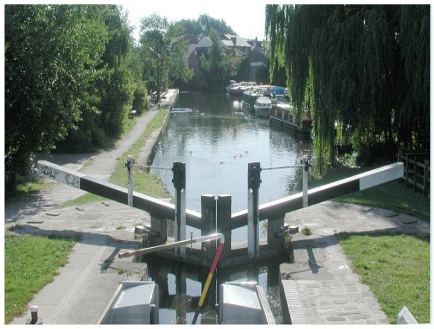
Bassetlaw District Council

Bassetlaw Outline Water Cycle Study

Final Report

January 2011

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Revision Schedule

Bassetlaw Water Cycle Study Outline Report
January 2011

Rev	Date	Details	Prepared by	Reviewed by	Approved by
01	October 2009	Draft	**Gemma Costin** Assistant Consultant **Sarah Kelly** Assistant Consultant	**Andrew Woodliffe** Senior Consultant **Michael Timmins** Principal Consultant	**Damon O'Brien** Technical Director
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Acronyms

Abbreviation	Description
AMP	Asset Management Plan
AWS	Anglian Water Services
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BDC	Bassetlaw District Council
BOD	Biochemical Oxygen Demand
CAMS	Catchment Abstraction Management Strategy
CFMP	Catchment Flood Management Plan
CSH	Code for Sustainable Homes
CSO	Combined Sewer Overflow
CLG	Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DO	Dissolved Oxygen/Deployable Output
DPD	Development Plan Document
DWF	Dry Weather Flow
EA	Environment Agency
ELCS	Employment Land Capacity Study
EP	English Partnerships
FtFT	Flow to Full Treatment
GI	Green Infrastructure
GQA	General Quality Assessment
HPPE	High Performance Poly Ethylene (pipe)
IDB	Internal Drainage Board
l/c.d	Litres per capita per day (water consumption measurement)
LDF	Local Development Framework
LiDAR	Light Detection and Ranging
LPA	Local Planning Authority
MBR	Membrane Bioreactor
N	Nitrogen
NGP	New Growth Point
NE	Natural England
NVZ	Nitrate Vulnerable Zone
OFWAT	The Office of Water Services
P	Phosphorous
PE	Population Equivalent

Abbreviation	Description
PPS	Planning Policy Statement
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SAC	Special Area for Conservation
SEA	Strategic Environmental Assessment
SfG	Strategy for Growth
SFRA	Strategic Flood Risk Assessment
SIMCAT	EA mathematical River Water Quality Model
SPA	Special Protection Area
SPZ	Source Protection Zone
SRP	Soluble Reactive Phosphorus
SSSI	Site of Special Scientific Interest
ST	Severn Trent Water
SWMP	Surface Water Management Plan
SUDS	Sustainable Drainage Systems
TSFR	Treated Sewage Flow Recorder (flow meter)
TSS	Total Suspended Solids (in waste water)
UWWTD	Urban Wastewater Treatment Directive
WCS	Water Cycle Strategy/Water Cycle Study
WFD	Water Framework Directive
WRMP	Water Resources Management Plan
WRPZ	Water Resources Planning Zone
WRZ	Water Resources Zone
WSI	Water Services Infrastructure
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works

Executive Summary

Overview

The East Midland Regional Plan identifies Worksop as a sub-regional centre, having the potential to accommodate sustainable growth and set targets to guide the scale and location of growth in Bassetlaw up to 2026. The Bassetlaw Core Strategy Preferred Options Consultation (May 2010) requires an additional 7,370 new dwellings to be built by Bassetlaw District Council (BDC) to 2026.

As part of BDCs overall strategy to meet future growth targets in a sustainable way, a Water Cycle Study (WCS) has been commissioned. This will make up one of a number of strategic studies and plans which will form part of the evidence base supporting the production of BDCs Local Development Framework (LDF). Specifically, the WCS will form an important basis of the Bassetlaw Core Strategy making up part the LDF, as well as providing input to the development of Supplementary Planning Documents (SPDs) to assist in ensuring the delivery of water cycle management requirements at the local planning application level.

This Outline WCS has builds upon the findings of a Scoping WCS and other on-going work providing a holistic and wider evidence-based approach to feed into the LDF.

Key Findings of Outline WCS

The key findings from the Outline WCS include:

Water Resources and Supply

- Virtually all the water supplies for Bassetlaw come from groundwater sources,
- In general, the CAMS document for the area shows a mixed picture, the River Idle is classified as being 'over-abstracted', whilst the River Poulter has 'no water available',
- The EA have assessed Bassetlaw as lying partly within an area of serious water stress (in the east of the district) and an area of moderate water stress (in the west of the district),
- Bassetlaw is served by two water companies, Severn Trent (ST) and Anglian Water (AWS). According Statement of Response published in March 2009, both companies are in surplus i.e. resources exceed demands. In the case of ST, this is position through to the end of planning period in 2035. In the case of AWS, the EA has reported that the supply zones within Bassetlaw are not forecast to have any supply/demand deficits throughout the planning period up to 2035,
- ST and AWS have both assumed the growth contained within the East Midlands RSS and East of England RSS respectively. The latest growth figures provided by BDC for new homes are slightly above those contained within these two now removed RSSs,
- Under the latest growth figures for Bassetlaw and based on Water Company consumption figures, the total residential water demand including an allowance for headroom for Bassetlaw up to 2026 would be

