the exception of legacy cases: *"where residential developments are legally contracted to apply a code policy (e.g. affordable housing funded through the national Affordable Housing Programme 2015 to 2018, or earlier programme), or where planning permission has been granted subject to a condition stipulating discharge of a code level, and developers are not appealing the condition or seeking to have it removed or varied"*.

3.1.5 Sustainable Drainage Systems (SuDS)

From April 2015, Local Planning Authorities (LPA) have been given the responsibility for ensuring through the planning system that sustainable drainage is implemented on developments of 10 or more homes or other forms of major development. This constitutes a significant change to the

12 Department of Communities and Local Government (2011) Cost of building to the Code for Sustainable Homes. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6378/1972728.pdf on 24/04/2015.

13 Anglian Water rates for 2016-17 accessed at www.anglianwater.co.uk/household/your-account/bills-and-payments/tariffs/standard-rates/ on 23/03/2016.

14 HM Government (2015) The Building Regulations (2010) Part G - Sanitation, hot water safety and water efficiency. 2015 edition. Accessed online at http://www.planningportal.gov.uk/uploads/br/BR_PDF_AD_G_2015.pdf on 09/12/2015.

previous government policy that Schedule 3 of the Flood and Water Management Act (FWMA) would be enacted, requiring the establishment of a SuDS Approving Body (SAB) to be set up within Lead Local Flood Authorities (LLFAs).

Under the new arrangements established in April 2015, the key policy and standards relating to the application of SuDS to new developments are:

- National Planning Policy Framework which requires that development in areas already at risk of flooding should give priority to sustainable drainage systems.
- The House of Commons written statement[15] setting out the governments intentions that LPAs should "ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate" and "clear arrangements in place for ongoing maintenance over the lifetime of the development." In practice this has been implemented by making Lead Local Flood Authorities (LLFAs) statutory consultees on the drainage arrangements of major developments.
- The Defra Non-statutory technical standards for sustainable drainage systems[16]. These set out the government's high level requirements for managing peak flows and runoff volumes, flood risk from drainage systems and the structural integrity and construction of SuDS. This very short document is not a design manual and makes no reference to the other benefits of SuDS, for example water quality, habitat and amenity. Neither does it address adoption and maintenance.

Lincolnshire County Council (LCC) is the LLFA covering East Lindsey District and under this arrangement LCC are now a statutory consultee on planning applications for major developments with surface water drainage. Local authorities are expected to ensure that SuDS, for the management of runoff, are put in place on planning applications relating to major development unless demonstrated to be inappropriate.

An updated version of the CIRIA SuDS Manual[17] was published in November 2015. The guidance covers the planning, design, construction and maintenance of SuDS for effective implementation within both new and existing developments. The guidance is relevant for a range of roles, including but not limited to drainage engineers, planners, drainage approval boards, highways authorities, developers and environmental regulars, with the level of technical detail increasing throughout the manual. The guidance does not include detailed information on planning requirements, SuDS approval and adoption processes and standards as these vary by region and should be checked early in the planning process. Various councils have introduced their own guidelines on adopting and designing SuDS, such as Cambridge City Council[18]. At the time of writing, LCC have not issued SuDS design guidance or advice on SuDS adoption specific to Lincolnshire.

Anglian Water have produced a SuDS adoption manual[19] on the design, construction and adoption of SuDS. SuDS located within a private property boundaries are the responsibility of the property owner. Anglian Water will consider the adoption and maintenance of SuDS features in public open space that can be shown to receive treated surface water runoff from a development. Anglian Water will not adopt any SuDS within the intermediate area unless they are satisfied that all this part of the management train is maintained effectively.

SuDS features not adopted by LCC or Anglian Water need to be maintained by householders (in the case of SuDS on private land) and by management companies for other SuDS on public open spaces and highways.

3.1.6 BREEAM

BREEAM (Building Research Establishment Environmental Assessment Methodology) is an internationally recognised method of assessing, rating and certifying the sustainability of buildings. BREEAM can be used to assess the environmental performance of any type of building: new and

15 Sustainable drainage systems: Written statement - HCWS161. Accessed online at http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/ on 14/08/2015.

16 Defra (2015) Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems

17 CIRIA (2015) The SuDS Manual (C753)

18 Sustainable Drainage Cambridge Design and Adoption Guide. Accessed online at https://www.cambridge.gov.uk/sites/default/files/docs/SUDS-Design-and-Adoption-Guide.pdf on 14/12/2015.

19 Towards Sustainable Water Stewardship. Sustainable drainage systems (SUDS) adoption manual. Accessed online at http://www.anglianwater.co.uk/_assets/media/AW_SUDS_manual_AW_FP_WEB.pdf on 26/08/2015.

existing. Standard BREEAM schemes exist for assessment of common domestic and non-domestic building types and less common building types can be assessed by developing bespoke criteria.

Using independent, licensed assessors, BREEAM assesses criteria covering a range of issues in categories that evaluate energy and water use, health and wellbeing, pollution, transport, materials, waste, ecology and management processes. This promotes both climate change mitigation (energy efficiency) and adaptation (water efficiency). Buildings are rated and certified on a scale of 'Pass', 'Good', 'Very Good', 'Excellent' and 'Outstanding'.

BREEAM has expanded from its original focus on individual new buildings at the construction stage to encompass the whole life cycle of buildings from planning to in-use and refurbishment. The standard is regularly revised to improve sustainability, respond to industry feedback and support sustainability strategies and commitments. BREEAM standard can be applied to virtually any building and location, with versions for new buildings, existing buildings, refurbishment projects and large developments.

BREEAM certification may be required by procuring organisations but, following the Government's Housing Standards Review, cannot be made a requirement in Local Plans.

3.2 Local Planning and Sustainable Development Policy

3.2.1 Local Plan

East Lindsey District Council is preparing a new ("emerging") Local Plan covering the period up to 2031. This will replace the existing Local Plan 1995.

The Draft Core Strategy[20] dated October 2012 sets out the vision and objectives for the District as follows:

"By 2028, East Lindsey will be a district with:-

- *A network of thriving, safer and healthy sustainable communities, where people can enjoy a high quality of life and an increased sense of well-being and where new development simultaneously addresses the needs of the economy, communities and the environment.*
- *Quality affordable and open market housing to try and meet the differing needs of the District's residents.*
- *A growing and diversified economy that builds on, and extends, the important agriculture and tourism base.*
- *A commitment to address the issues of deprivation and rural isolation to make an inclusive, equal and diverse district.*
- *A high quality environment that makes the most of its special qualities, particularly the coast, the Lincolnshire Wolds and the historic market towns; and*
- *A commitment to tackling the causes and effects of global climate change through local action."*

This Water Cycle Study will form one part of the evidence base for the Local Plan, including informing several of the strategic policies:

Table 3-3: Local Plan strategic policies relevant to the Water Cycle Study

Strategic Policy	Aspects this WCS should contribute to:
1. A Sustainable Pattern of Places	• *Council will encourage and support communities to work together in their clusters… deciding which settlement is the most appropriate in the cluster to accommodate that development.*
5. Design	• *It is important that the approach to landscaping and open space…[incorporates] Sustainable Urban Drainage Systems (SUDS) appropriate to the site.* • *Development that includes measures to regenerate, recycle, re-use or reduce the demand for, finite resources will be preferred. Water is a valued and scarce resource in the*

20 Draft Core Strategy (October 2012). Accessed online at http://www.e-lindsey.gov.uk/CHttpHandler.ashx?id=1410&p=0 on 15/125/2015.

Strategic Policy	Aspects this WCS should contribute to:
	District. Development that will unacceptably deplete water resources or pose a risk to the quality of the water table and aquifers will not be supported. Neither will development located around water sources be supported unless it includes adequate measures for their protection from pollution. This is to prevent any contamination of the public water supply and to avoid having to deal with the consequences of water pollution.
9. Widening the Inland Tourism and Leisure Economy	• *The Lincolnshire Wolds AONB is a valuable asset for tourists and particular emphasis needs to be given to its special character to maintain and protect those qualities in line with National Planning Policy.*
10. Inland Flood Risk	• *The Council's broad strategy to flood risk management inland will be to guide development away from areas that are identified as being at risk as part of a sequential approach to the identification of potential sites. The Environment Agencies Flood Zone Mapping will inform this approach.* • *…developers will be required to undertake site-specific flood risk assessments to establish the potential risk of flooding from river and other sources, establish the most appropriate means of mitigation, and meet the requirements of the Flood Management Act.* • *…to address the more extreme weather conditions that are predicted, the design of other new development apart from housing will need to incorporate appropriate measures to provide surface and foul water disposal to protect new and existing development. Where necessary this will involve the use of Sustainable Urban Drainage Systems along with other appropriate design features (such as green roofs and permeable surface treatment) to mitigate against changing conditions. The Council will not support development in areas required for flood storage.* • *The Council will support development for business, leisure and commercial uses in areas of inland flood risk providing it incorporates flood mitigation measures in its design.* • *The Council will support improvements to the existing flood defences, the creation of new flood defences and infrastructure associated with emergency planning.*
11. Coastal East Lindsey	• *We want the population of the coast to remain broadly stable but those living on the coast to be able to access good quality housing.* • *Because of the threat of flood risk, unconstrained housing growth with its associated increase in population cannot be justified. This would place more people at risk. The Coastal Study recommends that housing should be limited to only that much development required to maintain the existing population… However, that does not mean that there will be no housing development in the Coastal Area. The distribution of the housing will be set out in the Settlements Plan, which will use the information in the hazard mapping and the Councils Strategic Flood Risk Assessment to identify the most suitable locations for development in affected areas.*
14. Landscape	• *The Council will ensure that the distinctive character of the landscapes, cultural or historic significance will not be compromised. In particular, the highest level of protection will be given the Lincolnshire Wolds Area of Outstanding Natural Beauty, which is designated at a national level because of its landscape quality.*
16. Biodiversity and	• *The Council will protect sites designated internationally, nationally or locally for their biodiversity and geodiversity*

Strategic Policy	Aspects this WCS should contribute to:
Geodiversity	*importance, species populations and habitats identified in the Lincolnshire Biodiversity Action Plan. Development, which could adversely affect such a site, will only be permitted in exceptional circumstances.*
18. Infrastructure and S106 Obligations	• *Major infrastructure schemes will be supported provided they are shown to be essential in the national interest; contribute to sustainable development, and where they respect the distinctive character of the district and do not impact on the character of the landscape, either singly or cumulatively. The Council will require evidence to show that the impacts of such schemes are minimized, including the consideration of alternative options as part of their impact assessment.* • *The Council will only support proposals for development where it has been shown that adequate capacity is available or can be provided by the utility providers to meet the additional loads associated with the development.* • *The District Council is not directly responsible for the delivery of many infrastructure elements but, as part of the local plan, it is working closely with service providers to ensure they facilitate the necessary infrastructure to support new development* • *The Council will seek to avoid any significant adverse impacts from major schemes, including impact on the character of the landscape either singly or cumulatively and will seek alternative options, which reduce or eliminate those impacts.* • *The most significant amount of new development will be directed to the larger, more sustainable settlements. The Council has prepared an Interim Infrastructure Delivery Plan (IDP), which identifies existing infrastructure provision.* • *The water cycle is seen as a potentially significant issue and the Council will continue to work with Anglian Water Services and the EA to prioritise the resolution of these issues to ensure the levels of development set out in the Plan can be brought forward.*

3.2.2 Infrastructure Delivery Plan

The purpose of the Infrastructure Delivery Plan (IDP) is to support the production of the Core Strategy and to set out the infrastructure and services required to support the future levels of planned housing and employment in the District, including how, by whom and broadly when it will be provided and expected costs. The IDP identifies sources of funding to assist in the delivery of infrastructure to help upgrade facilities, promote economic growth to ultimately improve the quality of life[21].

The plan aims to sustainably develop towns and districts whilst maintaining a high quality environment. The vision for the East Lindsey District is to meet the needs of all the residents by creating safe, sustainable and socially balanced settlements, with sufficient services and facilities available. To respond to the threat for coastal flooding, ELDC has planned for growth by treating the district as two distinct areas (inland and coastal). In the coastal area the draft policy of the local plan will be to maintain stable population levels, whilst the inland areas will not be subject to the same constraints on further development. This plan will support the local economy, whilst adapting to climate change by promoting sustainable living along with reducing flood risks in order to safeguard the landscape.

The IDP notes that rates of growth for most parts of the District will be low and access to infrastructure (transport, utilities and waste, social infrastructure, and culture and leisure) is generally not seen as a major issue. However from the IDPs findings water and sewerage systems

21 East Lindsey District Council (July 2012) Interim Infrastructure Delivery Plan. Accessed online at http://www.e-lindsey.gov.uk/CHttpHandler.ashx?id=1629&p=0 on 28/09/2015

was rated as critical, although the scale of the issue would not be fully known until sites were looked at on a site by site basis. This will be considered in this WCS.

3.3 Environmental Policy

3.3.1 Urban Wastewater Treatment Directive (UWWTD)

The UWWTD is an EU Directive that concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of waste water from certain industrial sectors. The objective of the Directive is to protect the environment from the adverse effects of the abovementioned wastewater discharges. More specifically Annex II.A(a) sets out the requirements for discharges from urban wastewater treatment plants to sensitive areas which are subject to eutrophication. One or both parameters may be applied depending on the local situation. The values for concentration or for the percentage reduction shall apply. For specific information regarding concentration limits please refer to the UWWTD[22]. The Directive has been transposed into UK legislation through enactment of the Urban Waste Water Treatment (England and Wales) Regulations 1994 and 'The Urban Waste Water Treatment (England and Wales) (Amendments) Regulations 2003'.

3.3.2 Habitats Directive

The EU Habitats Directive aims to protect the wild plants, animals and habitats that make up our diverse natural environment. The directive created a network of protected areas around the European Union of national and international importance called Natura 2000 sites.

These sites include:

- Special Areas of Conservation (SACs) - these support rare, endangered or vulnerable natural habitats, plants and animals (other than birds).
- Special Protection Areas (SPAs) - support significant numbers of wild birds and their habitats.

Special Protection Areas and Special Areas of Conservation are established under the EC Birds Directive and Habitats Directive respectively. All in all the directive protects over 1,000 animals and plant species and over 200 so called "habitat types" (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.

3.3.3 The Water Framework Directive

The Water Framework Directive (WFD) was first published in December 2000 and transposed into English and Welsh law in December 2003. It introduced a more rigorous concept of what "good status" should mean than the previous environmental quality measures. The WFD estimated that 95% of water bodies were at risk of failing to meet “good status”.

River Basin Management Plans (RBMP) are required under the WFD and are strategies that should influence development plans and be influenced by them. The East Lindsey District predominately falls within the Anglian[23] River Basin District (RBD) with a small section in the north falling within the Humber[24] RBD. Under the WFD the RBMPs, which were originally published in December 2009 were reviewed and updated in December 2015. The main pressures faced within each of the RBDs is summarised in Sections 3.3.3.8 and 3.3.3.9.

One WFD objective is to have "no deterioration", therefore all water bodies must meet the class limits for its status class declared in the Final Anglian / Humber River Basin Management Plan. A second objective requires all water bodies to achieve good ecological status. Future development needs to be planned carefully so that it helps towards achieving the WFD and does not result in further pressure on the water environment and compromise WFD objectives. The WFD objectives as outlined in the updated RBMPs are summarised below:

22 UWWTD. Accessed online at http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:31991L0271 on 14/08/2015.

23 Environment Agency (Dec 2015) Part 1: Anglian river basin district River basin management plan Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500463/Anglian_RBD_Part_1_river_basin_management_plan.pdf on 19/04/2016.

24 Environment Agency (Dec 2009) Part 1: Humber river basin district River basin management plan. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500465/Humber_RBD_Part_1_river_basin_management_plan.pdf on 19/04/2016.

- "*To prevent deterioration of the status of surface waters and groundwater*
- *To achieve objectives and standards for protected areas*
- *To aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status*
- *To reverse any significant and sustained upward trends in pollutant concentrations in groundwater*
- *The cessation of discharges, emissions and loses of priority hazardous substances into surface waters*
- *Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants.*"

3.3.3.1 Protected Area Objectives

The WFD specifies that areas requiring special protection under other EC Directives, and waters used for the abstraction of drinking water, are identified as protected areas. These areas have their own objectives and standards.

Article 4 of the WFD requires Member States to achieve compliance with the standards and objectives set for each protected area by 22 December 2015, unless otherwise specified in the Community legislation under which the protected area was established. Some areas may require special protection under more than one EC Directive or may have additional (surface water and/or groundwater) objectives. In these cases, all the objectives and standards must be met.

The types of protected areas are:

- areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas);
- areas designated for the protection of economically significant aquatic species (Freshwater Fish and Shellfish);
- bodies of water designated as recreational waters, including areas designated as Bathing Waters;
- nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive (UWWTD); and
- areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites.

Many WFD protected areas coincide with water bodies; these areas will need to achieve the water body status objectives in addition to the protected area objectives. Where water body boundaries overlap with protected areas the most stringent objective applies; that is the requirements of one EC Directive should not undermine the requirements of another.

The objectives for Protected Areas relevant to this study are as follows:

3.3.3.2 Drinking Water Protected Areas

- Ensure that, under the water treatment regime applied, the drinking water produced meets the requirements of the Drinking Water Directive plus any UK requirements to make sure that drinking water is safe to drink; and
- Ensure the necessary protection to prevent deterioration in the water quality in the protected area in order to reduce the level of purification treatment required.

3.3.3.3 Economically Significant Species (Freshwater Fish Waters)

- To protect or improve the quality of running or standing freshwater to enable them to support fish belonging to:
- Indigenous species offering a natural diversity; or
- species the presence of which is judged desirable for water management purposes by the competent authorities of the Member States.

3.3.3.4 Nutrient Sensitive Areas (Nitrate Vulnerable Zones)

- Reduce water pollution caused or induced by nitrates from agricultural sources; and
- prevent further such pollution.

3.3.3.5 Nutrient Sensitive Areas (Urban Waste Water Treatment Directive)

- To protect the environment from the adverse effects of urban waste water discharges and waste water discharges from certain industrial sectors.

3.3.3.6 Natura 2000 Protected Areas (water dependent SACs and SPAs)

The objective for Natura 2000 Protected Areas identified in relation to relevant areas designated under the Habitats Directive or Birds Directive is to:

- Protect and, where necessary, improve the status of the water environment to the extent necessary to achieve the conservation objectives that have been established for the protection or improvement of the site's natural habitat types and species of Community importance in order to ensure the site contributes to the maintenance of, or restoration to, favourable conservation status.

3.3.3.7 Groundwater Source Protection Zones

The Environment Agency has a Groundwater Protection Policy to help prevent groundwater pollution. In conjunction with this the Environment Agency have defined groundwater Source Protection Zones (SPZs) to help identify high risk areas and implement pollution prevention measures. The SPZs show the risk of contamination from activities that may cause pollution in the area, the closer the activity, the greater the risk. There are three main zones (inner, outer and total catchment) and a fourth zone of special interest which is occasionally applied.

Zone 1 (Inner protection zone)

This zone is designed to protect against the transmission of toxic chemicals and water-borne disease. It indicates the area in which pollution can travel to the borehole within 50 days from any point within the zone and applies at and below the water table. There is also a minimum 50 metre protection radius around the borehole.

Zone 2 (Outer protection zone)

This zone indicates the area in which pollution takes up to 400 days to travel to the borehole, or 25% of the total catchment area, whichever area is the biggest. This is the minimum length of time the Environment Agency think pollutants need to become diluted or reduce in strength by the time they reach the borehole.

Zone 3 (Total catchment)

This is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Zone of special interest

This is defined on occasions, usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment area.

The Environment Agency's Groundwater protection: Principles and practice (GP3)[25] sets out a series of position statements that detail how the Environment Agency delivers government policy on groundwater and protects the resources from contamination. The position statements that are relevant to this study with regard to discharging liquid effluent into the ground (via infiltration drainage systems) are as follows:

Table 3-4: EA's groundwater protection position statements relevant to the Water Cycle Study

Position statements	
G10 - Developments	*We will object to new developments that pose an unacceptable*

25 Environment Agency (2013) Groundwater protection: Principles and practice (GP3). Accessed online at https://www.gov.uk/government/publications/groundwater-protection-principles-and-practice-gp3 on 10/03/2016

Position statements	
posing an unacceptable risk of pollution	*risk of pollution to groundwater from sewage effluent, trade effluent or contaminated surface water. This applies if the source of pollution is an individual discharge or the combined effects of several discharges, or where the discharge will cause pollution by mobilising contaminants already in the ground. In all cases we will object to any proposal to discharge untreated sewage* to groundwater and will use our notice powers to ensure treatment of any existing discharges.* **A sewage treatment system means a septic tank, infiltration system, drainage field and/or a package treatment plant or any other additional treatment in place. It does not include cesspools.*
G11 - Discharges from areas subject to contamination	*Discharges of surface water run-off to ground at sites affected by land contamination, or the storage of potential pollutants are likely to require an environmental permit. This applies especially to sites where storage, handling or use of hazardous substances occurs (such as for example, garage forecourts, coach and lorry parks/turning areas and metal recycling/vehicle dismantling facilities). The site will need to be subject to risk assessment with acceptable effluent treatment provided.*
G12 - Discharge of clean roof water to ground	*The discharge of clean roof water to ground is acceptable both within and outside SPZ1 provided that all roof water down-pipes are sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. The method of discharge must not create new pathways for pollutants to groundwater or mobilise contaminants already in the ground.*
G13 - Sustainable drainage systems	*We support the use of sustainable drainage systems (SuDS) for new discharges. Where infiltration SuDS are to be used for surface run-off from roads, car parking and public or amenity areas, they should have a suitable series of treatment steps to prevent the pollution of groundwater.* *Where infiltration SuDS are proposed for anything other than clean roof drainage (see G12 - discharge of clean roof water to ground) in a SPZ1 we will require a risk assessment to demonstrate that pollution of groundwater would not occur. They will also require approval from the SuDS approval body (SAB), when these bodies have been established, to ensure they follow the criteria set out in the SuDS national standards (when published), including standards for water quality, design and maintenance.* *For the immediate drainage catchment areas used for handling and storage of chemicals and fuel, handling and storage of waste and lorry, bus and coach parking or turning areas, infiltration SuDS are not permitted without an environmental permit.*

It is also stated that:

"The design of infiltration SuDS schemes and their treatment stages needs to be appropriate to the sensitivity of the location and subject to a relevant risk assessment considering the types of pollutants likely to be discharged, design volumes and the dilution and attenuation properties of the aquifer. Unless the supporting risk assessments show that SuDS schemes in SPZ1 will not pose an unacceptable risk to the drinking water abstraction, we will object to the use of infiltration SuDS under G10 - developments posing an unacceptable risk of pollution."

3.3.3.8 Anglian River Basin Management Plan

River Basin Management Plans are required under the WFD and are strategies that should influence development plans and be influenced by them. East Lindsey District is predominately covered by the Anglian[26] RBMP, with a small section in the north falling within the Humber[27] RBMP.

The WFD has a number of objectives which are summarised at the start of Section 3.3.3. One is that water bodies must have "no deterioration" and a second objective requires all water bodies to achieve good ecological status. Future development needs to be planned carefully so that it helps towards achieving the WFD and does not result in further pressure on the water environment and compromise WFD objectives.

One of the biggest challenges facing the Anglian river basin district is water management. Parts of the district are extremely dry, receiving only two thirds of the UK's average rainfall. Many of the wildlife sites are reliant on a good supply of water and it is also vitally important to public water supplies, agriculture (of which there is a large amount within the region) and industry. Flooding is also a challenge for the region with one fifth susceptible from inland or coastal flooding. Sea level rise and climate change will pose an increasing risk to people and property.

The most significant pressures identified within the Anglian RBMP are as follows:

- *"PhosphorusPhysical modifications -*
- *Pollution from waste water -*
- *Pollution from towns, cities and transport -*
- *Changes to the natural flow and level of water*
- *Negative effects of invasive non-native species*
- *Pollution from rural areas"*

A number of these pressures, specifically waste water and pollution from towns, cities and transport, are a result of increased development and hence sewage effluent discharge, therefore it is important that future growth is carefully planned to ensure water companies can make upgrades to address this issue where necessary.

3.3.3.9 Humber River Basin Management Plan

The northern tip of East Lindsey District falls within the Humber river basin district.

There is concern about future water availability within the district with some areas closed to new abstraction while others have no water available during low flows. It is important to restore sustainable abstraction to accommodate growth within the district whilst allowing wildlife to flourish. The main demands on the water resources are public water supply, irrigation for agriculture, horticulture and recreational use, and industrial abstractions. Climate change is also seen as a pressure on water resources.

Other major challenges within the district include the need to reduce runoff from urban developments and roads as this reduces ecosystem diversity. Sustainable drainage systems and clearly understood and enforced planning policies are essential for this. Also there is a need to work with farmers to reduce diffuse pollution through, for example, nutrient planning to establish exactly what nutrients are required for each crop thus reducing the risk of nutrients leaching from farmland and polluting the environment.

The most significant pressures identified within the Humber RBMP are as follows:

- *"Physical modifications -*
- *Pollution from waste water -*
- *Pollution from towns, cities and transport -*
- *Changes to the natural flow and level of water*
- *Negative effects of invasive non-native species*

26 Environment Agency (Dec 2015) Part 1: Anglian river basin district River basin management plan Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500463/Anglian_RBD_Part_1_river_basin_management_plan.pdf on 19/04/2016..

27 Environment Agency (Dec 2009) Part 1: Humber river basin district River basin management plan. Accessed online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500465/Humber_RBD_Part_1_river_basin_management_plan.pdf on 19/04/2016.

