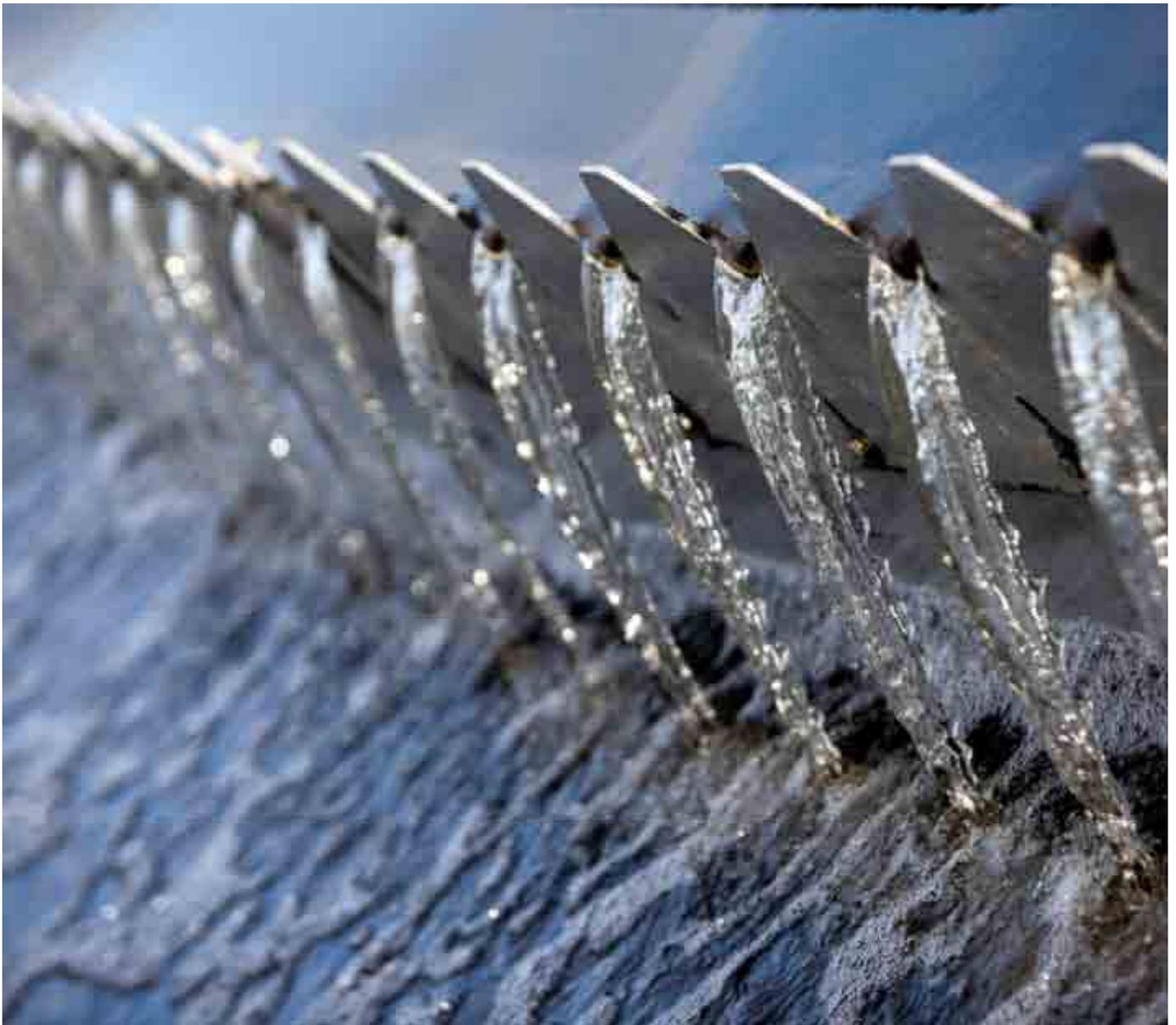


Gainsborough Water Cycle Study - Detailed Strategy



Prepared by: Christian Lomax
Principal Consultant

Checked by: Clive Mason
Technical Director

Approved by: Andy Yarde
Regional Director

Gainsborough Water Cycle Study - Detailed Strategy

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5th Floor, 2 City Walk, Leeds, LS11 9AR
Telephone: 0113 391 6800 Website: <http://www.aecom.com>

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Abbreviations

AMP	Asset Management Period
BOD	Biological Oxygen Demand
cDWF	consented Dry Weather Flow
CSO	Combined Sewer Overflow
DC	District Council
DO	Dissolved Oxygen
FFT	Flow to Full Treatment
HMA	Housing Market Area
IDB	Internal Drainage Board
m ³ /d	cubic metres per day
m ³ /s	cubic metres per second
mg/l	milligrams per litre
P	Phosphorous
RQP	River Quality Planning
SS	Suspended Solids
STW	Sewage Treatment Works
SUDS	Sustainable Drainage Systems
WCS	Water Cycle Study
WFD	Water Framework Directive

Executive Summary

Introduction

Two Water Cycle Studies (WCS) have been undertaken for the Central Lincolnshire Housing Market Area; this WCS addresses Gainsborough in West Lindsey whilst the Central Lincolnshire WCS covers the rest of West Lindsey, the City of Lincoln and North Kesteven. Gainsborough (West Lindsey) has been awarded Growth Point status and is set to provide the main focus for urban expansion in West Lindsey. This urban expansion is to be in the form of three Neighbourhood Extensions to the north, east and south of Gainsborough. The Extensions are forecast to provide up to 7440 homes according to the Programme of Development (October 2008) in addition to schools and employment opportunities and have the potential to place significant pressure on the water cycle. In response to this one of the conditions of Growth Point status was for a WCS to be undertaken.

Sewerage & Sewage Treatment

The Outline WCS for Gainsborough identified that sewerage and sewage treatment presented potentially significant constraints for the three Neighbourhood Extensions to Gainsborough and required further investigation as part of a Detailed WCS.

One of the issues is that the sewerage boundary between Severn Trent Water and Anglian Water dissects the Neighbourhood Extensions. The boundary runs immediately to the east of Gainsborough with the existing urban area being located entirely within the area covered by Severn Trent Water. The Southern Neighbourhood Extension is also on Severn Trent Water's side of the boundary, whilst the Eastern Extension is on Anglian Water's side. The Northern Extension is located across the boundary line.

The other issue is the ability of the existing infrastructure to accommodate the increase in foul flows that would result from the Neighbourhood Extensions which would represent a significant increase to the existing situation.

Anglian Water

The nearest Sewage Treatment Works (STW) to Gainsborough operated by Anglian Water is at Corringham. This is a small village STW designed to serve a population of approximately 300. Following review Anglian Water concluded that its purpose is to serve the existing properties in Corringham and is not appropriate to serve Gainsborough's Neighbourhood Extensions.

Severn Trent Water

The nearest STW operated by Severn Trent Water is the Gainsborough STW at Lea Road, which serves the existing urban area. The STW does not have sufficient spare capacity to serve the whole of the Southern Extension. However, there are no constraints which could not be overcome to extending the STW, to serve all three Neighbourhood Extensions.

If the Southern and half of the Northern Neighbourhood Extensions were to connect into the existing sewerage system serving Gainsborough, they would fall within a (Severn Trent Water) sewerage sub-catchment that has two significant constraints. Firstly, the foul flows from the Northern Extension would have to pass through an area with known hydraulic deficiencies and could consequently exacerbate flooding in this area. Secondly, both the Northern and Southern Extensions would have to drain to Heapham Road Pumping Station. The pumping station pumps flows directly to Gainsborough STW. Physical constraints inhibit the upgrade of the pumping station and associated infrastructure preventing it from serving the Neighbourhood Extensions in their entirety.

Solutions

The phasing of development of the Neighbourhood Extensions indicates that additional sewage treatment and sewerage capacity is required within the current AMP period; AMP5 (2010 - 2015). Given that only very limited capacity is available at present it will be appropriate to phase the provision of additional capacities in line with development of the Extensions (temporary arrangements may be necessary in the early years).

The most efficient and sustainable means of providing additional sewage treatment capacity would be to extend Gainsborough STW. Corringham STW is not suitable to accept additional flows from the Neighbourhood Extensions and it would be impractical to build a new STW given the existence of Gainsborough STW and would take too long to be able to serve the

Extensions. An extension to Gainsborough STW is required in AMP5 (2010 - 2015) with a possible further extension in AMP6 or 7 (2015 – 2020 and 2020 – 25 respectively). An assessment has identified that water quality and flood risk should not lead to objections, in principle, to extension of the STW.

A Drainage Strategy for the Southern Neighbourhood Extension has been produced as part of the Outline Planning application. This proposes to utilise the existing sewerage network for phase 1 of the development and implement new infrastructure to serve phases 2-4.

A holistic solution would be to strategically serve the (majority of the) three Neighbourhood Extensions together with a new sewerage network that does not impact upon the existing sewerage system serving Gainsborough. It appears possible to drain all three Extensions by gravity to the south east corner of the Eastern Extension, it would then be necessary to build a new pumping station and rising main to take the foul flows direct to Gainsborough STW.

If the Northern and Eastern Extensions are progressed it will be necessary to address the fact that the Neighbourhood Extensions lie across, and either side of, the boundary between the two water companies. It would be necessary for an agreement to be reached whereby foul flows are passed between the companies via a bulk transfer scheme or by relocating the boundary. Effectively, Foul flows from Severn Trent Water sewers on the Southern and Northern Extensions would need to be passed into Anglian Water sewers on both the Northern and Eastern Extensions which are ultimately taken to Severn Trent Water's Gainsborough STW.

In light of unpredictable rates of development under the current economic climate it is unlikely that the water companies will invest immediately in sewerage infrastructure that may not be required for ten years, if at all should any of the Extensions not go ahead.

Additional Items

This Detailed WCS has focused upon sewage treatment and foul sewerage that were identified by the Outline WCS as requiring further work.

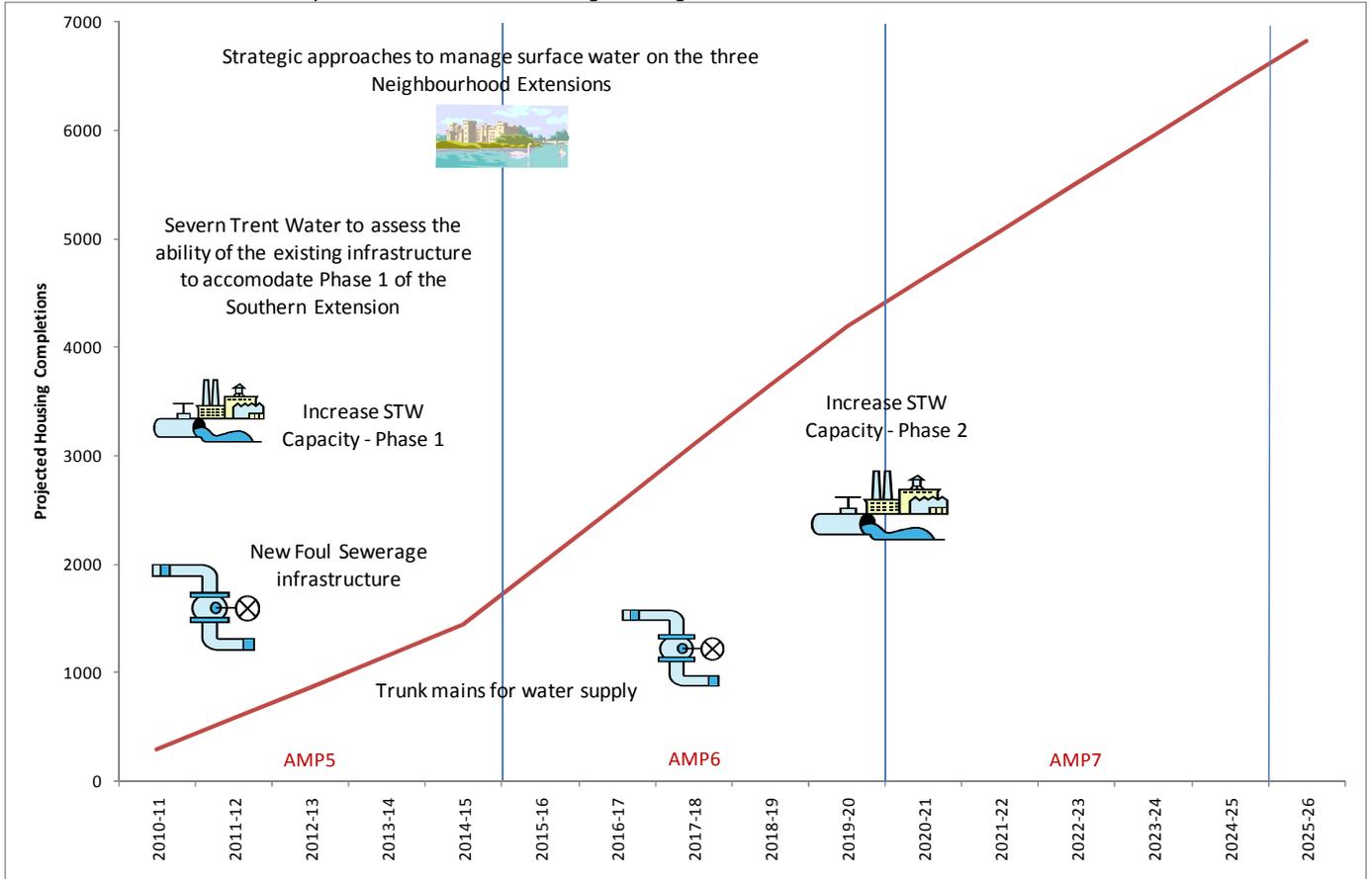
Anglian Water have advised that whilst the forecast number of new properties exceeds that which is forecast in the Water Resource Management Plan by approximately 1000, there is sufficient headroom available to accommodate the difference and water supply was identified as not posing a constraint to development of the Neighbourhood Extensions. Whilst it will be necessary to provide trunk supply networks there are no barriers that should hinder their provision.

Flood risk and surface water drainage were also not identified as presenting insurmountable barriers to development of the Neighbourhood Extensions by the Outline WCS although liaison with the appropriate bodies (e.g. Environment Agency, Internal Drainage Boards) early in the planning process will be essential to ensure smooth delivery.

Section 7 of this Detailed WCS provides a Developers Checklist and guidance concerning development of Gainsborough's Neighbourhood Extensions that should be given due consideration by developers and the planning authority.

The figure below presents a timeline of infrastructure associated with the water cycle that will be required for development of the Neighbourhood Extensions.

Timeline of Infrastructure Requirements for Gainsborough’s Neighbourhood Extensions



Introduction



1 Introduction

1.1 Background

New Growth Point status for West Lindsey, outside the Lincoln Policy Area, was announced in July 2008 (subject to confirmation in the ongoing review of the East Midlands Regional Plan). Over the next 20 years and beyond, Gainsborough is intended to provide the main focus for urban expansion in West Lindsey, expanding its role as the principal town and regionally important regeneration area. The regeneration of Gainsborough will be achieved by delivering a fundamental change in the level of housing and employment opportunities, particularly through the development of a series of Neighbourhood Extensions to the south, east and north of Gainsborough.

This growth will place pressure on the existing water services infrastructure and this water infrastructure has been identified as a potential constraint to the rate and nature of growth. In response to this potential constraint, the Gainsborough Water Cycle Study (WCS) was commissioned by West Lindsey District Council to identify the infrastructure required to support the levels of growth forecast and ensure that the development is sustainable.

1.2 Links with Other Studies

The Central Lincolnshire WCS is due for completion in May 2010. The study commenced by addressing future growth planned for the Lincoln Policy Area, which covers all of the City of Lincoln and parts of neighbouring West Lindsey and North Kesteven (Figure 1.1). Following developments amongst the three planning authorities it was considered appropriate to expand the study so that it covered all of West Lindsey and North Kesteven. West Lindsey, the City of Lincoln and North Kesteven are referred to as the Central Lincolnshire Housing Market Area (HMA) (Figure 1.1) in the East Midlands Regional Plan.