1.88 Mld^{-1}. Broken down into the main development areas, then the demands are highest in Worksop (0.28 Mld^{-1}), followed by Harworth / Bircotes (0.51 Mld^{-1}) and Retford (0.47 Mld^{-1}),

- Using the Code for Sustainable Homes estimates of water consumption, the total residential water demands would vary from 1.24 Mld^{-1} (Scenario 4 – CSH Level 5/6, 80 $lh^{-1}d^{-1}$) to 1.67 Mld^{-1} (Scenario 2 – CSH Level 1/2, 120 $lh^{-1}d^{-1}$) by 2026,

- ST and AWS recognise the importance of water efficiency in managing the future growth in demand within Bassetlaw. Leakage control will continue to play an important part, although it has to be recognised that maintaining leakage at existing levels with an increasing network will require a significant commitment from both water companies,

- ST and AWS currently hold a large number of groundwater licences locally and it is likely that there will be sufficient spare licence capacity available on these licences in order to meet these extra demands required up to 2026 within Bassetlaw. An initial assessment of where the main development may obtain their extra water has been made as part of this Outline WCS. Further work will be required at the detailed stage of this WCS to fully asses the constraints within the mains water supply network and at the water treatment works,

- Other potential risks to water supplies within Bassetlaw include; deteriorating groundwater quality within aquifers, the effects of climate change on both water resources and demands, water supply resilience issues and the EAs Review of Consent process which may reduce licensed abstractions,

- Once both ST and AWS have published their final WRMPs, the details contained within these plans should be incorporated into the Detailed WCS for Bassetlaw.

Flood Risk and Drainage

- Surface Water Management is a key consideration when assessing development within large areas. PPS25 requires that new development does not increase the risk of flooding elsewhere by managing surface water runoff generated as a result developing land. Altering large areas of land by urbanising it fundamentally alters the way in which rainfall drains to watercourses and has the potential to increase the rate and amount of water that enters watercourses causing an increase in flood risk. In many cases, the management of surface water is achieved via a requirement to restrict runoff from developed sites to that which occurs from the pre-development site usage and this is achieved by incorporating a range of Sustainable Drainage Systems (SUDS) which aim to maximise the amount of rainwater which is returned to the ground (infiltration) and then to hold back (attenuate) excess surface water. Incorporating SUDS often requires a large amount of space and for large developments often requires the consideration of large scale strategic features such as balancing ponds which can attenuate and store large volumes of water generated during very heavy rainstorms to prevent flood risk downstream,

- The management of surface water has the potential to act as a constraint to development within Bassetlaw, not just because of space requirements, but because the reduction in runoff rates and volumes is likely to be onerous, linked with permeability and groundwater related issues. Additionally, several of the smaller watercourses, ditches and drains in Bassetlaw are identified as low-flow channels

with no additional capacity to accept surface water runoff and will require attenuation of surface water generated by new development,

- These issues will require further consideration once site masterplans become available and should potentially be considered in the development of DPDs, AAPs or as part of site specific FRAs.

Wastewater Treatment and Collection

- The wastewater network assessment has shown that there is a good coverage of existing sewers across towns and villages identified for growth up to 2026 and that this should facilitate new connections to the existing network. However, detailed modelling will need to be undertaken to assess the capacity in the network especially for Harworth/Bircotes, Retford and Worksop where substantial housing growth is planned and for growth areas located upstream of small networks i.e. in some of the smaller villages; for small development sites it is recommended that this is undertaken through a pre-development enquiry by the developer,

- Where possible, it is recommended that housing and employment growth should be located at the downstream end of the wastewater network serving the town or village, thereby minimising the need to upgrade the existing network upstream and allowing connections to the larger pipes discharging to the WwTW,

- The existing sewer network has been used to identify the volume of proposed development that is likely to be served by each of the WwTWs and this has been used to calculate the future wastewater flows to be treated at the works and therefore future capacity,

- Two of the assessed WwTWs (North Wheatley and Rampton) are already exceeding their volumetric consents and therefore have no capacity to treat further flows from new development in areas that are served by these works unless they apply for, and are granted an increase to their flow consent by the EA. Worksop-Manton is currently exceeding its volumetric consent but ST have indicated that it has capacity to accommodate an additional 570 dwellings, but with 2,000 dwellings (plus employment growth) planned for the area this capacity will be exceeded under future growth conditions. Subsequent upgrades to the three works may be required to treat the additional flow, but ST have confirmed that should additional capacity be required, they do not envisage any physical constraints that would prevent this capacity provision. The upgrades are likely to take 2-3 years to provide, and would only be initiated once planned development proposals have been provided by BDC,

- Under future growth conditions Gamston, Harworth and Norton WwTW are also likely to exceed their existing flow consents by 24%, 10% and 24% respectively as a result of proposed growth in Gamston, Harworth/Bircotes and Cuckney. Gamston has capacity to accommodate 20 of the proposed 60 dwellings, whilst Harworth has capacity to accommodate 620 of the proposed 1,750 dwellings (and 2,718 jobs),

- Though capacity calculations for Retford WwTW indicate that there is sufficient spare hydraulic capacity to accommodate the proposed growth there are concerns relating to the capacity of the Biological Filters. Further process analysis will be required to confirm actual capacity but should additional

capacity be required ST do not envisage any physical constraints that would prevent additional capacity being provided,