- *Pollution from rural areas*
- *Pollution from abandoned mines"*Phosphorus

3.3.4 Abstraction Licensing Strategies

The Catchment Abstraction Management Strategy (CAMS) is prepared by the Environment Agency to manage abstractions in a particular area. The CAMS provides information on the resources available and what conditions might apply to new licences. The licences require abstractions to stop or reduce when a flow or water level falls below a specific point as a restriction to protect the environment and manage the balance between supply and demand for water users. The CAMS is published in a series of documents known as Abstraction License Strategies (ALSs), but for clarity here the term CAMS is used to refer to these.

New and varied licences are normally time limited, which allows time for a periodic review of the area as circumstances may have changed since the licences were granted. These are generally given for a twelve year duration, but shorter or longer duration licences can be accepted. This is dependent on local factors such as the lifetime of the infrastructure, the availability of resources and future plans or changes. The licences can be replaced or renewed near to the expiry date.

The CAMS is important in terms of the WRMP as this helps to determine the current and future pressures on water resources and how the supply and demand will be managed by water companies[28].

East Lindsey District Council is covered by the Grimsby, Ancholme and Louth[29] and the Witham[30] CAMS as shown in Figure 3-2. Abstraction licences for the whole region are required if more than 20m³/day of water is withdrawn from a river, lake, reservoir, pond, spring or an underground source. The licence is granted dependent on the amount of water available after the required needs for the environment and existing abstractions, which generally lasts for twelve years.

3.3.4.1 Grimsby, Ancholme and Louth

The principal aquifers in the area are the Lincolnshire Limestone and Lincolnshire Chalk. Large demands are placed on the limestone aquifer to meet public water supply demands in the northwest of the catchment, whilst the chalk aquifer supports industrial developments on the Humber bank and public water supply demands of Grimsby and Immingham in the northeast of the catchment. All the resources within these groundwater aquifers are fully committed to existing users and therefore no new license will be considered.

To assess the surface water resource the CAMS area has been divided into four sub-units based on their hydrological characteristics and geographic locations. These are River Ancholme, Barrow Beck and Skitter Beck, Laceby Beck and Buck Beck and White Beck and Louth Canal. In general, for all areas there is water available for abstraction at high flows but no water available at low flows. Therefore new licenses may be granted but will be subject to hands-off flow (HOF) conditions to prevent the river flows falling below the environmental flow indicators.

7.8% of the licences in Grimsby, Ancholme and Louth CAMS are time limited. The next common end date for all the licenses is 2018 which renews again in 2030.

Table 3-5: Resource Availability for the Assessment Points within the Grimsby, Ancholme and Louth CAMS within the East Lindsey District

AP	Name	Sub-unit	Local resource availability	HOF Q (1)	HOF (Ml/d) (2)	Days p.a. (3)	Available (Ml/d)	Gauging station at AP?	Additional restrictions
1	Jameson Bridge	Ancholme	Water available at high and medium flows, but no water available at medium/low and low flows	Q37	16.2	135	6.2	Yes	N/a
12	Laceby Beck	Laceby Beck and Buck Beck	Restricted water available at high flows, but no water available at medium to low	Q26	17.3	94	7.1	Yes	N/a

28 Environment Agency (2013) Managing Water Abstraction. Accessed online at https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams process on 23/09/2014

29 Environment Agency (February 2013) Grimsby, Ancholme and Louth Catchment Abstraction Management Strategy. Accessed online at https://www.gov.uk/government/publications/camsgrimsby-ancholme-and-louth-catchment-abstraction-management on 14/12/2015.

30 Environment Agency (February 2013) Witham Catchment Abstraction Management Strategy. Accessed online at https://www.gov.uk/government/publications/cams-witham-catchment-abstraction-management-strategy on 14/12/2015.

AP	Name	Sub-unit	Local resource availability	HOF Q (1)	HOF (Ml/d) (2)	Days p.a. (3)	Available (Ml/d)	Gauging station at AP?	Additional restrictions
			flows						
13	Brigsley	Waithe Beck and Louth Canal	Restricted water available at high flows, but no water available at medium to low flows	Q17	41.8	62	30.4	Yes	N/a
14	Lud	Waithe Beck and Louth Canal	Restricted water available at high flows, but no water available at medium to low flows	Q17	60.6	62	38.9	Yes	N/a
15	Tetney	Waithe Beck and Louth Canal	Restricted water available at high flows, but no water available at medium to low flows	Q17	145.2	62	9.7	No	N/a

(1) Hands off Flow restriction (Q value)
(2) Hands off Flow restriction (Ml/D value)
(3) Number of days per annum abstraction may be available
(4) Approximate volume available at restriction (Ml/D)

3.3.4.2 Witham

The largest surface water abstraction license in this CAMS area is part of the Trent Witham Ancholme Water Transfer Scheme (TWA), which abstracts water and transfers it to the neighbouring Ancholme catchment to meet the demand for public water supply and industrial uses. Otherwise the demand is for public supply and agriculture which are primarily from the Lincolnshire Limestone aquifer. All the resources within the groundwater aquifers are fully committed to existing users and therefore no new license will be considered (except possibly Bain Sands and Gravels).

To assess surface water resources the CAMS area has been divided into five sub-units based on their hydrological characteristics and geographic locations. These are:

- A: Fossdyke / Till
- B: Upper Witham and Brant
- C: River Witham, Slea and Bain
- D: Maud Foster and Witham
- E: South Forty Foot

Units C and D are within East Lindsey District.

There is variable local water resource availability within the River Witham, Slea and Bain unit, as shown in Table 3-6. All new licenses for abstraction for surface water within the CAMS area will be subject to HOF conditions.

Maud Foster and Witham Fourth level dependent management largely consists of low-lying fens controlled by the Witham Fourth Internal Drainage Board. The summer water levels in the fens are maintained by a water transfer system from the Lower Witham system. Water draining to the south from the Lincolnshire Wolds is captured by the East and West Fen Catchment Drains which in turn drain into the Stonebridge/ Maud Foster before then discharging into the Witham Haven. The Catchment Drains are separate to the low-lying fens with no water transferring between the two systems. There is water available for licensing from the East and West Fen Catchment Drains at all flows.

The water within the fens are characterised as Level dependent environments (LDE). LDEs are characterised by a network of river channels flowing above the level of the surrounding land. The low-lying land has a network of drainage ditches, which remove water from the low-lying land into the main river channels during the high/winter flows and provide an irrigation source during the low/summer flows. The EA will consult the relevant IDB for any license considered in these areas and there are additional license restrictions in each LDE area.

19.7% of the licences in Witham CAMS are time limited. The next common end date for all the licenses is 2016 which renews again in 2028.

Table 3-6: Resource Availability for the Assessment Points within the Witham CAMS within the East Lindsey District

AP	Name	Sub-unit	Local resource availability	HOF Q (1)	HOF (Ml/d) (2)	Days p.a. (3)	Available (Ml/d)	Gauging station at AP?	Additional restrictions

AP	Name	Sub-unit	Local resource availability	HOF Q (1)	HOF (Ml/d) (2)	Days p.a. (3)	Available (Ml/d)	Gauging station at AP?	Additional restrictions
6	Fossdyke Jetty	Fossdyke / Till	Water available at high and medium flows, restricted water available at medium/low flows, but no water available at low flows	Q61	78.3	222	125.7	No	N/a
7	South Forty Foot Outfall	South Fort Foot	Water available at high to medium/low flows, no water available at low flows.	Q78	13.2	284	3.8	No	Specific LDE restrictions
8	Langworth	River Witham, Slea and Bain	Water available at high and medium flows, restricted water available at medium/low flows, but no water available at low flows.	Q61	24.3	222	16.3	Yes	Specific LDE restrictions
9	Bardney	River Witham, Slea and Bain	Water available at high and medium flows, restricted water available at medium/low flows, but no water available at low flows.	Q61	192.7	222	59.4	No	Specific LDE restrictions
10	Goulceby	River Witham, Slea and Bain	Water available at high flows, no water available at medium to low flows.	Q21	37.3	76	9.3	Yes	N/a
11	Tattershall	River Witham, Slea and Bain	Water available at high and medium flows, restricted water available at medium/low flows, but no water available at low flows.	Q61	40.8	222	3.2	No	N/a
12	Maud Foster Outfall	Maud Foster and Witham Fourth	Water available from the East and West Fen Catchment Drains at all flows.	Q100	3.2	365	0.8	No	Specific LDE restrictions
13	Leasinghall	River Witham, Slea and Bain	No water available except at very high flows.	Q22	75.4	80	7.8	Yes	N/a
14	Grand Sluice	River Witham, Slea and Bain	Water available at high and medium flows, restricted water available at medium/low flows, but no water available at low flows.	Q61	236.6	222	17.7	No	N/a

(1) Hands off Flow restriction (Q value)
(2) Hands off Flow restriction (Ml/D value)
(3) Number of days per annum abstraction may be available
(4) Approximate volume available at restriction (Ml/D)

3.3.4.3 Recommendations for better management practices

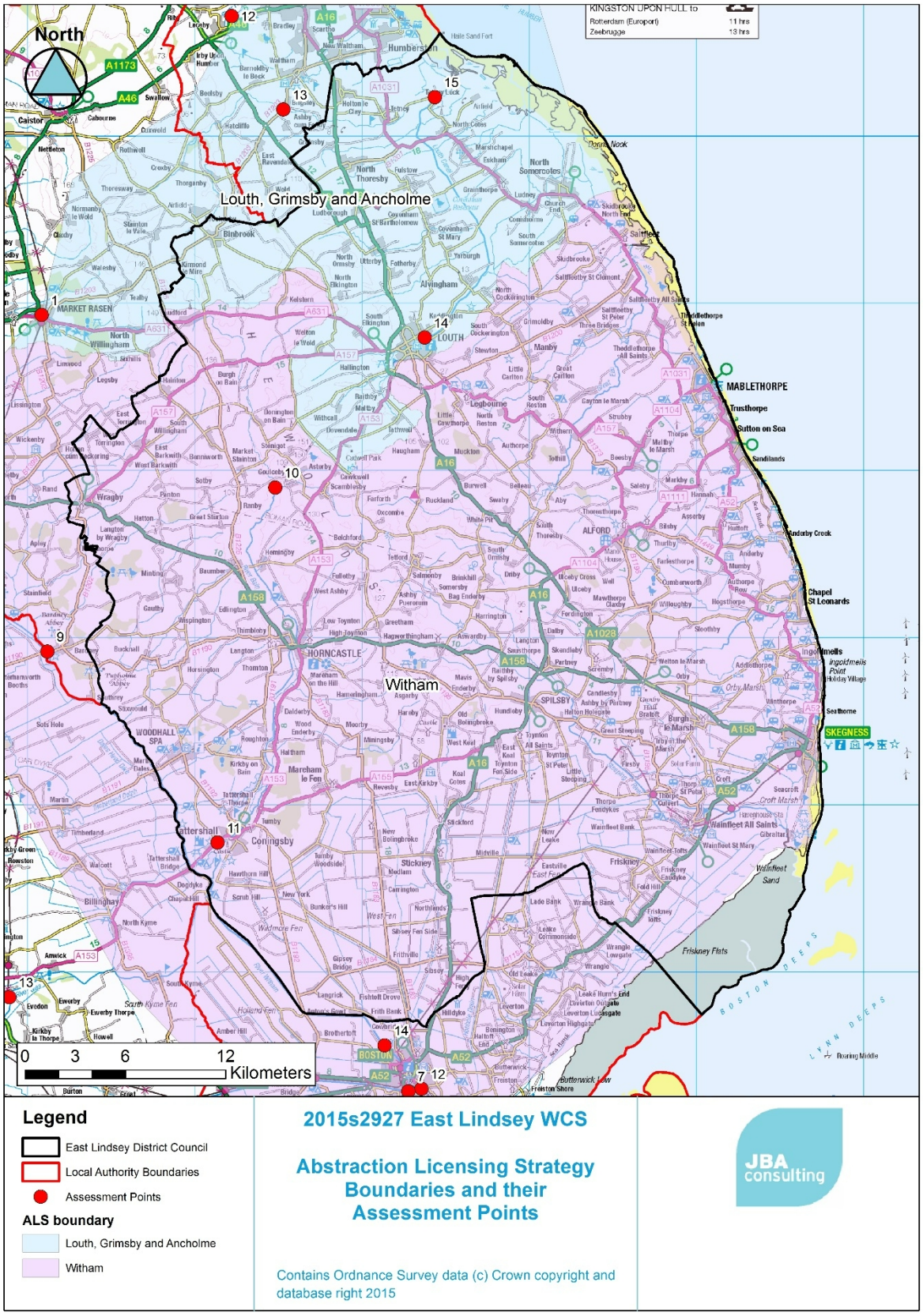
Due to abstraction, several water bodies in the district have fallen below the Ecological Flow Indicator (EFI) which may lead the EA to change or revoke some abstraction licenses. This underlines the need to reduce abstraction by using more efficient management practices. This would increase the sustainability of abstraction and reduce the impacts to the environment.

The main options for this identified in the CAMS are to adopt water efficiency and demand management techniques. Methods include:

- Testing the level of water efficiency before granting an abstraction licence
- Promoting efficient use of water
- Taking actions to limit the demand
- Reducing leakage.

This would ultimately cut the growth in abstraction and limit the impacts on flow and the ecology.

Figure 3-2: Abstraction Licences Strategy Boundaries for East Lindsey District Council



3.3.5 Water stress

Water stress is a measure of the level of demand for water (from domestic, business and agricultural users) compared to the available freshwater resources, whether surface or groundwater. Water stress causes deterioration of the water environment in both the quality and

quantity of water, and consequently restricts the ability of a waterbody from achieving "Good Status" under the WFD.

The Environment Agency has undertaken an assessment of water stress across the UK. This defines a water stressed area as where:

- "The current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or
- The future household demand for water is likely to be a high proportion of the effective rainfall available to meet that demand.

This assessment[31] has classified the Anglian Water supply region as an area of "serious" water stress. Under water industry regulations, water companies in areas classified as seriously water stressed need to evaluate compulsory metering alongside other options when preparing water resource management plans (WRMPs).

3.4 Water Industry Policy

3.4.1 The Water industry in England

Water and sewerage services in England and Wales are provided by 10 Water and Sewerage Companies (WaSCs) and 12 'water-only' companies. The central legislation relating to the industry is the Water Industry Act 1991[32]. The companies essentially operate as regulated monopolies within their supply regions, although very large water users and developments are able to obtain water and/or wastewater services from alternative suppliers - these are known as inset agreements.

The Water Act 2014 aims to reform the water industry to make it more innovative and to increase resilience to droughts and floods. Key measures which could influence the future provision of water and wastewater services include:

- All non-domestic customers will be able to switch their water supplier and/or sewerage undertaker.
- New businesses will be able to enter the market to supply these services.
- Measures to promote a national water supply network.
- Enabling developers to make connections to water and sewerage systems.

3.4.2 Regulation of the water industry

The water industry is primarily regulated by three regulatory bodies;

- the Water Services Regulation Authority (OfWAT) - economic and customer service regulation
- Environment Agency - environmental regulation
- Drinking Water Inspectorate (DWI) - drinking water quality.

Every five years the industry submits a Business Plan to OfWAT for a Price Review (PR). These plans set out the company's operational expenditure (OPEX) and capital expenditure (CAPEX) required to maintain service standards, enhance service (for example where sewer flooding occurs), to accommodate demand growth and to meet environmental objectives defined by the Environment Agency. OfWAT assesses and compares the plans with the objective of ensuring what are effectively supply monopolies are operating efficiently. The industry is currently at the beginning of the Asset Management Plan 6 (AMP6) which runs from 2015 to 2020.

When considering investment requirements to accommodate growing demand, water companies are required to ensure a high degree of certainty that additional assets will be required before funding them. Longer term growth is, however, considered by the companies in their internal asset planning processes and reported on in their 25-year Strategic Direction Statements (SDS) and Water Resource Management Plans (WRMPs).

31 Environment Agency and Natural Resources Wales (July 2013) Water stressed areas - final classification. Accessed at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf on 14/12/2015.

32 Water Industry Act 1991. Accessed online at http://www.legislation.gov.uk/ukpga/1991/56/contents on 14/08/2015.

3.4.3 Water Resource Management Plans

Water companies are required to prepare 25-year forward looking WRMPs, with updates prepared every five years. In reality water companies prepare regular internal updates more regularly. WRMPs are required to assess:

- Future demand (due to population and economic growth)
- Demand management measures (e.g. water efficiency and leakage reduction)
- How the company will address changes to abstraction licenses
- How the impacts of climate change will be mitigated
- Where necessary, set out the requirements for developing additional water resources to meet growing demand.

The individual WRMP for Anglian Water[33] is reviewed in Section 4.1.

3.4.4 Developer contributions

Developments with planning permission have a right to connect to the public water and sewerage systems, although the Floods and Water Management Act removes the automatic right to connect surface water to sewerage systems.

Developers may either requisition a water supply connection or sewerage system, or self-build the assets and offer these for adoption by the water company or sewerage undertaker. Self-build and adoption are usually practiced for assets within the site boundary, whereas requisitions are normally used where an extension of upgrading of the infrastructure requires construction on third party land.

The costs of requisitions are shared between the water company and developer as defined in the Water Industry Act 1991.

Where a water company is concerned that a new development may impact upon their service to customers or the environment (for example by causing foul sewer flooding or pollution) they may request the LPA to impose a Grampian condition, whereby the planning permission cannot be implemented until a third party action, for example the water company upgrading a sewer, is complete.

The Town and Country Planning Act Section 106 agreement and Community Infrastructure Levy agreements may not be used to obtain funding for water or wastewater infrastructure.

33 Anglian Water (2015) Water Resource Management Plan. Accessed online at http://www.anglianwater.co.uk/environment/our-commitment/our-plans/water-resource-management.aspx on 15/12/2015.

4 Water Resources and Water Supply

When new houses are planned it is important to ensure that there are enough water resources in the area to cover the increase in demand without the risk of shortage in the future or in periods of high demand.

The aims of this assessment are to flag up if the actual housing numbers proposed by ELDC exceeds what AW has considered in planning for the future demands so that actions can be implemented and resources planned to overcome future shortages.

The water resource assessment has been carried out by two approaches; firstly reviewing Anglian Water's Water Resource Management Plan (WRMP), and secondly by providing Anglian Water with the growth scenarios for each settlement and allowing them to assess each settlement with the different data sets they have.

4.1 Water resource assessment: WRMP

4.1.1 Methodology

Anglian Water's Water Resource Management Plan[34] (WRMP) was reviewed. Attention was focussed upon:

- The available water resources and future pressures which may impact the supply element of the supply/demand balance.
- The allowance within those plans for housing and population growth and its impact upon the demand side of the supply/demand balance.

The results were assessed using a red / amber / green traffic light definition to score the water resource zone:

Adopted WRMP has planned for the increase in demand.	Insufficient evidence in adopted WRMP to confirm that the planned increase in demand can be met.	Adopted WRMP does not take into consideration the planned increase in demand. Additional water resources may be required.

4.1.2 Data collection

The datasets used to assess the water resource capacity were:

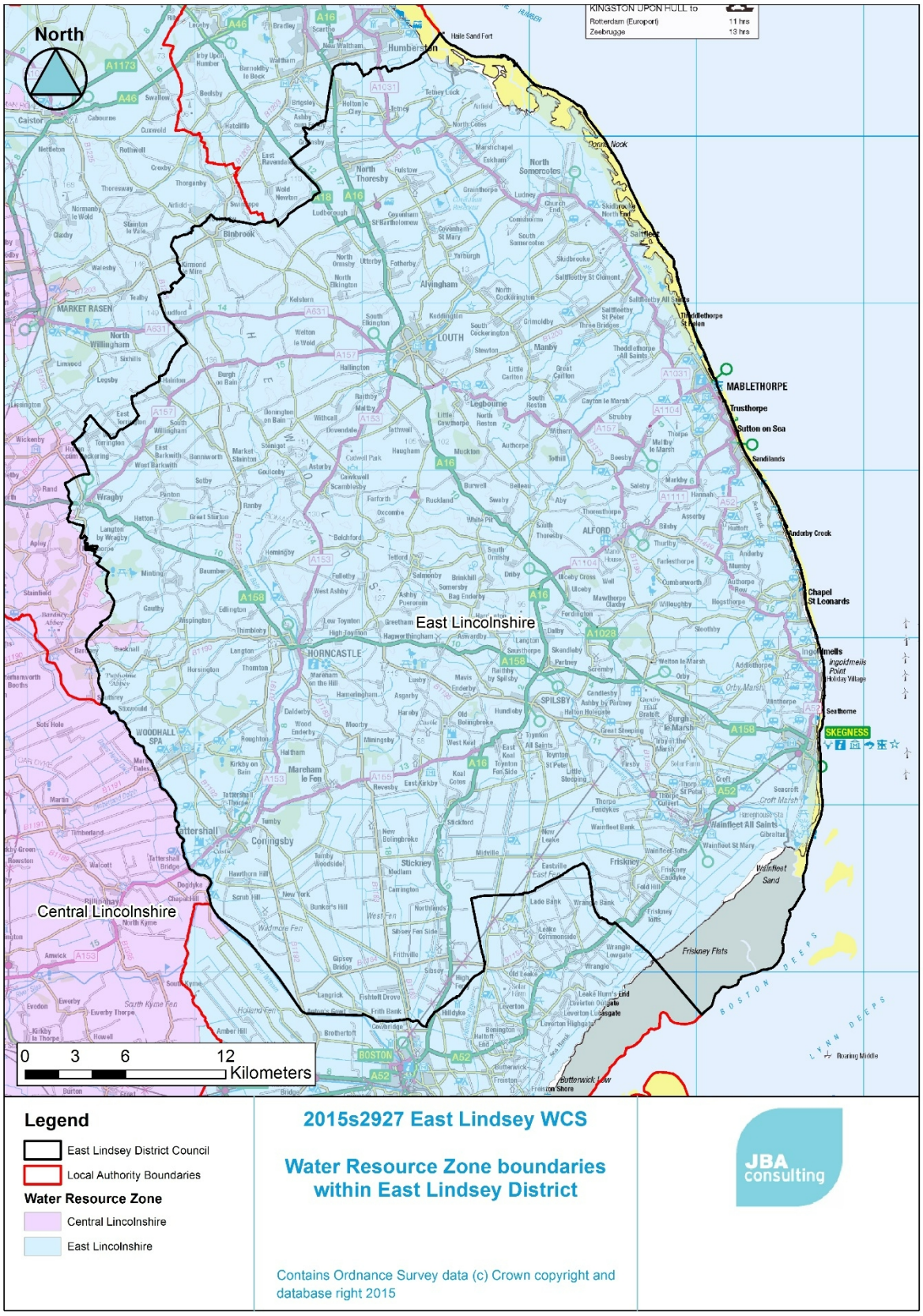
- Sites location in GIS format (provided by ELDC)
- Potential housing numbers for each site (provided by the ELDC)
- Company and water resource zone boundaries (AW)
- Final Water Resource Management Plans 2015-2040[27] (AW)

4.1.3 Results

Anglian Water manages water resources in 19 Water Resource Zones (WRZs). Their East Lincolnshire zone covers almost the entirety of East Lindsey District and all settlements under consideration in this WCS are within the Anglian Water's East Lincolnshire WRZ. A small area to the north west of Bucknall is served by AW's Central Lincolnshire WRZ, but this contains only a handful of water users, and is not a settlement under consideration for significant growth.

34 Anglian Water (2015) Water Resources Management Plan. Accessed online at http://www.anglianwater.co.uk/environment/our-commitment/our-plans/water-resource-management.aspx on 15/12/2015.

Figure 4-1: Water Supply Zone boundaries



AW's Water Resource Management Plan 2015 (WRMP) sets out their proposed 25 year strategy for maintaining the balance between the supply and demand for water in their region. AW update their WRMP each new AMP period, and takes into account actual changes in population and consumption, as well as regulatory changes.

Anglian Water's key points for the East Lincolnshire RZ are:

- *No supply-demand deficits are forecast in the East Lincolnshire RZ.*
- *Sustainability reductions are required to restrict abstractions from the Northern Chalk by up to 25Ml/d. The worst case sustainability reduction is up to 37Ml/d and a reduction of this magnitude would drive significant supply-demand investment and is the subject of further options appraisal.*
- *No significant baseline climate change or levels of service sensitivities have been identified, and in the worst case, climate change may reduce average daily source-works output by 2Ml/d. This would affect abstraction from the Louth Canal.*
- *Local authority policy based growth projections exceed our trend based projections by a significant amount. Our available and target headroom are sufficient to account for the difference and the associated supply-demand risk is minimal.*

The East Lincolnshire zone is not forecast to have a supply-demand deficit over the whole of the forecast period (2015 - 2040). However the supply-demand balance is forecasted to reduce over time from 61.7 Ml/d at the end of AMP 6 (2019-2020) to 12.82Ml/d at the end of AMP 10 (2039-2040). These are the Dry Year Annual Average (DYAA) condition demands, and the target headroom requirements are 9.8 Ml/d.

AW have forecast new properties equivalent to around 2,500 per year in the East Lincolnshire Resource Zone (RZ) in their 2015 WRMP, which is half the 5,000 forecast by local authority, as shown in Table 4-1 reported in their WRMP. Table 4-2 summarises the housing growth forecasts for each district within the East Lincolnshire WRZ from the Strategic Housing Market Assessment's published between 2012 and 2015.

Table 4-1: Anglian Water WRMP: AW and local authority growth estimate for East Lincolnshire WRZ.