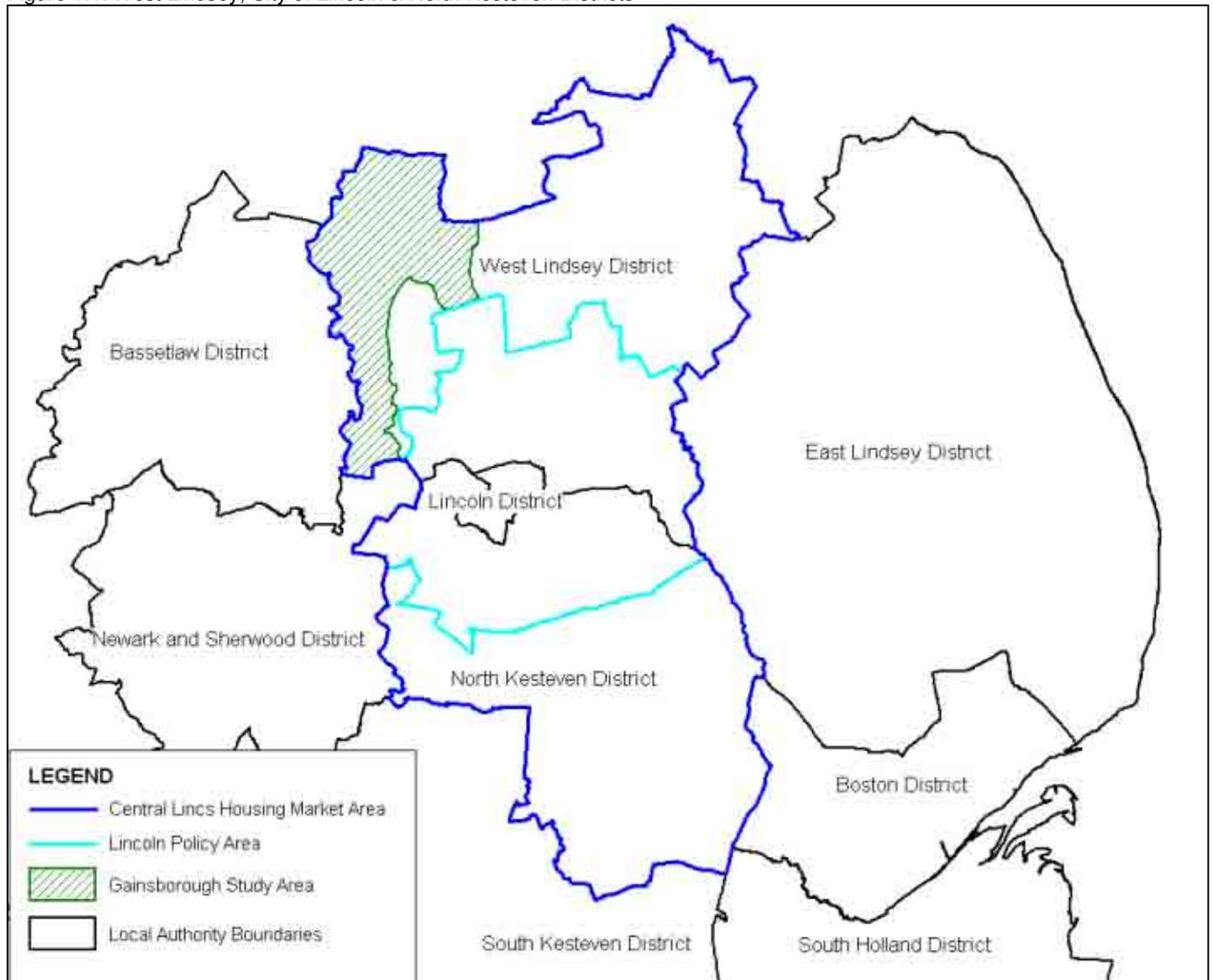
Gainsborough has been separated out from the Central Lincolnshire WCS as a standalone WCS for two principle reasons;

1. The high levels of growth in Gainsborough and Lincoln could result in several unforeseen issues which could cause delays to the delivery of either study. Undertaking two separate studies means that delays in one study should not have a knock-on effect for the other. This is particularly relevant since delivery of the Gainsborough WCS is seen as being urgent.
2. Severn Trent Water and Anglian Water both have interests in the north west of the West Lindsey district, whereas in the rest of West Lindsey, the City of Lincoln and North Kesteven, Anglian Water is the sole water company operating. WCSs involving cross border issues between water companies require greater consideration for stakeholders, due to the elements of commercial sensitivity and competition. This could potentially hamper progress towards developing a strategy for the Central Lincolnshire WCS.

Consequently a separate stand alone WCS has been established for Gainsborough, which is the focus of growth in West Lindsey. The Outline WCS for Gainsborough addressed the area of West Lindsey where both Anglian Water and Severn Trent Water have interests. This Detailed WCS is focussed on the Neighbourhood Extensions to Gainsborough which were highlighted as requiring further review in the Outline WCS.

Figure 1.1 illustrates the boundary of the area under consideration for the Gainsborough WCS within the context of the Central Lincolnshire HMA.

Figure 1.1: West Lindsey, City of Lincoln & North Kesteven Districts



1.3 Detailed WCS

An Outline WCS was completed for Gainsborough in January 2010 which identified issues that required further work to ensure that growth would be sustainable; hence this Detailed WCS. The issues requiring further investigation centred on foul sewerage and sewage treatment for the three Neighbourhood Extensions. The study area has therefore been reduced from the Outline WCS to focus on Gainsborough's Neighbourhood Extensions and exclude the other villages that had been reviewed in the Outline WCS in line with the project brief.

The purpose of the Gainsborough WCS is twofold. Firstly, to identify the limitations of the existing water services infrastructure and the requirements to support the levels of growth identified. Secondly, the WCS will provide an evidence base to help inform the Joint Core Strategy.

1.4 Stakeholders

The production of this WCS has been funded by West Lindsey District Council (DC) who appointed consultants AECOM to undertake the study. The planning authority worked in partnership with other key stakeholders; Anglian Water, Severn Trent Water and the Environment Agency to deliver the WCS.

1.5 Report Format

This report has been structured into the following sections;

- Future Growth,
- Sewage Treatment,
- Sewerage,
- Infrastructure Requirements,
- Conclusions & Strategy, and
- Guidance for Developers.

1.6 Strategy Development

Although the study has resulted in a Water Cycle Strategy for Gainsborough it does not mark the end of the process. The Gainsborough WCS has taken account of the most detailed information that is currently available. However, the situation is constantly changing therefore this WCS should be reviewed at regular intervals (e.g. every three to five years) in the future in light of the changes that will inevitably occur.

Future Growth



2 Future Growth

2.1 Introduction

West Lindsey DC, the City of Lincoln Council and North Kesteven DC have recently formed a Central Lincolnshire Joint Strategic Planning Committee with effect from 12th October 2009. This Committee will lead the production of the Local Development Framework for Central Lincolnshire including the production of a Core Strategy for the area. Therefore rather than each of the three local authorities producing a Core Strategy there will be one covering all three authority areas.

The first step in the process will be the approval of a Central Lincolnshire Local Development Scheme. The Central Lincolnshire Joint Planning Unit was formed on the 1st May 2010 to take forward the Local Development Framework work. In light of this work on the West Lindsey Core Strategy has ceased, and work on the Gainsborough Area Action Plan suspended pending the approval of the Local Development Scheme.

Irrespective of these issues, Gainsborough has Growth Point status and details of future growth are required to inform the WCS. The West Lindsey Annual Housing Supply Assessment¹ represents the most up-to-date information available concerning house building within the district. The Growth Point Bid – Programme of Development² is considered to provide the most accurate information concerning future housing growth with the district. These two documents have therefore been used to inform the WCS.

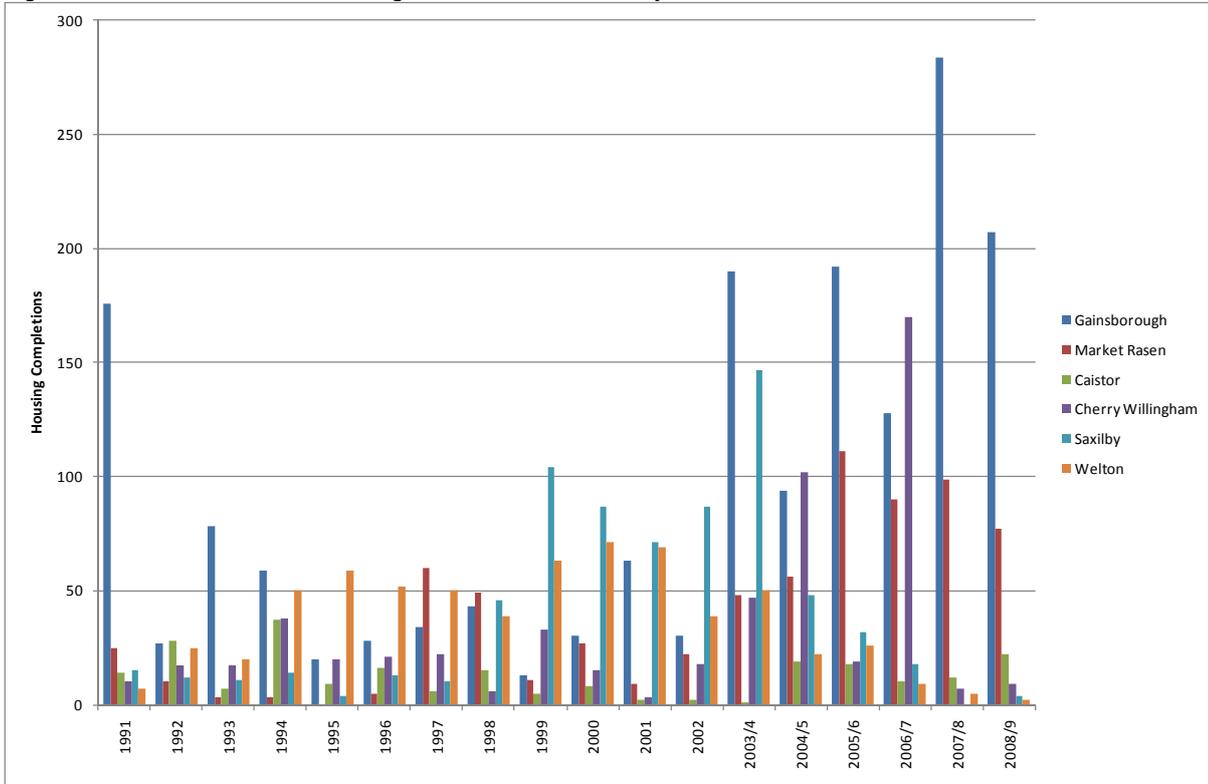
2.2 Historic Housing Growth

1,696 houses were built between 1991 and April 2009 in Gainsborough, at an average rate of 94 per year. The variation around the average is however considerable, hitting a low of 13 in 1999 and a high of 284 in 2007/08. Figure 2.1 illustrates the annual completions in Gainsborough where it can be seen that since 2002 it has dominated the housing market within West Lindsey, since the number of completions jumped in 2003/04 and remained at a much higher level than had been seen in the preceding years.

¹ West Lindsey DC (June 2009). Annual Housing Supply Assessment. For the period 1st April 2008 – 31st March 2009.

² West Lindsey DC (October 2008). Gainsborough (West Lindsey) Growth Point. Programme of Development 2008 – 2026.

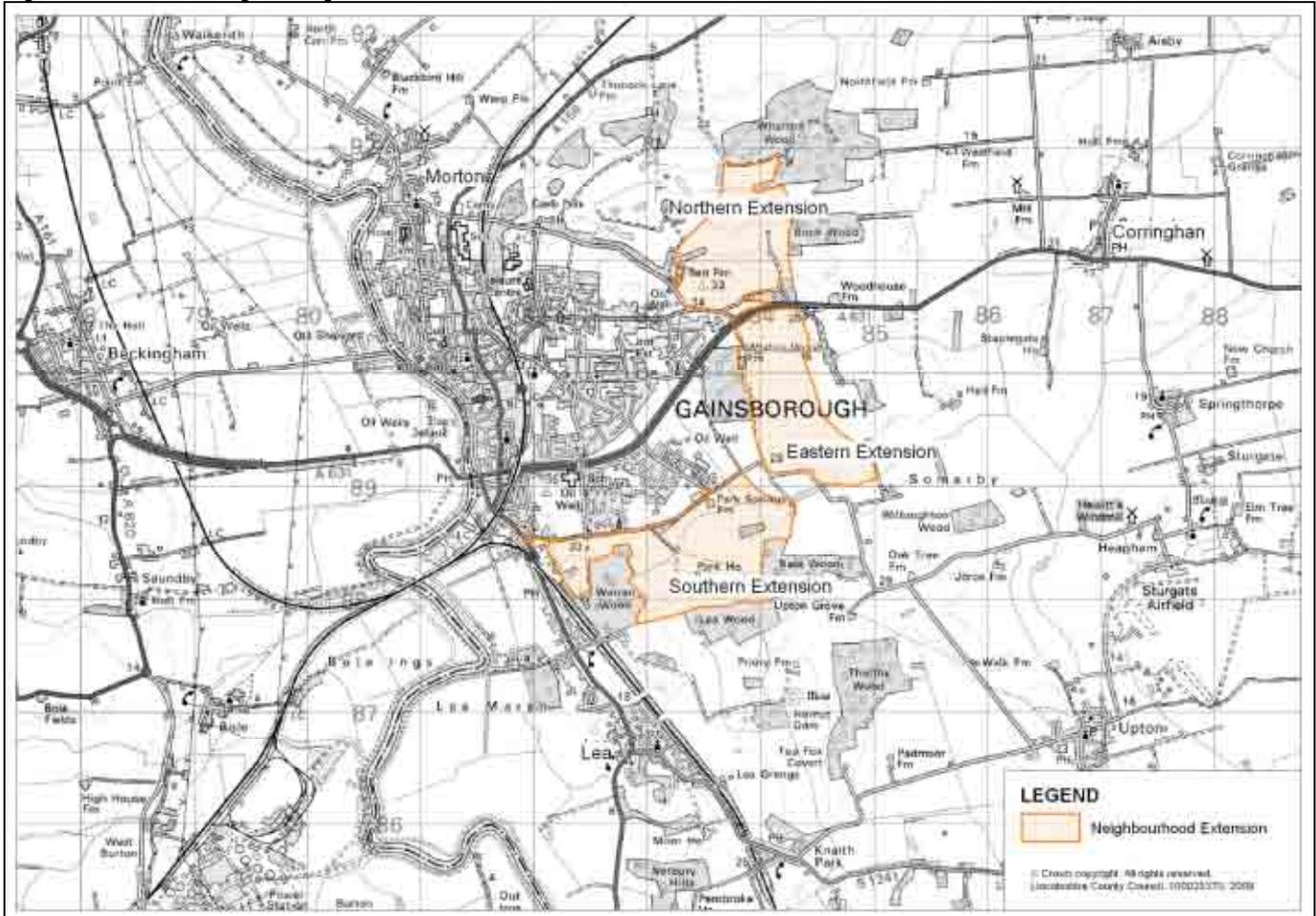
Figure 2.1: Historic Levels of Housing Growth within the Study Area



2.3 Gainsborough’s Neighbourhood Extensions

Gainsborough will comprise the majority (58%) of house building across West Lindsey over the period 2006 to 2026. The significant growth in Gainsborough is to be delivered primarily through the creation of three Neighbourhood Extensions to the north, east and south of the current urban area (Figure 2.2). These three Neighbourhood Extensions are the focus of this WCS.

Figure 2.2: Gainsborough's Neighbourhood Extensions



The proposals outlined in the Programme of Development are for the Northern Extension to comprise 2,427 houses, the Eastern Extension 2,138 and the Southern 2,875³.

Information contained within the Programme of Development indicates that;

- The Southern Extension will cover 140ha of land, including 13,445m² of employment land classes B1 and B2 and 3,143m² of community facilities classes A1, A2, A3, A4, A5, D1 & D2. A neighbourhood centre is to be provided and two primary schools; one in AMP5 (2010-15) the other in AMP7 (2020-25).
- Building on the Eastern Extension is to start in 2014 and is to include an employment area adjacent to Corringham Road, a neighbourhood centre and primary school.
- Building on the Northern Extension is to start in 2012 and will include an employment area adjacent to Corringham Road, opposite that in the eastern extension, a neighbourhood centre and primary school.

The phasing of development on the Neighbourhood Extensions (as agreed with West Lindsey DC for the purposes of the WCS) is set out in Table 2.1, the housing numbers have been grouped so that they are comparable with the water companies planning cycle; Asset Management Periods (AMP).

³ The Southern Neighbourhood proposals within the Outline Application now propose a total of 2,500 new dwellings and a build out rate of 200 dpa.