- ST have indicated that there are marginal concerns over future quality performance at Harworth WwTW as a result of proposed growth, and additional treatment capacity is likely to be required at the works and as such, is likely to take 2-3 years to provide. However, this would only be initiated once planned development proposals have been provided by BDC. It should be noted however that ST do not envisage any issues with the provision of additional treatment capacity (subject to a revised discharge consent being agreed with the EA),

- ST have also indicated that there are marginal concerns over future quality performance at Hodsock WwTW as a result of proposed growth in Blyth, Carlton-in-Lindrick and Langold, with the current sizing of biological filters indicating that there could be stress from a load perspective. However, due to the relatively small volume of growth planned for this works, ST do not envisage any issues in dealing with future growth demand at Hodsock WwTW,

- ST have indicated that should additional treatment capacity be required for other smaller works in the catchment, they do not envisage any physical constraints that would prevent additional capacity being provided,

- WwTW quality consents are likely to require tightening under the WFD and as a result of the proposed growth within the area to comply with WFD standards. Under the WFD the majority of receiving watercourses are already achieving 'high ecological status' or 'potential' for Ammonia and BOD, and as such, future discharges will need to ensure there is no deterioration from this status,

- The five largest works of Harworth, Hodsock, Langwith, Retford and Worksop already have phosphorus consents of $2mgl^{-1}$ in place under the UWwTD, but due to the current 'poor' status of phosphorus levels in the receiving watercourses, it is likely that these will require further tightening under future conditions (irrespective of growth) to comply with WFD standards,

- In terms of addressing growth specifically, Haworth WwTW will exceed its current flow consent as a result of growth and will require tightening of the quality consents in order to comply with WFD standards; however the consents required are within BAT and hence theoretically achievable.

- Three other works, namely North Wheatley, Rampton and Worksop will also exceed their flow consent with growth; however this is already the case with current population wastewater flows. Tightening is likely to be required to address the current flow and future flow capacity issues, but modelling has shown the consents required are within BAT and hence theoretically achievable,

- Worksop WwTW, which treats the largest volume of effluent in Bassetlaw and will receive the largest increase in wastewater as a result of growth in the study area, is likely to be the most constrained in terms of treating wastewater from future growth. It is already exceeding its flow consent and discharges to a smaller watercourse than the other larger works in the area. As such there is less dilution available for the effluent discharge in the receiving watercourse,

- Further modelling of the required future water consents may be required as part of the Detailed WCS, in conjunction with the EA and ST, to ensure that future discharges, particularly from the three largest works of Harworth, Retford and Worksop, are compliant with downstream WFD standards.

Water Quality

- In general, water quality within Bassetlaw is of good quality and has complied with current water objectives over the latest EA reporting periods. However, Phosphorus levels in the majority of watercourses are often high or very high and as such are assessed as poor under the WFD meaning that improvements are required within these watercourses to reach WFD objectives of 'good ecological status' or 'potential',

- Six of the fourteen watercourses are Heavily Modified Waterbodies or Artificial and are therefore required to reached 'good ecological potential' by 2015 or 2027,

- None of the watercourses are currently achieving 'good ecological status' or 'good ecological potential' under the WFD, with phosphorus and invertebrates frequently being assessed as poor. However, ammonia and dissolved oxygen are classed as 'high' in the majority of watercourses and as such, under the WFD should not deteriorate from this status under future conditions,

- A detailed water quality assessment will need to be undertaken as part of the Detailed WCS in conjunction with the wastewater treatment assessment to assess the impacts of proposed growth on downstream water quality, once the housing and employment levels and locations have been confirmed.

Ecology and Biodiversity

- Water resource issues relating to ecology and biodiversity do not require further investigation as no new water resources need to be developed,

- Uncertainty remains over whether new wastewater treatment infrastructure or consented discharge volumes will need to be increased to service Bassetlaw and as such there remains some potential for adverse water quality effects on the Humber Estuary SAC, SPA and RAMSAR,

- There is also potential for adverse water quality effects on the River Idle Washlands SSSI, Misson Line Banks SSSI and possibly the Misson Training Area SSSI as a result of treated effluent discharge from Retford WwTW,

- These issues therefore require further investigation in the Detailed WCS.

Recommendations for Detailed WCS / Area Action Plan Stage

Through completing this Outline WCS, the following issues have been determined which consider further detailed consideration. This should be undertaken as part of a Detailed WCS, or at the Area Action Plan (AAP) stage:

Water Resources

- Review of ST and AWS final WRMPs,
- Detailed assessment of constraints to development within the water supply network,
- Detailed review of WTW Capacities.

Flood Risk and Drainage

- Determination of pre-development surface water runoff,
- Determination of requirements for surface water management,
- Detailed assessment of suitable SUDS techniques (on an area by area basis).

Wastewater

- Wastewater network modelling for Harworth-Bircotes, Retford and Worksop (and potentially some smaller settlements),
- Review of wastewater capacity calculations,
- Detailed discussions with the EA, ST and AWS to determine the likelihood of DWF consents being extended,
- Detailed discussions with ST and AWS to determine the likelihood and feasibility of WwTW extensions.

Water Quality

- Detailed water quality assessment to fully assess impacts of growth.

Ecology and Biodiversity

- Detailed consideration of impacts of growth on water quality and wastewater volumes in relation to SSSIs and Humber Estuary SAC, SPA and RAMSAR.