Household Growth Estimates	2006-11	2015-20	2020-25	2025-30	2030-35	2035-40
Local Authority policy estimates		20500	20500	20500	20000	20000
WRMP trend estimate		10000	12000	12000	12000	12000
Annual Monitoring Report data	11500					

In summary, the WRMP is based on a forecast of 58,000 additional properties in the East Lincolnshire WRZ between 2015 and 2040. The latest growth figures indicate Anglian Water's projected growth of 58,000 units is greater than those forecast during the preparation of the SHMA's for East Lindsey, Boston, North East Lincolnshire and West Lindsey District Councils, which total 34,503.

Table 4-2: Summary of forecast housing growth for each district council in the East Lincolnshire WRZ.

Area	Forecast (properties)	Source
East Lindsey District	12,500 (2010 - 2031, Constrained to RSS dwelling delivery)	Coastal Lincolnshire Strategic Housing Market Assessment (September 2012)[35]
Boston District	5,500 (7,500) (2010 - 2031, Constrained to RSS dwelling delivery)	Coastal Lincolnshire Strategic Housing Market Assessment (September 2012)
North East Lincolnshire District	9,690 (13,340) (2011 - 2030, Regional spatial strategy)	North East Lincolnshire Strategic Housing Market Assessment (May 2013)[36]
West Lindsey	6,813 (2012 - 2036, 2012 population and household projections)	Central Lincolnshire Strategic Housing Market Assessment (July 2015)[37]

35 Coastal Lincolnshire Strategic Housing Market Assessment (September 2012)

36 North East Lincolnshire Strategic Housing Market Assessment (May 2013)

37 Central Lincolnshire Strategic Housing Market Assessment (July 2015)

Area	Forecast (properties)	Source
Total within WRZ	**34,503 (40,153)**	

Note: Figures in brackets are taken from the 2016 Pre-Submission Draft Local Plans for the relevant areas, but as this information is not available for all areas the assessment is based on published figures.

4.1.4 Conclusions

All settlements and sites within East Lindsey District are supplied by Anglian Water. Table 4-1 summaries the conclusion of the assessment. The Water Resource Management Plan (WRMP) makes adequate provision for the forecast growth in housing within East Lindsey District. Therefore water resources should not be considered to be a barrier to the planned growth in the District.

Table 4-3: Water resource summary (using Anglian Water's WRMP as evidence)

Location	Assessment
All settlements supplied by Anglian Water's East Lincolnshire WRZ	Adopted WRMP has planned for the increase in demand.

4.2 Water resource assessment: Anglian Water development assessment

4.2.1 Methodology

Anglian Water were provided with the list of settlements, the potential housing numbers and the four other housing growth scenarios. They were invited to provide an assessment of the availability of water resources at a strategic level and provide any additional comments.

The results were assessed using a red / amber / green traffic light definition to score each housing growth scenario for each settlement:

Can be provided to the proposed potential housing numbers without risk of shortage.	Can be provided to the proposed housing numbers but some investment may be needed now or in the future to avoid risk of shortage.	Cannot be provided to the proposed housing numbers. Further modelling will be required and subsequent investment may be needed.

4.2.2 Data collection

The datasets used to assess the water resource capacity were:

- List of settlements (provided by ELDC)
- Future growth scenarios of the number of planned houses for each settlement (provided by ELDC)
- Population equivalent using a occupancy rate of 2.3p/h (calculated by AW)
- Water demand by multiplying the population equivalent by 133 l/p/d (calculated by AW)

4.2.3 Results

Anglian Water provided a spreadsheet containing a R/A/G score for each housing growth scenario for each settlement. No additional comments were provided.

The results of the water resource assessment are presented in Table 4-4.

Table 4-4: Water resource summary (Anglian Water's assessment)

Location	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Alford	Green	Green	Green	Green	Green
Binbrook	Green	Green	Green	Green	Green
Burgh le Marsh	Green	Green	Green	Green	Green
Coningsby / Tattershall	Green	Green	Green	Green	Green
Friskney	Green	Green	Green	Green	Green
Grainthorpe	Green	Green	Green	Green	Green
Grimoldby & Manby	Green	Green	Green	Green	Green
Hogsthorpe	Green	Green	Green	Green	Green
Holton le Clay	Green	Green	Green	Green	Green
Horncastle	Green	Green	Green	Green	Green
Huttoft	Green	Green	Green	Green	Green
Legbourne	Green	Green	Green	Green	Green
Louth	Green	Green	Green	Green	Green
Mareham le Fen	Green	Green	Green	Green	Green
Marshchapel	Green	Green	Green	Green	Green
North Thoresby	Green	Green	Green	Green	Green
Sibsey	Green	Green	Green	Green	Green
Spilsby	Green	Green	Green	Green	Green
Stickney	Green	Green	Green	Green	Green
Tetford	Green	Green	Green	Green	Green
Tetney	Green	Green	Green	Green	Green
Wainfleet All Saints	Green	Green	Green	Green	Green
Woodhall Spa	Green	Green	Green	Green	Green
Wragby	Green	Green	Green	Green	Green

4.2.4 Conclusions

The Anglian Water water resource assessment of the five potential housing growth scenarios supports the WRMP assessment and confirms that there is adequate provision for the forecast growth in housing within East Lindsey District and that therefore water resources should not be considered to be a barrier to the planned growth in the District.

4.2.5 Recommendations

Table 4-5: Water resource actions

Action	Responsibility	Timescale
Anglian Water should monitor actual population and property numbers across East Lincolnshire RZ through its annual review of its WRMP and initiate mitigation measures as necessary.	AW	Annually
Provide updates to AW of projected housing growth on an annual basis for the remainder of the period and for 5 year supply period	ELDC and other LPAs in the WRZ	Annually
East Lindsey is defined as an area under "serious" water stress. It is therefore appropriate to implement the need for new development to be designed to Building regulations water consumption standard for water scarce areas (110 litres per person per day) as permitted by National Planning Policy Guidance.	ELDC	Ongoing
Work together to ensure that sites within the District that may be required for future strategic water resource infrastructure are safeguarded from further development.	ELDC	Ongoing

4.3 Water supply infrastructure assessment

Increase in water demand adds pressure to the existing supply infrastructure. An assessment is required to identify whether the existing infrastructure is adequate or whether upgrading will be required. The time required to plan, obtain funding and construct major pipeline works can be considerable and therefore water companies and planners need to work closely together to ensure that the infrastructure is able to meet growing demand.

Water supply companies make a distinction between supply infrastructure, the major pipelines, reservoirs and pumps that transfer water around a WRZ, and distribution infrastructure, smaller scale assets which convey water around settlements to customers. This assessment is focussed on the supply infrastructure. It is expected that developers should fund assessments and the modelling of the distribution systems to assess requirements for local capacity upgrades.

4.3.1 Methodology

AW were provided with the list of sites and the potential housing numbers for each site. Using this information AW assessed each site using the different data sets they hold.

AW used the following red / amber / green traffic light definition to score each site:

Capacity available to serve the proposed growth.	Infrastructure and/or treatment upgrades required to serve proposed growth or diversion of assets may be required.	Major constraints to provision of infrastructure and/or treatment to serve proposed growth.

4.3.2 Data collection

The datasets used to assess the water supply and distribution capacity are the following:

- Site location in GIS format (provided by ELDC)
- Potential housing numbers for each site (provided by the ELDC)
- Population equivalent using a occupancy rate of 2.3p/h (calculated by AW)
- Water demand by multiplying the population equivalent by 133 l/p/d (calculated by AW)

4.3.3 Results

Anglian Water provided a spreadsheet containing a R/A/G assessment of the water supply infrastructure to each site. No additional comments were provided.

The results of the water supply network assessment are presented in Table 4-6.

Table 4-6: Water supply and distribution summary

Site Ref	Location	Potential Housing Numbers	Water Supply Network
AL036	Land adjacent to 9 Chauntry Road.	3	Amber
AL042	Land adjacent to Peachcroft, Farlsthorpe Road.	10	Amber
AL302	Land off Spendluffe Avenue	90	Amber
AL303	Land east of Tothby Lane	43	Amber
AL304	Land to rear of Hunt's Depot	22	Amber
AL312	Land off Tothby Lane	150	Amber
AL316	Land at Farlesthorpe Road	37	Amber
AL325	Land off Chauntry Road.	90	Amber
BIN306	Land north of Louth Road	21	Amber
BIN307	High Street	20	Amber
BIN309	Rear of Binbrook Mews, Market Place	1	Green
BLM305	Land south of Hall Lane	94	Amber
BLM310	Wildshed Lane	52	Amber
BLM313	Land south of Wildshed Lane	31	Amber
BLM318	Station Road	8	Amber
C&T305	Land off Park Lane	160	Green
C&T306	Leagate Road	57	Green
C&T311	Tumby Road	54	Green
C&T313	Leagate Farm	96	Green
FRIS301	Land adj Beech Cottage, Church Road	63	Amber
FRIS306	Land Adj Fendale, Low Gate	10	Amber
FRIS311	Church Lane/Yawling Gate	15	Amber
FRIS316	Low Road/The Avenue	3	Green
FRIS317	Church End	2	Green
FRIS321	Burgh Road	20	Amber
GRA209	Poors End, Grainthorpe	9	Amber
GRA211	Land north of Staples Garth, Grainthorpe	9	Amber
GRA312	Land at Garth House, Main Road	1	Green
HLC206	Former scrapyard, r/o 1 Louth Road, Holton le Clay	19	Amber
HLC301	Land Opp Jug and Bottle	337	Amber
HLC302	Land off Church Lane	32	Amber
HLC303	Land east of Louth Road	292	Amber
HLC304	Land north of Tetney Road	19	Amber
HLC305	Land north of Louth Road	91	Amber
HOG306	Land off West End	89	Amber
HOG309	Tumby Road	11	Green
HOR050	Land at the Wong	12	Green
HOR063	Land adjacent to Greystones, Lincoln Road	12	Green
HOR301	Land east of Lincoln Road	500	Amber
HOR303	Land east of Elmhirst Road	16	Green
HOR308	Land off Station Lane/The Sidings	25	Green
HOR312	Linpac Site, Mareham Road	49	Amber
HOR314	Land south of Banovallum Gardens	146	Amber
HOR315	Land south of Spilsby Road	60	Amber
HOR320	Highways Depot, Hemingby Lane	43	Green
HOR324	off Lincoln Road	24	Green
HOR327	Land on Lincoln Road	7	Green
HOR330	Land off Mareham Road	230	Amber
HOR333	Land to the west of Churchill Avenue	124	Amber
HUT206	Adj Hemingby House, Mumby Road, Huttoft	3	Green
HUT306	Adjacent Hemingby House, Mumby Road	13	Green
LEG303	Extension of Househams Lane, Legbourne	66	Amber
LEG307	Station Road	3	Green
LEG313	Land off Station Road	1	Green
LO044	Land off St Marys Lane (Close to Grimsby Rd end)	4	Green
LO096	Land to rear of property off Hortons Yard, Kidgate	5	Green
LO099	Land to rear of The Kings Head PH, Mercer Row	2	Green
LO143	Land between Spire View Road and Pleasant Avenue	16	Amber

Site Ref	Location	Potential Housing Numbers	Water Supply Network
LO154	Land to rear of 87-107 Eastfield Road	5	Green
LO155	Land to rear of 119-155 Eastfield Road	8	Green
LO301	Land east of A16	30	Amber
LO305	Land adjoining Greenways, Brackenborough Road	129	Amber
LO306	Land between Keddington Road and Brackenborough Road	400	Amber
LO311	Land adjacent to Louth United Football Ground	396	Amber
LO312	Wallis House, Birch Road	38	Amber
LO313	Land NE of Legbourne Road	240	Amber
LO324	Adj Shangri-la, Stewton Lane	1	Green
LO325	Land off Shearwater Close	54	Amber
LO326	Land South of Eastfield Road	76	Amber
LO329	Land at Legbourne Road	89	Amber
LO331	Land off Stewton Lane	1	Green
LO339	Land at Legbourne Road	55	Amber
LO341	Bluestone Rise (extension of)	5	Green
LO344	Louth Garden Centre, Legbourne Road	45	Amber
LO462	Land at Louth Golf Course	30	Amber
MAN314	Land at Carlton Road	50	Green
MAN316	Former Caravan Site	27	Green
MAN330	Redundant RAF Hangers, Manby Park	142	Amber
MAN332	Land at Manby Middlegate	4	Green
MAR217	End of Mill Lane, Marshchapel	34	Green
MAR226	Land adj Chain Terrace, Seadyke Way, Marshchapel	15	Green
MAR300	R/O Seadyke Way	15	Green
MAR304	Land off Mill Lane	20	Green
MLF021	Land adjacent to garage, Main Street	3	Green
MLF305	Moat Farmyard, Watery Lane	35	Green
MLF328	Land off Main Street	32	Green
NTH301	Station Road	33	Amber
NTH307	Off High Street	10	Amber
NTH308	East of A16	130	Amber
NTH313	Land off High Street	20	Amber
NTH317	Land adj to Quidi Vidi	1	Green
SIB302	Land to the West of A16	101	Amber
SIB303	Land to rear of Sibsey House	320	Amber
SIB304	Land to R/O Tregarthan House, Main Road	5	Amber
SIB406	Land to the rear of Page Close	34	Amber
SPY008	Land adjacent to Shades Hotel, Church Street	1	Green
SPY301	Post Office Lane	67	Amber
SPY302	Land fronting and rear of 55 Ashby Road	35	Amber
SPY303	East of Ashby Road	100	Amber
SPY304	North of Halton Road	30	Amber
SPY305	Land adj to Halton Road	129	Amber
SPY306	Land off Halton Road	70	Amber
SPY307	Land adjacent to 1 Ashby Meadows	1	Green
STK013	Land at Station Bridge Bungalow, Main Road	10	Amber
STK304	Land north of Halls Lane	50	Amber
STK312	West of Main Road	39	Amber
STK314	Adj Lynwood, Main Road	1	Amber
STK315	Land to rear of Main Road	20	Amber
STK319	Land adjacent to a depot, Main Road	15	Amber
TEF302	Land at South Road	38	Amber
TEF303	South Road	12	Amber
TNY308	Land west of Hoop End, Tetney	10	Amber
TNY311	Humberstone Road, Tetney	32	Amber
TNY313	Humberston Road	97	Amber
TNY316	Land at Tetney Golf Club, Station Road	183	Amber
WAI305	Land south of Matt Pits Lane	35	Green
WAI308	Land off Church Walk	7	Green

Site Ref	Location	Potential Housing Numbers	Water Supply Network
WAI308B	Land off Station Road	9	Green
WAI401	Land off Matt Pitts Lane	11	Green
WAI405	Land off Brewster Lane	3	Green
WRA024	Land to rear of Thornfield, Louth Road	32	Amber
WRA301	Land off Victoria Street	79	Amber
WRA304	Land off Bardney Road	42	Amber
WRA306	South of Wire Hill Lane	7	Amber
WRA313	Land on Bardney Road	79	Amber
WSP304	Land adj to St Hughs School	100	Amber
WSP310	Land off Clinton Way	18	Green
WSP314	Land off Witham Road	228	Amber
WSP315	196/198 Witham Road	13	Green

4.3.4 Conclusions

Anglian Water provided an assessment of the water supply infrastructure to each proposed development site. Anglian Water confirmed that for 48 of the 129 sites capacity was available to serve the proposed growth and for the remaining 81 sites infrastructure upgrades would be required.

Anglian Water confirmed that there were no major constraints to the provision of infrastructure to serve any of the proposed development sites. Therefore, whilst it is expected that infrastructure upgrades will be required to serve the majority of the proposed sites, there remains adequate time for this infrastructure to be delivered by Anglian Water without restricting the timing, location or scale of planned development.

4.3.5 Recommendations

Table 4-7: Water supply and distribution actions

Action	Responsibility	Timescale
Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery programme to identify key dates and potential programme constraints.	AW	Ongoing
Undertake technical studies to understand options to provide sufficient bulk and local transfer capacity and communicate results with ELDC.	AW	Ongoing
Developers seek early consultation with Anglian Water in order to ensure adequate time is available to provide local distribution main upgrades to meet additional demand.	Developers	Ongoing

5 Wastewater Collection and Treatment

Anglian Water (AW) is the Sewerage Undertaker (SU) for the whole District. The role of sewerage undertaker includes collection and treatment of wastewaters from domestic and commercial premises, and in some areas drainage of surface water from building curtilages to combined or surface water sewers. It excludes, unless adopted by AW, systems that do not connect directly to the wastewater network, e.g. SuDS or highway drainage.

Increased wastewater flows into collection systems due to growth in population or per-capita consumption can lead to overload of infrastructure, increasing the risk of sewer flooding and, where present, increasing the frequency of discharges from Combined Sewer Overflows (CSOs).

Likewise, headroom at water recycling centres can be eroded by growth in population or per-capita consumption, requiring investment in additional treatment capacity. As the volume of treated effluent rises, even if the effluent quality is maintained, the pollutant load discharged to the receiving watercourse will increase. In such circumstances the Environment Agency, as the environmental regulator, may tighten the consented effluent consents in order to achieve a "load standstill", i.e. ensuring that as effluent volumes increase the pollutant load discharged does not increase. Again, this would require investment by the water company to improve the quality of the treated effluent.

In combined sewerage systems, or foul systems with surface water misconnections, there is potential to create headroom in the system, thus enabling additional growth, by removal of surface water connections. This can most readily be achieved on redevelopment of brownfield sites with combined sewerage, where there is potential to discharge surface water via sustainable drainage systems (SuDS) to groundwater, watercourses or surface water sewers.

5.1 Sewerage system capacity assessment

New houses add pressure to the existing sewerage system. An assessment is required to identify the available capacity within the existing systems, and the potential to upgrade overloaded systems to accommodate growth. The scale and cost of upgrading works may vary very significantly depending upon the location of development in relation to the network and the receiving WRC.

It may be possible that an existing sewerage system is already working at its full capacity and further investigations have to be carried out to define which solution is necessary to implement to increase its capacity. New infrastructures may be required if for example a site is not served by an existing system.

Sewerage undertakers must consider growth in demand for wastewater services when preparing their five-yearly Strategic Business Plans (SBPs) which set out investment for the next Asset Management Plan (AMP) period. Typically, investment is committed to provide new or upgraded sewerage capacity to support allocated growth with a high certainty of being delivered. Additional sewerage capacity to service windfall sites, smaller infill development or to connect a site to the sewerage network across third party land are normally funded via developer contributions.

5.1.1 Methodology

AW were provided with the list of sites and the potential housing numbers. Using this information AW assessed each site using the different data sets they hold.

AW used the following red / amber / green traffic light definition to score each site:

Capacity available to serve the proposed growth	Infrastructure and/or treatment upgrades required to serve proposed growth or diversion of assets may be required	Major constraints to provision of infrastructure and/or treatment to serve proposed growth

5.1.2 Data collection

The datasets used to assess the sewerage system capacity are the following:

- Site location in GIS format (provided by ELDC)
- Potential housing numbers for each site (provided by the ELDC)

- Population equivalent using a occupancy rate of 2.3p/h (calculated by AW)
- Water demand by multiplying the population equivalent by 133 l/p/d (calculated by AW)

5.1.3 Results

AW provided a spreadsheet containing a R/A/G score for the foul sewerage network capacity, surface water network capacity and Water Recycling Centre (WRC) capacity for each site. An overall R/A/G score was provided for each site, as well as additional comments for some of the sites. The results of the sewerage system capacity assessment are presented in Table 5-1.

The following information was received alongside the assessment from AW:

- *Note 1: The information and RAG status for each proposed site has been assessed considering existing commitments but on an individual site basis. The cumulative impact from all of the proposed sites on the allocated treatment or network resource is not indicated by the RAG status. It should be noted therefore that the cumulative effect of all of the identified allocated sites may require enhancement to capacity. This impact will be advised separately.*
- *Note 2: Please note that where dwelling numbers have not been stated, capacity assessment has been based on a 30 properties per hectare.*
- *Note 3: Should all the available capacity be taken up at the WRC then upgrade to the works may be required that may involve seeking consent from the Environment Agency for an increase in discharge of final effluent.*
- *Note 4: All new development sites will reduce the wastewater network capacity. Therefore mitigation measures will be required to ensure flooding risk is not increased.*
- *Note 5: Available capacity in FW (foul water) networks will be determined by more detailed analysis. For developments of greater than 10 properties it is assumed that some enhancement to capacity may be required.*
- *Note 6: SW (surface water) capacity assessment reflects Anglian Water's preferred method of surface water disposal of using a sustainable drainage system (SuDS) with connection to sewer seen as the last option. This is in line with Planning Policy Statement 25: Development and Flood Risk emphasises the role of SuDS and introduces a presumption that they will be used in all developments.*
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Table 5-1: Sewerage system assessment

Site Ref	Location	Potential Housing Numbers	Water Recycling Centre (WRC)	WRC capacity (see note 1)	Foul Sewerage Network capacity (see note 5)	Surface Water Network capacity (see note 6)	Additional Comments	Anglian Water Overall RAG rating
AL036	Land adjacent to 9 Chauntry Road.	3	Alford WRC	Green	Green	Red		Amber
AL042	Land adjacent to Peachcroft, Farlsthorpe Road.	10	Alford WRC	Green	Green	Red		Amber
AL302	Land off Spendluffe Avenue	90	Alford WRC	Green	Amber	Red		Amber
AL303	Land east of Tothby Lane	43	Alford WRC	Green	Amber	Red		Amber
AL304	Land to rear of Hunt's Depot	22	Alford WRC	Green	Amber	Red		Amber
AL312	Land off Tothby Lane	150	Alford WRC	Green	Amber	Red		Amber
AL316	Land at Farlesthorpe Road	37	Alford WRC	Green	Amber	Red		Amber
AL325	Land off Chauntry Road.	90	Alford WRC	Green	Amber	Red		Amber
BIN306	Land north of Louth Road	21	Binbrook WRC	Green	Amber	Red		Amber
BIN307	High Street	20	Binbrook WRC	Green	Amber	Red		Amber
BIN309	Rear of Binbrook Mews, Market Place	1	Binbrook WRC	Green	Green	Red		Green
BLM305	Land south of Hall Lane	94	Ingoldmells WRC	Amber	Amber	Red	Enhancement to treatment capacity may be required	Amber
BLM310	Wildshed Lane	52	Ingoldmells WRC	Green	Amber	Red		Amber
BLM313	Land south of Wildshed Lane	31	Ingoldmells WRC	Green	Amber	Red		Amber
BLM318	Station Road	8	Ingoldmells WRC	Green	Amber	Red		Amber
C&T305	Land off Park Lane	160	Coningsby WRC	Amber	Amber	Red	Enhancement to treatment capacity may be required	Amber
C&T306	Leagate Road	57	Coningsby WRC	Green	Amber	Red		Amber
C&T311	Tumby Road	54	Coningsby WRC	Green	Amber	Red		Amber
C&T313	Leagate Farm	96	Coningsby WRC	Green	Amber	Red		Amber
FRIS301	Land adj Beech Cottage, Church Road	63	Friskney WRC	Green	Amber	Red		Amber
FRIS306	Land Adj Fendale, Low Gate	10	Friskney WRC	Green	Green	Red		Amber
FRIS311	Church Lane/Yawling Gate	15	Friskney WRC	Green	Amber	Red		Amber
FRIS316	Low Road/The Avenue	3	Friskney WRC	Green	Green	Red		Green
FRIS317	Church End	2	Friskney WRC	Green	Green	Red		Green
FRIS321	Burgh Road	20	Friskney WRC	Green	Amber	Red		Amber
GRA209	Poors End, Grainthorpe	9	North Cotes WRC	Green	Green	Red		Amber

Site Ref	Location	Potential Housing Numbers	Water Recycling Centre (WRC)	WRC capacity (see note 1)	Foul Sewerage Network capacity (see note 5)	Surface Water Network capacity (see note 6)	Additional Comments	Anglian Water Overall RAG rating
GRA211	Land north of Staples Garth, Grainthorpe	9	North Cotes WRC	Green	Green	Red		Amber
GRA312	Land at Garth House, Main Road	1	North Cotes WRC	Green	Green	Red		Green
HLC206	Former scrapyard, r/o 1 Louth Road, Holton le Clay	19	Holton le Clay WRC	Green	Amber	Red		Amber
HLC301	Land Opp Jug and Bottle	337	Holton le Clay WRC	Green	Amber	Red		Amber
HLC302	Land off Church Lane	32	Holton le Clay WRC	Green	Amber	Red		Amber
HLC303	Land east of Louth Road	292	Holton le Clay WRC	Green	Amber	Red		Amber
HLC304	Land north of Tetney Road	19	Holton le Clay WRC	Green	Amber	Red		Amber
HLC305	Land north of Louth Road	91	Holton le Clay WRC	Green	Amber	Red		Amber
HOG306	Land off West End	89	Ingoldmells WRC	Amber	Amber	Red	Enhancement to treatment capacity may be required	Amber
HOG309	Tumby Road	11	Ingoldmells WRC	Green	Amber	Red		Amber
HOR050	Land at the Wong	12	Horncastle WRC	Green	Amber	Red		Amber
HOR063	Land adjacent to Greystones, Lincoln Road	12	Horncastle WRC	Green	Amber	Red		Amber
HOR301	Land east of Lincoln Road	500	Horncastle WRC	Green	Amber	Red		Amber
HOR303	Land east of Elmhirst Road	16	Horncastle WRC	Green	Amber	Red		Amber
HOR308	Land off Station Lane/The Sidings	25	Horncastle WRC	Green	Amber	Red		Amber
HOR312	Linpac Site, Mareham Road	49	Horncastle WRC	Green	Amber	Red		Amber
HOR314	Land south of Banovallum Gardens	146	Horncastle WRC	Green	Amber	Red		Amber
HOR315	Land south of Spilsby Road	60	Horncastle WRC	Green	Amber	Red		Amber
HOR320	Highways Depot, Hemingby Lane	43	Horncastle WRC	Green	Amber	Red		Amber
HOR324	off Lincoln Road	24	Horncastle WRC	Green	Amber	Red		Amber
HOR327	Land on Lincoln Road	7	Horncastle WRC	Green	Green	Red		Green
HOR330	Land off Mareham Road	230	Horncastle WRC	Green	Amber	Red		Amber
HOR333	Land to the west of Churchill Avenue	124	Horncastle WRC	Green	Amber	Red		Amber
HUT206	Adj Hemingby House, Mumby Road, Huttoft	3	Ingoldmells WRC	Green	Green	Red		Green
HUT306	Adjacent Hemingby House, Mumby Road	13	Ingoldmells WRC	Green	Amber	Red		Amber
LEG303	Extension of Househams Lane,	66	Legbourne WRC	Red	Amber	Red	Enhancement to treatment	Red