Table 2.1: Phasing of Development

Neighbourhood Extension	AMP4	AMP5	AMP6	AMP7	TOTAL
	2006-2010	2010-2015	2015-2020	2020-2026	
Northern	0	520	867	1,040	2,427
Eastern	0	178	891	1,069	2,138
Southern	0	745	996	520	2,261
Total	0	1,443	2,754	2,629	6,826

2.4 Other Development

Development in Gainsborough will not be restricted to the three Neighbourhood Extensions. Between 2006 and 2026, a total of 8,280 houses are forecast for the West Lindsey growth point area. Development in central Gainsborough, Morton and Lea could have implications for the Neighbourhood Extensions therefore the development expected in these locations has been accounted for where appropriate.

2.5 Potential for Change

Whilst the Southern Neighbourhood Extension is now the subject of an Outline Planning Application (ref: Foxby Lane App# 125020), there is only a limited amount of information concerning the proposed Eastern and Northern Extensions which has been taken from the Programme of Development (2008). Since the original housing trajectory within the Programme of Development was written, there has been a substantial downturn in the housing market and it is therefore likely that the rate of new development will be somewhat slower than originally predicted. This, uncertain economic climate combined with the changes in the planning process occurring across West Lindsey, the City of Lincoln and North Kesteven serves to make the pattern of future development highly uncertain. The creation of a Joint Planning Unit for the HMA may lead to changes in the housing data that has been used in this study and the relevance of Regional Planning Polices may change.

As such it will be necessary to review this WCS on a regular basis (e.g. every three to five years) to establish if there have been any significant changes to the development data that will affect the conclusions of this study.

Sewage Treatment



3 Sewage Treatment

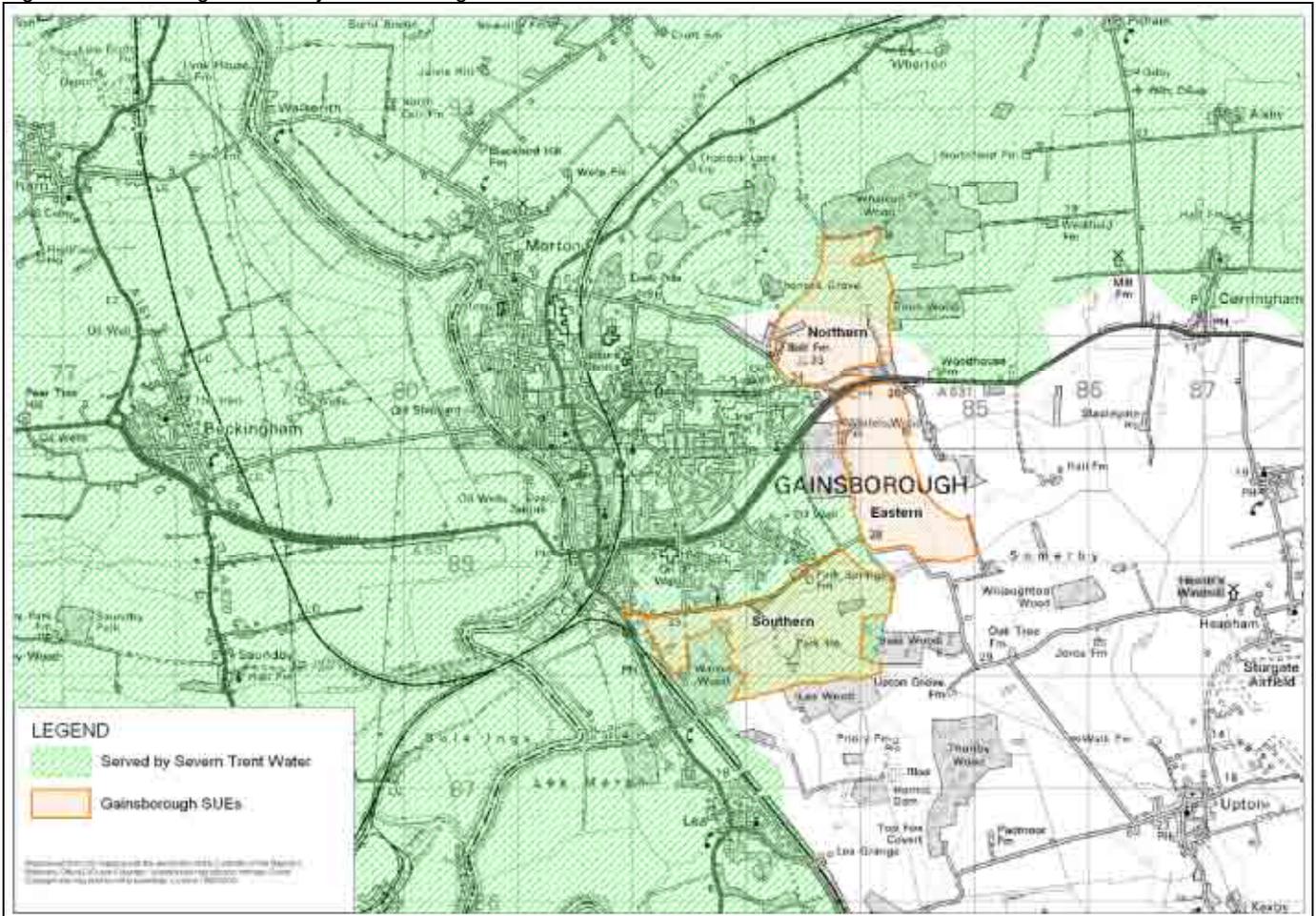
3.1 Introduction

The Outline WCS for Gainsborough identified that a Detailed WCS was required on the basis of sewerage and sewage treatment since the proposed Neighbourhood Extensions represent a significant increase in loading for the infrastructure. A key factor in the sewerage and sewage treatment situation is that Anglian Water and Severn Trent Water both operate infrastructure serving the Gainsborough area.

3.2 Water Company Coverage

Figure 3.1 illustrates the sewerage boundary between the two water companies within the locality of Gainsborough.

Figure 3.1: Sewerage Boundary between Anglian Water and Severn Trent Water



It is apparent that Severn Trent Water is responsible for sewerage currently serving the urban area of Gainsborough. However, the boundary between Severn Trent Water and Anglian Water skirts around the eastern periphery of Gainsborough and does not extend to the east of the current urban area to a significant distance.

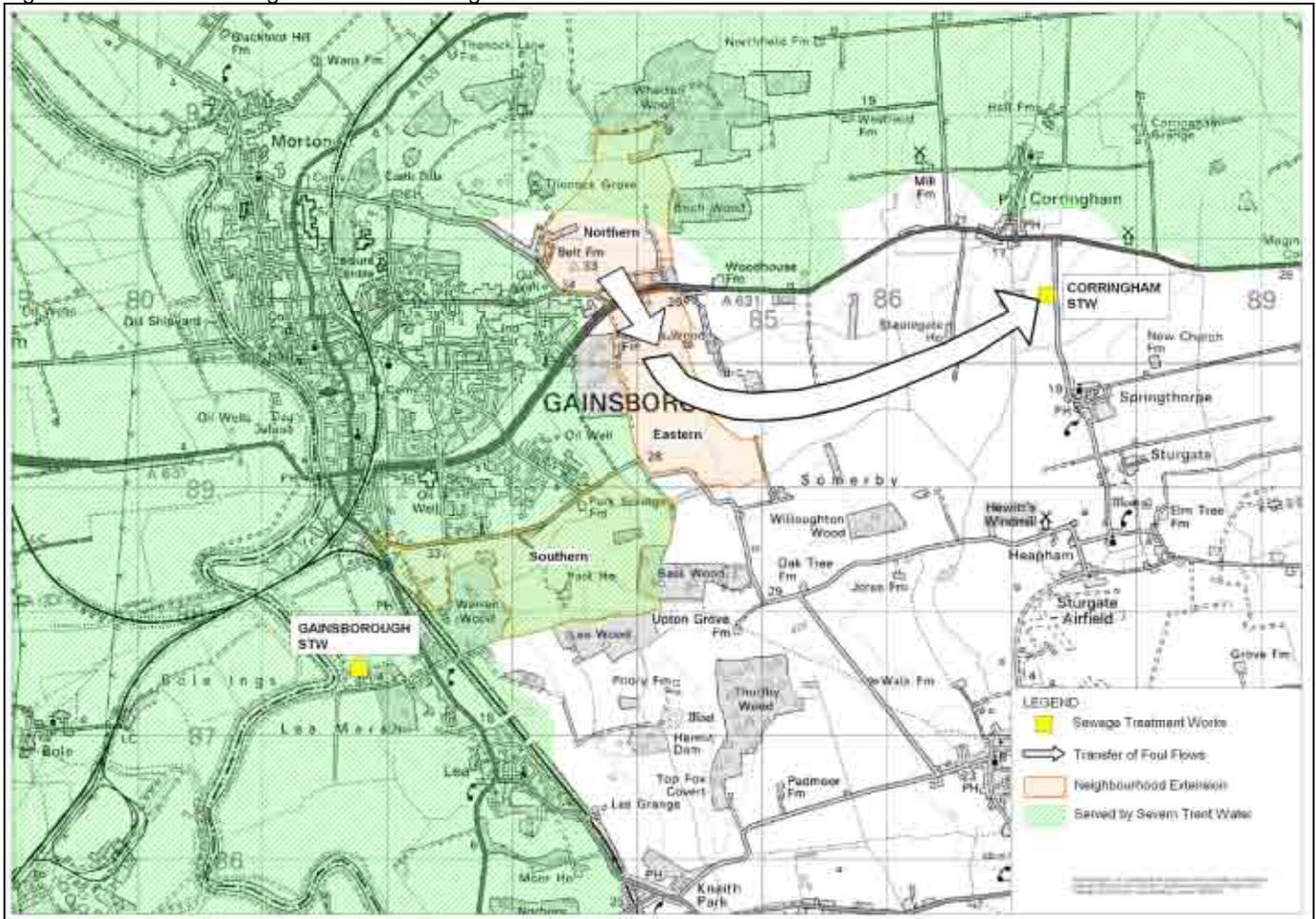
This has important implications as far as the three proposed Neighbourhood Extensions are concerned. The Southern Extension falls entirely within the area served by Severn Trent Water, the Eastern Extension falls entirely within the area served by Anglian Water, whilst the Northern Extension falls either side of the boundary. This will have implications concerning arrangements for how the three extensions are served for sewerage and sewage treatment.

In light of this it was agreed that in the first instance each water company ought to review its ability to serve the development that would occur within its own area.

3.3 Anglian Water

If Anglian Water were to serve the Eastern Extension and half of the Northern Extension it would be necessary to install trunk sewers to collect foul water from the Extensions and take it to a Sewage Treatment Works (STW). The nearest Anglian Water operated STW to the Neighbourhood Extensions is located at Corringham (Figure 3.2).

Figure 3.2: Location of Anglian Water's Corringham STW



Corringham is a small village works which was designed to serve an equivalent population of approximately 300. The Outline WCS identified that the village of Corringham may accommodate windfall development of 82 properties between 2006 and 2026 and Anglian Water indicated that if all of this development occurred it would exceed the existing capacity of the STW which could potentially accept an additional 50 houses approximately.

The Eastern Neighbourhood Extension could comprise 2,138 houses, an employment area adjacent to Corringham Road, a neighbourhood centre and primary school. The Northern Extension within Anglian Water's area could include an employment area adjacent to Corringham Road, opposite that in the Eastern Extension, a neighbourhood centre, primary school and possibly half of the proposed 2,427 houses.

In light of the scale of the potential development and scale of Corringham STW, Anglian Water has indicated that major extensions to the STW would be required in order to accommodate the Neighbourhood Extensions and concluded its purpose is to serve existing properties in Corringham and is not appropriate to serve the Neighbourhood Extensions.

An interesting point of note is that the Anglian Water – Severn Trent Water sewerage boundary runs through the middle of Corringham and there is an existing arrangement in place between the two water companies for foul flows from sewerage infrastructure operated by Severn Trent Water to be pumped to the Corringham STW, operated by Anglian Water.

3.4 Severn Trent Water

The principle STW in the area of interest is the Severn Trent Water STW at Lea Road, Gainsborough (Figure 3.2). Gainsborough STW currently serves an equivalent population of approximately 24,600, is an activated sludge works and

discharges treated effluent directly to the River Trent. Severn Trent Water has estimated that the Gainsborough STW could accommodate up to 1,250 additional new houses within the current discharge consent.

Consequently there is not sufficient spare hydraulic capacity at Gainsborough STW to accommodate all of the Southern Neighbourhood Extension, therefore it would be necessary to expand the STW. A Drainage Strategy Report⁴ produced as part of the Outline Planning Application for the Southern Neighbourhood Extension states that there may be sufficient capacity at the STW to accommodate the first phase of the Southern Extension which would comprise 419 houses and a school. Severn Trent Water has confirmed that this is the case.

Severn Trent Water has indicated that there are no known land constraints or potential odour issues which would prevent additional treatment capacity being provided at Gainsborough STW. Additional capacity to accommodate the entire Southern Neighbourhood Extension could be provided at the same time as a capital investment scheme that Severn Trent Water will be undertaking with regard to a new consent obligation under the Environment Agency National Environmental Programme. The cost of providing the additional capacity will be funded by Severn Trent Water; under Section 94 of the Water Industry Act 1991 sewerage undertakers have an obligation to provide treatment capacity for future domestic development.

Given that Gainsborough STW is the largest STW in the area, and will need to be extended to accommodate the Southern Extension which is at outline planning stage, it would make sense to expand the STW to be able to serve the Eastern and Northern Extensions as well. This would avoid excessive investment in a new STW given that Anglian Water's Corringham STW has been ruled out as being a possibility.

Due to the potential level of additional growth being proposed it would be prudent to provide future capacity for all planned development in Gainsborough as cost effectively as possible. Consequently confirmation concerning the anticipated size and phasing of the Northern and Eastern Neighbourhood Extensions is required to ensure that the required level of additional capacity can be provided as efficiently as possible.

Given that there is insufficient capacity at Gainsborough STW to support the Southern Extension, the STW needs to be expanded as soon as possible to enable development to go ahead. It is considered unlikely that Severn Trent Water would provide sufficient additional capacity at the STW for all three Neighbourhood Extensions in one go. To avoid potential inefficient investment based on speculative development water companies tend not to provide additional capacity until there is reasonable certainty that the development will actually take place. The uncertainty of development, building rates and current economic climate could affect the phasing of development for all three Extensions. Consequently it is assumed that Severn Trent Water would expand Gainsborough STW in stages, initially in AMP5 and a second stage in AMP6 or 7 depending on how quickly the Extensions are developed.

3.5 Water Quality

One factor requiring consideration, if Gainsborough STW is to be extended to accommodate the three Neighbourhood Extensions, is the water quality requirements of the receiving watercourse; the River Trent, to which Gainsborough STW discharges. The consent standard that will be imposed by the Environment Agency is critical.

Although the River Ecosystem classification was used by the Environment Agency to assess water quality, the standards set by the Water Framework Directive (WFD) came into force in January 2010. The WFD is a significant piece of water legislation produced by the European Commission for the European Union. It is designed to integrate the way water bodies are managed across Europe and it requires all inland and coastal waters to reach 'good status' by 2015. In summary, the WFD has the aim of achieving healthy rivers, lakes etc and a well-balanced water environment.

The WFD stipulates that the default objectives should be met by 2015, for example ensuring no deterioration of the water environment, or achieving good status. However, the Directive also requires that social, environmental and economic issues should be considered and allows alternative objectives to be set where it may not be able to achieve good status or it will be disproportionately expensive to do so.

The River Ecosystem target for the River Trent was RE3, in line with the WFD, the target will become 'good' status. Table 3.1 presents a comparison of the draft standards for good status and the superseded RE3 standards.

⁴ WYG (August 2009). Gainsborough Southern Neighbourhood – Drainage Strategy Report.

Table 3.1: Comparison of WFD and River Ecosystem Target

Class	Ammonia (mg/l)	BOD* (mg/l) 90%ile	DO** (% saturation) 10%ile	pH
RE3	1.3	6	60	6 to 9
WFD - GOOD	0.6	5	60	≥6 to ≤9

* - BOD = Biological Oxygen Demand

** - DO = Dissolved Oxygen

The implication of the move from RE3 to 'good' is that the water quality targets are more stringent in terms of BOD and Ammonia. The WFD also introduces a standard for phosphorus which has not previously been assessed. In order to achieve 'good' status it will be necessary for the Environment Agency to impose tighter, more onerous consents for discharges, such as those from STWs. This will have implications for water companies, particularly if there is a need to increase discharges from certain STWs in response to proposed development, as is the case with Gainsborough. Other forms of pollution such as from diffuse sources will also need to be addressed by the Environment Agency in order to help achieve good status.