1 Introduction

1.1 Terms of Reference

Scott Wilson Ltd (SW) were commissioned by Bassetlaw District Council (BDC) to undertake a Scoping, Baseline and Outline Water Cycle Study (WCS) for their administrative area in Northern Nottinghamshire. However, following a meeting with BDC on 17th April 2009 it was agreed that a standalone Baseline WCS was no longer required. It should be noted that through the undertaking of the Scoping WCS and this Outline WCS, all aspects that were proposed for the Baseline WCS have been covered.

WCSs are required to ensure that proposed growth does not adversely impact on the existing water cycle environment and that new Water Services Infrastructure (WSI) can be planned for and provided alongside new development in a sustainable and cost effective manner.

BDC requires a WCS to produce a 'sound' evidence base for their Core Strategy and Site Allocation Plan Development Plan Documents (DPDs). In so doing, it will also integrate with other related studies and reports, to jointly inform the overall Local Development Framework (LDF). It will also provide sufficient information for Severn Trent Water (ST) and Anglian Water (AWS) to allow for any additional WSI to be included in their draft Business Plans as part of the 2009 Price Review Process (PR09).

1.2 Background Overview

The East Midland Regional Plan (2009) identifies Worksop as a sub-regional centre, having the potential to accommodate sustainable growth. Worksop and Retford are likely to be the focus for much of the future development that will take place within Bassetlaw. The west of Bassetlaw, with clear links to Sheffield and access to the A1, is also being considered as a focus for employment development. The RSS is now defunct, but the BDC Core Strategy Preferred Options (May 2010) follows the guidance previously set out by this document.

1.3 Aims and Objectives

The objective of the Bassetlaw WCS is to identify any constraints on housing and employment growth planned up to 2026, that may be imposed by the water cycle and how these can be resolved (i.e. by ensuring that appropriate WSI is provided to support the proposed development). Furthermore, it will provide a strategic approach to the management and use of water which ensures that the sustainability of the water environment is not compromised.

The first stage of this study, the Scoping WCS, undertook a review and provided an overview of the following specific items:

- Capacity issues with regards to water treatment works (WTWs), clean water network and water resources in Bassetlaw,

- Potential impacts of future water abstraction and wastewater discharge near water-dependent European Sites,
- Water quality issues with respect to the discharge of wastewater and surface water, groundwater quality and the management of gravity and pumped discharges.

This Outline WCS has built upon the findings of and upon the relationships forged during the Scoping WCS and has undertaken:

- An assessment of the water resource availability up to 2026 within Bassetlaw,
- An assessment of potential high level Sustainable Drainage Systems (SUDS) options for proposed development,
- An assessment of the capacity of the existing wastewater network, both current and proposed, to identify the key constraints to ensure that development does not outstrip capacity,
- An assessment of the capacity of the existing clean water (supply) network, both current and proposed, to identify the key constraints to ensure that development does not outstrip supply capacity,
- An environmental assessment of the impact of the proposed development upon receiving (and downstream) watercourses and ecologically important sites,
- Advise on the requirements for the Detailed WCS if necessary.

2 Water Cycle Studies

2.1 The Water Cycle

In its simplest form, the water cycle can be defined as:

> *'The process by which water is continually recycled between the earth's surface and the atmosphere'.*

Without considering anthropogenic (human) influences, it is simply the process by which rain falls and either flows over the earth's surface or stored and is then returned to the atmosphere (via evaporation from the sea, the ground, surface water or animal and plant life) ready for the whole process to repeat again.

In the context of this study, the water cycle has a broader definition than the simple water or hydrological cycle. Anthropogenic influences on the water cycle introduce many new factors into the cycle through the need to abstract water from the natural environment, use it for numerous purposes and then return to the natural system (Figure 2-1). The development and introduction of technology such as pipes, pumps, drains and chemical treatment processes has meant that human development has been able to manipulate the natural water cycle to suit its needs and to facilitate growth and development. The water cycle in this context is therefore defined as both the natural water related environment (such as rivers, wetland ecosystems, aquifers etc.) and the water infrastructure (hard engineering focused elements such as: WTWs, supply pipelines and pumping stations) which are used by human activity to manipulate the cycle.

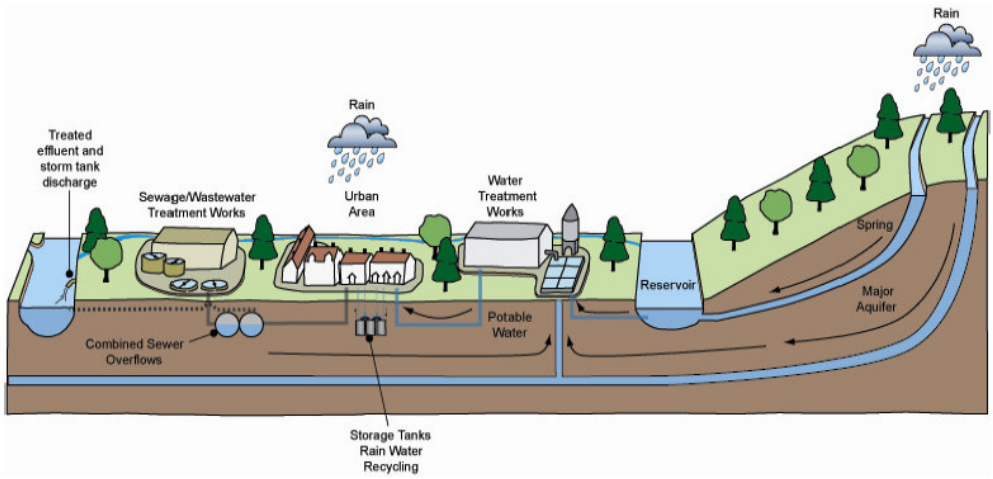


Figure 2-1: The Water Cycle Study (Source: Environment Agency[1])