Site Ref	Location	Potential Housing Numbers	Water Recycling Centre (WRC)	WRC capacity (see note 1)	Foul Sewerage Network capacity (see note 5)	Surface Water Network capacity (see note 6)	Additional Comments	Anglian Water Overall RAG rating
	Legbourne						capacity will be required	
LEG307	Station Road	3	Legbourne WRC	Green	Green	Red		Green
LEG313	Land off Station Road	1	Legbourne WRC	Green	Green	Red		Green
LO044	Land off St Marys Lane (Close to Grimsby Rd end)	4	Louth WRC	Green	Amber	Red		Amber
LO096	Land to rear of property off Hortons Yard, Kidgate	5	Louth WRC	Green	Amber	Red		Amber
LO099	Land to rear of The Kings Head PH, Mercer Row	2	Louth WRC	Green	Amber	Red		Amber
LO143	Land between Spire View Road and Pleasant Avenue	16	Louth WRC	Green	Amber	Red		Amber
LO154	Land to rear of 87-107 Eastfield Road	5	Louth WRC	Green	Amber	Red		Amber
LO155	Land to rear of 119-155 Eastfield Road	8	Louth WRC	Green	Amber	Red		Amber
LO301	Land east of A16	30	Louth WRC	Green	Amber	Red		Amber
LO305	Land adjoining Greenways, Brackenborough Road	129	Louth WRC	Green	Amber	Red		Amber
LO306	Land between Keddington Road and Brackenborough Road	400	Louth WRC	Green	Amber	Red		Amber
LO311	Land adjacent to Louth United Football Ground	396	Louth WRC	Green	Amber	Red		Amber
LO312	Wallis House, Birch Road	38	Louth WRC	Green	Amber	Red		Amber
LO313	Land NE of Legbourne Road	240	Louth WRC	Green	Amber	Red		Amber
LO324	Adj Shangri-la, Stewton Lane	1	Louth WRC	Green	Amber	Red		Amber
LO325	Land off Shearwater Close	54	Louth WRC	Green	Amber	Red		Amber
LO326	Land South of Eastfield Road	76	Louth WRC	Green	Amber	Red		Amber
LO329	Land at Legbourne Road	89	Louth WRC	Green	Amber	Red		Amber
LO331	Land off Stewton Lane	1	Louth WRC	Green	Amber	Red		Amber
LO339	Land at Legbourne Road	55	Louth WRC	Green	Amber	Red		Amber
LO341	Bluestone Rise (extension of)	5	Louth WRC	Green	Amber	Red		Amber
LO344	Louth Garden Centre, Legbourne Road	45	Louth WRC	Green	Amber	Red		Amber

Site Ref	Location	Potential Housing Numbers	Water Recycling Centre (WRC)	WRC capacity (see note 1)	Foul Sewerage Network capacity (see note 5)	Surface Water Network capacity (see note 6)	Additional Comments	Anglian Water Overall RAG rating
LO462	Land at Louth Golf Course	30	Louth WRC	Green	Amber	Red		Amber
MAN314	Land at Carlton Road	50	Manby WRC	Amber	Amber	Red	Enhancement to treatment capacity may be required	Amber
MAN316	Former Caravan Site	27	Manby WRC	Amber	Amber	Red	Enhancement to treatment capacity may be required	Amber
MAN330	Redundant RAF Hangers, Manby Park	142	Manby WRC	Red	Amber	Red	Enhancement to treatment capacity will be required	Red
MAN332	Land at Manby Middlegate	4	Manby WRC	Green	Green	Red		Green
MAR217	End of Mill Lane, Marshchapel	34	North Cotes WRC	Green	Amber	Red		Amber
MAR226	Land adj Chain Terrace, Seadyke Way, Marshchapel	15	North Cotes WRC	Green	Amber	Red		Amber
MAR300	R/O Seadyke Way	15	North Cotes WRC	Green	Amber	Red		Amber
MAR304	Land off Mill Lane	20	North Cotes WRC	Green	Amber	Red		Amber
MLF021	Land adjacent to garage, Main Street	3	Mareham le Fen WRC	Amber	Green	Red		Amber
MLF305	Moat Farmyard, Watery Lane	35	Mareham le Fen WRC	Amber	Amber	Red		Amber
MLF328	Land off Main Street	32	Mareham le Fen WRC	Amber	Amber	Red		Amber
NTH301	Station Road	33	North Thoresby WRC	Green	Amber	Red		Amber
NTH307	Off High Street	10	North Thoresby WRC	Green	Green	Red		Amber
NTH308	East of A16	130	North Thoresby WRC	Green	Amber	Red		Amber
NTH313	Land off High Street	20	North Thoresby WRC	Green	Amber	Red		Amber
NTH317	Land adj to Quidi Vidi	1	North Thoresby WRC	Green	Green	Red		Green
SIB302	Land to the West of A16	101	Sibsey WRC	Amber	Amber	Red		Amber
SIB303	Land to rear of Sibsey House	320	Sibsey WRC	Amber	Amber	Red		Amber
SIB304	Land to R/O Tregarthan House, Main Road	5	Sibsey WRC	Green	Green	Red		Amber
SIB406	Land to the rear of Page Close	34	Sibsey WRC	Green	Amber	Red		Amber
SPY008	Land adjacent to Shades Hotel, Church Street	1	Spilsby WRC	Green	Green	Red		Green
SPY301	Post Office Lane	67	Spilsby WRC	Green	Amber	Red		Amber

Site Ref	Location	Potential Housing Numbers	Water Recycling Centre (WRC)	WRC capacity (see note 1)	Foul Sewerage Network capacity (see note 5)	Surface Water Network capacity (see note 6)	Additional Comments	Anglian Water Overall RAG rating
SPY302	Land fronting and rear of 55 Ashby Road	35	Spilsby WRC	Green	Amber	Red		Amber
SPY303	East of Ashby Road	100	Spilsby WRC	Green	Amber	Red		Amber
SPY304	North of Halton Road	30	Spilsby WRC	Green	Amber	Red		Amber
SPY305	Land adj to Halton Road	129	Spilsby WRC	Green	Amber	Red		Amber
SPY306	Land off Halton Road	70	Spilsby WRC	Green	Amber	Red		Amber
SPY307	Land adjacent to 1 Ashby Meadows	1	Spilsby WRC	Green	Green	Red		Green
STK013	Land at Station Bridge Bungalow, Main Road	10	Stickney WRC	Green	Green	Red		Amber
STK304	Land north of Halls Lane	50	Stickney WRC	Green	Amber	Red		Amber
STK312	West of Main Road	39	Stickney WRC	Green	Amber	Red		Amber
STK314	Adj Lynwood, Main Road	1	Stickney WRC	Green	Green	Red		Amber
STK315	Land to rear of Main Road	20	Stickney WRC	Green	Amber	Red		Amber
STK319	Land adjacent to a depot, Main Road	15	Stickney WRC	Green	Amber	Red		Amber
TEF302	Land at South Road	38	Tetford WRC	Green	Amber	Red		Amber
TEF303	South Road	12	Tetford WRC	Green	Amber	Red		Amber
TNY308	Land west of Hoop End, Tetney	10	Tetney Newton Marsh WRC	Green	Green	Red		Amber
TNY311	Humberstone Road, Tetney	32	Tetney Newton Marsh WRC	Green	Amber	Red		Amber
TNY313	Humberston Road	97	Tetney Newton Marsh WRC	Green	Amber	Red		Amber
TNY316	Land at Tetney Golf Club, Station Road	183	Tetney Newton Marsh WRC	Green	Amber	Red		Amber
WAI305	Land south of Matt Pits Lane	35	Wainfleet WRC	Green	Amber	Red		Amber
WAI308	Land off Church Walk	7	Wainfleet WRC	Green	Green	Red		Green
WAI308B	Land off Station Road	9	Wainfleet WRC	Green	Green	Red		Green
WAI401	Land off Matt Pitts Lane	11	Wainfleet WRC	Green	Amber	Red		Amber
WAI405	Land off Brewster Lane	3	Wainfleet WRC	Green	Green	Red		Green
WRA024	Land to rear of Thornfield, Louth Road	32	Wragby WRC	Green	Amber	Red		Amber
WRA301	Land off Victoria Street	79	Wragby WRC	Green	Amber	Red		Amber
WRA304	Land off Bardney Road	42	Wragby WRC	Green	Amber	Red		Amber

Site Ref	Location	Potential Housing Numbers	Water Recycling Centre (WRC)	WRC capacity (see note 1)	Foul Sewerage Network capacity (see note 5)	Surface Water Network capacity (see note 6)	Additional Comments	Anglian Water Overall RAG rating
WRA306	South of Wire Hill Lane	7	Wragby WRC	Green	Green	Red		Amber
WRA313	Land on Bardney Road	79	Wragby WRC	Green	Amber	Red		Amber
WSP304	Land adj to St Hughs School	100	Woodhall Spa WRC	Amber	Amber	Red	Enhancement to treatment capacity may be required	Amber
WSP310	Land off Clinton Way	18	Woodhall Spa WRC	Amber	Amber	Red		Amber
WSP314	Land off Witham Road	228	Woodhall Spa WRC	Red	Amber	Red	Enhancement to treatment capacity will be required	Red
WSP315	196/198 Witham Road	13	Woodhall Spa WRC	Amber	Amber	Red		Amber

5.1.4 Conclusions

The assessment of the sewerage system capacity has brought the following conclusions:

- Except for a few of the smaller developments (10 houses or fewer) it is anticipated that surface water infrastructure upgrades will be required within the sewerage systems for each site. Exact capacity requirements will be determined by Anglian Water in more detailed analysis.
- Anglian Water's preferred method of surface water disposal is using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.
- Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented following an application for a connection, adoption or requisition from a developer. Early developer engagement with water companies is therefore essential to ensure that sewerage capacity can be provided without delaying development.

5.1.5 Recommendations

Table 5-2: Sewerage systems actions

Action	Responsibility	Timescale
Take into account sewerage infrastructure constraints in phasing development in partnership with Anglian Water.	ELDC	Ongoing
Anglian Water to continue to assess growth demands as part of their wastewater asset planning activities and feedback to ELDC where concerns arise.	AW	Ongoing
Anglian Water and developers will be expected to work closely and early on in the planning promotion process to develop an outline Drainage Strategy for the site. The Outline Drainage strategy should set out sufficient detail to determine the likely timescales for the delivery of the infrastructure and the likely costs of the infrastructure. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	Developers	Ongoing
Developers will be expected to show that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.	Developers	Ongoing

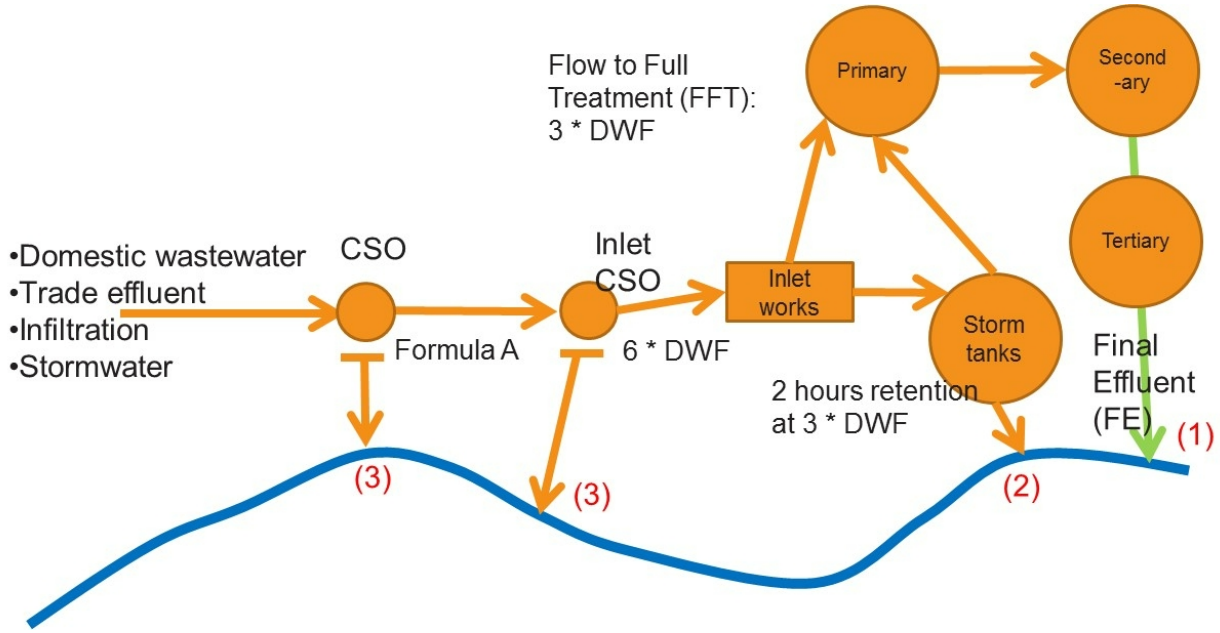
5.2 Water recycling centre flow and quality consent assessment

The EA is responsible for regulating sewage discharge releases via a system of Environmental Permits (EPs). Monitoring for compliance with these permits is the responsibility of both the EA and the plant operators. Figure 5-1 summarises the different types of wastewater releases that might take place, although precise details vary from works to works depending on the design.

Anglian Water has recently adopted the term Water Recycling Centres (WRCs) in order to better emphasise their role within the water cycle. WRC is used in this report in place of the traditionally used terms of Sewerage Treatment Works (STW) or Wastewater Treatment Works (WwTW).

During dry weather the final effluent from the WRCs should be the only discharge (1). With rainfall, the storm tanks fill and eventually start discharging to the watercourse (2) and Combined Sewer Overflows (CSOs) upstream of the storm tanks start to operate (3). The discharge of storm sewage from treatment works is allowed only under conditions of heavy rain or snow melt, and therefore the flow capacity of treatment systems is required to be sufficient to treat all flows arising in dry weather and the increased flow from smaller rainfall events. After rainfall, storm tanks should be emptied back to full treatment, freeing their capacity for the next rainfall event.

Figure 5-1: Overview of typical combined sewerage system and water recycling centre discharges



Environmental permits are used alongside water quality limits as a means of controlling the pollutant load discharged from a water recycling centre to a receiving watercourse. Sewage flow rates must be monitored for all WRCs where the permitted discharge rate is greater than 50 m^3/day in dry weather.

Permitted discharges are based on a statistic known as the Dry Weather Flow (DWF). As well as being used in the setting and enforcement of effluent discharge permits, the DWF is used for water recycling centre design, as a means of estimating the 'base flow' in sewerage modelling and for determining the flow at which discharges to storm tanks will be permitted by the permit (Flow to Full Treatment, FFT).

WRC Environmental Permits also consent for maximum concentrations of pollutants, in most cases suspended solids (SS), Biochemical Oxygen Demand (BOD) and Ammonia (NH_4). These are determined by the Environment Agency with the objective of ensuring that the receiving watercourse is not prevented from meeting its environmental objectives, in particular that the Chemical Status element of the Water Framework Directive (WFD) classification.

Increased domestic population and/or employment activity can lead to increased wastewater flows arriving at a WRC. Where there is insufficient headroom at the works to treat these flows, this could lead to failures of flow consents.

5.2.1 Methodology

AW were provided with the list of settlements, the potential housing numbers and the four other housing growth scenarios. They were invited to provide an assessment of the receiving WRC and to provide any additional comments

The results were assessed using a red / amber / green traffic light definition to score each housing growth scenario for each settlement:

Capacity available to serve the proposed growth.	Infrastructure and/or treatment upgrades required to serve proposed growth or diversion of assets may be required.	Major constraints to provision of infrastructure and/or treatment to serve proposed growth.

An assessment of the WRC capacity was carried out by calculating the extra flow reaching each WRC for each scenario. The extra flow was calculated by AW by:

- Grouping the settlements that are served by the same WRC using the sewerage drainage area boundaries

- Calculating the population equivalent for each WRC by using a occupancy rate of 2.3p/h
- Multiplying the population equivalent for the water demand of 133 l/p/d and assuming 95% of water consumption reaches the WRC

5.2.2 Data collection

The datasets used to assess the WRC capacity are the following:

- List of settlements (provided by ELDC)
- Future growth scenarios of the number of planned houses for each settlement (provided by ELDC)
- Sewerage drainage area boundaries (used by AW)
- Occupancy rate, water demand and % of water that reach the WRC (used by AW)

5.2.3 Results

Anglian Water provided a spreadsheet containing a R/A/G score for each housing growth scenario for each settlement. An additional comment has been provided for some of the WRCs.

The results of the WRC capacity assessment is presented in Table 5-3. See Table 5-1 to identify which WRC each site drains to and the WRC capacity assessment for each individual site. However, note that the R/A/G status and comment in Table 5-1 for the WRC capacity has been assessed considering existing commitments but on an individual site basis whilst the cumulative impact from the proposed growth scenarios is considered in Table 5-3.

5.2.4 Conclusions

The water recycling centre flow and quality consent assessment has brought the following conclusions:

- Anglian Water provided an assessment of the available headroom in the flow and quality consents at their existing water recycling centres to accommodate additional wastewater flows for each of the five housing growth scenarios. In addition, JBA Consulting undertook water quality impact modelling to assess the impact of additional treated effluent on the receiving watercourses.
- Water recycling centres (WRC) at Alford, Binbrook, Friskney, North Cotes, Holton le Clay, Spilsby, Stickney, Tetford, Tetney Newton Marsh, Wainfleet and Wragby are assessed to have capacity available to meet the proposed growth scenarios. Mareham le Fen and North Thoresby WRCs may require some treatment upgrades to serve the proposed growth, whilst there are major constraints identified to meet the proposed growth at Ingoldmells, Coningsby, Manby, Legbourne, Louth, Sibsey and Woodhall Spa WRC.

Table 5-3: Water recycling centre capacity assessment

Location	Receiving WRC	Scenario 1 RAG	Scenario 2 RAG	Scenario 3 RAG	Scenario 4 RAG	Scenario 5 RAG	Overall RAG	Additional comments
Alford	Alford WRC	Green	Green	Green	Green	Green	Green	
Binbrook	Binbrook WRC	Green	Green	Green	Green	Green	Green	
Burgh le Marsh	Ingoldmells WRC	Red	Red	Red	Red	Red	Red	Capacity will be needed to be made available
Coningsby / Tattershall	Coningsby WRC	Red	Red	Red	Red	Red	Red	Some capacity is available
Friskney	Friskney WRC	Green	Green	Green	Green	Green	Green	
Grainthorpe	North Cotes WRC	Green	Green	Green	Green	Green	Green	
Grimoldby & Manby	Manby WRC	Red	Red	Red	Red	Red	Red	Some capacity is available
Hogsthorpe	Ingoldmells WRC	Red	Red	Red	Red	Red	Red	Capacity will be needed to be made available
Holton le Clay	Holton le Clay WRC	Green	Green	Green	Green	Green	Green	
Horncastle	Horncastle WRC	No AW assessment						
Huttoft	Ingoldmells WRC	Red	Red	Red	Red	Red	Red	Capacity will be needed to be made available. Ingoldmells is a relatively large works so increased flows will have relatively less impact
Legbourne	Legbourne WRC	Red	Red	Red	Red	Red	Red	
Louth	Louth WRC	Red	Red	Red	Red	Red	Red	Some capacity is available
Mareham le Fen	Mareham le Fen WRC	Green	Amber	Amber	Amber	Amber	Amber	Small WRC with capacity
Marshchapel	North Cotes WRC	Green	Green	Green	Green	Green	Green	
North Thoresby	North Thoresby WRC	Green	Amber	Amber	Amber	Amber	Amber	
Sibsey	Sibsey WRC	Amber	Red	Red	Red	Red	Red	
Spilsby	Spilsby WRC	Green	Green	Amber	Amber	Amber	Amber	
Stickney	Stickney WRC	Green	Green	Green	Green	Green	Green	
Tetford	Tetford WRC	Green	Green	Green	Green	Green	Green	
Tetney	Tetney Newton Marsh WRC	Green	Green	Green	Green	Green	Green	
Wainfleet All Saints	Wainfleet WRC	Green	Green	Green	Green	Green	Green	
Woodhall Spa	Woodhall Spa WRC	Amber	Red	Amber	Red	Amber	Red	
Wragby	Wragby WRC	Green	Green	Green	Green	Green	Green	

5.2.5 Recommendations

Table 5-4: Water recycling centre capacity actions

Action	Responsibility	Timescale
Take into account WRC available capacity in phasing of development going to the same WRC.	ELDC	Ongoing
Provide annual updates to AW of projected housing growth.	ELDC	Annually
AW to assess growth demands as part of their wastewater asset planning activities and feedback to ELDC where concerns arise.	AW	Ongoing
AW, ELDC and the EA will work closely to ensure the timely delivery of any necessary WRC upgrades.	AW, EA and ELDC	Ongoing
Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, the EA should provide clear advice ELDC and AW on: • the approach to permitting, • requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), • advise where water quality constraints may limit the potential for growth.	EA	Ongoing

5.3 Water recycling centre odour assessment

Where new development encroaches upon an existing Water Recycling Centre (WRC), odour from that site may become a cause for nuisance and complaints from residents. Managing odour at WRCs can add considerable capital and operational costs, particularly when retro-fit to existing WRCs.

National Planning Policy Guidance recommends that plan-makers considering whether new development is appropriate near to sites used (or proposed) for water and wastewater infrastructure, in particular due to the risk of odour impacting on residents and requiring additional investment to address.

5.3.1 Methodology

It is generally the case for water companies that a new development may need an odour assessment if the site is close to a WRC and is encroaching closer to the WRC than existing urbanised areas.

A GIS exercise was carried out by JBA to identify sites that are less than 800m from a WRC and encroaching closer to the WRC than existing urbanised areas. It is noted that it is AW policy to consider sites within a distance of 400m. If there are no existing houses it is more likely that an odour assessment is needed. Another important aspect is the location of the site in respect to the WRC because the predominant winds blow from the south west.

A red / amber / green assessment was applied:

Site is unlikely to be impacted by odour from WRC	Site location is such that an odour impact assessment is recommended	Site is in an area with confirmed WRC odour issues

5.3.2 Data collection

The datasets used to assess the impact of odour from a WRC were:

- Sites location in GIS format (provided by the ELDC)

- WRC locations (provided by AW through digdat®[38])
- OS maps

5.3.3 Results

Table 5-5 list those sites where it is recommended that an odour assessment be undertaken.

Table 5-5: Sites where an odour assessment is recommended

Site Ref	WRC	Encroach-ment?	Direction of the WRC from the site	Site boundary distance from WRC (m)
AL302	Alford WRC	Yes	North	235
FRIS321	Friskney WRC	Yes	Southwest	500
HLC304	Holton le Clay WRC	Yes	Southwest	290
SIB303	Sibsey WRC	Yes	West / Northwest	320
WAI405	Wainfleet WRC	Yes	Southeast	260
WRA304	Wragby WRC	Yes	Southeast	270

5.3.4 Conclusions

The odour screening assessment concluded six sites may be at risk of experiencing odour due to their proximity to the existing WRC (see Table 5-6). It is recommended that odour impact assessments be undertaken as part of the planning application process. All other sites are unlikely to be impacted by odour from WRCs.

Table 5-6: Wastewater treatment odour summary

Site Ref	Location	Assessment
AL302	Land off Spendluffe Avenue	Site location is such that an odour impact assessment is recommended as part of the planning application process
FRIS321	Burgh Road	
HLC304	Land north of Tetney Road	
SIB303	Land to rear of Sibsey House	
WAI405	Land off Brewster Lane	
WRA304	Land off Bardney Road	
All other sites		Site is unlikely to be impacted by odour from WRC

5.3.5 Recommendations

Table 5-7: Wastewater treatment odour actions

Action	Responsibility	Timescale
Consider odour risk in selection of site allocations.	ELDC	Ongoing
Carry out an odour assessment for 'amber' assessed sites.	Site promoters	Ongoing

5.4 Water quality impact assessment

The increased discharge of effluent due to an increase in the population served by a WRC may impact on the quality of the receiving water. The Water Framework Directive (WFD) does not allow a watercourse to deteriorate from its current class (either water body or element class).

It is EA policy to model the impact of increasing effluent volumes on the receiving watercourse. Where the scale of development is such that a deterioration is predicted, a new Environmental Permit (EP) may be required for the WRC to improve the quality of the final effluent, so that the extra pollution load will not result in a deterioration in the water quality of the watercourse. This is known as a “no deterioration” or “load standstill".