3.5.1 Water Quality Assessment Methodology

As part of the Central Lincolnshire WCS the Environment Agency advised that it was necessary to review the discharge consents for key STWs being affected by growth using their in-house software; River Quality Planning (RQP). Therefore the discharge consent for Gainsborough STW has also been reviewed using the same methodology.

When the Environment Agency review permits for existing discharges or issue permits for new ones their aim is to issue permits that prevent or minimise any deterioration in the quality of water bodies that could otherwise occur as a result of the discharge. This is referred to as 'no deterioration' and the ideal is for no increase in the pollutant load in the water body.

3.5.2 Water Quality results

The current discharge consent information for Gainsborough STW is presented in Table 3.2.

Table 3.2: Discharge Consent for Gainsborough STW

Reference	FFT*	DWF** (m ³ /d)	Ammonia	BOD	SS	P
T/69/45776/R	23,155	9,100	n/a	40	60	See below

* FFT – Flow to Full Treatment

** DWF – Dry Weather Flow

Severn Trent Water currently has an Environment Agency National Environmental Programme consent tightening obligation for phosphorus of 2mg/l by 30 September 2014. If the STW was to be extended to accommodate some or all of the Neighbourhood Extensions it would be necessary to review the consented discharge of treated effluent to the River Trent.

Existing water quality and river flow data was obtained from the Environment Agency and compared against the existing discharge to review how the discharge consent would fare against the incoming WFD standards and impact of future development. It should be noted that there is no river flow or water quality data available for the River Trent at Gainsborough, in light of the river being tidally influenced. River flow data for the River Trent at the North Muskham gauging station has been used with an allowance for additional inputs to the system and water quality data used from the nearest upstream sampling point at Dunham.

Table 3.3 presents the existing discharge consents alongside the RQP outputs that would be required to achieve WFD 'good' status. This initial assessment did not account for any development that would require Gainsborough STW to increase its discharge.

Table 3.3: Comparison of existing discharge consent and what is required to achieve WFD 'good' status

Sewage Treatment Works	BOD (mg/l)		Ammonia (mg/l)		Phosphorus (mg/l)	
	Existing	WFD	Existing	WFD	Existing	WFD
Gainsborough	40.00	1033.7	N/A	216.6	2*	44.7

* - as of 30/09/14

It is apparent from Table 3.3 that the numbers produced by RQP to meet the WFD standards are considerably more lenient than those currently in force; this is a function of the considerable volume of water in the Trent available to dilute the discharge. The Environment Agency would not seek to relax the current consent standards at Gainsborough STW; no deterioration would apply and they may seek to tighten the consent where possible to achieve wider benefits.

However, the purpose of the water quality assessment is to determine the effects of the forecast growth for Gainsborough and if growth would mean the WFD standards could not be achieved. Table 3.4 presents the results of increasing the discharge from Gainsborough STW in light of potential growth that may be experienced and the impact it would have on the discharge consent. In terms of assessing the increased discharge from Gainsborough STW a worst case scenario was developed. It has been assumed that the STW has no spare capacity and that a potential 9,000 new homes could be built on the Neighbourhood Extensions, in central Gainsborough, Lea and Morton which would be all be accommodated at Gainsborough STW.

In doing so, it was assumed that there are 2.5 people per house, who consume 208 litres of water per day (includes an allowance for commercial flows and infiltration). The additional flow from the 9,000 homes was combined with the existing consented Dry Weather flow (cDWF) of 9,100 m³/d, which was subsequently increased by 20% to make an allowance for headroom (uncertainty) and natural variability in the weather. This generated an increased DWF of 16,536 m³/d.

Table 3.4: Impact of Growth on Consent Required to meet the WFD

STW	Scenario	DWF (m ³ /d)	Discharge Consent (mg/l)		
			BOD	Ammonia	Phosphorus
Gainsborough	To meet WFD	9,100	1033.7	216.6	44.7
	Plus Growth	16,536	574.8	119.5	24.7

It is notable, that a considerable increase in the number of houses being served by Gainsborough STW would significantly tighten the discharge consent with regard to what would hypothetically be required to meet 'good' status under the WFD. However, irrelevant of this fact, the standards are still more lenient than those currently imposed and the Environment Agency would seek no deterioration and possibly tighter standards.

The primary conclusion from the assessment is that water quality impacts should not present a barrier to growth in and around Gainsborough.

3.6 Expanding Gainsborough STW & Flood Risk

3.6.1 Increasing the Flood Risk

Treating additional foul flows at Gainsborough STW would mean that Severn Trent Water would need to expand the STW and it may also be necessary to increase the volume of treated effluent that is returned to the environment. As water quality was considered above so it is appropriate to consider what impact the increased discharge might have on flood risk.

The increased DWF of 16,536 m³/d (see Section 3.5.2) represents an increase of 7,436 m³/d or 0.09 m³/s on the existing DWF.

Gainsborough STW discharges into the tidal River Trent, the closest gauging station on the River Trent is upstream of the tidal limit at North Muskham (28022), some distance upstream of Gainsborough. The HiFlows-UK website provides gauged high flow data for the gauging station and states that the QMED flow is 446 m³/s. QMED is the median annual maximum flood, or flow that could be expected to be exceeded every other year.

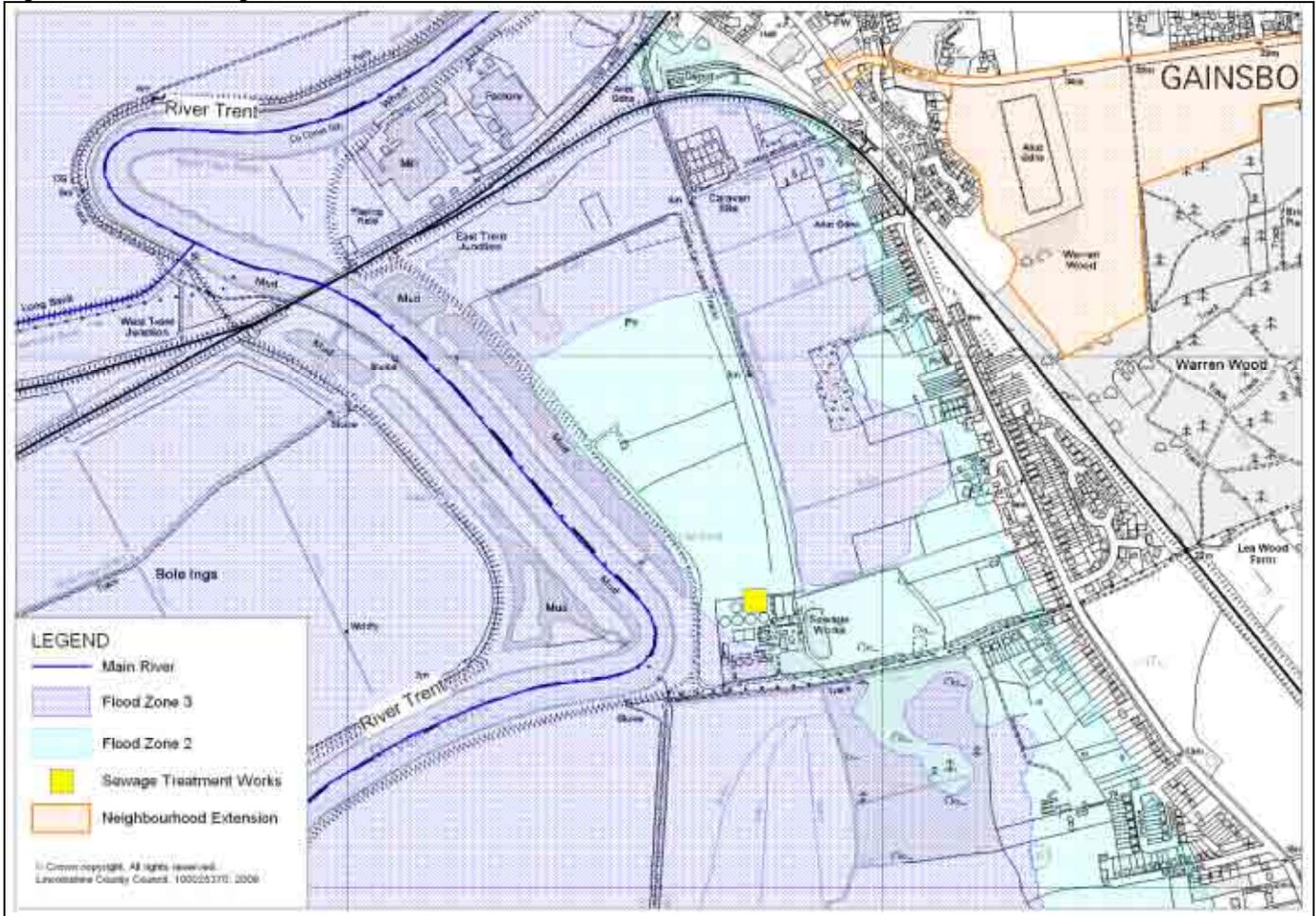
The 0.09 m³/s increase in discharge from Gainsborough STW represents 0.02% of QMED at North Muskham. Given that the increased discharge is almost insignificant in comparison to QMED, the gauging station is a considerable distance further upstream and additional flows will have contributed to flows in the Trent between North Muskham and the STW it is concluded that the increased discharge will not represent a significant increase in the downstream fluvial flood risk.

Gainsborough is also at risk of tidal flooding. Through Gainsborough the flood defences have been designed for the 1 in 200 year level plus freeboard, based on predicted still water levels for the year 2045. The 1 in 200 year water level in 2000 was estimated as 6.05mAOD and in the year 2045 as 6.5mAOD. The new defence height is 6.8mAOD providing a freeboard of 300mm. It has been assumed that the 0.09 m³/s increase in discharge from Gainsborough STW would not significantly impact upon the freeboard although should it become necessary to increase the discharge from the STW, and a more accurate DWF is calculated in comparison to the conservative one developed for the purposes of the WCS, the Environment Agency have a hydraulic model of the River Trent that could be made available if there is a need to demonstrate the actual impact of the increased discharge on water levels and what, if any mitigation is required.

3.6.2 Building in the Floodplain

Severn Trent Water has indicated that there are no constraints preventing expansion of the STW although in light of its position on the right bank of the River Trent it does lie within the Environment Agency's Flood Zones 2 and 3. Figure 3.3 illustrates the STW location; mainly within Flood Zone 2, but also partially within Flood Zone 3.

Figure 3.3: Gainsborough STW Flood Risk



Many STWs are located near to Main Rivers which often results in them being in Flood Zones 2 and 3. In the case of Gainsborough STW; the River Trent has flood defence banks and structures which provide a standard of protection of approximately 1 in 200 years. Hence, there is a residual risk of flooding if overtopping and / or breaches occur. It appears that sufficient land is available to carry out extensions to the STW in Flood Zone 2 (Figure 3.3). This implies that the works extensions would have an inherent degree of protection between 1 in 200 years and 1 in 1000 years (i.e. an annual probability of flooding between 0.5% and 0.1%). The probability of breaches occurring is very small.

STWs are classified in Table D2 of Planning Policy Statement 25 as being "less vulnerable" (if adequate pollution control measures are in place). Less vulnerable uses of land are appropriate in Flood Zone 2. Hence, there should be no objection, in principle, to extending Gainsborough STW.

The River Trent is tidal at Gainsborough, and water levels in the future will be increased as a result of climate change. However, the Environment Agency will monitor the situation, and the Catchment Flood Management Plan for the area states that the preferred flood risk management policy, in this location, is to maintain current standards of protection, allowing for the impacts of climate change.

Sewerage



4 Sewerage

4.1 Severn Trent Water

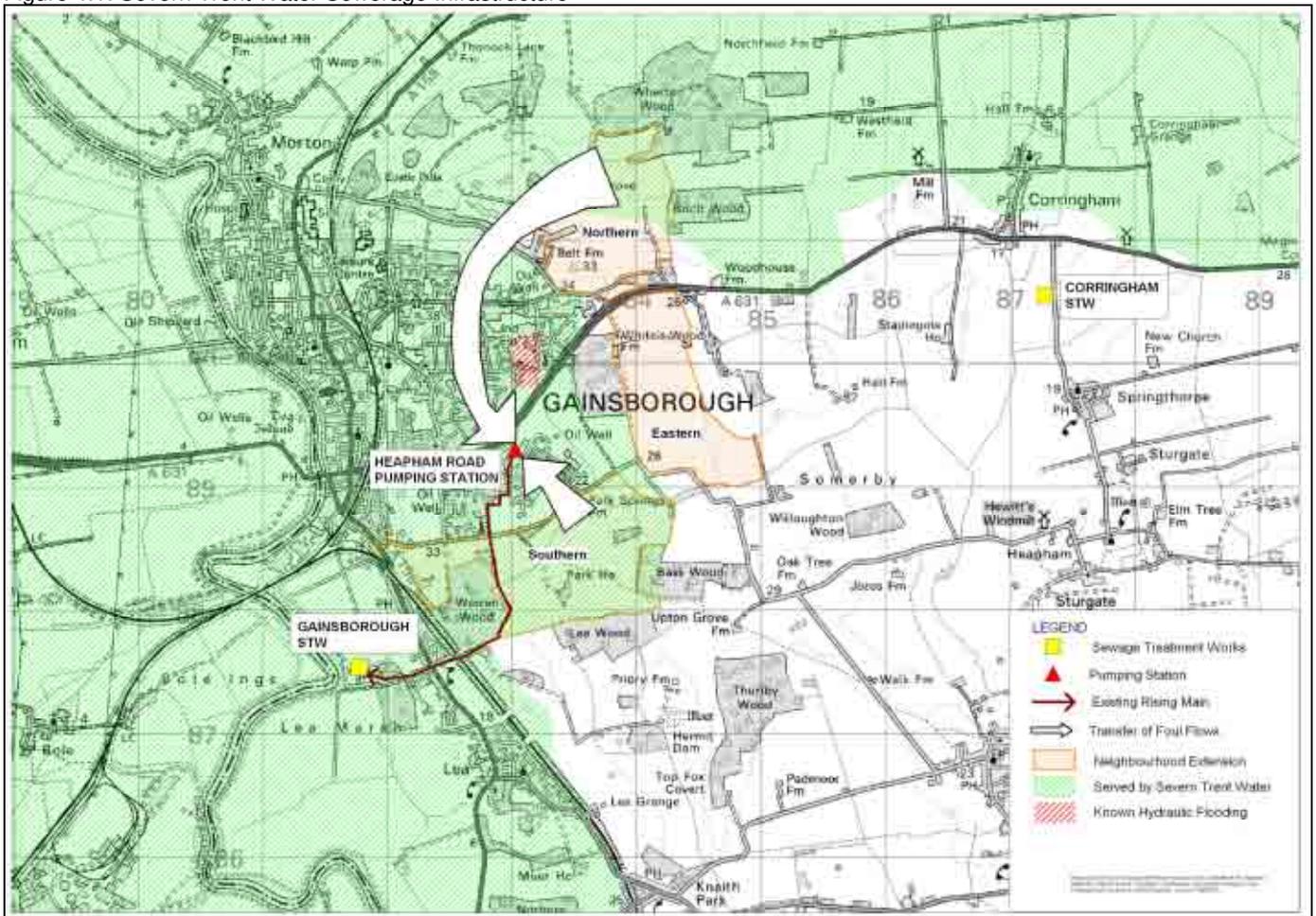
In light of Anglian Water having indicated that the Corringham STW is not capable of accommodating flows from the Neighbourhood Extensions sewerage implications for Anglian Water have not been considered.

If Severn Trent Water were to serve the Southern Extension and half of the Northern Extension (i.e. just the parts of the Extensions falling within their area) it would be necessary to install trunk sewers to collect foul water from the Extensions and take it to a STW; in all likelihood Gainsborough STW.