[1] Water Cycle Study Guidance, Environment Agency, January 2009 (http://publications.environment-agency.gov.uk/pdf/GEHO0109BPFF-e-e.pdf)

2.2 Implications for Development

In directly manipulating elements of the water cycle, man effects many changes to the natural water cycle which can often be negative. To facilitate growth and development, there is a requirement for clean water supply which is taken from natural sources (often depleting groundwater stores or surface water systems); the treatment of wastewater which has to be returned to the system (affecting the quality of receiving waters) and the alteration and management of natural surface water flow paths which has implications for flood risk. These impacts can indirectly affect ecology which can be dependent on the natural features of a water cycle. For example, wading birds and wetland habitat, or brown trout breeding in a chalk stream which derives much of its flow from groundwater sources.

In many parts of the United Kingdom, some elements of the natural water cycle are considered to be at, or close to their limit in terms of how much more they can be manipulated. Further development will lead to an increase in demand for water supply and a commensurate increase in the requirement for wastewater treatment; in addition, flood risk may increase if development is not planned for in a strategic manner. The sustainability of the natural elements of the water cycle are therefore at risk.

A WCS is an ideal solution to address this problem. It will ensure that the sustainability of new development is considered with respect to the water cycle, and that new WSI introduced to facilitate growth is planned for in a strategic manner; in so doing, the WCS can ensure that provision of WSI is sufficient such that it maintains a sustainable level of manipulation of the natural water cycle.

2.3 Stages of a Water Cycle Study

Current Environment Agency (EA) guidance on WCSs[1] suggests that they should generally be undertaken in three stages, dependent on the status of the various Local Development Documents (LDDs), as part of the wider LDF, being prepared by a Local Planning Authorities (LPA) for submission. To coincide with BDCs timescales for responses and submissions the WCS has been undertaken in two stages: Scoping and Outline. These stages may be followed by a Detailed WCS (if required).

Figure 2-2 illustrates the three stages of the WCS and how they inform planning decisions and documents.

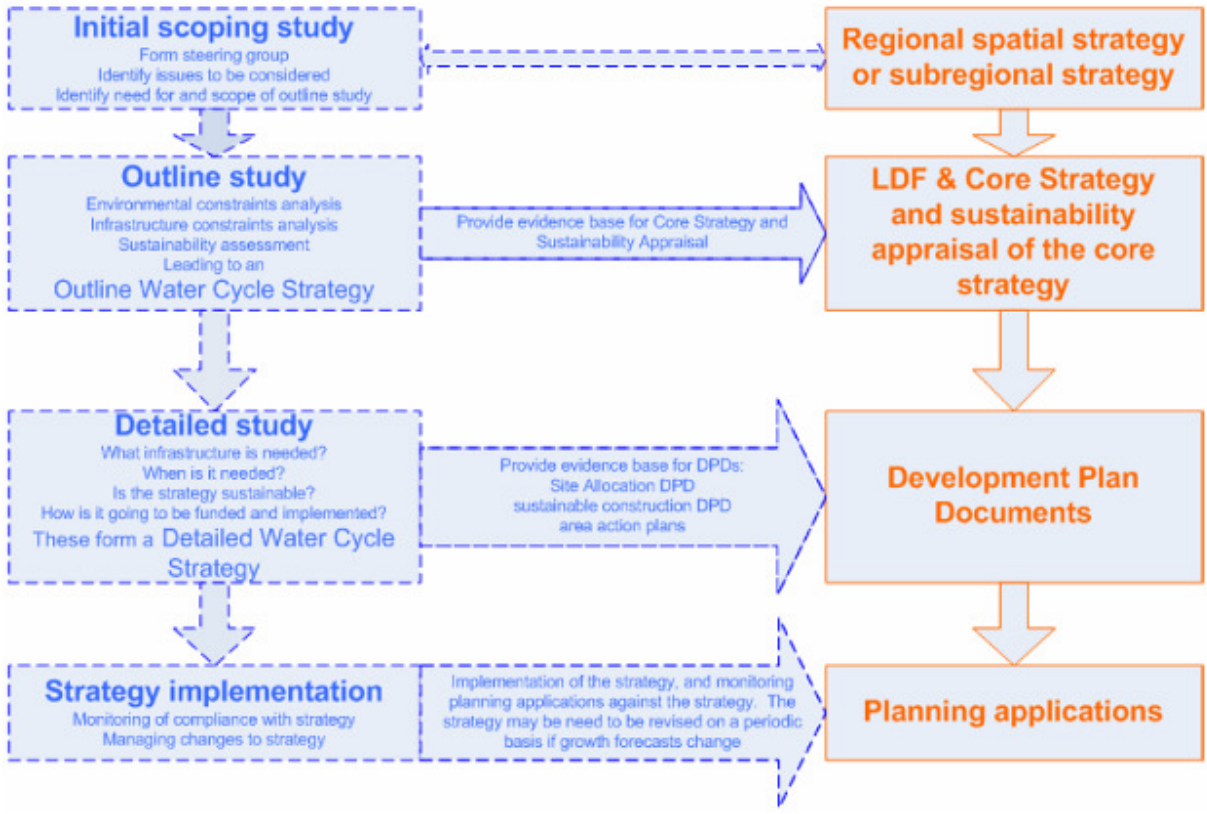


Figure 2-2: Stages of the Water Cycle Study Process (Source: Environment Agency)

This study builds upon the findings of the Scoping WCS and forms an Outline WCS

2.3.1 Scoping Water Cycle Study

A Scoping WCS determines the key 'water-cycle' areas where development is likely to either impact on the water environment, or is likely to require significant investment in water infrastructure (i.e. pipes, or treatment) to service new development.