EA guidance states that a 10% deterioration in the receiving water can be allowed in some circumstances as long as this does not cause a class deterioration to occur.

38 www.digdat.co.uk

If a watercourse fails the 'good status' target, further investigations are needed in order to define the 'reasons for fail' and which actions could be implemented to reach such status.

Anglian Water prepared a RAG analysis of the capacity and performance of all WRCs within East Lindsey which may see increased flows due to housing allocations. This analysis identified eight WRCs with potential future capacity issues due to growth. For the preparation of the phase II Water Cycle Study (WCS), East Lindsey District Council requested that a water quality impact assessment should be carried out at these eight WRCs:

- Coningsby
- Horncastle
- Ingoldmells
- Legbourne
- Louth
- Manby
- Sibsey
- Woodhall Spa

This WCS assesses the potential water quality impacts due to growth in WRC effluent flows and loads at 7 WRC discharge points. Ingoldmells was not assessed because it discharges to the sea. Please note that, whilst the other WRCs not considered in this assessment may have capacity within their consents to accommodate the planned growth scenarios, this does not necessarily imply that the watercourse would, with the existing consent, be able to meet Good Status, nor that future increases in discharges within the permitted consent would not lead to a deterioration occurring.

The full water quality assessment is included in Appendix B. This section provides a summary of the methodology, results and conclusions.

5.4.1 Methodology

The contaminants assessed were Biochemical Oxygen Demand (BOD), Ammonia (NH4) and Phosphorus (P).

The selected approach was to use the EA River Quality Planning (RQP) tool in conjunction with their recommended guidance documents: "Water Quality Planning: no deterioration and the Water Framework Directive" and "Horizontal guidance". This uses a steady state Monte Carlo Mass Balance approach where flows and water quality are sampled from modelled distributions based on data where available.

The data required to run the RQP software were:

Upstream river data:

- Mean flow
- 95% exceedance flow
- Mean for each contaminants
- Standard deviation for each contaminant

Discharge data:

- Mean flow
- Standard deviation for the flow
- Mean for each contaminants
- Standard deviation for each contaminant

River quality target data:

- No deterioration target
- 'Good status' target

The above data inputs should be based on observations where available. In the absence of observed data EA guidance requires that:

If the observed WRCs discharge flow and quality data were not available, the following values were used:

- Flow mean: 1.25*DWF.
- Flow SD: 1/3*mean.
- Quality data: permit values or assumed values.

If observed river flows were not available these were obtained from an existing model or a low-flows estimation software.

If observed water quality data were not available these were obtained from an existing model or a neighbouring catchment with similar characteristics, or the mid-point of the WFD class.

The observed data available for WRCs discharges were analysed in the statistical tool, Aardvark and the values reported as "less than" (these are samples where was not possible to get an accurate value and a limit value was assigned) were multiplied for 0.5 as agreed with the EA.

5.4.2 Data collection

The datasets required to assess the discharge permits were the following:

- River flow data (received from the EA)
- River quality data (received from the EA)
- Current WRC permits (received from the EA)
- RQP tool (received from the EA)
- Existing water quality models: GIS SIMCAT model (not available)
- Current river classifications (received from the EA)
- 2015 WFD river target for BOD, P and NH_4 (received from the EA, see section **Error! Reference source not found.**)
- EA guidance documents (received from the EA)
- WRC flow and quality data (received from the EA)
- WRC discharge information e.g. location, receiving watercourse, etc. (received from the EA)

5.4.3 Results

Table 5-8 summaries the modelling results for passing or failing of the following targets:

- 'Good status';
- 'No 10% deterioration';
- 'No class deterioration'.

Table 5-8: RQP results summaries for passing or failing targets of: 'Good Status', 'No >10% Deterioration' and 'No Class Deterioration'.

Watercourse (WRC discharging into it)	Scenario	Achieves 'Good status' target?			Achieves 'No > 10% deterioration' target?			Achieves 'Class deterioration' target?		
		BOD	NH4	P	BOD	NH4	P	BOD	NH4	P
Key		Achieves good status			No deterioration			No class deterioration		
		NA			Up to 10% deterioration			NA		
		Fails good status			More than 10% deterioration			Class deterioration		
River Bain (Coningsby)	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	S4	yes	yes	no	-0.4%	7.7%	8.6%	yes	yes	yes
	S2	yes	yes	no	0.0%	< 8%	2.9%	yes	yes	yes
	S1, S3, S5	yes	yes	no	0.0%	< 8%	3.0%	yes	yes	yes
Old River Bain (Horncastle)	Present day	no	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	S4	no	yes	no	1.9%	5.2%	5.4%	yes	yes	yes
	S2	no	yes	no	0.7%	3.5%	2.9%	yes	yes	yes
	S1, S3, S5	no	yes	no	0.9%	3.5%	2.5%	yes	yes	yes
Unnamed drain (Legbourne)	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	S3, S5	yes	yes	no	3.1%	8.1%	1.1%	yes	yes	yes
	S1, S2, S4	yes	yes	no	< 3.1%	5.4%	0.6%	yes	yes	yes
Louth Canal (Louth)	Present day	yes	no	no	N/A	N/A	N/A	N/A	N/A	N/A
	S4	yes	no	no	5.0%	6.4%	8.8%	yes	yes	yes
	S2,S3,S5	yes	no	no	2.7%	3.2%	4.4%	yes	yes	yes
	S1	yes	no	no	2.2%	3.2%	3.5%	yes	yes	yes
Unnamed drain (Manby)	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	S4	yes	yes	no	0.4%	0.0%	0.5%	yes	yes	yes
	S2,S3,S5	yes	yes	no	0.4%	0.0%	0.5%	yes	yes	yes
	S1	yes	yes	no	0.4%	0.0%	0.5%	yes	yes	yes
Unnamed drain (Sibsey)	Present day	no	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	S4	no	yes	no	0.5%	0.0%	3.7%	yes	yes	yes
	S2,S3,S5	no	yes	no	0.5%	0.0%	3.3%	yes	yes	yes
	S1	no	yes	no	0.4%	0.0%	2.8%	yes	yes	yes
Unnamed drain (Woodhall Spa)	Present day	yes	yes	no	N/A	N/A	N/A	N/A	N/A	N/A
	S4	yes	yes	no	0.0%	0.0%	0.0%	yes	yes	yes
	S2	yes	yes	no	0.0%	0.0%	0.0%	yes	yes	yes
	S3, S5	yes	yes	no	0.0%	0.0%	0.0%	yes	yes	yes
	S1	yes	yes	no	0.0%	0.0%	0.0%	yes	yes	yes

5.4.4 Best Available Technology (BAT) assessment

Where river target failures occurred, the modelling results were compared against BAT to assess if improving the works to such level of performance could prevent the failure to occur. Table 5-9 summarises for each WRC the following questions:

- Will the WRC remain within its existing permit?
- Do any of the determinands experience a 10% deterioration and if so can this be prevented by application of BAT?
- Do any of the determinands experience a class deterioration and if so can this be prevented by application of BAT?
- Do any of the determinands experience a failure in reaching good status and if so can this be prevented by application of BAT?

- Do any of the determinands experience a failure in reaching the actual WFD status and if so can this be prevented by application of BAT?

The EA advised that the following permit values are achievable using best available technology, and that these values should be used for modelling all WRC potential capacity irrespective of the existing treatment technology and size of the works:

- BOD (95%ile) = 5mg/l
- Ammonia (95%ile) = 1mg/l
- Phosphorus (mean) = 0.5mg/l

Note that phosphorus removal is the subject of ongoing national trials investigating novel techniques and optimisation of existing methods. This major study, which involves all UK water companies, is not due to report until 2017, therefore this assessment is based on the current assumption of BAT for phosphorus. AW is assuming 1 mg/l as BAT till the study's results will be available.

This does not take in consideration if it is feasible to upgrade each existing WRC to such technology due to constraints of cost, timing, space, carbon cost etc. Table 5-9 shows a summary of the conclusions using BAT.

Table 5-9: Summary of results assuming BAT is applied.

Watercourse (WRC discharging into it)	DWF Permit Compliant	Could the development cause a greater than 10% deterioration in WQ?	Could the development cause a deterioration in WFD class of any element?	Could the development prevent the water body from reaching GES?
Key		Passes		
		Fails: target is achievable using BAT or permit capacity is reached		
		Fails: target is not achievable using BAT or permit capacity is exceeded.		
River Bain (Coningsby)	Currently working below DWF permit	Predicted deterioration is less than 10%. No WRC upgrade is required	No class deterioration is predicted. No WRC upgrade is required	Good status is not reached for P. Upgrade to the WRC is needed and it is achievable with BAT assuming GES upstream.
Old River Bain (Horncastle)	Currently working below DWF permit	Predicted deterioration is less than 10%. No WRC upgrade is required	No class deterioration is predicted. No WRC upgrade is required	Good status is not reached for BOD and P. Upgrade to the WRC is needed and it is achievable with BAT only for BOD. For P even assuming GES upstream it is not possible to achieve GES.

Watercourse (WRC discharging into it)	DWF Permit Compliant	Could the development cause a greater than 10% deterioration in WQ?	Could the development cause a deterioration in WFD class of any element?	Could the development prevent the water body from reaching GES?
Key		Passes		
		Fails: target is achievable using BAT or permit capacity is reached		
		Fails: target is not achievable using BAT or permit capacity is exceeded.		
Unnamed drain (Legbourne)	Currently working below DWF permit	Predicted deterioration is less than 10%. No WRC upgrade is required	No class deterioration is predicted. No WRC upgrade is required	Good status is not reached for P. Upgrade to the WRC is needed and it is not achievable with BAT even assuming GES upstream. For P even assuming GES upstream it is not possible to achieve GES.
Louth Canal (Louth)	Currently working below DWF permit	Predicted deterioration is less than 10%. No WRC upgrade is required	No class deterioration is predicted. No WRC upgrade is required	Good status is not reached for NH4 and P. Upgrade to the WRC is needed but it is achievable with BAT only for NH4 (the mean requested for S4 scenario is within the 10% model tolerance / variability).
Unnamed drain (Manby)	Currently working below DWF permit	Predicted deterioration is less than 10%. No WRC upgrade is required	No class deterioration is predicted. No WRC upgrade is required	Good status is not reached for P. Upgrade to the WRC is needed and it is not achievable with BAT even assuming GES upstream. For P even assuming GES upstream it is not possible to achieve GES.

Watercourse (WRC discharging into it)	DWF Permit Compliant	Could the development cause a greater than 10% deterioration in WQ?	Could the development cause a deterioration in WFD class of any element?	Could the development prevent the water body from reaching GES?
Key		Passes		
		Fails: target is achievable using BAT or permit capacity is reached		
		Fails: target is not achievable using BAT or permit capacity is exceeded.		
Unnamed drain (Sibsey)	Currently working below DWF permit	Predicted deterioration is less than 10%. No WRC upgrade is required	No class deterioration is predicted. No WRC upgrade is required	Good status is not reached for BOD and P. Upgrade to the WRC is needed but it is achievable with BAT only for BOD.
Unnamed drain (Woodhall Spa)	Currently working below DWF permit	Predicted deterioration is less than 10%. No WRC upgrade is required	No class deterioration is predicted. No WRC upgrade is required	Good status is not reached for P. Upgrade to the WRC is needed and it is achievable with BAT assuming GES upstream.

5.4.5 Conclusions

The water quality impact assessment has brought the following conclusions:

- All works are currently working below their DWF permits.
- The proposed growth is not predicted to lead to any class deteriorations, or deteriorations of quality of greater than 10% for any determinand.
- For Phosphorus all receiving watercourses at all WRCs fail their targets for the present-day situation:
    - At Coningsby and Woodhall, good ecological status could be achieved in the receiving watercourses if these were achieving GES upstream of the works.
    - At Horncastle, Legbourne and Manby even assuming GES upstream, the modelling predicts that it would not be possible to achieve GES in the receiving watercourses.
    - Louth and Sibsey have already GES upstream and it not possible to achieve GES at the receiving watercourses. Note: the reason for the P GES target failure could be due to the fact that by not having any observed data available an assumed discharge value (same for all works) was used.

      Note: for phosphorus an average value provided by the EA based on actual data of around 2000 discharges with no P removal was used for all WRCs.
- For BOD only receiving watercourses at Horncastle and Sibsey fail GES but targets can achieved by using BAT.
- For NH4 only receiving watercourse at Louth fails GES but target can achieved by using BAT.

5.4.6 Recommendations

Table 5-10: Wastewater treatment odour actions

Action	Responsibility	Timescale
Where possible, take into account the water quality constraints when allocating and phasing development sites.	ELDC	Ongoing
Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, provide clear advice to sewerage undertakers and ELDC on: • the approach to permitting, • requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), • advise ELDC where water quality constraints may limit the potential for growth	EA	Ongoing
Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery programme to identify key dates and potential programme constraints.	AW	Annually

6 Flood Risk Management

This section considers the flood risk to the potential site allocations, as well as the potential risk of increased flood flows in watercourses due to additional flows of sewage effluent.

6.1 Flood risk assessment

6.1.1 Methodology

The ELDC Draft Strategic Flood Risk Assessment (SFRA)[39] is the main source of information regarding the flood risk to the settlements and the proposed strategic site allocations. As this document was produced in 2012 and is comprehensive in covering the fluvial flood risk as well as flooding from other sources at a settlement level there is no need to reproduce the contents within the WCS.

However as flood risk is site specific and the flood maps produced by the Environment Agency are subject to periodic review a simple Red / Amber / Green assessment has been prepared from the most up to date Flood Zone and updated Flood Map for Surface Water information.

A R/A/G score was defined as follows:

River or Sea Flood Risk	Pluvial Flood Risk
>95% of the site is within Flood Zone 1 (Low Risk). Very unlikely to be a constraint to development as long as access to the site can be maintained	<5% of site is within the updated Flood Map for Surface Water 1 in 1000 year outline (Low Risk). Potential surface water drainage constraints are extremely low.
90-95% of the site is within Flood Zone 1 (Low Risk). Unlikely to be a constraint to development as long as access to the site can be maintained	5-20% of site is within the updated Flood Map for Surface Water 1 in 1000 year outline (Low Risk). Potential surface water drainage constraints are very low to low.
<90% of the site is within Flood Zone 1 (Low Risk). Some constraint is likely for example housing numbers may be reduced	>20% of site is within the updated Flood Map for Surface Water 1 in 1000 year outline (Low Risk). Potential surface water drainage constraints are medium to very high

6.1.2 Data collection

The datasets used to assess the risk of flooding have been provided by the EA through Geostore and are listed below:

- Flood Zone 2 and 3
- updated Flood Map for Surface Water (uFMfSW)

6.1.3 Results

The percentage of each site within Flood Zone 1 and uFMfSW 1 in 1000-year outline is included within the final summary of results in Appendix A. For fluvial and tidal flood risk the higher the percentage the lower the risk of flooding, whilst the opposite applies for pluvial flood risk.

Table 6-1 below shows the red / amber / green score for fluvial and tidal flood risk and pluvial flood risk for each site.

Table 6-1: Flood risk assessment

Site Ref	Location	Potential Housing Numbers	River or Sea Flood Risk	Pluvial Flood Risk
AL036	Land adjacent to 9 Chauntry Road.	3	Green	Green
AL042	Land adjacent to Peachcroft, Farlsthorpe Road.	10	Green	Green
AL302	Land off Spendluffe Avenue	90	Red	Green
AL303	Land east of Tothby Lane	43	Red	Red

39 East Lindsey District Council (September 2012) Draft Strategic Flood Risk Assessment. Accessed online at http://www.e-lindsey.gov.uk/article/2202/Strategic-Flood-Risk-Assessment on 15/12/2015.

Site Ref	Location	Potential Housing Numbers	River or Sea Flood Risk	Pluvial Flood Risk
AL304	Land to rear of Hunt's Depot	22	Green	Amber
AL312	Land off Tothby Lane	150	Green	Green
AL316	Land at Farlesthorpe Road	37	Green	Amber
AL325	Land off Chauntry Road.	90	Green	Green
BIN306	Land north of Louth Road	21	Red	Red
BIN307	High Street	20	Red	Amber
BIN309	Rear of Binbrook Mews, Market Place	1	Green	Green
BLM305	Land south of Hall Lane	94	Red	Amber
BLM310	Wildshed Lane	52	Green	Amber
BLM313	Land south of Wildshed Lane	31	Green	Red
BLM318	Station Road	8	Green	Red
C&T305	Land off Park Lane	160	Green	Green
C&T306	Leagate Road	57	Green	Green
C&T311	Tumby Road	54	Green	Red
C&T313	Leagate Farm	96	Green	Green
FRIS301	Land adj Beech Cottage, Church Road	63	Red	Green
FRIS306	Land Adj Fendale, Low Gate	10	Red	Amber
FRIS311	Church Lane/Yawling Gate	15	Red	Green
FRIS316	Low Road/The Avenue	3	Red	Green
FRIS317	Church End	2	Red	Green
FRIS321	Burgh Road	20	Red	Green
GRA209	Poors End, Grainthorpe	9	Green	Green
GRA211	Land north of Staples Garth, Grainthorpe	9	Red	Amber
GRA312	Land at Garth House, Main Road	1	Red	Amber
HLC206	Former scrapyard, r/o 1 Louth Road, Holton le Clay	19	Green	Amber
HLC301	Land Opp Jug and Bottle	337	Green	Amber
HLC302	Land off Church Lane	32	Green	Red
HLC303	Land east of Louth Road	292	Green	Red
HLC304	Land north of Tetney Road	19	Green	Amber
HLC305	Land north of Louth Road	91	Green	Amber
HOG306	Land off West End	89	Red	Green
HOG309	Tumby Road	11	Red	Green
HOR050	Land at the Wong	12	Green	Green
HOR063	Land adjacent to Greystones, Lincoln Road	12	Green	Green
HOR301	Land east of Lincoln Road	500	Green	Green
HOR303	Land east of Elmhirst Road	16	Red	Amber
HOR308	Land off Station Lane/The Sidings	25	Green	Amber
HOR312	Linpac Site, Mareham Road	49	Green	Green
HOR314	Land south of Banovallum Gardens	146	Green	Red
HOR315	Land south of Spilsby Road	60	Green	Amber
HOR320	Highways Depot, Hemingby Lane	43	Green	Amber
HOR324	off Lincoln Road	24	Green	Green
HOR327	Land on Lincoln Road	7	Green	Green
HOR330	Land off Mareham Road	230	Green	Red
HOR333	Land to the west of Churchill Avenue	124	Amber	Red
HUT206	Adj Hemingby House, Mumby Road, Huttoft	3	Green	Green
HUT306	Adjacent Hemingby House, Mumby Road	13	Green	Green
LEG303	Extension of Househams Lane, Legbourne	66	Green	Green
LEG307	Station Road	3	Green	Green
LEG313	Land off Station Road	1	Green	Green
LO044	Land off St Marys Lane (Close to Grimsby Rd end)	4	Green	Green
LO096	Land to rear of property off Hortons Yard, Kidgate	5	Green	Green
LO099	Land to rear of The Kings Head PH, Mercer Row	2	Green	Green
LO143	Land between Spire View Road and Pleasant Avenue	16	Green	Green
LO154	Land to rear of 87-107 Eastfield Road	5	Red	Green
LO155	Land to rear of 119-155 Eastfield Road	8	Green	Red
LO301	Land east of A16	30	Green	Green

Site Ref	Location	Potential Housing Numbers	River or Sea Flood Risk	Pluvial Flood Risk
LO305	Land adjoining Greenways, Brackenborough Road	129	Green	Amber
LO306	Land between Keddington Road and Brackenborough Road	400	Green	Amber
LO311	Land adjacent to Louth United Football Ground	396	Green	Amber
LO312	Wallis House, Birch Road	38	Green	Amber
LO313	Land NE of Legbourne Road	240	Amber	Amber
LO324	Adj Shangri-la, Stewton Lane	1	Green	Green
LO325	Land off Shearwater Close	54	Green	Amber
LO326	Land South of Eastfield Road	76	Green	Green
LO329	Land at Legbourne Road	89	Green	Green
LO331	Land off Stewton Lane	1	Red	Red
LO339	Land at Legbourne Road	55	Green	Amber
LO341	Bluestone Rise (extension of)	5	Green	Green
LO344	Louth Garden Centre, Legbourne Road	45	Green	Amber
LO462	Land at Louth Golf Course	30	Green	Green
MAN314	Land at Carlton Road	50	Green	Amber
MAN316	Former Caravan Site	27	Green	Red
MAN330	Redundant RAF Hangers, Manby Park	142	Green	Amber
MAN332	Land at Manby Middlegate	4	Green	Amber
MAR217	End of Mill Lane, Marshchapel	34	Red	Green
MAR226	Land adj Chain Terrace, Seadyke Way, Marshchapel	15	Red	Green
MAR300	R/O Seadyke Way	15	Red	Green
MAR304	Land off Mill Lane	20	Red	Green
MLF021	Land adjacent to garage, Main Street	3	Green	Green
MLF305	Moat Farmyard, Watery Lane	35	Green	Amber
MLF328	Land off Main Street	32	Green	Red
NTH301	Station Road	33	Green	Red
NTH307	Off High Street	10	Green	Red
NTH308	East of A16	130	Green	Amber
NTH313	Land off High Street	20	Green	Red
NTH317	Land adj to Quidi Vidi	1	Green	Red
SIB302	Land to the West of A16	101	Green	Green
SIB303	Land to rear of Sibsey House	320	Red	Amber
SIB304	Land to R/O Tregarthan House, Main Road	5	Green	Amber
SIB406	Land to the rear of Page Close	34	Green	Green
SPY008	Land adjacent to Shades Hotel, Church Street	1	Green	Green
SPY301	Post Office Lane	67	Green	Green
SPY302	Land fronting and rear of 55 Ashby Road	35	Green	Red
SPY303	East of Ashby Road	100	Green	Amber
SPY304	North of Halton Road	30	Green	Green
SPY305	Land adj to Halton Road	129	Green	Green
SPY306	Land off Halton Road	70	Green	Green
SPY307	Land adjacent to 1 Ashby Meadows	1	Green	Green
STK013	Land at Station Bridge Bungalow, Main Road	10	Green	Red
STK304	Land north of Halls Lane	50	Green	Green
STK312	West of Main Road	39	Green	Amber
STK314	Adj Lynwood, Main Road	1	Green	Green
STK315	Land to rear of Main Road	20	Green	Amber
STK319	Land adjacent to a depot, Main Road	15	Green	Amber
TEF302	Land at South Road	38	Green	Amber
TEF303	South Road	12	Green	Amber
TNY308	Land west of Hoop End, Tetney	10	Red	Red
TNY311	Humberstone Road, Tetney	32	Red	Red
TNY313	Humberston Road	97	Red	Amber
TNY316	Land at Tetney Golf Club, Station Road	183	Green	Amber
WAI305	Land south of Matt Pits Lane	35	Amber	Green
WAI308	Land off Church Walk	7	Green	Green
WAI308B	Land off Station Road	9	Green	Amber

Site Ref	Location	Potential Housing Numbers	River or Sea Flood Risk	Pluvial Flood Risk
WAI401	Land off Matt Pitts Lane	11	Red	Green
WAI405	Land off Brewster Lane	3	Red	Green
WRA024	Land to rear of Thornfield, Louth Road	32	Green	Green
WRA301	Land off Victoria Street	79	Green	Amber
WRA304	Land off Bardney Road	42	Green	Green
WRA306	South of Wire Hill Lane	7	Green	Green
WRA313	Land on Bardney Road	79	Green	Amber
WSP304	Land adj to St Hughs School	100	Red	Green
WSP310	Land off Clinton Way	18	Green	Red
WSP314	Land off Witham Road	228	Green	Green
WSP315	196/198 Witham Road	13	Green	Green

6.1.4 Conclusions

The percentage of each site at risk from fluvial or surface water flooding was calculated. This information may be used to supplement the information presented at the settlement scale in the Strategic Flood Risk Assessment. Refer to this document for a detailed flood risk assessment.

6.2 Assess flooding from increased Water Recycling Centre discharge

In catchments with a large planned growth in population and which discharge effluent to a small watercourse, the increase in the discharged effluent might have a negative effect on the risk of flooding. An assessment has been carried out in order to quantify such effect.

6.2.1 Methodology

The following process has been used to assess the potential increased risk of flooding due to extra flow reaching a specific WRC:

- Identify which WRCs will be receiving additional flows;
- Calculate the increase in DWF as a result of planned growth;
- Identify the point of discharge of these WRCs;
- At each outfall point, use the FEH CD-ROM v3.0 to extract the catchment descriptors;
- Use ReFH[40] method to calculate peak 1 in 30 (Q30) and 1 in 100 (Q100) year fluvial flows at the WRC outfall;
- Calculate the additional foul flow as a percentage of the Q30 and Q100 flow.

A red / amber / green score was applied to score the associated risk as follows:

Additional flow ≤5% of Q30. Low risk that increased discharges will increase fluvial flood risk	Additional flow ≥5% of Q30. Moderate risk that increased discharges will increase fluvial flood risk	Additional flow ≥5% of Q100. High risk that increased discharges will increase fluvial flood risk

Only the seven WRCs assessed for the water quality impact assessment have been assessed to understand the risk of flooding from increased WRC discharge. Please note that whilst the other WRCs not considered in this assessment may have capacity within their consents to accommodate the planned growth scenarios, this does not necessarily imply that the increase in the discharged effluent will not have a negative effect on the risk of flooding.