4.1.1 Sewerage Infrastructure Overview

The existing Severn Trent Water sewerage network is effectively split into two sub-catchments which drain to Gainsborough STW. These two sub-catchments are split by the railway line running north to south. The Neighbourhood Extensions would be located within the sub-catchment to the east of the railway which drains to a sewage pumping station at Heapham Road (Figure 4.1). All flows are then pumped directly to Gainsborough STW via an existing rising main. In addition there are three small satellite pumping stations to the south of Heapham Road which lift flows to the gravity sewers upstream of Heapham Road sewage pumping station.

Figure 4.1: Severn Trent Water Sewerage Infrastructure



The Heapham Road pumping station was refurbished in 2008 to address general maintenance issues and to provide additional emergency storage following historical pollution problems. At the same time a 505m section of the 2.8km rising main was also

replaced. Severn Trent Water has advised that there is minimal scope to increase the pumping capacity due to restrictions associated with the rising main but there are no plans for its replacement. As a result of the physical constraints at the pumping station there is minimal scope to expand the sub-catchment to incorporate the Southern and half of the Northern Neighbourhood Extensions.

The hydraulic model for Gainsborough's sewerage networks was last updated in 2004 as part of Severn Trent Water's drainage area study programme. This indicated that there are hydraulic deficiencies in the combined foul sewer to the north of Heapham Road pumping station (Figure 4.1). There are also known internal flooding problems which are currently being assessed as part of Severn Trent Water's capital investment programme. These additional constraints limit the ability of the existing network to accommodate additional flows from the Neighbourhood Extensions.

An additional factor is development within Gainsborough, other than the Neighbourhood Extensions that would need to utilise the existing sewerage network and may need to go via Heapham Road pumping station.

4.1.2 Implications of the Proposed Development

The local topography may allow the Northern Neighbourhood Extension to be drained by gravity to the Heapham Road pumping station however as stated above, there is limited capacity for this pumping station to accept additional flows. The foul flows from the Northern Extension would also pass through the area of known sewer flooding. In light of this it is concluded that the existing sewerage infrastructure serving Gainsborough is not capable of serving half of the Northern Extension.

The majority of the Southern Neighbourhood Extension lies in a topographic low spot (as does the Eastern Extension) and would therefore require a new pumping station to pump the foul flows up to connect with the existing sewerage system however, this would be constrained by the pumping capacity issues at Heapham Road pumping station. Phase 1 of the Southern Extension could drain by gravity. It is therefore concluded that it is not practical for Severn Trent Water to utilise their existing sewerage infrastructure to serve the Neighbourhood Extensions.

4.2 A Sewerage Strategy for the Southern Neighbourhood Extension

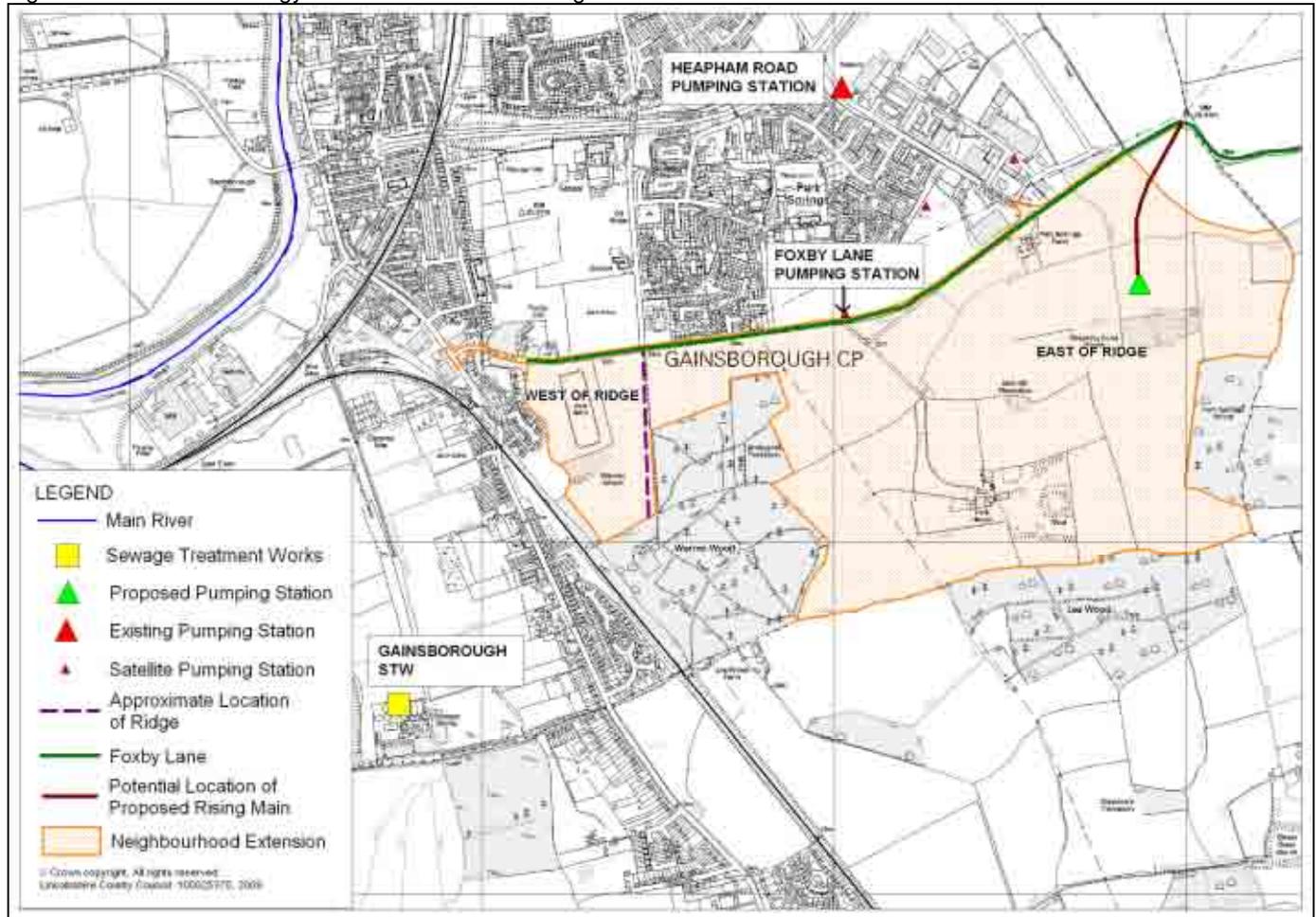
The Drainage Strategy Report produced as part of the Outline Planning Application for the Southern Neighbourhood Extension includes an assessment of draining wastewater from the site. The report refers to a ridge of high land which divides the site into east and west (location guesstimated in Figure 4.2). Phase 1 of the development would incorporate the land to the west of the ridge and comprise 419 houses and a school. It is proposed to drain this area by gravity to the existing sewer network located in Foxby Hill which flows down to Lea Road and then north to Bridge Street sewage pumping station. Severn Trent Water are undertaking detailed modelling to confirm there is sufficient spare capacity to accommodate flows from phase 1 as part of the sewerage requisition enquiry.

Phases 2-4 of the development would focus on land to the east of the ridge and comprise of the order of 2,000 houses. The ridge of high land prevents foul flows being drained by gravity to the Foxby Hill system and the constraints of the existing pumped sewer network prevent it from accommodating an additional 2,000 houses. The report consequently recommends construction of a pumping station and rising main to serve phases 2-4 of the Southern Neighbourhood Extension.

The pumping station, which would be adopted by the water company, would be within the eastern portion of the Southern Extension where flows could drain by gravity, and a new rising main would convey wastewater heading north east where it would meet a new gravity sewer that would be installed along Foxby Lane running parallel to the existing sewer system (Figure 4.2) to connect directly with Lea Road Sewage Treatment Works.

The report also refers to the potential to install small "sacrificial" package pumping stations as a temporary measure until such a time that the development warrants a single pumping facility. It should be noted that the Environment Agency would not consider such a solution to be a preferred or sustainable option.

Figure 4.2: Potential Strategy to Serve the Southern Neighbourhood Extension



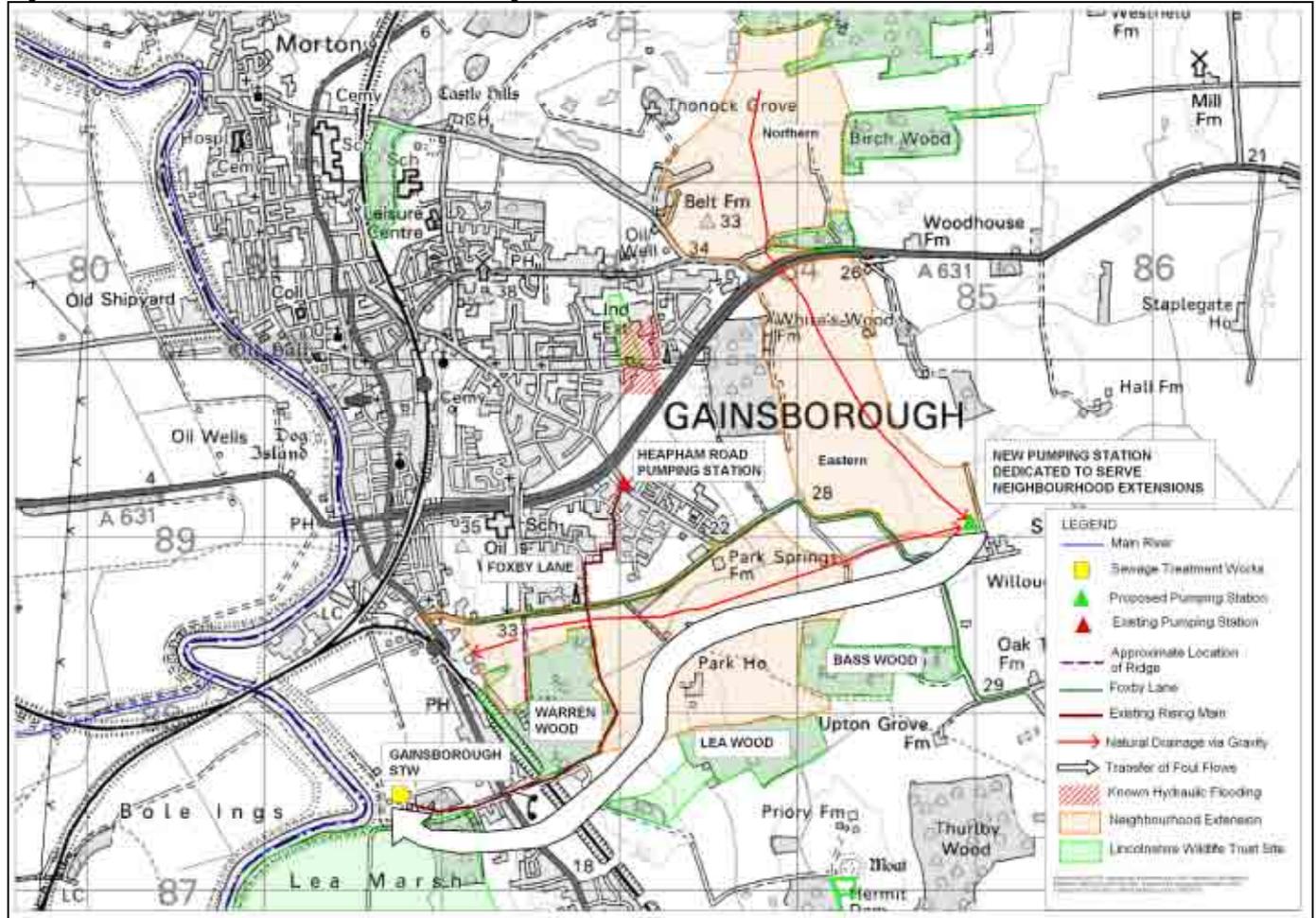
4.3 A Sewerage Strategy for All the Neighbourhood Extensions

If all three Extensions were to be treated at Gainsborough STW it would also make sense to utilise a sewerage scheme that strategically served all three Extensions in combination. An alternative approach to that in Section 4.2, would be to drain (the majority of) the foul flows via a dedicated sewerage system that did not interact with, or impact on the existing system and its associated constraints, thereby allowing any existing spare capacity in the system to accommodate development within central Gainsborough. The nature of this option is to holistically serve all three Neighbourhood Extensions together rather than piecemeal as would be the case if each water company served that development within its own boundary, or developers devised schemes independently for each Neighbourhood Extension.

The contours on the 1:50,000 OS mapping indicate that the Southern Extension would drain naturally by gravity towards the Eastern Neighbourhood Extension running parallel to the watercourse to the south of Park Springs Farm. The contours also indicate that the Northern Neighbourhood Extension would naturally drain by gravity south into the Eastern Neighbourhood Extension. Having drained the foul flows from the three Neighbourhood Extensions to a low point they would need pumping to Gainsborough STW. A suitable location for a pumping station would be to the south east of the Eastern Neighbourhood Extension, or in-between the Southern and Eastern Extensions and a dedicated rising main would connect direct to the STW (Figure 4.3). The location of the pumping station would require careful consideration to avoid overly deep sewers. This could be constructed as part of the developer's adoptable drainage under Section 104 of the Water Industry Act 1991 or requisitioned.

Given the uncertainty as to whether or not the Eastern and Northern Extensions will be developed in the near future the practical solution may be to install infrastructure to serve the Southern Extension that can be easily upgraded to serve the Eastern and Northern Extensions as required. Severn Trent Water have advised that further assessment on the feasibility of this option would be required to avoid construction of unnecessary infrastructure whilst ensuring that the phasing of flows does not result in future operational issues.

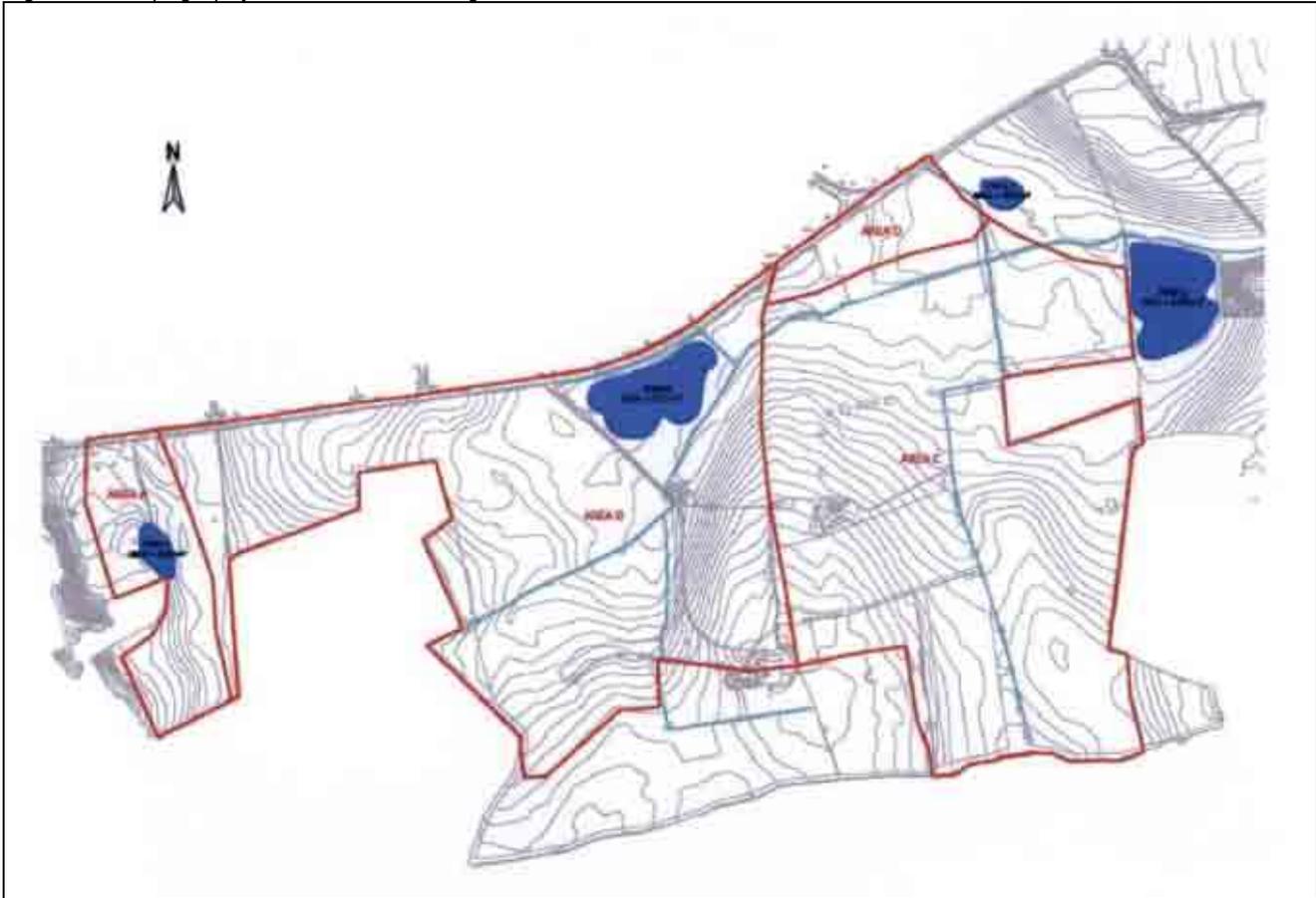
Figure 4.3: Holistic Solution to serve all Three Neighbourhood Extensions



The western portion of the Southern Extension could potentially still be drained by gravity to the existing sewerage network as set out in the Outline Planning Application, if Severn Trent Water confirms that there is sufficient capacity within the sewerage network to accommodate the proposed 419 houses and school. If the existing network is not capable of accepting these flows it still ought to be possible to drain them by gravity to the east and the new pumping station. Figure 4.4 illustrates the topography of the Southern Neighbourhood Extension which has been reproduced from Appendix E of the Flood Risk Assessment⁵ accompanying the Outline Planning Application for the Southern Extension, where it would appear that the land falls west to east following the line of Foxy Lane.