Its key purpose is to define whether there are significant constraints that would need further assessment to determine whether they affect either the locations of allocation options, or the amount of development that can be provided within an allocation site.

It is a high level assessment that looks at town-wide or area-wide issues. The level of assessment covered is dependent on whether:

- There is a potential for an area-wide negative supply and demand balance for potable water i.e. demand is likely to be greater than supply for the growth area,
- There are any ecologically sensitive sites that have a hydrological link to development i.e. an Scientific Advisory Committee (SAC) wetland site located on a river downstream of discharges from a wastewater treatment works,
- Local watercourses have water quality concerns which will be made worse if further discharge of wastewater from new development occurs.

A Scoping WCS therefore:

- Defines the study area,
- Defines the key stakeholders required to input into the study,
- Concludes what issues require further investigation,
- Informs the scope of future stages of the WCS,
- Includes preliminary data collection, collation and strategy inception.

2.3.2 Outline Water Cycle Study

The Outline WCS considers all of the ways in which new development will impact on the water environment or water infrastructure specific to where growth is most likely to be targeted. It is usually undertaken during consideration of allocation sites such that it can inform the decision process in terms of where development will be targeted for each authority by identifying the infrastructure required to meet the demands for growth.

The key aim of the Outline WCS is to provide an LPA with the evidence base which ensures that water issues have been taken into account when deciding the location and intensity of development within an LPA planning area as part of the development of the Core Strategy. It also aids in setting core policies related to water as part of the Development Control Policies Supplementary Planning Document (SPD).

Finally, it gives water companies an evidence base to its business plans which determine how much they can charge customers to invest in upgrades and what new infrastructure is required to service proposed development. Methods for developer contributions to the capital costs of the proposed schemes should therefore be identified.

2.3.3 Detailed Water Cycle Study

Once the principles of the Outline WCS have been agreed by the stakeholders and identified as potential options, a Detailed WCS (if required) would then build upon this. A Detailed WCS can vary significantly in its scope and remit. However, its key purpose is to define what specific infrastructure and mitigation is required to

facilitate development, once the decisions have been made on the location of allocations and the likely intensity and type of development within them. It would entail the development of a strategy and provide supporting evidence for the proposed development works and confirm the capital and operating costs associated with these.

Dependent on the findings of the Outline WCS, there could be the potential requirement to undertake detailed and complex studies (within a detailed WCS) in order to define exactly what infrastructure or mitigation is required. Furthermore, it would provide an in-depth assessment of developer contributions.

The Detailed WCS should be undertaken in conjunction with the development of DPDs such as Area Action Plans (AAPs) and should provide the evidence base to site specific policies in SPDs.

2.4 Integration with the Planning System

As part of the LDF process, LPAs are required to produce evidence based studies which support the selection processes used in deciding on final growth targets and areas to be promoted for growth. The WCS is one such example of an evidence-based study which specifically addresses the impact of proposed growth on the water cycle.

As part of BDCs overall strategy to meet future growth targets set out in the RSS in a sustainable way, the WCS will make up one of a number of strategic studies and plans which will form part of the evidence base supporting the production of BDCs LDF. Specifically, the WCS will form an important basis for the Core Strategy making up part of the LDF evidence base, as well as providing input to the development of SPDs to assist in ensuring the delivery of water cycle management requirements at the local planning application level. There is a strong inter-relationship between the WCS and other components of the LDF evidence base and this interaction is discussed further in Section 4.

It is important that the findings of the WCS feed into and make use of the findings of other LDF studies that BDC are undertaking. The studies that are particularly relevant include the Strategic Flood Risk Assessment (SFRA), Harworth Scoping Study and the Strategic Housing Land Availability Assessment (SHLAA). Additionally, the findings of the WCS can be used by BDC in the preparation of its masterplans and design briefs for future development.

2.5 Data Availability

The undertaking of a WCS requires a large amount of data collection, much of which is reliant on the willingness of third parties to supply in order to allow the study to be progressed. In some cases, the availability of data with respect to water cycle infrastructure and future planning is not available within the time required to undertake the assessment and various assumptions have to be used to enable the study to continue. This Outline WCS has used the data collated as part of the Scoping WCS, which has been supplemented by additional data and information, where necessary.

3 Development in Bassetlaw

3.1 Study Area

The administrative area of Bassetlaw covers an area of approximately 631 km^2 (Figure 3-1). Bassetlaw has a population of approximately 112,000[2], with over half of the population living in the towns of Worksop and Retford.

The area is endowed with good quality agricultural land, with the dominant rural land uses being intensive agriculture and the cultivation of protected crops.