6.2.2 Data collection

The datasets used to assess the risk of flooding are the following:

- Current and predicted future DWF for each WRC

40 Note: ReFH2 was released in February 2015. This implements improvements which are mainly relevant to permeable and urbanised catchments. As the study catchments are not permeable or highly urbanised, and that the ReFH method is not being used to generate hydrographs in this case, ReFH1 has been used. The ReFH boundary unit in ISIS Free v3.7.0.233 was used.

- Location of WRC outfall
- Catchment descriptors from FEH CD-ROM v3.0[41]

6.2.3 Results

Table 6-2 shows that the effect of the increase of flow due to the future development has a negligible effect on the predicted peak flow for events with return period of 30 and 100 years. The WRC with the highest flow increase is Woodhall Spa with a predicted 0.31% increased risk during a 30 year return period event due to the small drain the WRC discharges into.

41 FEH CD-ROM v3.0 © NERC (CEH). © Crown copyright. © AA. 2009. All rights reserved.

Table 6-2: Summary of the predicted DWF increase

WRC	Receiving watercourse	ReFH Q30 (m^3/s)	ReFH Q100 (m^3/s)	Current DWF (m^3/d)	Max predicted DWF (m^3/d)	Flow increase (m^3/d)	Flow increase (m^3/s)	Flow increase % Q30	Flow increase % Q100
Coningsby	River Bain	15.6	22.3	1629	1917	288	<0.01	0.02%	0.01%
Horncastle	Old River Bain	1.6	2.2	2738	3148	410	<0.01	0.29%	0.21%
Legbourne	Drain / Long Eau	0.5	0.8	269	298	28	<0.01	0.06%	0.04%
Louth	Louth Canal	6.2	9.3	7716	8689	973	0.01	0.18%	0.12%
Manby	Drain / Long Eau	0.3	0.5	1400	1457	56	<0.01	0.19%	0.14%
Sibsey	Mallows Drain	0.4	0.6	452	519	67	<0.01	0.18%	0.14%
Woodhall Spa	Drain / River Witham	0.5	0.7	1637	1774	137	<0.01	0.31%	0.23%

Notes: The above flood estimates are based solely on extracted catchment descriptors. They are suitable only for this simple analysis of the impact of WRC effluent flows, and should not be used for flood modelling purposes.

Max predicted DWF correlates to Scenario 4, except for Legbourne WRC which correlates to Scenario 3/5.

6.2.4 Conclusions

The impact of increased effluent flows is unlikely to have a significant impact upon flood risk in the receiving watercourses.

6.2.5 Recommendations

None

6.3 Assess surface water drainage

New developments may increase the runoff volume that reach the surface water drainage system with the risk of overloading it and increase the risk of flooding during heavy rain events. Additionally, conventional urban drainage systems have significant impacts on catchment hydrology and water quality. Surface water runoff from development sites should be managed following the SuDS hierarchy, and from April 2015 is now managed via the planning system, with the Lead Local Flood Authority (LLFA) Lincolnshire County Council being a statutory consultee on surface water drainage issues on major developments.

This assessment investigates whether development of a site may increase the surface water flood risk downstream of it and whether the site may be required to provide “betterment” to reduce existing downstream flood risk. Similarly, where there is currently a surface water flood risk to the site, whether a local solution may need to be considered to protect the new developments.

This assessment also identifies the potential opportunities to manage surface water at each preferred site, including the potential to use infiltration drainage techniques. Where the soils are freely draining and there isn't a high water table the potential to use infiltration components is high, however investigations should be undertaken on a site by site basis and suitability may vary across the entire site. A risk assessment should be undertaken when infiltrating into areas of contaminated land.

The Environment Agency’s Source Protection Zones (SPZ) have been checked to determine the level of treatment steps required before surface water is infiltrated to prevent the pollution of groundwater. The EA supports the use of SuDS for new discharges, including within SPZ 1, providing there is no pollution or risk of groundwater flooding. The augmentation of groundwater resources through SuDS or artificial recharge are further encouraged where water resources are scarce or where it would help reduce flood risk from development.

Where infiltration SuDS are proposed for anything other than clean roof drainage (see G12 in section 3.3.3.7) in a SPZ 1 the EA will require a risk assessment to demonstrate that pollution of groundwater would not occur. The drainage system would also require approval from the LLFA. The discharge of clean roof water to ground is acceptable both within and outside SPZ 1 provided that all roof water down-pipes are sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. Also note that there is no assumption within any of the position statements within the EA's Groundwater protection: Principles and practice (GP3)[42] document that discharges to ground outside of SPZ 1 (but within SPZ 2 or 3) are acceptable without a risk assessment. Ultimately the developer is obliged to ensure their proposals will not involve any "direct input" of hazardous substances to groundwater and ensure any discharges of polluting matter are therefore avoided. Most discharges within a SPZ would need to be looked at on a case by case basis.

6.3.1 Methodology

A GIS exercise was carried out to determine, for each site, the following three questions:

- Is the site likely to be suitable for infiltration SuDS techniques to be applied?
- Could the site be required to provide "betterment" in order to reduce downstream flood risk to existing communities?
- Is the site identified as being a significant surface water flow pathway or ponding area?

The method for assessing these is described below:

Is the site likely to be suitable for infiltration SuDS techniques to be applied?

42 Environment Agency (2013) Groundwater protection: Principles and practice (GP3). Accessed online at https://www.gov.uk/government/publications/groundwater-protection-principles-and-practice-gp3 on 10/03/2016

The bedrock, superficial deposits and soil characteristic for each site were identified, as well as whether it is within a SPZ or contains a historic or current landfill site.

Based on these physical characteristics an infiltration SuDS appraisal red / amber / green score and more detailed comment was given to each site. The individual comment for each site can be seen in Appendix A. The red / amber / green assessment definition is as follows:

Most SuDS techniques should be suitable including infiltration components as the soils are freely draining.	The soils generally have impeded drainage and/or the groundwater levels are high which limits the use of infiltration SuDS. Further site investigation is required.	Site is in an area which is confirmed to not be suitable for infiltration SuDS techniques.

Could the site be required to provide "betterment" in order to reduce downstream flood risk to existing communities?

A separate GIS exercise was carried out to determine whether the site is located at the upstream or along an uFMfSW flow path such that the site could be used to provide "betterment" to the existing downstream flood risk. At a minimum it should be shown during the planning stage that the development of a site will not increase flood risk downstream but this assessment shows where there are potential opportunities to also provide "betterment". For example runoff from site BIN307 in Figure 6-1 would naturally contribute to the uFMfSW flow path unless the site drainage was designed to reduce runoff rates and manage the water on site potentially reducing the risk downstream.

The potential for downstream betterment at each site was assessed thus:

a. Given the location of the site, development is potentially a good opportunity to provide "betterment" to reduce existing downstream flood risk, through a carefully designed drainage strategy, or
b. There is no significant flood risk downstream of the site and therefore the site would not be required to provide "betterment" to reduce existing flood risk.

In Table 6-3 the letter 'a' or 'b' has been used to identify which of the above statements represents the potential for downstream betterment at each site

Is the site identified as being a significant surface water flow pathway or ponding area?

The uFMfSW was also used to determine if the site was currently at flood risk and whether a local solution (SuDS) may need to be considered to protect the new developments. For example site BIN306 in Figure 6-1 is at high risk from pluvial flooding and as well as passing the Sequential Test a drainage strategy should be submitted demonstrating how existing surface water flow paths will be managed and show how the new development will be protected through the use of sequential planning, SuDS and design for exceedance.

A red / amber / green assessment was applied:

Site is at low risk from surface water flooding but on site drainage will need to be managed with a local solution as part of the overall site design.	Site is currently at medium / high risk from surface water flooding which will need to be managed with a local solution as part of the overall site design.

Figure 6-1: Surface water drainage assessment examples

6.3.2 Data collection

The datasets used to assess the surface water drainage and infiltration potential are listed below:

- British Geology Survey bedrock and superficial deposits 1: 625 000 scale
- Soil map[43]
- Source Protection Zones (provided through EA Geostore)
- Historic landfill sites and landfill sites (provided through EA Geostore)
- updated Flood Map for Surface Water (provided through EA Geostore)
- EA OpenData 2m LIDAR

6.3.3 Results

Table 6-3 below shows the red / amber / green score for the infiltration SuDS appraisal and surface water drainage assessment for each site.

The SuDS appraisal additional comments for each site is included within the final summary of results in Appendix A.

43 Soilscape map. Accessed online at www.landis.org.uk/soilscapes/

The final column shows which IDB the site falls within. Those labelled 'region' fall within either the Lindsey Marsh, Witham Third or Witham Fourth IDB boundaries. Those labelled as 'catchment' fall within the extended IDB catchment boundaries. Within both areas the IDBs undertake duties on behalf of Lincolnshire's Lead Local Flood Authority.

Note that the letters 'a' and 'b' in the 'Site potential to provide betterment to downstream flood risk' column refers to the assessment definitions provided in the methodology section (section 6.3.1).

Table 6-3: Surface water drainage assessment

Site Ref	Infiltration SuDS appraisal	Site potential to provide betterment to downstream flood risk	Site identified as being a significant surface water flow pathway or ponding area	IDB region / catchment
AL036	Green	b	Green	Lindsey Marsh region
AL042	Amber	b	Green	Lindsey Marsh region
AL302	Amber	b	Green	Lindsey Marsh region
AL303	Green	a	Red	Lindsey Marsh region
AL304	Amber	a	Red	Lindsey Marsh catchment
AL312	Amber	a	Green	Lindsey Marsh catchment
AL316	Amber	b	Red	Lindsey Marsh region
AL325	Amber	b	Green	Lindsey Marsh catchment
BIN306	Green	a	Red	Lindsey Marsh catchment
BIN307	Green	a	Red	Lindsey Marsh catchment
BIN309	Green	b	Green	Lindsey Marsh catchment
BLM305	Amber	b	Red	Lindsey Marsh region
BLM310	Amber	b	Red	Lindsey Marsh catchment
BLM313	Amber	b	Red	Lindsey Marsh region
BLM318	Amber	a	Red	Lindsey Marsh catchment
C&T305	Amber	a	Green	Witham Fourth catchment
C&T306	Amber	b	Green	Witham Fourth catchment
C&T311	Amber	a	Red	Witham Fourth catchment
C&T313	Amber	b	Green	Witham Fourth catchment
FRIS301	Amber	b	Green	Witham Fourth region
FRIS306	Amber	b	Red	Witham Fourth region
FRIS311	Amber	b	Green	Witham Fourth region
FRIS316	Amber	b	Green	Witham Fourth region
FRIS317	Amber	b	Green	Witham Fourth region
FRIS321	Amber	b	Green	Witham Fourth region
GRA209	Amber	b	Green	Lindsey Marsh region
GRA211	Amber	b	Red	Lindsey Marsh region
GRA312	Amber	b	Red	Lindsey Marsh region
HLC206	Amber	a	Red	Lindsey Marsh catchment
HLC301	Amber	a	Red	Lindsey Marsh catchment
HLC302	Amber	a	Red	Lindsey Marsh catchment
HLC303	Amber	b	Red	Lindsey Marsh catchment
HLC304	Amber	b	Red	Lindsey Marsh catchment
HLC305	Amber	b	Red	Lindsey Marsh catchment
HOG306	Amber	b	Green	Lindsey Marsh region
HOG309	Amber	b	Green	Lindsey Marsh region
HOR050	Amber	b	Green	Witham Third region
HOR063	Amber	b	Green	Witham Third catchment
HOR301	Amber	a	Green	Witham Third region
HOR303	Amber	a	Red	Witham Third region
HOR308	Amber	a	Red	Witham Third catchment
HOR312	Amber	a	Green	Witham Third catchment
HOR314	Amber	a	Red	Witham Third catchment
HOR315	Amber	a	Red	Witham Third catchment
HOR320	Amber	a	Red	Witham Third region
HOR324	Green	b	Green	Witham Third catchment
HOR327	Green	b	Green	Witham Third catchment
HOR330	Amber	a	Red	Witham Third catchment
HOR333	Amber	a	Red	Witham Third region

Site Ref	Infiltration SuDS appraisal	Site potential to provide betterment to downstream flood risk	Site identified as being a significant surface water flow pathway or ponding area	IDB region / catchment
HUT206	Amber	a	Green	Lindsey Marsh region
HUT306	Amber	a	Green	Lindsey Marsh region
LEG303	Amber	a	Green	Lindsey Marsh catchment
LEG307	Amber	b	Green	Lindsey Marsh catchment
LEG313	Amber	b	Green	Lindsey Marsh catchment
LO044	Green	a	Green	Lindsey Marsh catchment
LO096	Amber	b	Green	Lindsey Marsh catchment
LO099	Amber	b	Green	Lindsey Marsh catchment
LO143	Amber	a	Green	Lindsey Marsh catchment
LO154	Amber	b	Green	Lindsey Marsh region
LO155	Amber	b	Red	Lindsey Marsh region
LO301	Amber	a	Green	Lindsey Marsh catchment
LO305	Amber	a	Red	Lindsey Marsh catchment
LO306	Amber	a	Red	Lindsey Marsh catchment
LO311	Amber	a	Red	Lindsey Marsh catchment
LO312	Amber	a	Red	Lindsey Marsh catchment
LO313	Amber	a	Red	Lindsey Marsh catchment
LO324	Amber	b	Green	Lindsey Marsh catchment
LO325	Amber	b	Red	Lindsey Marsh catchment
LO326	Amber	a	Green	Lindsey Marsh catchment
LO329	Amber	b	Green	Lindsey Marsh catchment
LO331	Amber	a	Red	Lindsey Marsh catchment
LO339	Amber	b	Red	Lindsey Marsh catchment
LO341	Amber	b	Green	Lindsey Marsh catchment
LO344	Amber	b	Red	Lindsey Marsh catchment
LO462	Amber	a	Green	Lindsey Marsh catchment
MAN314	Amber	a	Red	Lindsey Marsh catchment
MAN316	Amber	a	Red	Lindsey Marsh catchment
MAN330	Amber	a	Red	Lindsey Marsh catchment
MAN332	Amber	b	Red	Lindsey Marsh catchment
MAR217	Amber	b	Green	Lindsey Marsh region
MAR226	Amber	b	Green	Lindsey Marsh region
MAR300	Amber	b	Green	Lindsey Marsh region
MAR304	Amber	b	Green	Lindsey Marsh region
MLF021	Amber	b	Green	Witham Fourth catchment
MLF305	Amber	a	Red	Witham Fourth catchment
MLF328	Amber	a	Red	Witham Fourth region
NTH301	Amber	a	Red	Lindsey Marsh catchment
NTH307	Amber	a	Red	Lindsey Marsh catchment
NTH308	Amber	b	Red	Lindsey Marsh catchment
NTH313	Amber	a	Red	Lindsey Marsh catchment
NTH317	Amber	a	Red	Lindsey Marsh catchment
SIB302	Amber	b	Green	Witham Fourth region
SIB303	Amber	b	Red	Witham Fourth region
SIB304	Amber	b	Red	Witham Fourth region
SIB406	Amber	b	Green	Witham Fourth region
SPY008	Green	b	Green	Lindsey Marsh region
SPY301	Green	b	Green	Lindsey Marsh region
SPY302	Green	b	Red	Lindsey Marsh region
SPY303	Green	b	Red	Lindsey Marsh region
SPY304	Green	b	Green	Lindsey Marsh region
SPY305	Green	b	Green	Lindsey Marsh region / Witham Fourth region
SPY306	Green	b	Green	Lindsey Marsh region
SPY307	Green	b	Green	Lindsey Marsh region
STK013	Amber	b	Red	Witham Fourth region
STK304	Amber	b	Green	Witham Fourth region
STK312	Amber	b	Red	Witham Fourth region

Site Ref	Infiltration SuDS appraisal	Site potential to provide betterment to downstream flood risk	Site identified as being a significant surface water flow pathway or ponding area	IDB region / catchment
STK314	Amber	b	Green	Witham Fourth region
STK315	Amber	b	Red	Witham Fourth region
STK319	Amber	b	Red	Witham Fourth region
TEF302	Green	b	Red	Lindsey Marsh catchment
TEF303	Green	b	Red	Lindsey Marsh catchment
TNY308	Amber	b	Red	Lindsey Marsh region
TNY311	Amber	a	Red	Lindsey Marsh region
TNY313	Amber	b	Red	Lindsey Marsh region
TNY316	Amber	a	Red	Lindsey Marsh catchment
WAI305	Amber	b	Green	Lindsey Marsh region
WAI308	Amber	b	Green	Lindsey Marsh region
WAI308B	Amber	b	Red	Lindsey Marsh region
WAI401	Amber	b	Green	Lindsey Marsh region
WAI405	Amber	b	Green	Lindsey Marsh region
WRA024	Amber	b	Green	Witham Third catchment
WRA301	Amber	a	Red	Witham Third catchment
WRA304	Amber	b	Green	Witham Third catchment
WRA306	Amber	b	Green	Witham Third catchment
WRA313	Amber	b	Red	Witham Third catchment
WSP304	Amber	b	Green	Witham Third region
WSP310	Amber	b	Red	Witham Third region
WSP314	Amber	b	Green	Witham Third region
WSP315	Amber	b	Green	Witham Third region

6.3.4 Conclusions

The surface water drainage assessment has brought the following conclusions:

- In general, sites in the Lincolnshire Wolds have freely draining soils ideal for infiltration SuDS in contrast to the soils with impeded drainage and high groundwater levels closer the coast and to the west.
- A number of the sites (located within Alford, Binbrook, Holton Le Clay, Louth, Manby, Marshchapel, North Thoresby and Tetney) are within the Environment Agency's Source Protection Zones (SPZ) and the use of infiltration SuDS in these areas may be restricted although the risk of groundwater contamination from SuDS can be effectively managed. SuDS are further encouraged in water scarce regions to improve (or maintain) recharge of an aquifer. The suitability of SuDS will need to be assessed on a site by site basis through a risk assessment which would require approval from LCC as LLFA and the EA.
- Sites were also assessed to determine whether development may increase the surface water flood risk downstream and whether the site may be required to provide "betterment" to reduce existing downstream flood risk. Similarly, sites were identified where there is currently a surface water flood risk to the site which will need to be managed with a local solution (such as SuDS) as part of the overall site design to protect the new developments.

6.3.5 Recommendations

Table 6-4: Surface water drainage actions

Action	Responsibility	Timescale
Consider the potential to use SuDS in selection of site allocations.	ELDC	Ongoing
Drainage of the site should be considered at the earliest stages of site design. Consultation with the LCC (as LLFA), AW and, where applicable, the IDB is essential.	Developers	Ongoing
Any development must pass the Sequential Test. Sequential design of a new site should ensure that built development and access routes are entirely within Flood Zone 1 and should avoid impacting on surface water flow routes or ordinary watercourses.	Developers	Ongoing
A Drainage Strategy must be submitted at the earliest opportunity to show how the impact of the development will be reduced through the use of SuDS techniques, with surface water run-off rates attenuated following the Non-statutory technical standards for sustainable drainage systems[44]. The Drainage Strategy should demonstrate that existing surface water flow paths will be preserved.	Developers	Ongoing
Opportunities should be exploited at the master planning stage for multiple benefits in terms of integrated sustainable drainage, green infrastructure, amenity, biodiversity and WFD status.	Developers	Ongoing

44 Department for Environment, Food and Rural Affairs (March 2015) Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems. Accessed online at https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards on 14/03/2016.

7 Environmental Constraints and Opportunities

7.1 Methodology

A GeoPDF map has been created for each of the 24 settlements to easily identify environmental risks and opportunities associated with the 129 proposed allocation sites. The GeoPDF maps allow for a range of notable environmental designations and features to be displayed 'on' or 'off' with the aim of being able to quickly identify the presence of environmental features within or close to the proposed sites. The maps should be used in conjunction with Sustainability Appraisals (SA) and/or Strategic Environmental Assessments (SEAs) when these are available.

The maps can be used to identify the distance of a site from an environmental features. The distance at which the feature becomes significant to the development of the site depends on the type, nature and potential sensitivity of different environmental designations and features to the development of the sites for residential use. Table 7-2 shows the approximate distance at which a feature may become significant to the development of the site. The potential adverse impacts associated with development of the sites were then considered in relation to these features, and potential environmental opportunities, such as habitat creation or recreational opportunities were also identified.

The environmental assessment provides an overview of the wider environment within the ELDC area and the potential risks and opportunities associated with the development of the proposed sites. The traffic-light scoring system has not been applied to this element of the study as its focus is on risks to the water environment, whilst the environmental appraisal has also considered the sensitivity of non-water related features. As such, there may be instances where development does not pose a risk to the water environment but could have a detrimental effect or could lead to an improvement to a sensitive environmental feature i.e., designated habitat, historic monument, etc. Application of a scoring system may therefore result in a misleading outcome in relation to such sites.

7.2 Data collection

Information was collected on a range of environmental designations and features (Table 7-1). This information was provided by the EA, East Lindsey District Council or sourced from OS OpenData. The features were grouped into seven topic areas: Biodiversity, Historic environment, Landscape, Water, Geology and soils, Air and Waste (see Table 7-2).

Table 7-1: Environmental designations and features

Environmental feature	Description	Relevant to ELDC area
Agricultural Land Classification	Agricultural Land Classification (ALC) is a method for assessing the quality of farmland. The ALC system classifies land into five grades: Grade 1: Excellent Grade 2: Very Good Grade 3: 3a – Good / 3b – Moderate Grade 4: Poor Grade 5: Very Poor The highest quality and most versatile land is defined as Grades 1, 2 and 3a.	Yes
Air Quality Management Area	An area that the local authority must declare where national air quality objectives are not likely to be achieved.	No
Ancient or Semi-Natural Woodland	Ancient woodland is land that has had a continuous woodland cover since at least 1600 AD, and may be ancient semi-natural woodland (ASNW), which retains a native tree and shrub cover that has not been planted.	Yes
Aquifer - Bedrock / Superficial Deposits	Underground layers of water-bearing permeable rock or drift deposits from which groundwater can be extracted. These are split into: Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels. Bedrock - solid permeable formations e.g. sandstone, chalk and limestone. These classifications are further split into the following	Yes

Environmental feature	Description	Relevant to ELDC area
	designations: Principle Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability. Secondary Aquifers include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage.	
Area of Great Landscape Value	A non-statutory area designated by the local planning authority within which the quality of the landscape is of overriding significance. Development should not harm its special character and particular regard should be given to the siting, mass, scale, appearance, external materials used, external lighting and extent of any associated landscape proposals.	Yes
Area of Outstanding Natural Beauty	An Area of Outstanding Natural Beauty (AONB) is an area of high scenic quality which has statutory protection in order to conserve and enhance the natural beauty of its landscape. AONB landscapes range from rugged coastline to water meadows to gentle lowland and upland moors.	Yes
Conservation Area	Conservation Areas are designated for their special architectural and historic interest. Most are designated by the local planning authority and place restrictions on a range of development including property alterations, tree works, advertisements and demolition.	Yes
Green Belt	A designation for land around certain cities and large built-up areas. The fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open. Inappropriate development that is harmful to the Green Belt should not be approved except in very special circumstances.	No
Green Corridor	Green corridors are areas identified by the council that link development to amenity areas and help to promote environmentally sustainable forms of transport such as walking and cycling within urban areas. They also act as vital linkages for wildlife dispersal between urban and rural areas.	No
Groundwater Source Protection Zones	Source Protection Zones (SPZs) are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.	Yes
Landfill/Historic Landfill	Landfill sites and Historic landfill sites are places where records indicate waste materials have been buried. Some sites remain open to further waste deposits (landfill), whilst others are now closed or covered (historic landfill).	Yes
Listed Building	Listed buildings are buildings or structures of exceptional architectural or historic special interest. Listed building have three grades: Grade I buildings are of exceptional interest, sometimes considered to be internationally important; Grade II* buildings are particularly important buildings of more than special interest; and Grade II buildings are nationally important and of special interest.	Yes
Local Wildlife Site	Local Wildlife Sites (LWSs) are non-statutory areas of local importance for nature conservation that complement nationally and internationally designated geological and wildlife sites. Local Wildlife Sites are protected within the local planning system. They are a 'material consideration' in the determination of planning applications, and there is a general presumption against development upon them. Also referred to as Site of Nature Conservation Interest (SNCI) or Site of Importance for Nature Conservation (SINC).	Yes
National Nature Reserve	A National Nature Reserve (NNR) is one of the finest sites in England for wildlife and/or geology. A NNR is given protection against damaging operations, and any such operations must be authorised by the designating body. It also has strong protection against development on and around it.	Yes
National Park	National Parks are areas protected for their outstanding value in terms of natural beauty, ecological, archaeological, geological and	No

Environmental feature	Description	Relevant to ELDC area
	other features, and recreational value.	
National Trails	National Trails are long distance walking, cycling and horse riding routes through the best landscapes in England and Wales.	No
Ramsar Site	Ramsar sites are wetlands of international importance, designated under the Ramsar Convention 1971. As a matter of UK Government policy, Ramsar sites are protected as European sites (as set out in the Habitats Regulations).	Yes
Registered Battlefield	Registered battlefields are designated heritage assets and are included on the English Heritage Register of Historic Battlefields. Its purpose is to offer them protection and to promote a better understanding of their significance.	Yes
Registered/Historic Park and Garden	Registered parks and gardens are designated heritage assets and planning authorities must consider the impact of any proposed development on the landscapes' special character.	Yes
Scheduled Monument	Scheduled Monuments are historic sites of national importance and are protected under the Ancient Monuments and Archaeological Areas Act, as amended by the National Heritage Act 1983.	Yes
Site of Special Scientific Interest	Protected under a range of UK legislation, a Site of Special Scientific Interest (SSSI) is an area of land of special interest by reason of any of its flora, fauna, geological or physiographical features. An SSSI is given certain protection against damaging operations, and any such operations must be authorised by the designating body.	Yes
Special Area of Conservation / Sites of Community Importance	A Special Area of Conservation (SAC) is an area which has been given special protection under the European Union's Habitats Directive (as transcribed into UK law under the Conservation of Habitats and Species Regulations 2010 (As amended) – known as the 'Habitats Regulations'). SACs provide increased protection to a variety of wild animals, plants and habitats and are a vital part of global efforts to conserve the world's biodiversity.	Yes
Special Protection Area	A Special Protection Area (SPA) is an area of land, water or sea which has been identified as being of international importance for the breeding, feeding, wintering or migration of rare and vulnerable bird species found within the European Union. SPAs are European designated sites, classified under the European Wild Birds Directive.	Yes
Watercourse	A river, stream or other riparian feature i.e., ditch, as shown on OS mapping.	Yes
Water Framework Directive (WFD) classification	The Water Framework Directive (WFD) requires that all 'water bodies' (rivers, lakes, estuaries, coastal waters and groundwater) achieve good ecological potential by 2015. Under the WFD, all waterbodies are classified by their current and future predicted water quality, and specifically their ecological and chemical status.	Yes
World Heritage Site	World Heritage Sites are places of outstanding universal value to all humanity and are of great importance for the conservation of mankind's cultural and natural heritage. They need to be preserved for future generations, as part of a common universal heritage.	No

Table 7-2: Approximate distance an environmental feature becomes significant to the development of the site

Topic	Environmental feature	Buffer (m)
Biodiversity	Site of Special Scientific Interest (SSSI)	1000m
	Special Area of Conservation (SAC)	2000m
	Special Protection Area (SPA)	2000m
	Ramsar site	2000m
	National Nature Reserve	1000m
	Local Nature Reserves	100m
	Ancient or Semi-Natural Woodland	100m
Historic environment	Scheduled Monument	500m
	Listed Building	100m
	Registered/Historic Park and Garden	500m
	World Heritage Site	500m

Topic	Environmental feature	Buffer (m)
	Registered Battlefield	500m
Landscape	Area of Outstanding Natural Beauty (AONB)	1000m
	National Park	1000m
	National Trails	500m
	Green Belt	100m
Water	Watercourse	200m
	Water Framework Directive (WFD) classification	No Buffer applicable
	Groundwater source protection zones (SPZ)	No Buffer applicable
	Aquifer Maps - Superficial Deposits Designation	No Buffer applicable
	Aquifer Maps - Bedrock Designation	No Buffer applicable
Geology and soils	Agricultural Land Classification (ALC)	100m
Waste	Landfill	100m
	Historic Landfill	100m

7.3 Baseline natural environment

The East Lindsey area is predominately rural in character with widespread settlement pattern which is a legacy of a history of small farming communities with local markets. Farming still remains the dominant land use across the district.