⁵ WYG (June 2009). Gainsborough Southern Neighbourhood – Flood Risk Assessment.

Figure 4.4: Topography of the Southern Neighbourhood Extension



*The boundary of the southern neighbourhood extension has been superseded. Please see the figures above for the correct boundary.

4.3.1 Constraints

Whilst such a scheme appears the most appropriate one, there are a number of constraints that would need to be accounted for prior to the scheme going ahead. The arrows indicating the transfer of foul flows in Figures 4.1 and 4.3 are purely indicative rather than illustrating a specific proposed drainage route. Warren Wood, Lea Wood and Bass Wood all lie immediately to the south of the Southern Neighbourhood (Figure 4.3) and are designated Lincolnshire Wildlife Trust Sites. Their location presents a potential constraint to the new rising main that would be required to transfer foul flows to Gainsborough STW.

It is envisaged that the route of the rising main would need to be to the north of Bass Wood and Lea Wood before dropping to the south of Warren Wood and running parallel to the existing rising main, as illustrated in Figure 4.3. If this were to be the case the rising main would pass through the Southern Neighbourhood Extension, which would need to be accounted for in master planning the development to ensure that access to the main is available. Alternatively the route of the rising main may have to run to the south of all three of the Wildlife Trust Sites. It would be essential to liaise with the Lincolnshire Wildlife Trust prior to implementing this rising main to avoid any negative repercussions for the sites.

Other potential constraints would include the new rising main needing to cross the railway line for which permits would need to be obtained and the existence of a gas easement through the Southern Neighbourhood Extension.

4.4 Conclusions

The selection of appropriate drainage strategies for the three Neighbourhood Extensions will depend on the phasing of the developments, and on the choice of systems. Each Neighbourhood Extension contains substantial numbers of residential properties and other land uses (e.g. schools) and each are will require individual consideration. However, this should be in the context of the ultimate, overall development.

Decisions will have to be made on preferred routes for sewers and rising mains and on the location and number of pumping stations. A drainage strategy has been prepared for the Southern Neighbourhood Extension, which involves providing a new foul drainage system in two stages; stage one connecting to the existing sewerage system in Foxby Lane and stage two involving construction of a new system draining by gravity to a new pumping station which would discharge via a new rising main to a new, duplicate, gravity sewer in Foxby Lane. It is also stated in the drainage strategy that temporary measures may be needed, such as sacrificial package pumping stations, presumably depending on the rate and timing of development.

Whilst the above drainage strategy considers the situation in the Southern Neighbourhood Extension, it doesn't consider the overall strategy covering all three Extensions. It may, for example, be better to drain all three Extensions (including or excluding the 419 houses in the western part of the Southern Neighbourhood Extension), to one location on the Eastern Extension, and pump the foul flows from there to Gainsborough STW. If phase one of the Southern Extension were to connect into the existing system it may inhibit the ability of the system to accommodate additional development within Gainsborough.

Whichever strategies and layouts are preferred, construction of drainage systems should take into account the need to;

- Avoid wasteful and premature expenditure (both capital and resource),
- Provide adequate, short and long term capacity,
- Minimise adverse environmental impacts, and
- Make access readily available for inspection and maintenance.

4.5 Combined Sewer Overflows

The sewerage network serving the Neighbourhood Extensions will deal with wastewater and surface water separately. However, the majority of sewers in central Gainsborough are combined sewers. Combined sewer systems usually have "combined sewer overflows" (CSOs) built into the system. A CSO is designed to allow wastewater and surface water to discharge directly into a watercourse, lake or ocean. The concept being that during wet weather when the combined sewers could become overloaded the CSO allows the diluted wastewater to escape into a watercourse rather than potentially flood properties.

The discharge of untreated wastewater, albeit diluted with surface water, can prove detrimental to water quality, flora and fauna. Consequently increasing flows upstream of a CSO is something the Environment Agency would like to avoid since this could increase the frequency and severity of spills from the CSO.

Whilst development within central Gainsborough has not been the focus of this study, should significant development occur that could impact on CSOs it will be necessary to review the CSOs to determine if Urban Pollution Management (UPM) studies are required. The Environment Agency has stated that the installation of new CSOs is unsustainable and should not be considered for future developments.

Infrastructure Requirements



5 Infrastructure Requirements

5.1 Introduction

This Section of the report considers what infrastructure (associated with the water cycle) would be required to serve Gainsborough's three Neighbourhood Extensions.

5.2 Sewage Treatment

It has been identified that there is insufficient capacity at the Gainsborough and Corringham STWs to cater for the development of the proposed Neighbourhood Extensions. Therefore if the Extensions are to go ahead it will be necessary to provide additional sewage treatment facilities. Given that Anglian Water has indicated that the Corringham STW is not appropriate for expansion either Gainsborough STW will need to be extended or a new STW built.

The additional sewage treatment capacity is required immediately to serve the Southern Extension which is currently at Outline Planning stage. The reality is that providing this additional capacity will take some time, particularly if a new STW were to be built which could take ten years or more to be fully operational. In light of which the extension of Gainsborough STW appears to be the most practical solution. Even so the phasing of development ought to be tied in with the ability of the STW to accept additional flows. Extension of the STW at Gainsborough would also appear to be preferential in terms of its location discharging into the River Trent in terms of water quality.

In the short term, if development of the Southern Extension were to be in advance of additional capacity being provided at the STW, interim measures may be required. It should be noted that the Environment Agency does not consider package plants to be a sustainable option.

5.3 Sewerage

It has been concluded that the most practical means of removing foul water from the three Neighbourhood Extensions is to avoid using Gainsborough's existing infrastructure network in light of a number of constraints associated with it. It is particularly important for the three Extensions to be served strategically rather than piecemeal.

Trunk sewers will be needed for each Extension, draining by gravity to the south east corner of the Eastern Extension. A new pumping station will be required to lift the foul flows from the gravity sewers into a new purpose built rising main to take them to be treated. Severn Trent Water is currently undertaking work to determine if it may be possible for phase 1 of the Southern Extension to utilise the existing infrastructure. Table 2.1 indicates that building on all three Extensions will start in the current AMP period; AMP5 therefore the additional sewerage infrastructure is required as soon as possible.

If the final solution is one where foul flows from the Neighbourhood Extensions are treated at Gainsborough STW it will be necessary for the two water companies to establish an appropriate agreement for this to happen. Such an agreement would only be required if a planning application were to be submitted for either the Northern or Eastern Neighbourhood Extension. This may involve transfer of foul flows between water companies, (several bulk transfer agreements are already in place between the two water companies) or alternatively the water companies may consider it more appropriate to revise the existing sewerage boundary. Revision of the sewerage boundary would require variation to the licence of appointment through OFWAT and could take of the order of 12 to 18 months to process. Any agreement could involve a lengthy process which could ultimately delay provision of infrastructure and consequently development. Therefore this process ought to be initiated by the developers and West Lindsey DC as early as possible when the planning of the Northern and Eastern Neighbourhood Extensions progresses to a more detailed stage.

5.4 Water Resources & Supply

The Outline WCS for Gainsborough identified that water resources and supply would not prove to be a constraint to development of the Neighbourhood Extensions. Anglian Water have since advised that whilst the forecast number of new properties exceeds that which is forecast in the Water Resources Management Plan⁶ by approximately 1000, there is sufficient headroom available to accommodate the difference.

⁶ Anglian Water (February 2010). Water Resources Management Plan, Main Report.

It is envisioned that new water supply trunk mains will be required to provide the Neighbourhood Extensions with a water supply although the Outline WCS did not identify any constraints to providing these. Provision of the trunk mains ought to be phased in line with the rate of development.

5.5 Fluvial Flood Risk

The Neighbourhood Extensions are located outside the River Trent's Flood Zones 2 and 3 however it will be appropriate for each of the Neighbourhood Extensions to be accompanied by an appropriate Flood Risk Assessment.

5.6 Surface Water

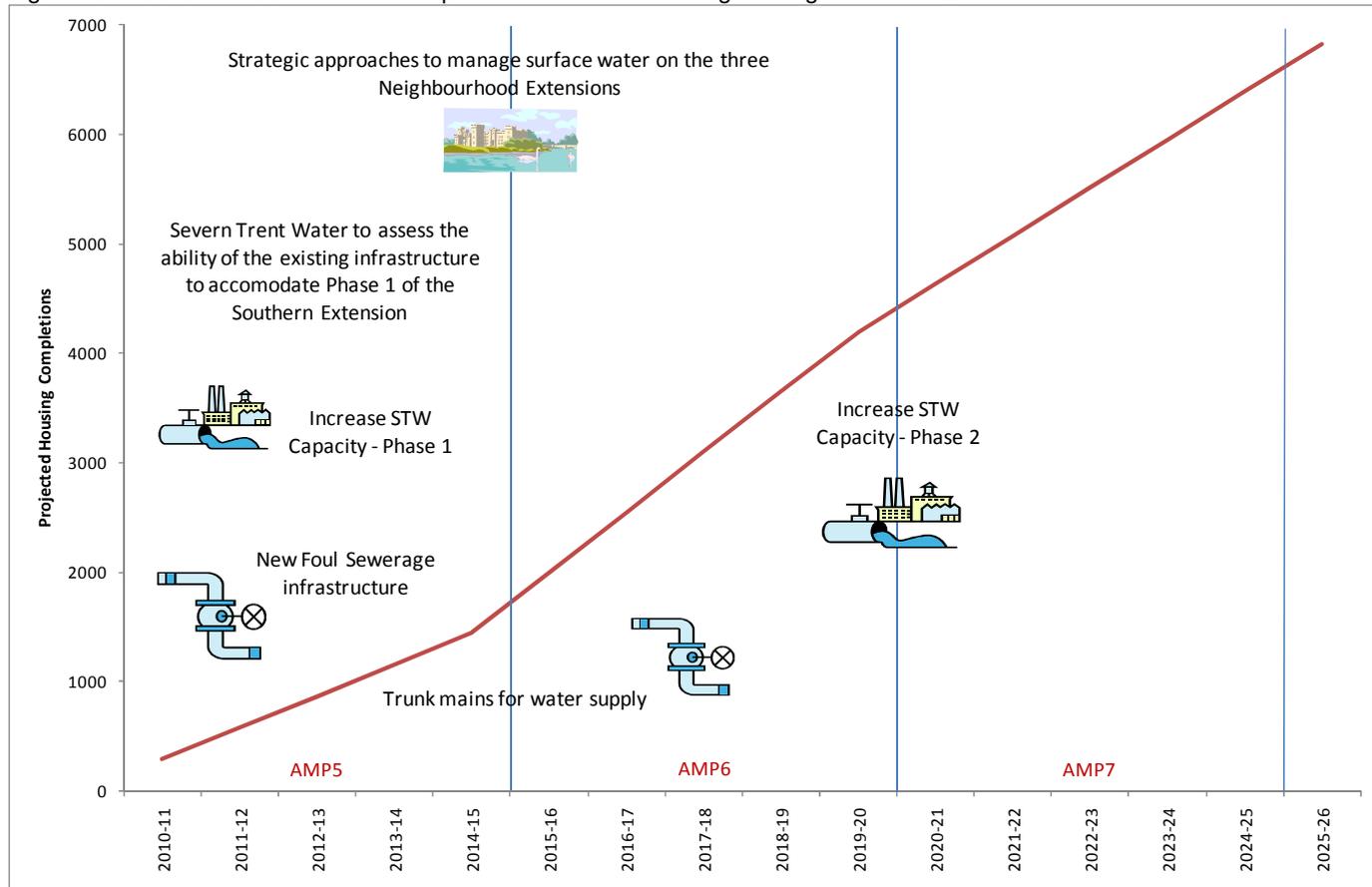
The Drainage Strategy for the Southern Neighbourhood Extension indicates that the majority of the site can drain naturally towards Somerby Drain which runs through the site. SUDS and rainwater harvesting have been outlined as being viable, however the report flags the underlying geology as potentially limiting the ability of infiltration systems. The Drainage Strategy has used the central location of Somerby Drain as a natural outfall for surface water and proposed a series of connected attenuation systems/drainage ponds and swales. This has been proposed following discussions with the Upper Witham Internal Drainage Board (IDB).

The Eastern and Northern Extensions are dissected by a number of drains and field ditches, most of which will ultimately find their way into Somerby Drain and the River Till which subsequently flows south easterly towards Lincoln. These are likely to provide means of draining surface water from the sites which will impact upon the district of the Upper Witham IDB. Therefore it is imperative that developers enter into discussions with the IDB at an early stage in the master planning process.

5.7 Required Infrastructure

Figure 5.1 presents a Timeline of infrastructure requirements based on the phasing of development set out in Table 2.1.

Figure 5.1: Timeline of Infrastructure Requirements for Gainsborough’s Neighbourhood Extensions



5.8 Challenges to be Overcome in Providing Water Services Infrastructure

The overall challenges will depend on the scale and rate of development, the extent of infrastructure requirements, potential impacts on the environment, the degree of complexity in selecting preferred, sustainable options, lead-in times, availability and phasing of expenditure, and on the degree of clarity of organisational responsibilities. Each of these is covered below.

5.8.1 Scales and Rates of Development

The current economic situation appears to be limiting growth rates, and developers are not progressing two of the three Neighbourhood Extensions. There are some issues which will have to be resolved before development can go ahead e.g. foul drainage strategy.

Notwithstanding the current economic situation, it is clear that the Gainsborough STW will need to be extended and new foul sewerage infrastructure required to serve the Neighbourhood Extensions.

5.8.2 Potential Impacts on the Environment

Development and the provision of water services infrastructure can have adverse impacts on the environment, but they can also lead to environmental enhancements. Section 4.3.1 of the report highlighted an overview of Lincolnshire Wildlife Trust sites that could potentially be affected by development, and Section 3.5 gave consideration to the impacts on water quality. The construction of new or altered infrastructure often creates temporary, adverse environmental impacts - which have to be managed or controlled during the construction process. However, permanent adverse impacts are much less prevalent and may be limited to some sterilisation of land for building (over trunk mains, rising mains, sewers etc), and to some loss of visual amenity.

5.8.3 Selecting Sustainable Options

Sustainable options for development and infrastructure provision are not necessarily the “least cost” investment options. Selection of options can be quite complex and involve consideration of existing problems in addition to new requirements,

planned replacement of assets and consideration of whole life costs. As the locations and phasing of developments become more defined, detailed infrastructure provision will be more clearly identified. The challenge will be to select options which are “sustainable” in the long term – both economically and environmentally.

5.8.4 Lead in Times

Planning applications for major developments (e.g. the three Neighbourhood Extensions) can take substantial periods of time to process. Provision of water services infrastructure requires lead-in times for Feasibility Studies, Modelling and Detailed Design. Overall time periods will depend on the scale and nature of the new assets, but could be several years for the expansion of the STW, and several months for the new mains extensions/sewers. Consultation processes and obtaining legal consents affect both development and infrastructure provisions. The co-ordination of timetables is a major challenge.