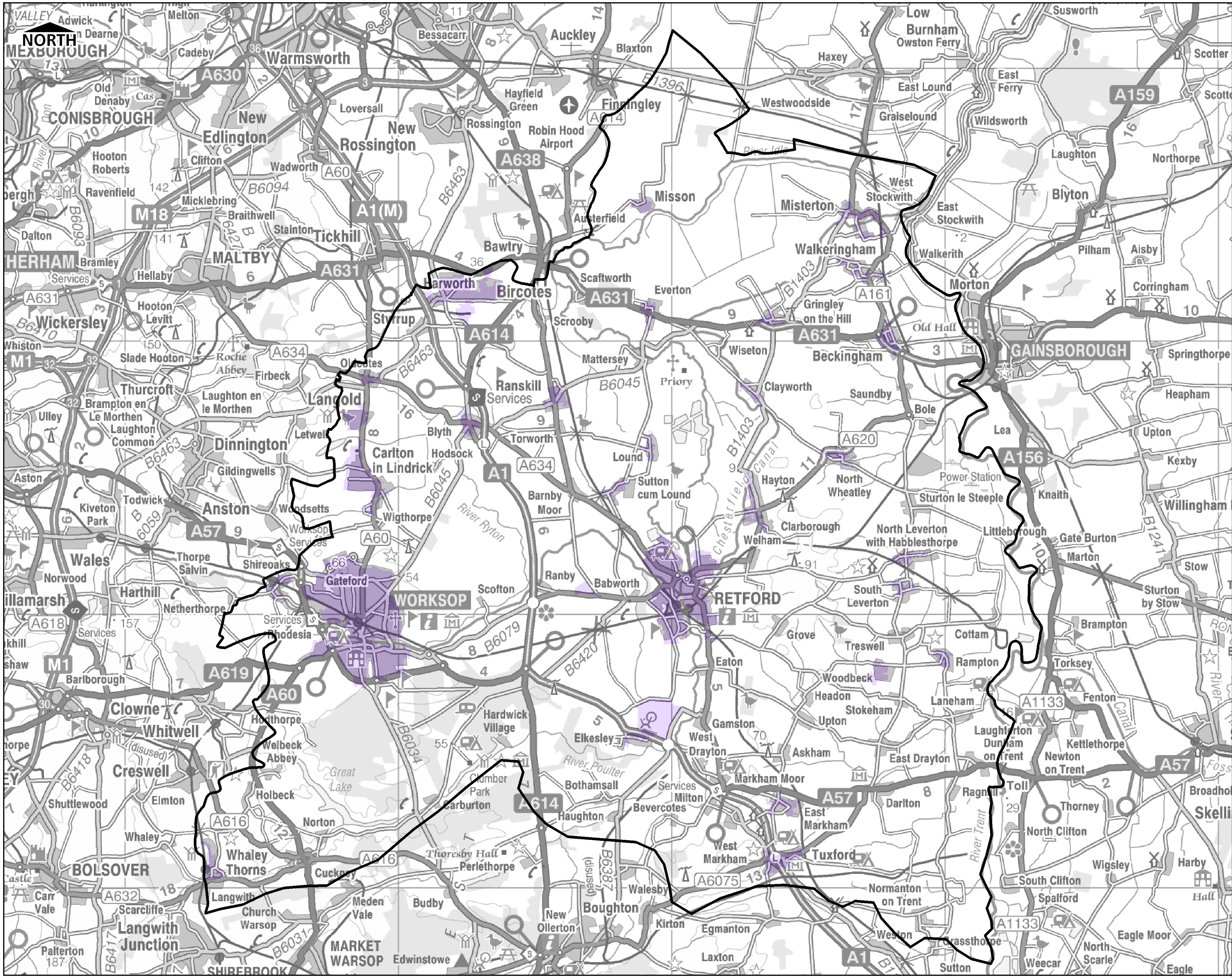
3.2 Development Strategy in Bassetlaw

The East Midland Regional Plan identified Worksop as a sub-regional centre, having the potential to accommodate sustainable growth. Worksop and Retford are likely to be the focus for much of the future development that will take place within Bassetlaw. The west of Bassetlaw, with clear links to Sheffield and access to the A1, is also being considered as a focus for employment development.

3.3 National, Regional and Local Drivers and Policies

Section 4.3 of the Scoping WCS for Bassetlaw determines the National, Regional and Local Drivers and Policies.

[2] Bassetlaw Preferred Options Core Strategy and Development Management Policies, May 2010



BASSETLAW DISTRICT COUNCIL

NORTH NOTTINGHAMSHIRE

Legend

- Boundary
- Urban Areas

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: BASSETLAW OUTLINE WATER CYCLE STUDY

Drawing Title: LOCATION PLAN

Scale at A3: NOT TO SCALE

Drawn	Approved
GC	

Stage 1 Check	Stage 2 Check	Originated	Date
			NOV 2010

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Drawing Number: FIGURE 3-1

3.4 Development of Housing and Employment

The BDC Preferred Options Consultation builds upon the target as set out in the East Midlands Regional Plan and aims to deliver 7,370 dwellings to 2026.

Since 2006, 1,233 dwellings of this target have already been built, with an additional 95 dwellings expected to be completed in this current financial/monitoring year (2009/2010). Therefore the latest growth figures provided by BDC show that 6,042 new dwellings are to be built by 2026. This figure excludes the 1,233 new homes built over the last 2 years (2006-08)[3] and the 95 dwellings due for completion.

In addition the East Midlands Regional Plan identifies *"north of Worksop towards Robin Hood Airport Doncaster Sheffield concentrating on the former mining communities and mining operations"* as a sub-regional priority for employment regeneration.