East Lindsey contains a diverse range of countryside landscape features with the North Sea coastline forming the eastern boundary of the district. There are four distinctive broad landscapes in East Lindsey: the Fens around the Wash Basin, the Central Lincolnshire Clay Vale, the Chalk Wolds and the Coastal Marshes.

The Lincolnshire Wolds is the only Area of Outstanding Natural Beauty in the East Midlands region and covers approximately one third of the District's area. The Chalk Wolds are characterised by a large open plateau of rolling hills and secluded wooded valleys. The area is dominated by large arable fields. In addition, the region around the perimeter of the AONB is classified as an Area of Great Landscape Value.

Between the Wolds and the coastline, the landscapes north and south of the River Steeping are classed as marsh and fen respectively. They are both characterised by flat expansive land and 'large skies'. The peaty fens in the south lack trees and hedgerows, whilst to the north, between the Wolds and the coast, the fields are lined by small hedges with small clumps of trees. The area has numerous drainage ditches maintained by the Internal Drainage Boards.

There are three Special Conservation Area (SAC) sites, Ramsar sites and Special Protection Area (SPA) sites within the coastal region of the District. SACs, Ramsar sites and SPAs are all European designated sites and are of international importance. The Wash in the south, the Humber Estuary in the north and Gibraltar Point in the centre of the coastal region are extensive remote salt marshes rich in flora and fauna and are important areas on bird migration routes. The closest site to a SAC is MAR217 approximately 3km away.

Table 7-3: Humber Estuary SAC

Feature	Description
SAC EU code[45]	UK0030170
Area (ha)	36,657.15
General site character	- Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins) (94.9%) - Salt marshes, Salt pastures, Salt steppes (4.4%) - Coastal sand dunes, Sand beaches, Machair (0.4%) - Bogs, Marshes, Water fringed vegetation, Fens (0.4%)
Annex I habitats that are a primary reason for selection of this site	- Estuaries - Mudflats and sandflats not covered by seawater at low tide
Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site	- Sandbanks which are slightly covered by sea water all the time - Coastal lagoons - Salicornia and other annuals colonizing mud and sand

45 JNCC Humber Estuary. Accessed online at http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030170 on 14/03/2016

Feature	Description
	- Atlantic salt meadows (Glauco-Puccinellietalia maritimae) - Embryonic shifting dunes - "Shifting dunes along the shoreline with Ammophila arenaria (""white dunes"")" - "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" - Dunes with Hippopha rhamnoides
Annex II species that are a primary reason for selection of this site	Not applicable
Annex II species present as a qualifying feature, but not a primary reason for site selection	- Sea lamprey *Petromyzon marinus* - River lamprey *Lampetra fluviatilis* - Grey seal *Halichoerus grypus*

Table 7-4: Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC

Feature	Description
SAC EU code[46]	UK0030270
Area (ha)	967.65
General site character	- Salt marshes, Salt pastures, Salt steppes (35%) - Coastal sand dunes, Sand beaches, Machair (63%) - Bogs, Marshes, Water fringed vegetation, Fens (2%)
Annex I habitats that are a primary reason for selection of this site	- "Shifting dunes along the shoreline with Ammophila arenaria (""white dunes"")" - "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" - Dunes with Hippopha rhamnoides - Humid dune slacks
Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site	- Embryonic shifting dunes
Annex II species that are a primary reason for selection of this site	Not applicable
Annex II species present as a qualifying feature, but not a primary reason for site selection	Not applicable

Table 7-5: The Wash and North Norfolk Coast SAC

Feature	Description
SAC EU code[47]	UK0017075
Area (ha)	107718
General site character	- Marine areas, Sea inlets (51%) - Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins) (46%) - Salt marshes, Salt pastures, Salt steppes (3%)
Annex I habitats that are a primary reason for selection of this site	- Sandbanks which are slightly covered by sea water all the time - Mudflats and sandflats not covered by seawater at low tide - Large shallow inlets and bays - Reefs - Salicornia and other annuals colonizing mud and sand - Atlantic salt meadows (Glauco-Puccinellietalia maritimae) - Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)
Annex I habitats present as a qualifying feature, but not a primary reason for selection of	- Coastal lagoons

46 JNCC Saltfleetby-Theddlethorpe Dunes and Gibraltar Point. Accessed online at http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030270 on 14/03/2016.

47 JNCC The Wash and North Norfolk Coast. Accessed online at http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0017075 on 14/03/2016.

Feature	Description
this site	
Annex II species that are a primary reason for selection of this site	- Harbour seal *Phoca vitulina*
Annex II species present as a qualifying feature, but not a primary reason for site selection	- Otter *Lutra lutra*

There are also 47 Sites of Special Scientific Interest (SSSI) within East Lindsey. Several of these sites are located within the vicinity of the proposed draft allocation sites, and therefore could potentially be affected by pollution, disturbance or a reduction in water resources as a result of their development.

At a local level there are 220 Local Wildlife Sites and four Local Nature Reserves within the East Lindsey. There are a number of Ancient Woodland sites, principally located in and around the Lincolnshire Wolds and also in the west of the District.

There are 160 Scheduled Monuments in the District, where consent is required for any works affecting the monument from the Secretary of State. In addition, East Lindsey currently has over 1400 Listed Buildings, which occur scattered across the district located in the many small villages and towns. East Lindsey has 17 designated Conservation Areas, six historic parks and gardens that are included in the English Heritage National Register of Parks and Gardens of Special Historic Interest, and a registered Civil War battlefield at Winceby.

The distribution of good quality agricultural land within the District varies but is generally of good quality and versatile. The Lincolnshire Wolds, the central and the south of the region is classified as ALC Grade 2 (very good quality) agricultural land. There are some areas of Grade 1 (Excellent) agricultural land inland from the Wash and Humber coastal regions.

River quality in East Lindsey is generally classified as 'Moderate' with the Louth Canal, Waithe Beck upper catchment, Great Eau and upper River Bain being classified as 'Poor' ecological quality. Pressures on water quality in the District include phosphorus contamination through diffuse pollution from agricultural areas.

The eastern half of the District comprised of chalk bedrock is principally classified as Principal Aquifer with a small area in the south classified as Secondary B Aquifer. There are a many groundwater Source Protection Zones (SPZs) located in or to the east of the Lincolnshire Wolds. Source Protection Zones identify groundwater deposits sensitive to contamination, and within which pollution prevention measures may apply. A number of the proposed allocation sites are located in or near to a SPZ.

7.4 Environmental risks

GeoPDF maps of each of the settlements have been produced to show the presence of environmental features within or in proximity to the proposed sites. These can be seen in Appendix C. The presence of an environmental designation or feature may present a constraint to the development of the site or may require the implementation of mitigation measures to enable the development to proceed in a manner that does not have a significant adverse effect on the environment.

Potential adverse impacts on the environment from the development of the draft allocation sites and associated water supply/sewerage infrastructure improvements include:

- Habitat loss and species disturbance in areas associated with new infrastructure and residential developments and along pipeline routes;
- Increased surface runoff and sediment loading leading to increased turbidity in receiving watercourses;
- Pollutants in chemicals and sewage effluent affecting water quality in surface waters and groundwaters;
- Increased pressure on water resources due to over-abstraction;
- Temporary and permanent landscape and visual impacts associated with ground disturbance, construction activities and the presence of new residential development/water treatment works;

- Loss or disturbance of archaeological features in areas associated with new infrastructure and residential developments and along pipeline routes;
- Increased waterlogging or drying out of buried archaeological features due to changes in groundwater levels and surface water runoff;
- Increased energy consumption and carbon emissions associated with construction and operation of new development, and the piping and treatment of increased volumes of water;
- Temporary air quality impacts associated with dust generated during construction; and
- Noise and vibration generated from construction activities.

A number of the sites have a watercourse or drainage ditch running through them or along their boundary. River corridors form natural wildlife corridors and are an important feature of the landscape in the District, requiring adequate buffer zones free of development. An assessment should be made of the impact of site development on the WFD status of each waterbody that site water will drain into. The assessment should consider both water quality and quantity. Measures may need to be provided to avoid any impact on water quality or channel morphology in these waterbodies.

The Council should aim to set back development a minimum of 6m from watercourses (wider buffers of 7-8m are set by the EA regions for Main Rivers), providing buffer strip to 'make space for water' and allow additional capacity to accommodate climate change. Developments should look at opportunities for river restoration, de-culverting and river enhancement as part of the development. Such measures could provide an important contribution to the WFD objectives for the watercourse.

Many sites are near to watercourses therefore restricted development in flood zones could be used to provide flood storage areas and provide a number of other environmental opportunities such as biodiversity and recreational benefits.

The sites within Binbrook and Tetford are within the Lincolnshire Wolds AONB and development in this area may be restricted. Appropriate mitigation will need to be agreed with ELDC to avoid any adverse impact on the landscape quality of the AONB.

Many of the sites fall on agricultural land classified as ALC Grade 1 (excellent) or 2 (very good). ELDC will need to justify the loss of the 'best and most versatile land' rather than develop poorer quality land.

A few sites are within close proximity of an SSSI, therefore the SSSI could potentially be affected by pollution, disturbance or a reduction in water resources as a result of the development. In addition, water sensitive sites in the District could be affected by changes in flow conditions in local watercourses and groundwater flow, and impacts on water quality. This indicates that development of an allocation site could present a risk to the features of the SSSI, particularly if there is a direct pathway between the site and the SSSI. These risks may include habitat loss, contamination or disturbance through the release of contaminants from the development site or increased public access (for amenity purposes) to the designated site. Operations likely to damage the special interest of a SSSI have been identified by Natural England; therefore an assessment of each individual development proposal would need to be made to determine whether a development is likely to have an effect. Mitigation measures such as introducing buffer zones and creating new habitats within the allocation sites may help reduce any potential adverse effects, while also providing new habitat for mobile interest features from the SSSI. No sites are within 3km of Humber Estuary SAC, Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC or The Wash and North Norfolk Coast SAC. However, other development sites will also need to be assessed if a pathway to a SAC exists and adverse effects are likely.

A few of the sites are located close to a known landfill site. A risk assessment would be required to determine the potential for the development site to be contaminated or for the presence of pathways between the development site and landfill that could be created through its development. Contamination of groundwater and surface waters could occur if pathways from the landfill site are created.

Settlements located in the eastern part of the District are located within an area designated as an aquifer. Most of these sites lie on Principal Aquifer, which is geology that exhibits high irregular and/or fracture permeability, usually providing a high level of water storage. These aquifers may

also support water supply and/or river base flow on a strategic scale[48]. Some sites are also on superficial deposits, mainly categorised as 'Secondary A', which are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers. Therefore, many, if not all, sites may require measures to avoid the risk of groundwater contamination.

Sites within Alford, Binbrook, Holton Le Clay, Louth, Manby, Marshchapel, North Thoresby and Tetney are located within groundwater Source Protection Zones. There may be restrictions on the use of SuDS in SPZs, although the risk of groundwater contamination from SuDS can be effectively managed. The use of SuDS also provides an opportunity to improve (or maintain) recharge of the aquifer. SuDS can have numerous benefits by creating wildlife habitats, recreation and amenity areas and improvements to the local landscape. The suitability of SuDS will need to be assessed on a site by site basis through a risk assessment which would require approval from the LLFA and EA.

7.5 Management options and policies

The following management options outline how the proposed site allocations can minimise their impact on the neighbouring watercourses by reducing both diffuse and point sources of pollution.

New developments are required to attenuate surface water runoff and SuDS are the recommended approach as stated in NPPF, paragraph 51[49] of the Planning Practice Guidance and Building Regulations H. The implementation of SuDS schemes can:

- Mitigate the impact on receiving waters by holding and treating urban surface water run-off at or near to the source;
- Slow down surface runoff during heavy rain, reducing flooding problems;
- Provide new still water (i.e., ponds and ditches) and wetland habitat to benefit biodiversity;
- Offer recreational and amenity opportunities to local residents; and
- Enhance the local landscape character.

HR Wallingford's study, '*Maximising the Ecological Benefits of Sustainable Drainage Schemes*' (2003)[50], advises that the maximum ecological benefits derived from SuDS may come from improvements to the still water aquatic environment and that the best that can often be achieved for the receiving waters is to prevent further deterioration. However, research indicates that whilst ponds and ditches may support quite rich wildlife communities, most SuDS schemes do not fulfil their ecological potential. This is due to inappropriate design features or a lack of maintenance of the structures leading to poor water quality and domination by common plant species. The design of a SuDS scheme would need to be specific to the development site and would need to meet the topographic and hydrological characteristics present there.

Riparian buffer strips can also be provided adjacent to watercourses within the development site or along its periphery. Buffer strips provide an intermediate protection zone between developed land and areas of conservation value, restricting the flow of pollutants and preventing them from being washed from the site into the watercourse. The width of the buffer strips will depend on the size of the water body. Natural England guidance[51] in relation to buffer strips adjacent to agricultural land states that *'Generally speaking, the wider the buffer the better the protection for the water body. Current evidence shows that 6m is the minimum effective width.'* Scottish Environmental Protection Agency (SEPA) guidance[52] for riparian zones for wildlife benefit states that a strip of at least 10m is recommended.

Impermeable surfaces in urban areas reduce rates of infiltration and therefore reduce rates of recharge to the underlying aquifers. Additional impermeable surfaces in areas with poor

48 Environment Agency (2016) Aquifers. Accessed online at http://apps.environment-agency.gov.uk/wiyby/117020.aspx on 14/03/2016.

49 Planning Policy Guidance (revision date 23.03.2015). Accessed online at http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/why-are-sustainable-drainage-systems-important/#paragraph_051 on 14/03/2016.

50 HR Wallingford Maximising the Ecological Benefits of Sustainable Drainage Schemes December 2003

51 Natural England (2011), Protecting water from agricultural runoff: buffer strips (TIN100), First edition, September 2011. Accessed online at http://adlib.everysite.co.uk/adlib/defra/content.aspx?doc=266477&id=276564 on 14/03/2016

52 SEPA (2009), Riparian Vegetation Management Good Practice Guide. Accessed online at https://www.sepa.org.uk/media/151010/wat_sg_44.pdf on 14/03/2016

groundwater status will potentially reduce groundwater recharge further. The use of SuDS can help return water to groundwater by slowing down rainfall runoff in soakaways, permeable surfaces, ponds and wetlands. It is therefore recommended that SuDS are used wherever possible and particular in areas assessed as having poor groundwater status. SuDS can also provide ecological gain and in doing so have the potential to contribute towards the green infrastructure network in the District. Other examples of green infrastructure include:

- Woodland;
- Watercourses;
- Playing fields;
- Nature reserves;
- Cemeteries;
- Footpaths;
- Hedgerows; and
- Amenity landscaping.

Further provision of green infrastructure in the District has the potential to achieve a number of benefits. These include:

- Creation of new wildlife habitat and benefits to a range of species;
- Improvements to the local landscape character;
- Contribution to flood risk management; and
- Provision of new amenity assets and recreational opportunities.

7.6 Opportunities

There are a number of environmental opportunities that could be considered for each of the proposed development sites. Implementation of these opportunities would have the potential to help mitigate the environmental impacts of development of each site and deliver environmental benefits, particularly in relation to biodiversity and water quality. The nature and scale of any environmental benefits achieved would depend upon the site characteristics and sensitivity of the surrounding environment. These environmental opportunities are summarised in Table 7-6.

Table 7-6: Environmental opportunities and benefits

Environmental opportunity	Potential environmental benefits
Allocation of green space for the provision of SuDS	• Potential to provide flood risk benefits through interception of surface runoff. • Reduced sediment loading in receiving watercourses and improved water quality. • Amenity value.
Retention and enhancement of existing water features on the site i.e., ponds, ditches and streams through creation of vegetated buffer strips.	• Increased biodiversity value, particularly for amphibians, invertebrates and small mammals. • Potential to provide flood risk benefits through interception of surface runoff. • Increased amenity value.
Creation of new water features on site i.e., ponds, ditches and streams.	• Increased biodiversity value, particularly for amphibians, invertebrates and small mammals. • Potential to provide flood risk benefits through interception of surface runoff. • Provision of amenity resource.
Terrestrial and marginal vegetation planting along river corridors to increase vegetation cover and improve water quality.	• Reduced river bank erosion. • Reduced water temperatures. • Increased biodiversity value, particularly for birds, invertebrates and fish. • Reduced sediment loading in receiving watercourses and improved water quality.
Planting of native broadleaved trees and retention of existing mature trees.	• Increased rainfall interception and reduced surface runoff. • Reduced sediment loading in receiving watercourses and improved water quality.

Environmental opportunity	Potential environmental benefits
	• Increased local biodiversity, particularly in relation to birds, invertebrates and small mammals. • Increased shading and reduced heat-island effect. • Improved local air quality. • Increased amenity value.
Habitat creation and provision of amenity areas in location at risk of flooding.	• Maintain floodplain connectivity. • Increased biodiversity value of floodplain, particularly for birds, invertebrates and small mammals. • Reduced flood risk to people and properties. • Reduced sediment loading in receiving watercourses and improved water quality. • Increased amenity value.

7.7 Recommendations

This study has provided a high-level appraisal of the potential environmental risks and opportunities associated with each of the proposed development sites. This should be used in conjunction with Sustainability Appraisals (SA) and/or Strategic Environmental Assessments (SEAs) when these are available. More detailed assessment of the environmental issues associated with the development of each site should be undertaken prior to the approval for development to commence. This should include a thorough desk study and site surveys as required to fully identify sensitive environmental features present on each site.

The following recommendations are proposed in relation to the proposed development sites:

- Consultation with East Lindsey District Council ecologist and heritage officer should be undertaken in relation to the development of each site to further identify potential environmental risks and opportunities, and to determine specific requirements for mitigation measures.
- Developers should seek to maximise the water quality and amenity/ecological benefits when installing SuDS for surface water flood management. The design of SuDS schemes should be specific to each allocation site to maximise the environmental benefits derived. Careful planning of SuDS schemes in areas identified as groundwater aquifers or sensitive to groundwater contamination would be required to ensure no adverse impact on groundwater quality. However, provision of SuDS has the potential to maintain or improve groundwater recharge.
- Watercourses should be protected through the inclusion of riparian buffer strips. These zones will increase infiltration of surface runoff with potential benefits in terms of flood risks and water quality in the receiving watercourse.
- Existing water features i.e., ponds, ditches and streams should be retained as a high priority and incorporated into SuDS schemes where appropriate to maintain the aquatic biodiversity value of the sites and to provide a local source of flora and fauna that may naturally colonise new habitats.
- The removal or modification of existing river culverts should be considered where practicable in line with Environment Agency guidance. Modification of culverts has the potential to reduce flood risk due to blockages, create a more natural river bed profile and hydromorphological process, and also benefit a range of aquatic wildlife through new habitat creation or improving access to valuable habitat. Implementation of these measures could contribute towards delivery of the requirements of the Water Framework Directive.
- Good design principles should be applied to all developments, particularly those located in sensitive or protected landscapes so as to minimise the impact on landscape character and visual amenity. Design advice provided by ELDC should be applied and consultation with the Council's landscape officer should be undertaken to inform the design of the development of a site.

7.8 Summary and conclusions

Development of the proposed development sites has the potential to cause a range of adverse impacts. Further environmental surveys and more detailed assessment are required for each of the sites to determine the acceptability of their development and to inform the requirement for

mitigation measures. Sites shown on the GeoPDF maps in Appendix C to have few environmental features in close proximity should not necessarily be assumed suitable for development. Likewise sites with a greater amount of environmental features in close proximity should not be assumed unsuitable for development, constraints could be appropriately addressed.

The potential for adverse impacts on the water environment is closely related to the presence and sensitivity of water features on or in close proximity to each site. Where such features exist, adequate protection measures should be implemented in the design of the development to ensure effective protection during both construction and operational phases. Such measures would include the provision of wide vegetated buffer zones adjacent to watercourses, to reduce the risk of contaminated runoff affecting river water quality and to promote aquatic biodiversity. In addition, measures would be required to protect water quality and water resources in underlying aquifers. The use of SuDS systems would promote infiltration of surface runoff and contribute to groundwater recharge, whilst also offering potential biodiversity, flood risk and amenity benefits.

Development of each site may also result in other environmental risks not specifically related to the water environment. Such effects could include the loss of, or damage to, important archaeological and heritage features, adverse impacts on terrestrial biodiversity, impacts on the setting of landscape or historic environment features, and the loss of high quality agricultural land. Development proposals for these sites would need to consider the sites wider context and planning policy.

There are also a range of potential environmental opportunities that could be delivered through any development proposals. Opportunities include enhancement of existing ecological features, such as watercourses, field margins and trees, the provision of new biodiversity habitats, and the creation of new recreational and amenity areas.

8 Climate Change Impact Assessment

8.1 Methodology

A qualitative assessment has been undertaken to assess the potential impacts of climate change on the assessments made in this water cycle study. This has been done using a matrix which considers both the potential impact of climate change on the assessment in question, and also the degree to which climate change has been considered in the information used to make the assessments contained within the WCS (see Table 8-1).

The impacts have been assessed on a district wide basis; the available climate models are generally insufficiently refined to draw different conclusions for different parts of the District, or doing so would require a degree of detail beyond the scope of this study.

Table 8-1: Climate Change Pressures Scoring Matrix

		Impact of pressure		
		Low	Medium	High
Have climate change pressures been considered in the assessment?	Yes - quantitative consideration			
	Some consideration but qualitative only			
	Not considered			

8.2 Results

Table 8-2: Scoring of Climate Change Consequences for the Water Cycle Study

Assessment	Impact of Pressure (source of information)	Have climate change pressures been considered in the assessment?	Climate Change Score
Water resources	High(1 and 2)	Yes - qualitative within WRMP and RMBP	
Water supply infrastructure	Medium(2) - some increased demand during hot weather	Yes - qualitative consideration within WRMP	
Sewerage system capacity	High(3) - Intense summer rainfall and higher winter rainfall increases flood risk	No - not considered in company assessments	
Wastewater treatment	Medium(3) - Increased winter flows and more extreme weather events reduces flow headroom	No - not considered	
WRC odour	Low	No - not considered	
Water quality	Nutrients: High(1) Sanitary determinands: Medium(1)	No - not considered	
Flood risk (fluvial, pluvial and Tidal)	High(4)	Yes - climate change modelling and mapping	
Flooding from increased WRC discharge	Low	No - not considered	

Sources:

(1) River Basin Management Plan Anglian River Basin District - Annex H: Adapting to climate change

(2) Anglian Water's Water Resource Management Plan 2015

(3) Anglian Water Our Plan 2015-20

(4) ELDC Draft Strategic Flood Risk Assessment

8.3 Recommendations

Table 8-3: Climate change actions

Action	Responsibility	Timescale
When undertaking detailed assessments of environmental or asset capacity, consider how the latest climate change guidance can be included.	EA, AW, ELDC	As required
Take "no regrets" decisions in the design of developments which will contribute to mitigation and adaptation to climate change impacts.	ELDC, Developers	As required

9 Summary and Recommendations

9.1 Water Cycle Study summary

The WCS has been carried out in co-operation with the Environment Agency and Anglian Water. Overall, there are no issues which indicate that the planned scale, location and timing of planned development within the District is unachievable from the perspective of supplying water and wastewater services and preventing deterioration of water quality in receiving waters.