5.8.5 Availability and Phasing of Expenditure

In any AMP period, the expenditure available to water companies is that which is approved by OFWAT. Developers will only invest if the economic climate is reasonable and if the general public can buy and rent properties at affordable prices. The Environment Agency budgets depend on limits defined by DEFRA and LPAs / IDBs rely on Environment Agency approved grants for drainage schemes. The challenge is to secure appropriate levels of expenditure and then to ensure that it is used effectively.

5.8.6 Organisation Responsibilities

The Floods and Water Act will change some responsibilities for surface water drainage and will introduce new requirements on water companies. During the transitional period there may be a lack of willingness (by some organisations) to commit resources, or to take initiatives until roles and responsibilities are clearly defined by the Act. Lack of financial resources may result in desirable projects being delayed.

The fact that the three Neighbourhood Extensions are located across the boundary between Anglian Water and Severn Trent Water will affect the arrangements as to how foul sewerage infrastructure is provided.

5.9 Approaches to Overcoming the Challenges

The challenges defined above can be overcome if the organisations involved continue to work in a “partnership” mode. Each of the major stakeholders can contribute significantly to the achievement of an effective, integrated water cycle strategy and the following sections identify some key points.

5.9.1 West Lindsey District Council

The formation of the Joint Planning Committee and re-structuring of local authorities should enable:

- Allocation of housing numbers across all parts of the Housing Market Area and production of a Core Strategy
- Development of the Gainsborough Action Area Plan
- Better indication of locations and phasing of preferred developments
- Discussions with developers regarding progress of Neighbourhood Extensions

West Lindsey DC could also prompt and facilitate negotiations between the two water companies regarding the cross boundary issues.

5.9.2 Lincolnshire County Council

The County Council will become the Lead Local Flood Authority for local flood risk and will become responsible for approving and adopting SUDS under the Floods and Water Act.

5.9.3 Water Companies

The main objective for the two water companies with regard to Gainsborough is to provide infrastructure when required to service approved growth. Each water company has strategic and business unit plans on which it sets and reviews its objectives, obligations and targets. These units will help with the planning, design and provision of infrastructure at both the strategic and local level.

It may be appropriate for Severn Trent Water to update their hydraulic model of Gainsborough’s sewerage networks given that it was last updated in 2004. A modelling study could assess the available capacity of the system and determine whether any spare

capacity could be used to serve phase 1 of the Southern Neighbourhood Extension or if it ought to be used to serve additional development within Gainsborough.

5.9.4 Environment Agency

The Environment Agency will be involved in the processes as “Regulator, Statutory Consultee, Provider and Operator of Flood Risk Management systems, and a provider of grants to local planning authorities and IDBs.

The Environment Agency will be able to use their various planning and operational resources to assist in the determination of sustainable options and strategic solutions.

5.9.5 Implementation Group

It is recommended that an “Implementation Group” is established to review and promote the Water Cycle Study to ensure that maximum benefit is gained from the work undertaken, and from future policies and technical studies.

Conclusions & Strategy



6 Conclusions & Strategy

6.1 Conclusions

In summary the following bullet points are offered to bring out the pertinent conclusions of the Gainsborough WCS;

- Factors such as the current economic climate mean that the timing and rate of future development of the three Neighbourhood Extensions is very unpredictable. Potential build rates are further complicated by the current status of the Local Development Framework. Therefore the overall strategy needs to be both flexible and robust to change.
- There is insufficient sewage treatment capacity to accommodate all of the Neighbourhood Extensions (although a small amount does exist).
- The STW at Gainsborough appears the most appropriate means of providing additional capacity, possibly in a phased manner over a number of AMP periods. Additional capacity will be required in AMP5 (2010 – 2015).
- There are significant constraints within the existing foul and combined sewerage network that prevent it from receiving additional foul flows from the Neighbourhood Extensions. There may be sufficient capacity within the existing network to accommodate phase 1 of the Southern Extension.
- New sewerage infrastructure will need to be provided during AMP5 which will comprise gravity trunk mains, a pumping station(s) and rising main(s). The final approach ought to holistically address the three Extensions together. Provision of sewerage infrastructure may need to be phased over two AMP periods.
- It is anticipated that it will be necessary for an appropriate agreement to be drawn up between water companies to address the transfer of foul flows. This could be a lengthy process which may delay the delivery of infrastructure.

6.2 Strategy

6.2.1 Overall Strategy

The Strategy will be;

- i. To phase the provision of additional sewerage and sewage treatment capacities in line with development of the Neighbourhood Extensions. Phasing the provision of infrastructure will avoid unnecessary early or abortive expenditure, and any adverse environmental impacts.
- ii. Surface water drainage from the Neighbourhood Extensions will make use of SUDS techniques to manage runoff on site.
- iii. The developments will include measures for limiting water consumption (Section 7).

6.2.2 Strategy Implementation

Sewage treatment capacity will be provided through the phased expansion of the existing Gainsborough STW to ensure compliance with consent standards and the WFD and a new sewerage system, which does not impact on the existing system, will be provided in a phased manner to strategically serve the three Neighbourhood Extensions. To facilitate this Severn Trent Water is to undertake additional works to confirm the ability of the existing sewerage network to accommodate phase 1 of the Southern Extension. Provision of additional infrastructure should take into account the proximity of Lincolnshire Wildlife Trust sites to the Southern Extension to avoid any potential adverse consequences for the sites.

6.2.3 Strategy Review

Development progress will be monitored annually and the Strategy will require regular review, as development patterns become more clearly defined, and policies are formulated by the new Joint Planning Committee. Revisions to items identified on the initial timeline may be required as the economic situation changes and as the provisions of new legislation come into force (e.g. Floods and Water Act).

Guidance for Developers



7 Guidance for Developers

7.1 Introduction

This section is intended to provide Developers with guidance as to how they will be able to ensure that the three Neighborhood Extensions to Gainsborough are sustainable and do not compromise the water cycle.

7.2 Water Resources

Water is becoming scarcer at the same time as population and demand for water is increasing, therefore the development of practical ways to reduce water demand is very important. The Code for Sustainable Homes aims to reduce the consumption of potable water in the home and for external water uses.

Twenty per cent of the UK's water is used domestically with over 50 per cent of this used for flushing toilets and washing. Most of which comes from drinking quality standard or potable water. The amount of potable water used within the dwelling can be reduced by using fixed fittings which reduce water use in WC's, taps and showers. It is recommended that developers are encouraged to provide water efficiency measures such as these in all new developments.

Future Action 1 – Provide water efficiency measures in new homes.

Water is an increasingly scarce resource and more and more homes have metered water supplies with householders having to pay for any water they use. Installing water meters is known to have the effect of reducing demand for water and Anglian Water actively encourage this by metering all new households.

Future Action 2 – Water companies and West Lindsey DC to encourage metering of new properties.

Another area where demand for water can be reduced, or managed is for outdoors use, particularly for activities such as watering gardens. We cannot dictate the type of gardens that people have but can try to influence them by ensuring developers provide low maintenance gardens in the first place. This can be done by providing new properties with a system to collect rainwater. The simplest and most cost-effective system for rainwater collection is the water butt. Harvesting rainwater also has the additional benefits of reducing:

- the amount of water being discharged into drains and watercourses,
- the risk of localised flooding, and
- overall water bills for householders.

It is recommended that each new house be able to store runoff from its roof that can be used for external purposes such as cleaning cars and irrigating gardens.

Future Action 3 – Implement rainwater harvesting measures where appropriate.

7.2.1 Code for Sustainable Homes

The Code for Sustainable Homes is a voluntary standard designed to improve the overall sustainability of new homes in England by setting a framework within which the building industry can design and construct homes to higher environmental standards. The Code measures the sustainability of a home against nine design categories, rating the 'whole home' as a complete package. The design categories are:

- | | |
|--|------------------------|
| - Energy and CO ₂ Emissions | - Pollution |
| - Water | - Health and Wellbeing |
| - Materials | - Management |
| - Surface Water Runoff | - Ecology |
| - Waste | |

Each category includes a number of environmental issues which have a potential impact on the environment. Of particular relevance to the WCS are the categories of Water and Surface Water Runoff.

The Water category has two aims relating to water consumption within the home and water consumed outside the home for activities such as car washing and garden watering. The internal water use aim is *"To reduce the consumption of potable water*

in the home". The amount of potable water used within houses can be reduced by using fixed fittings which reduce water use in WC's, taps and showers. Further reductions could be achieved by installing grey water or rain water collection and treatment systems.

The external water aim is "To encourage the recycling of rainwater and reduce the amount of mains potable water used for external water uses." The installation of water butts is a very simple yet extremely effect means of reducing the volume of potable water used externally.

The Surface Water Runoff category also has two aims, one to manage runoff from developments and a second concerning flood risk. The aim of managing surface water runoff from developments is to design housing developments which avoid, reduce and delay the discharge of rainfall to public sewers and watercourses. This will protect watercourses and reduce the risk of localised flooding, pollution and other environmental damage.

The flood risk aim is to encourage housing development in low flood risk areas, or to take measures to reduce the impact of flooding on houses built in areas with a medium or high risk of flooding.



7.2.2 Water Neutrality

The concept of water neutrality has arisen as a response to plans for housing growth in areas where water resources are under pressure. Without water neutrality, or a similarly robust response, housing growth will lead to increased demand for water at a time when climate change threatens to reduce water supply. This presents clear risks to the water environment.

Water neutrality is an ambitious concept which aims to ensure there is enough water to support new development without requiring additional water resources. The definition used by the Environment Agency and the Government is that the total water use after development does not exceed the total water use before development.

A water neutrality strategy will involve a range of measures designed to offset the predicted increase in water that would result from a new development in a business-as-usual scenario. This predicted increase will be limited by implementing water efficiency measures for the *new* buildings. The remaining increase will then be offset by reducing water use in *existing* buildings.

An alternative approach to water neutrality would not relate it specifically to new housing development. Instead, a water-stressed area would be selected, and a strategy put in place not to exceed water use from the baseline year.

The Environment Agency published a report with the Department for Environment, Food and Rural Affairs (Defra) and Communities and Local Government (CLG) in 2007 which showed it is possible to move towards water neutrality in the Thames Gateway. The Gateway is a major growth area that will help deliver the Government's aims to build more homes. Water resources are very stretched in the area. However, the scale of development in the Gateway also presents an opportunity to make the area an exemplar for sustainable development.

Water neutrality is achievable through a combination of measures:

- increasing the level of metering;
- introducing variable tariffs;
- improving water efficiency of new housing;
- retrofitting existing homes with water efficient options;
- reducing demand from non-households.

In October 2009, the Environment Agency published a new study which demonstrates that water neutrality provides an overall economic as well as environmental benefit to society. Analysis showed that for every £1 invested in water neutrality, benefits of about £1.40 would be realised. This benefit depends principally on using less water and energy in homes and businesses through more efficient use of water, particularly hot water use. From an environmental perspective, everyone gains from reduced CO₂ emissions resulting from domestic energy savings and abstracting less water in a water-stressed area helping to protect water quality and biodiversity.

The WCS partners may wish to consider establishing Gainsborough as a water neutral area. Anglian Water have identified that water resources are available to serve the planned growth however implementing a water neutral scheme could help to limit the amount of additional water that is required.

7.2.3 Use rather than Dispose of Rainfall



Historically developments have sought to dispose of rainfall from developments as quickly as possible however, it is now recognised that this is wasting a valuable resource particularly in areas which receive relatively little rainfall and are classed as being water deficient such as Lincolnshire. As a result there is increasing support for developments to collect and use rain water rather than trying to drain it from the site.

Planted biofiltration areas can be integrated with roof gardens to collect rainfall, treat the water and provide additional roof insulation. Biofiltration has the benefit of slowing down water flows by 6-12 hours so that water can be released gradually. The grey water that is collected and treated by the biofiltration areas (roof gardens) can subsequently be used for a variety of uses.

A tall building will allow the grey water to be cascaded between floors down the building under gravity, being used directly to flush toilets and irrigate green walls on the outside of the building. Water from sinks or showers can also be used to irrigate these green walls, and excess water would be captured to supplement toilet flushing in the floors below. The cascading living green wall provides treatment of the grey water before it is returned to the building. Green walls have the added benefits of providing insulation thereby lowering energy consumption, and regulate the local microclimate.

Future Action 4 – Developers to endeavour to re-use rainfall within the Neighbourhood Extensions.

7.3 Surface Water

7.3.1 Design Standards

Different design standards are usually applied to different systems; highway drainage is usually designed for a 1 in 2 year event, surface water sewers should not surcharge for a 1 in 30 year event and the 1 in 100 year event is often used to assess fluvial flooding. New developments also have differing design standards applied to them. For discharge into a Main River or an Ordinary Watercourse, outside of IDB Districts, the discharge rate will be based on the calculated pre-development (greenfield) run-off rate for the site and for a simple control structure will be based on the QBAR rate. This should be agreed in discussions with the Environment Agency.

If complex controls are to be used for control of discharge rates, calculations for the greenfield run-off rate should be provided for the 1, 30 and 100 year return periods. The methodology set out in the Environment Agency/Defra document "Preliminary Rainfall Runoff Management for Development (W5-074/A/TR1)" should be used as the basis for calculations.

A similar approach may be applicable for discharge to an IDB controlled watercourse however early discussions with the appropriate IDB are essential to ensure that discharge rates consider the design standard of the systems downstream especially if within a pumped catchment which may have a fixed discharge rate based on historic agricultural rates.

Future Action 5 – Developers to enter into discussions with the Environment Agency and IDBs at the start of the planning process.

7.3.2 Surface Water Sewers

Developers usually prefer the surface water sewers draining their sites to be adopted by the local water company. Under Section 106 of the Water Industry Act 1991, developers had the right to connect drainage from roofs and paved areas within the curtilages of dwellings within their development where there is an existing surface water sewer available. (This right is being amended in the Floods and Water Act). In order for the water company to take on responsibility for the sewers they should be designed in accordance with *Sewers for Adoption* which provides guidance on the standards of design.

If a developer provides a new surface water sewer which discharges directly to a watercourse this may also be offered for adoption by the water company. This is generally acceptable to the water company where the sewer meets the required engineering specification. The developer is however responsible for obtaining the 'right to discharge' from the riparian owner and consent from the Environment Agency or IDB where appropriate for the outfall structure. IDB consent is also required for discharge to a watercourse within their district whether the discharge is direct or via a public or private sewer or SUDS system. This is to ensure that the available capacity in the watercourse to accept increases in flows is not exceeded.

The greenfield rule should be applied to all new development and on brownfield sites a significant reduction of discharge should be sought, ideally 30% to account for climate change.

Future Action 6 – Developers to restrict runoff from the Neighbourhood Extensions.

7.3.3 Future Management of Surface Water

Management of surface water flood risk is in the process of changing. The Floods and Water Act is designed to improve the UK's resilience to future flooding threats that are likely to be intensified by climate change. The Act will continue implementing the recommendations of Sir Michael Pitt's report after the 2007 floods which need legislation. The Pitt Review called for a better spread of information in the event of flooding and clearer guidelines on which local and government agencies would take responsibility.

Local councils will be given responsibility for surface water flooding for the first time, but the Act gives overall responsibility for flooding to the Environment Agency. It will also require housebuilders and developers to incorporate drainage that minimises flood damage and improves water quality at new building developments. To encourage the uptake of sustainable drainage systems the automatic right to connect to sewers is to be removed and provision made for unitary and county councils to adopt SUDS for new developments and redevelopments.

In Lincolnshire the County Council, District Councils, Environment Agency, Anglian Water, Internal Drainage Boards and the NFU are already working together to develop of an inclusive partnership framework to ensure facilitation of a co-ordinated approach to all aspects of flood and drainage risk management across the county. The County Council is leading this initiative with strong support from partners.

The Lincolnshire Flood Risk and Drainage Management Framework is designed to provide co-ordinated management and delivery of flood risk and drainage functions of all relevant organisations across Lincolnshire. The framework implements the recommendations of the Pitt Review and the provisions of the Floods and Water Act in a way that is tailored to suit the geographical, social, economic and environmental characteristics of Lincolnshire. Its purpose is to ensure that local communities and infrastructure are better protected from flood risk, and that improved resilience towards flooding is built into all aspects of planning and service provision in the future.