The WCS has identified whether infrastructure upgrades are expected to be required to accommodate planned growth. Timely planning and provision of infrastructure upgrades will be undertaken through regular engagement between ELDC, AW, the EA and developers.

Table 9-1 and Table 9-2 provide a summary of the Red / Amber / Green analysis results for each settlement and site respectively. The full tables are shown in Appendix A.

Table 9-1: Summary of results by settlement

Settlement	Water resources assessment	WRC capacity assessment	Water quality assessment	WRC additional flow flood risk
	Overall RAG	Overall RAG	Overall RAG	Maximum housing scenario
Alford	Green	Green	Not assessed	Not assessed
Binbrook	Green	Green	Not assessed	Not assessed
Burgh le Marsh	Green	Red	Not assessed	Not assessed
Coningsby / Tattershall	Green	Red	Amber	Green
Friskney	Green	Green	Not assessed	Not assessed
Grainthorpe	Green	Green	Not assessed	Not assessed
Grimoldby & Manby	Green	Red	Red	Green
Hogsthorpe	Green	Red	Not assessed	Not assessed
Holton le Clay	Green	Green	Not assessed	Not assessed
Horncastle	Green	Not assessed by AW	Red	Green
Huttoft	Green	Red	Not assessed	Not assessed
Legbourne	Green	Red	Red	Green
Louth	Green	Red	Red	Green
Mareham le Fen	Green	Amber	Not assessed	Not assessed
Marshchapel	Green	Green	Not assessed	Not assessed
North Thoresby	Green	Amber	Not assessed	Not assessed
Sibsey	Green	Red	Red	Green
Spilsby	Green	Amber	Not assessed	Not assessed
Stickney	Green	Green	Not assessed	Not assessed
Tetford	Green	Green	Not assessed	Not assessed
Tetney	Green	Green	Not assessed	Not assessed
Wainfleet All Saints	Green	Green	Not assessed	Not assessed
Woodhall Spa	Green	Red	Red	Green
Wragby	Green	Green	Not assessed	Not assessed

Table 9-2: Summary of results by site

Site	Water Resources and Supply		Wastewater					Flood risk		Surface water drainage		
	Water resource assessment	Water supply infrastructure assessment	WRC capacity (see note 1)	Foul sewerage network capacity (see note 5)	Surface water network capacity (see note 6)	AW Overall RAG	WRC odour assessment	Fluvial flood risk	Pluvial flood risk	Infiltration SuDS appraisal	Site potential to provide betterment to downstream flood risk (see section 6.3.1 for a and b definitions)	Site identified as being a significant surface water flow pathway or ponding area
AL036	Green	Amber	Green	Green	Red	Amber	Green	Green	Green	Green	b	Green
AL042	Green	Amber	Green	Green	Red	Amber	Green	Green	Green	Amber	b	Green
AL302	Green	Amber	Green	Amber	Red	Amber	Amber	Red	Green	Amber	b	Green
AL303	Green	Amber	Green	Amber	Red	Amber	Green	Red	Red	Green	a	Red
AL304	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
AL312	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
AL316	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
AL325	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
BIN306	Green	Amber	Green	Amber	Red	Amber	Green	Red	Red	Green	a	Red
BIN307	Green	Amber	Green	Amber	Red	Amber	Green	Red	Amber	Green	a	Red
BIN309	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	b	Green
BLM305	Green	Amber	Amber	Amber	Red	Amber	Green	Red	Amber	Amber	b	Red
BLM310	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
BLM313	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	b	Red
BLM318	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
C&T305	Green	Green	Amber	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
C&T306	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
C&T311	Green	Green	Green	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
C&T313	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
FRIS301	Green	Amber	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
FRIS306	Green	Amber	Green	Green	Red	Amber	Green	Red	Amber	Amber	b	Red
FRIS311	Green	Amber	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
FRIS316	Green	Green	Green	Green	Red	Green	Green	Red	Green	Amber	b	Green
FRIS317	Green	Green	Green	Green	Red	Green	Green	Red	Green	Amber	b	Green
FRIS321	Green	Amber	Green	Amber	Red	Amber	Amber	Red	Green	Amber	b	Green
GRA209	Green	Amber	Green	Green	Red	Amber	Green	Green	Green	Amber	b	Green
GRA211	Green	Amber	Green	Green	Red	Amber	Green	Red	Amber	Amber	b	Red
GRA312	Green	Green	Green	Green	Red	Green	Green	Red	Amber	Amber	b	Red
HLC206	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
HLC301	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
HLC302	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
HLC303	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	b	Red

HLC304	Green	Amber	Green	Amber	Red	Amber	Amber	Green	Amber	Amber	b	Red
HLC305	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
HOG306	Green	Amber	Amber	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
HOG309	Green	Green	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
HOR050	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
HOR063	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
HOR301	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
HOR303	Green	Green	Green	Amber	Red	Amber	Green	Red	Amber	Amber	a	Red
HOR308	Green	Green	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
HOR312	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
HOR314	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
HOR315	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
HOR320	Green	Green	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
HOR324	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Green	b	Green
HOR327	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	b	Green
HOR330	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
HOR333	Green	Amber	Green	Amber	Red	Amber	Green	Amber	Red	Amber	a	Red
HUT206	Green	Green	Green	Green	Red	Green	Green	Green	Green	Amber	a	Green
HUT306	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
LEG303	Green	Amber	Red	Amber	Red	Red	Green	Green	Green	Amber	a	Green
LEG307	Green	Green	Green	Green	Red	Green	Green	Green	Green	Amber	b	Green
LEG313	Green	Green	Green	Green	Red	Green	Green	Green	Green	Amber	b	Green
LO044	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Green	a	Green
LO096	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
LO099	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
LO143	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
LO154	Green	Green	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
LO155	Green	Green	Green	Amber	Red	Amber	Green	Green	Red	Amber	b	Red
LO301	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
LO305	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
LO306	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
LO311	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
LO312	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
LO313	Green	Amber	Green	Amber	Red	Amber	Green	Amber	Amber	Amber	a	Red
LO324	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
LO325	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
LO326	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
LO329	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
LO331	Green	Green	Green	Amber	Red	Amber	Green	Red	Red	Amber	a	Red
LO339	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
LO341	Green	Green	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
LO344	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red

LO462	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	a	Green
MAN314	Green	Green	Amber	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
MAN316	Green	Green	Amber	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
MAN330	Green	Amber	Red	Amber	Red	Red	Green	Green	Amber	Amber	a	Red
MAN332	Green	Green	Green	Green	Red	Green	Green	Green	Amber	Amber	b	Red
MAR217	Green	Green	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
MAR226	Green	Green	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
MAR300	Green	Green	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
MAR304	Green	Green	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
MLF021	Green	Green	Amber	Green	Red	Amber	Green	Green	Green	Amber	b	Green
MLF305	Green	Green	Amber	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
MLF328	Green	Green	Amber	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
NTH301	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
NTH307	Green	Amber	Green	Green	Red	Amber	Green	Green	Red	Amber	a	Red
NTH308	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
NTH313	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Amber	a	Red
NTH317	Green	Green	Green	Green	Red	Green	Green	Green	Red	Amber	a	Red
SIB302	Green	Amber	Amber	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
SIB303	Green	Amber	Amber	Amber	Red	Amber	Amber	Red	Amber	Amber	b	Red
SIB304	Green	Amber	Green	Green	Red	Amber	Green	Green	Amber	Amber	b	Red
SIB406	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
SPY008	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	b	Green
SPY301	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Green	b	Green
SPY302	Green	Amber	Green	Amber	Red	Amber	Green	Green	Red	Green	b	Red
SPY303	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Green	b	Red
SPY304	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Green	b	Green
SPY305	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Green	b	Green
SPY306	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Green	b	Green
SPY307	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	b	Green
STK013	Green	Amber	Green	Green	Red	Amber	Green	Green	Red	Amber	b	Red
STK304	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
STK312	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
STK314	Green	Amber	Green	Green	Red	Amber	Green	Green	Green	Amber	b	Green
STK315	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
STK319	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
TEF302	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Green	b	Red
TEF303	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Green	b	Red
TNY308	Green	Amber	Green	Green	Red	Amber	Green	Red	Red	Amber	b	Red
TNY311	Green	Amber	Green	Amber	Red	Amber	Green	Red	Red	Amber	a	Red
TNY313	Green	Amber	Green	Amber	Red	Amber	Green	Red	Amber	Amber	b	Red
TNY316	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
WAI305	Green	Green	Green	Amber	Red	Amber	Green	Amber	Green	Amber	b	Green

WAI308	Green	Green	Green	Green	Red	Green	Green	Green	Green	Amber	b	Green
WAI308B	Green	Green	Green	Green	Red	Green	Green	Green	Amber	Amber	b	Red
WAI401	Green	Green	Green	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
WAI405	Green	Green	Green	Green	Red	Green	Amber	Red	Green	Amber	b	Green
WRA024	Green	Amber	Green	Amber	Red	Amber	Green	Green	Green	Amber	b	Green
WRA301	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	a	Red
WRA304	Green	Amber	Green	Amber	Red	Amber	Amber	Green	Green	Amber	b	Green
WRA306	Green	Amber	Green	Green	Red	Amber	Green	Green	Green	Amber	b	Green
WRA313	Green	Amber	Green	Amber	Red	Amber	Green	Green	Amber	Amber	b	Red
WSP304	Green	Amber	Amber	Amber	Red	Amber	Green	Red	Green	Amber	b	Green
WSP310	Green	Green	Amber	Amber	Red	Amber	Green	Green	Red	Amber	b	Red
WSP314	Green	Amber	Red	Amber	Red	Red	Green	Green	Green	Amber	b	Green
WSP315	Green	Green	Amber	Amber	Red	Amber	Green	Green	Green	Amber	b	Green

9.1.1 Development scenarios and policy issues

- The WCS is based on an assessment of the impact of planned development within East Lindsey District.
- An assessment of strategic growth within the District was defined by East Lindsey District Council as five housing growth scenarios for 24 of the large towns and villages in the District where growth was to be focussed up until 2031.
- East Lindsey District Council also had a list of 230 potential housing developments sites within the District at the start of this study which had been promoted by developers and land owners through the Strategic Housing Land Availability Assessment (SHLAA) process. This list of non-discounted sites has been altered since the Phase I WCS. 129 of the 230 sites are within the towns and large villages assessed within this study.
- In addition to the proposed site allocations, the number of houses with planning permission (as of October 2015) but which have not yet been constructed were also collated. The housing growth scenarios do not take these commitments into account (i.e. the housing scenarios quote the total housing numbers required in a settlement until 2031). The scenario growth figures for the water resource and water recycling centre (WRC) assessments use a total potential housing number for the settlements, which includes those sites with existing planning permission. When the original assessments were undertaken for individual planning applications the full capacity assessments included in this study may not have been undertaken. The total volume of additional water Anglian Water will need to supply and treat for the full period 2015-2031 has therefore been considered.
- The potential housing growth figures have been compared with existing commitments for each settlement. The majority of the settlements have enough capacity to meet the potential housing number through the current list of non-discounted SHLAA sites. Binbrook, Grainthorpe, Huttoft and Wainfleet All Saints have a shortfall of capacity within the current list of proposed sites.
- Legal agreements under the Town and Country Planning Act Section 106 agreement, and Community Infrastructure Levy agreements are not intended to be used to obtain funding for water or wastewater infrastructure. It is not therefore necessary for East Lindsey District Council to identify requirements for developers to contribute towards the cost of upgrades in its Local Plan.
- The Water Industry Act sets out arrangements for connections to public sewers and water supply networks, and developers should ensure that they engage at an early stage with Anglian Water to ensure that site specific capacity checks can be undertaken and where necessary additional infrastructure constructed to accommodate the development. Where permitted Anglian Water may seek developer contributions towards infrastructure upgrades. Upgrades to water resources, water treatment works and water recycling centres are funded through the company business plans.

9.1.2 Water resources

- All settlements and sites within East Lindsey District are supplied by Anglian Water. The Water Resource Management Plan (WRMP) makes adequate provision for the forecast growth in housing within East Lindsey District. This is confirmed by Anglian Water's water resource assessment of the five potential housing growth scenarios. Therefore water resources should not be considered to be a barrier to the planned growth in the District.

9.1.3 Water supply infrastructure

- Anglian Water provided an assessment of the water supply infrastructure to each proposed development site. Anglian Water confirmed that for 48 of the 129 sites capacity was available to serve the proposed growth and for the remaining 81 sites infrastructure upgrades would be required.
- Anglian Water confirmed that there were no major constraints to the provision of infrastructure to serve any of the proposed development sites. Therefore whilst it is expected that infrastructure upgrades will be required to serve the majority of the proposed sites, there remains adequate time for this infrastructure to be delivered by Anglian Water without restricting the timing, location or scale of planned development.

9.1.4 Wastewater collection

- Anglian Water provided an assessment of the sewerage system capacity for each proposed development sites. Except for a few of the smaller developments (10 houses or fewer) it is anticipated that surface water infrastructure upgrades will be required within the sewerage systems for each site. Exact capacity requirements will be determined by Anglian Water in more detailed analysis.
- Anglian Water's preferred method of surface water disposal is using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.
- Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented following an application for a connection, adoption or requisition from a developer. Early developer engagement with water companies is therefore essential to ensure that sewerage capacity can be provided without delaying development.

9.1.5 Water recycling centre and quality consent assessments

- Anglian Water provided an assessment of the available headroom in the flow and quality consents at their existing water recycling centres to accommodate additional wastewater flows for each of the five housing growth scenarios. In addition, JBA Consulting undertook water quality impact modelling to assess the impact of additional treated effluent on the receiving watercourses.
- Water recycling centres (WRC) at Alford, Binbrook, Friskney, North Cotes, Holton le Clay, Spilsby, Stickney, Tetford, Tetney Newton Marsh, Wainfleet and Wragby are assessed to have capacity available to meet the proposed growth scenarios. Mareham le Fen and North Thoresby WRCs may require some treatment upgrades to serve the proposed growth, whilst there are major constraints identified to meet the proposed growth at Ingoldmells, Coningsby, Manby, Legbourne, Louth, Sibsey and Woodhall Spa WRC.

9.1.6 Water recycling centre odour assessment

- An odour screening assessment concluded six sites may be at risk of experiencing odour due to their proximity to the existing WRC. It is recommended that odour impact assessments be undertaken as part of the planning application process. All other sites are unlikely to be impacted by odour from WRCs.

9.1.7 Water quality impact assessment

- All works are currently working below their DWF permits.
- The proposed growth is not predicted to lead to any class deteriorations, or deteriorations of quality of greater than 10% for any determinand.
- For Phosphorus all receiving watercourses at all WRCs fail their targets for the present-day situation:
    - At Coningsby (if BAT for P = 0,5mg/l is considered) and Woodhall, good ecological status could be achieved in the receiving watercourses if these were achieving GES upstream of the works.
    - At Horncastle, Legbourne and Manby even assuming GES upstream, the modelling predicts that it would not be possible to achieve GES in the receiving watercourses.
    - Louth and Sibsey have already GES upstream and it not possible to achieve GES at the receiving watercourses. Note: the reason for the P GES target failure could be due to the fact that by not having any observed data available an assumed discharge value (same for all works) was used.

      Note: for phosphorus an average value provided by the EA based on actual data of around 2000 discharges with no P removal was used for all WRCs.
- For BOD only receiving watercourses at Horncastle and Sibsey fail GES but targets can achieved by using BAT.
- For NH4 only receiving watercourse at Louth fails GES but target can achieved by using BAT.

9.1.8 Flood risk

- The percentage of each site at risk from fluvial or surface water flooding was calculated. This information may be used to supplement the information presented at the settlement scale in the Strategic Flood Risk Assessment.
- An assessment was carried out to determine whether increased discharges of treated effluent from a WRC due to increased population growth would increase the risk of fluvial flooding from the receiving watercourse. This assessment was carried out for the seven WRCs assessed within the water quality impact assessment and showed that the impact of increased effluent flows are not predicted to have a significant impact upon flood risk in any of the receiving watercourses.

9.1.9 Surface water drainage

- A desk study exercise was carried out to determine the potential of each site to use sustainable drainage systems (SuDS), in particular the potential to use infiltration drainage techniques. In general, sites in the Lincolnshire Wolds have freely draining soils ideal for infiltration SuDS in contrast to the soils with impeded drainage and high groundwater levels closer the coast and to the west.
- A number of the sites (located within Alford, Binbrook, Holton Le Clay, Louth, Manby, Marshchapel, North Thoresby and Tetney) are within the Environment Agency's Source Protection Zones (SPZ) and the use of infiltration SuDS in these areas may be restricted although the risk of groundwater contamination from SuDS can be effectively managed. SuDS are further encouraged in water scarce regions to improve (or maintain) recharge of an aquifer. The suitability of SuDS will need to be assessed on a site by site basis through a risk assessment which would require approval from LCC as LLFA and the EA.
- Sites were also assessed to determine whether development may increase the surface water flood risk downstream and whether the site may be required to provide "betterment" to reduce existing downstream flood risk. Similarly, sites were identified where there is currently a surface water flood risk to the site which will need to be managed with a local solution (such as SuDS) as part of the overall site design to protect the new developments.

9.1.10 Environmental constraints and opportunities

- GeoPDF maps have been created to allow for a range of notable environmental designations and features to be displayed 'on' or 'off' with the aim of being able to quickly identify the presence of environmental features within or close to the proposed sites. The maps should be used in conjunction with Sustainability Appraisals (SA) and/or Strategic Environmental Assessments (SEAs) when these are available.
- The environmental assessment provides an overview of the wider environment within the District and the potential risks and opportunities associated with the development of the proposed sites.

9.1.11 Climate change

- A qualitative assessment has been undertaken to assess the potential impacts of climate change on the assessments made within this water cycle study. The assessment used a matrix which considers both the potential impact of climate change on the assessment in question, and also the degree to which climate change has been considered in the information used to make the assessments contained within the WCS.
- The capacity of the sewerage system and the water quality of receiving water bodies stand out as two elements of the assessment where the consequences of climate change are expected to be high but no account has been made of climate impacts in the assessment. This is a matter to be addressed at detailed assessment stage.

9.2 Recommendations

Table 9-3 summarises the recommendations made throughout the Water Cycle Study.

Table 9-3: Summary of all Water Cycle Study recommendations

Aspect	Action	Responsibility	Timescale
Water resources	Anglian Water should monitor actual population and property numbers across East Lincolnshire RZ through its annual review of its WRMP and initiate mitigation measures as necessary.	AW	Annually
	Provide updates to AW of projected housing growth on an annual basis.	ELDC and other LPAs in the WRZ	Annually
	East Lindsey is defined as an area under "serious" water stress. It is therefore appropriate to implement the need for new development to be designed to Building regulations water consumption standard for water scarce areas (110 litres per person per day) as permitted by National Planning Policy Guidance.	ELDC	Ongoing
	Work together to ensure that sites within the District that may be required for future strategic water resource infrastructure are safeguarded from further development.	ELDC	Ongoing
Water supply infrastructure	Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery programme to identify key dates and potential programme constraints.	AW	Ongoing
	Undertake technical studies to understand options to provide sufficient bulk and local transfer capacity and communicate results with ELDC.	AW	Ongoing
	Developers should seek early consultation with Anglian Water in order to ensure adequate time is available to provide local distribution main upgrades to meet additional demand.	Developers	Ongoing
Sewerage system infrastructure	Take into account sewerage infrastructure constraints in phasing development in partnership with Anglian Water.	ELDC	Ongoing
	Anglian Water to continue to assess growth demands as part of their wastewater asset planning activities and feedback to ELDC where concerns arise.	AW	Ongoing
	Anglian Water and developers will be expected to work closely and early on in the planning promotion process to develop an outline Drainage Strategy for the site. The Outline Drainage strategy should set out sufficient detail to determine the likely timescales for the delivery of the infrastructure and the likely costs of the infrastructure. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a	Developers	Ongoing

	drainage planning condition to be set.		
	Developers will be expected to show that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to sewer seen as the last option.	Developers	Ongoing
WRC flow and quality	Take into account WRC incapacity in phasing of development going to the same WRC.	ELDC	Ongoing
	Provide annual updates to AW of projected housing growth.	ELDC	Annually
	AW to assess growth demands as part of their wastewater asset planning activities and feedback to ELDC where concerns arise.	AW	Ongoing
	AW, ELDC and the EA will work closely to ensure the timely delivery of any necessary WRC upgrades.	AW, EA and ELDC	Ongoing
	Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, the EA should provide clear advice ELDC and AW on: the approach to permitting, requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), advise where water quality constraints may limit the potential for growth.	EA	Ongoing
WRC odour	Consider odour risk in selection of site allocations.	ELDC	Ongoing
	Carry out an odour assessment for 'amber' assessed sites.	Site promoters	Ongoing
Water quality	Where possible, take into account the water quality constraints when allocating and phasing development sites.	ELDC	Ongoing
	Where the water quality assessment indicates that permits may require a higher standard of treatment than currently achievable using Best Available Technologies, provide clear advice to sewerage undertakers and ELDC on: • the approach to permitting, • requirements for any additional studies (for example additional water quality sampling, modelling, macro-invertebrate surveys etc.), advise SODC where water quality constraints may limit the potential for growth	EA	Ongoing
	Where necessary, identify the scale of likely solutions to accommodate growth, and build the likely timescale for delivering the infrastructure into the overall delivery	AW	Annually

	programme to identify key dates and potential programme constraints.		
Surface water drainage	Consider the potential to use SuDS in selection of site allocations.	ELDC	Ongoing
	Drainage of the site should be considered at the earliest stages of site design. Consultation with the LCC (as LLFA), AW and, where applicable, the IDB is essential.	Developers	Ongoing
	Any development must pass the Sequential Test. Sequential design of a new site should ensure that built development and access routes are entirely within Flood Zone 1 and should avoid impacting on surface water flow routes or ordinary watercourses.	Developers	Ongoing
	A Drainage Strategy must be submitted at the earliest opportunity to show how the impact of the development will be reduced through the use of SuDS techniques, with surface water run-off rates attenuated following the Non-statutory technical standards for sustainable drainage systems[53]. The Drainage Strategy should demonstrate that existing surface water flow paths will be preserved.	Developers	Ongoing
	Opportunities should be exploited at the master planning stage for multiple benefits in terms of integrated sustainable drainage, green infrastructure, amenity, biodiversity and WFD status.	Developers	Ongoing
Protecting and enhancing the water environment	Consultation with ELDC ecologist and heritage officer should be undertaken in relation to the development of each site to further identify potential environmental risks and opportunities, and to determine specific requirements for mitigation measures.	ELDC	Ongoing
	Developers should seek to maximise the water quality and amenity/ecological benefits when installing SuDS for surface water flood management. The design of SuDS schemes should be specific to each allocation site to maximise the environmental benefits derived. Careful planning of SuDS schemes in areas identified as groundwater aquifers or sensitive to groundwater contamination would be required to ensure no adverse impact on groundwater quality. However, provision of SuDS has the potential to maintain or improve groundwater recharge.	ELDC andDevelopers	Ongoing

53 Department for Environment, Food and Rural Affairs (March 2015) Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems. Accessed online at https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards on 14/03/2016.

	Watercourses should be protected through the inclusion of riparian buffer strips. These zones will increase infiltration of surface runoff with potential benefits in terms of flood risks and water quality in the receiving watercourse.	ELDC and Developers	Ongoing
	Existing water features i.e., ponds, ditches and streams should be retained as a high priority and incorporated into SuDS schemes where appropriate to maintain the aquatic biodiversity value of the sites and to provide a local source of flora and fauna that may naturally colonise new habitats.	ELDCand Developers	Ongoing
	The removal or modification of existing river culverts should be considered where practicable in line with EA guidance. Modification of culverts has the potential to reduce flood risk due to blockages, create a more natural river bed profile and hydromorphological process, and also benefit a range of aquatic wildlife through new habitat creation or improving access to valuable habitat. Implementation of these measures could contribute towards delivery of the requirements of the WFD.	ELDC and Developers	Ongoing
	Good design principles should be applied to all developments, particularly those located in sensitive or protected landscapes so as to minimise the impact on landscape character and visual amenity. Design advice provided by ELDC should be applied and consultation with the Council's landscape officer should be undertaken to inform the design of the development of a site.	ELDC and Developers	Ongoing
	The EA's Environment Programme team work with a number of partners in East Lindsey through Catchment Partnerships to develop and deliver projects which help improve and protect rivers. Examples include, river restoration and removal of barriers to fish passage with the driver being Water Framework Directive obligations. Such projects can help mitigate the impacts of low flow conditions and can make river environments more resilient to the impact of nearby developments. For larger developments it would be beneficial for developers to liaise with Environment Programme and Sustainable Place teams to assess whether there is the potential to work with the EA or its partners to help deliver such projects.	EA, ELDC and Developern	Ongoing
Climate change	When undertaking detailed assessments of environmental or asset capacity, consider how climate change can be considered.	EA, AW, ELDC	Ongoing

	Take "no regrets" decisions in the design of developments which will contribute to mitigation and adaptation to climate change impacts.	ELDC, Developers	Ongoing

Appendices

A Site and settlement assessment tables

B Water quality assessment

C Environmental constraints and opportunities maps

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