7.4 Sustainable Drainage Systems

Traditional drainage is designed to move rainwater as rapidly as possible from the point at which it has fallen to a discharge point, either a watercourse or soakaway. This approach has a number of potentially harmful effects:

- Runoff from hard paving and roofing can increase the risk of flooding downstream, as well as causing sudden rises in water levels and flow rates in watercourses.
- Surface water runoff can contain contaminants such as oil, organic matter and toxic metals. Although often at low levels, cumulatively they can result in poor water quality in rivers and groundwater, affecting biodiversity, amenity value and potential water abstraction. After heavy rain, the first flush is often highly polluting.
- By diverting rainfall to piped systems, water is stopped from soaking into the ground, depleting groundwater and reducing flows in watercourses in dry weather.

In recent years there has been a change of thinking; from the historic view of removing rainfall from urban areas as quickly as possible via the sewer network, to managing the water in-situ. This has the effect of reducing the need to upgrade the sewer networks and reduce the risk of flooding. Sustainable Drainage Systems (SUDS) have come to the fore as a means of managing surface water at source. Government guidance in the form of the SUDS Manual (CIRIA 697) promotes the use of SUDS to provide protection against flooding downstream of new developments and as a means of protecting the water quality and amenity of any receiving watercourse.

SUDS include tried-and-tested techniques that are already being implemented on a range of projects and they incorporate cost-effective techniques that are applicable to a wide range of schemes. Planning Policy Statement 25 emphasises the role of SUDS and introduces a general presumption that they will be used; indeed going forward it is hoped that SUDS of one form or another will be incorporated into 75% of new developments. As with other key considerations in the planning process, incorporating SUDS needs to be considered early in the site evaluation and planning process, as well as at the detailed design stage.

The ongoing maintenance of SUDS is a complicated issue and has had the effect of limiting the take up of SUDS. Very rarely would Local Authorities, Internal Drainage Boards, or the Environment Agency agree to take over the long-term maintenance of any SUDS installations. As such developers have been known to set up Management Companies to maintain SUDS where residents can be required to contribute towards annual maintenance costs. However, these arrangements may not be sustainable in the longer term.

The Floods and Water Act is set to bring about changes to facilitate the use and maintenance of SUDS.

Future Action 7 – Developers to use SUDS wherever possible with due regard to the constraints associated with the specific site.

Lincolnshire County Council will become the approving and adopting body for all SUDS. All drainage systems in new developments and redevelopments, including SUDS schemes will need to be approved by Lincolnshire County Council before construction can commence. It is also proposed that S106 of Water Industry Act 1991 will be amended to make the right to connect surface water run-off to public sewers conditional on approval of the site drainage plans. Should the SUDS scheme serve more than one property Lincolnshire County Council would subsequently adopt and maintain the scheme where constructed as approved.

A national specification is to be developed for SUDS which could follow a similar format to PPS25, where it will be expected that all new developments should incorporate SUDS unless 'testing' can prove otherwise. The testing is likely to apply to both implementation of SUDS and the type of SUDS to be implemented. Ideally the runoff should be managed on site, if that is not possible testing will determine if it can be managed local to the development or regionally in an amenity space.

The SUDS approach to drainage incorporates a wide variety of techniques and as a result, there is no one correct drainage solution for a site. In most cases, a combination of techniques, using the Management Train principle, will be required. The elements of the Management Train are outlined below.

7.4.1 Source Control

Green roofs can improve water quality and reduce the peak flow and the total volume discharged from a roof. In addition, they can enhance insulation and increase the lifespan of the roof. Rainwater reuse (or harvesting) involves the collection and storage of rainwater on site and its use as a substitute for mains water, for example in watering gardens or for flushing toilets.

The need for surface water drains and off-site sewers can be reduced or eliminated where runoff is encouraged to permeate through a porous pavement, such as permeable concrete blocks, crushed stone or porous asphalt.

Depending on the ground conditions, the water may infiltrate directly into the subsoil or be stored in an underground reservoir (for example, a crushed stone layer) before slowly soaking into the ground. If infiltration is not possible or appropriate (for example, because of ground contamination), an impermeable membrane can be used with an overflow to keep the pavement free from water in all conditions. Pollutant removal occurs either within the surfacing or sub-base material itself, or by the filtering action of the reservoir or subsoil.

7.4.2 Infiltration Techniques

An infiltration trench is a shallow, excavated trench that has been filled with stone to create an underground reservoir. Storm water entering the trench is gradually infiltrated into the ground. Their longevity can be enhanced by providing pre-treatment of the storm water using a filter strip, gully or sump pit to remove excessive solids.

Filter drains are widely used by highway authorities for draining roads. They are similar structures through which a perforated pipe runs. This facilitates the storage, filtering and some infiltration of water passing from the source to the discharge point. Pollutants are removed by absorption, filtering and microbial decomposition in the surrounding soil. Systems can be designed to successfully incorporate both infiltration and filter systems.

7.4.3 Swales and Basins

These can be created as features within the landscaped areas of the site, or they can be incorporated into ornamental, amenity and screen-planted areas where they would be looked after as part of the normal maintenance contract. Swales and basins are often installed as part of a drainage network connecting to a pond or wetland, prior to discharge to a natural watercourse.

Swales are grassed depressions which lead surface water overland from the drained surface to a storage or discharge system, typically using the green space of a roadside margin. They may be used to replace conventional roadside kerbs, saving construction and maintenance costs. Compared to a conventional ditch, a swale is shallow and relatively wide, providing temporary storage, conveyance, treatment and the possibility of infiltration under suitable conditions.



A basin is designed to hold back storm runoff for a few hours and to allow the settlement of solids. They are dry outside of storm periods. They provide temporary storage for storm water, reduce peak flows to receiving waters, facilitate the filtration of pollutants (deposited and incorporated into the substrate) and encourage microbial decomposition, as well as allowing water infiltration directly into the ground.

7.4.4 Ponds and Wetlands

Ponds or wetlands can be designed to accommodate considerable variations in water levels during storms, thereby enhancing flood-storage capacity. Although these can be designed as wet or dry ponds, or wetlands, they are most likely to contribute to visual amenity and biodiversity where they include a permanent water body. By allowing adequate detention time, the level of solids removal can be significant. The algae and plants of wetlands provide a particularly good level of filtering and nutrient removal. Ponds and wetlands can be fed by swales, filter drains or piped systems. The use of inlet and outlet sumps enhances performance by trapping silt and preventing clogging of the outlet. Removal of collected sediment from the inlet sump may be needed, although typically this is unlikely to be more than once every seven years.

7.4.5 Geology

The effectiveness and suitability of some of the above SUDS techniques will depend on the ground conditions into which the water permeates. The ground is made up of different layers and the material within each layer will determine how groundwater flows through the catchment. The bedrock is made up of compacted rocks. Above this are less compact rocks, known as drift geology. The top layer is soil. Drift deposits are not always present and when this is the case, the soil is positioned directly on top of the solid geology.

Some types of solid geology can be more permeable than others (e.g. sandstone compared to clay). Permeable bedrock absorbs and stores water, which reduces runoff and can result in rivers taking longer to respond to rainfall events. This reduces peak flows in rivers, and reduces the flood risk as a result.

Where no storage is available, in the less permeable bedrock, less rainfall is absorbed and it can run through the shallow soil strata to the nearest watercourse. The same applies to drift geology (e.g. peat is highly permeable).

7.4.6 Adoption and Maintenance

For SUDS to provide consistent and effective long-term attenuation of runoff from a development, they have to be maintained in an efficient condition for the life of the development. This may involve the control of weed growth in ponds and lagoons, the frequent removal of debris, both natural and man-made, from watercourses and weedcreens, the clearance of blockages, sometimes at short notice, from pipes and culverts, and the repair of malicious damage and vandalism. A routine inspection regime is essential to ensure that any such problems are identified and dealt with in a timely manner.

Following the publication of the Pitt Review, the Government made a commitment to resolve some of the barriers to SUDS through the draft Floods and Water Act. This included an announcement that Upper Tier Local Authorities would be given a duty to adopt SUDS drainage systems constructed for new developments. This is an important commitment which will go some way to reducing the impact of new developments on surface water quality and flood risk.

7.4.7 SUDS & Future Development

In the Growth Point Area, appropriate SUDS will be required for all new developments whenever practicable. All sites ought to be able to incorporate SUDS to some extent, be it small scale such as permeable pavements and rain water harvesting or larger schemes using swales and soakaways.

The use of SUDS, and the particular technique, is determined by soil type and sub-soil geology in addition to the layout of the development site. Soil types can only be determined by undertaking ground investigations following on from which it will be possible to evaluate the most appropriate SUDS technique based upon the permeability of the soil. In some cases, infiltration techniques may be appropriate, whilst in others, attenuation may be more suitable.

The site layout will influence the location and type of SUDS. Many forms of SUDS have restrictions on their proximity to structures, for example soakaways must be a minimum of 5m from any adjacent structure (Building Regulations Part H). It is important for all new development to ensure that SUDS are investigated during design from the outline stages. Detailed information should be provided in the planning application and be considered by the Central Lincolnshire Drainage Strategy Group.

All new dwellings should consider permeable driveways that will allow run-off to soak into the ground. Where hard paving systems are required products can be specified that still allow run-off to filter through voids and joints to be stored in the sub-base before further infiltration or connection to a drainage system. In areas where pollution is likely to be a problem, systems which allow microbes to develop to break down pollution should be specified.

Another option that should be considered, especially on larger developments, is the possibility of combining SUDS measures that incorporate surface water storage with the provision of water for fire fighting. There may also be other potential benefits of stored surface water re-use; these should be considered on a site specific basis.

One means of reducing runoff is rainwater harvesting – covered in the previous section of demand management.

It is anticipated that in terms of the Neighbourhood Extensions the most practical method will be to establish a strategic approach to draining each of the three sites in their entirety rather than sub-dividing the sites. Strategic balancing ponds are an obvious solution to store and manage rainfall on site rather than channelling it into the nearest watercourse.

Future Action 8 – Developers to consider strategic balancing ponds for the Neighbourhood Extensions.

7.5 Internal Drainage Boards

An Internal Drainage Board (IDB) is a statutory body which provides flood protection and water level management services. IDBs are found across England in low lying areas; four operate within the Gainsborough area; the Upper Witham IDB, Ancholme IDB, Gainsborough IDB and Isle of Axholme IDB

IDBs have permissive powers under the Land Drainage Act to supervise all land drainage matters within their district. IDB maintained watercourses assist in the removal of storm water from low lying areas behind Environment Agency maintained flood defences. Pumping stations operated by the IDB's aid in removing this water, and thus reducing flood risk.

IDBs mainly operate in the lower parts of the country where the drainage is often pumped into the higher level main rivers. Land in pump-drained catchments is subject to two main but distinct types of flood risk. The first (frequent) risk is waterlogging of low lying land. Flooding is not usually deep but can impact on crops. A second and possibly more serious type of flooding, is inundation resulting from the overtopping or breaching of the flood defences of the high-level embanked watercourse into which the catchments are pumped. The second is flooding which can arise if the runoff entering the arterial drainage system exceeds the capacity of the pumps or that of the drainage channels leading to the pumping station. Residual risk flooding could also occur as a result of a mechanical or electrical failure at the pumping station.

7.6 Contact Points

The main organisations involved in the water cycle process are the Environment Agency, Anglian Water, Severn Trent Water, the relevant Local Planning Authority; West Lindsey DC, Internal Drainage Boards and the County Council (Highways Department). Developers should liaise with all these organisations to obtain the necessary approvals, agreements and permissions.

7.7 Items of The Water Cycle To Be Considered

This list below is intended to give Developers an indication of items which should be considered in connection with various elements of the Water Cycle.

	Checklist Items	Completed Y/N?
1.	Water Resources	
1.1	Confirm that water supply capacity is available and that demand can be met.	Y/N
1.2	Provide water efficiency measures in new homes (including metering).	Y/N
1.3	Implement rainwater harvesting measures and consider re-use of rainwater.	Y/N
2.	Water Supply	
2.1	Identify if agreement is required for provision of new water supply, off site, mains.	Y/N
2.2	Agree layout with water company for water distribution mains, within site boundaries.	Y/N
3.	Water Consumption	
3.1	Confirm that the development can meet a water consumption target of 120l/h/d and enclose supporting details (e.g. proposals for rainwater harvesting, grey water recycling, low/dual flush toilets and water saving tap and shower fittings).	Y/N
3.2	Identify a strategy for the supply of water for fire fighting.	Y/N
4.	Sewerage	
4.1	Agree strategy for surface water and foul drainage IDBs and water companies (to ensure integrated approach). Limit runoff to Greenfield rates.	Y/N
4.2	If the site is over 1ha, a FRA will be required to comply with PPS25 and an indication will be required of the extent of impermeable areas both before and after development.	Y/N
4.3	Demonstrate that surface water runoff rates will not be increased and that balancing arrangements will be designed in accordance with the Environment Agency Technical Report "Preliminary Rainfall Runoff Management for Developments (W5-074/A/TR1).	Y/N
4.4	Apply for Byelaw consents from the Environment Agency and/or the Internal Drainage Board if new outfalls are proposed into watercourses, or if new buildings/structures are proposed within a specified distance from the banks. (For the EA this distance is 9 metres. For the Upper Witham IDB it is 6 metres). Designs will have to be in accordance with relevant standards/specifications.	Y/N
4.5	If appropriate, has the potential to separate combined systems been considered?	Y/N
5.	Sustainable Drainage Systems (SUDS)	
5.1	Provide details of any SUDS proposed and supporting evidence, e.g. ground investigation results as per BRE 365 – Soakaway Design. For design guidance of SUDS see CIRIA publication C697.	Y/N
5.2	Confirm methods of interception and infiltration (where applicable) and quantify the amount of surface water to be controlled by SUDS.	Y/N
5.3	Confirm the arrangements for the future ownership and maintenance of all SUDS installations.	Y/N
5.4	Obtain approval for SUDS from Lincolnshire County Council.	Y/N
6.	Sewage Treatment	
6.1	Confirm whether or not sewage treatment capacity is available in accordance with the Water Cycle Strategy and whether a financial contribution is required to works extensions.	Y/N
6.2	Identify if new outfall sewer to STW is required in the Water Cycle Strategy, and possible costs.	Y/N
7.	Flood Risk Management	
7.1	Has a Flood Risk Assessment (FRA) been prepared, as required by Planning Policy Statement Note 25 (Annex 'E')?	Y/N
7.2	Is development proposed within flood zones 2 or 3 (see Environment Agency Flood Map)?	Y/N
7.3	If the answer to 7.2 is 'Yes', have the Sequential Test and the Exception Test been applied (see Annex 'D' of PPS25), and account taken of Vulnerability classification?	Y/N

	Checklist Items	Completed Y/N?
7.4	Will arterial drains be affected by surface water runoff from the development, and will financial contributions be required from the Internal Drainage Board or the Environment Agency?	Y/N
7.5	Demonstrate that all sources of flooding have been taken into account, and that allowances have been made for the possible impacts of climate change.	Y/N
7.6	Where residual risks are involved, demonstrate that appropriate mitigation measures will be provided, e.g. raising of floor levels, flood resilience and resistance measures, dry access/egress, compensatory flood storage areas, etc (see Annex 'G' of PPS25), and use of the EA's flood warning system.	Y/N
8.	Pollution Prevention	
8.1	Provide details of measures to minimise pollution to watercourses during construction.	Y/N
8.2	Provide details of pollution prevention measures for the life of the development such as oil and silt interceptors. Consider whether permeable pavement areas are protected from siltation.	Y/N
9.	Conservation / Enhancement of Ecological Interest	
9.1	Confirm that an environmental assessment, proportional to the size and nature of the development, has been undertaken. This should identify any impacts on wildlife habitats (include surveys) and detail suitable mitigation measures, where necessary.	Y/N
9.2	Confirm that the green infrastructure, such as the surface water system, links to the neighbouring green infrastructure to assist the creation and maintenance of green corridors.	
9.3	Identify opportunities for creating or improving watercourse habitats, where practicable.	Y/N
9.4	Confirm whether the Local Biodiversity Action Plan (LBAP) has been consulted and whether any habitats or species detailed within the LBAP are present or near the development site.	Y/N

7.8 Reference Documents

The following documents should be referred to, as necessary for all developments.

Source	Document
Environment Agency	CFMPs, Flood Maps, Byelaws Various documents giving standing advice are available on the website.
Water Company	Sewers for Adoption, maps of existing infrastructure
Local Planning Authorities	SFRAs, LPA Policies, Building Regulations, WCS
Lincs CC (Highways)	Road Specification – highway drains
Internal Drainage Boards	Byelaws, Policies
National	PPS25 and practice guide, R & D Technical Reports, BRE365 – Soakaway Design, SUDS – CIRIA Report 522