The BDC Preferred Options Consultation (May 2010) identified the need for employment land within the district and potential employment locations. This recommended a gross employment land requirement of 80 hectares between 2009 and 2026, with employment growth focused on Worksop, Retford and Harworth / Bircotes.

For the purposes of this study, the employment growth is based on the options presented within the Core Strategy Issues and Options Consultation document. The document provides one main employment option, with employment growth focused across the major urban areas of Worksop, Harworth / Bircotes and Retford - allowing for 80 hectares of employment land across the three areas. These figures are not static and are likely to change as part of the progress of the Core Strategy.

Table 3-1 is taken from the Core Strategy Issues and Options Consultation document and provides an indication of spatial distribution and quantity of development across the district.

[3] These figures are taken from the interim findings of the SHLAA, 2009

Table 3-1: Potential Development Numbers and Locations

Settlement	Potential Number of Dwelling	Employment	
		%	Ha
Worksop	2,000	45%	36
Retford	1,500	20%	16
Harworth	1,750	35%	28
Carlton-in-Lindrick	300	0%	0
Tuxford	250	0%	0
Misterton	250	0%	0
Beckingham	60	0%	0
Blyth	60	0%	0
Clarborough/Hayton	60	0%	0
Cuckney	60	0%	0
Dunham	60	0%	0
East Markham	60	0%	0
Elkesley	60	0%	0
Everton	60	0%	0
Gamston	60	0%	0
Gringley-on-the-Hill	60	0%	0
Langold	60	0%	0
Lound	60	0%	0
Mattersey	60	0%	0
Misson	60	0%	0
Nether Langwith	60	0%	0
North Leverton	60	0%	0
North/South Wheatley	60	0%	0
Rampton	60	0%	0
Ranskill	60	0%	0
Sturton-le-Steeple	60	0%	0
Sutton	60	0%	0
Walkeringham	60	0%	0

*Note: * The villages of Langold, Misterton and Tuxford have been identified as local service centres for employment growth*

4 Water Resources and Water Supply

4.1 Introduction

4.1.1 Outline Report Structure

This assessment covers the existing baseline with respect to available water resources and where the raw water to supply the new development may be sourced by ST and AWS. An assessment of the residential demands and broad assessment of non-residential demands have been considered as part of this Outline WCS, resulting from the expected growth up to 2026. Also considered is the important role which water efficiency can play in order to reduce the demand for new water resources.

4.1.2 Overview of Water Resources and Water Supply Issues from Scoping Study

The average annual rainfall for the area is 620mm, less than the annual average rainfall for England of 897mm (EA, 2007).

There are two Major Aquifers[4] underlying the district; the Lower Magnesian Limestone (LML) and the Sherwood Sandstone (SS). The LML outcrops along the western flank of the district, where it provides a baseflow contribution to various tributaries of the River Idle, including the River Poutler and River Ryton.

There are several major groundwater supply abstractions within the district, with Source Protection Zones (SPZs) around these major Public Water Supply abstraction sources. The presence of SPZs means that there is the potential for discharges from development areas in the west of the district in particular to affect the underlying Major Aquifer.

In terms of water resources, the Idle and Torne Catchment Abstraction Management Strategy (CAMS) has indicated that parts of this catchment are already 'over-abstracted'. Future growth cannot therefore rely on new local water resources being developed and instead will have to rely on greater efficiency in water use from either existing local sources or regional resource schemes in neighbouring water supply zones.

ST and AWS have both re-assessed the supply/demand balance in their respective draft WRMPs and Statement of Response (SoR) to consultation on their draft WRMPs. The latest findings are that ST and AWS both currently have surpluses (i.e. water resources exceed demands) over the entire planning period through to 2035/36. Although OFWAT has now published its final determinations and these have been accepted by both ST and AWS, these Companies have yet to publish their final WRMPs (due early 2010), it is therefore still unclear as to what the investment plans will be implemented [see footnote 3 in section 4.3.1].

4.2 Available Data

The principal sources of data assessed within the water resources and water supply review are:

[4] A Major Aquifer is Highly Permeable strata usually with a known or probable presence of significant fracturing

- ST draft Water Resources Management Plan (2008),
- AWS draft Water Resources Management Plan (2008),
- ST - Statement of Response to draft Water Resources Management Plan Consultation (2009),
- AWS - Statement of Response to draft Water Resources Management Plan Consultation (2009),
- EA Representation on ST draft Water Resources Management Plan (2008),
- EA Representation on AWS draft Water Resources Management Plan (2008),
- Catchment Abstraction Management Plans – made available by the EA,
- The location of the existing sources of raw water supply across the district, including licensed daily abstraction and annual maximum abstraction limits – made available by the EA (letter dated 11th December 2009).

4.3 Water Resource Baseline Assessment

According to the EA, Bassetlaw lies partly within an area of serious water stress (in the east of the district) and an area of moderate water stress (in the west of the district).

The EA manages water resources at the local level through the use of CAMS and Bassetlaw lies within the Idle and Torne CAMS area. Within the Idle and Torne CAMS, the EAs assessment of the availability of water resources is based on a classification system that allocates a resource availability status indicating:

- The relative balance between the environmental requirements for water and how much is licensed for abstraction,
- Whether water is available for further abstraction,
- Areas where abstraction needs to be reduced.

The categories of resource availability status are shown in Table 4-1. The classification is based on an assessment of a river system's ecological sensitivity to abstraction-related flow reduction. This classification can then be used to assess the potential for additional water resource abstractions.

Table 4-1: CAMS Resource Availability Status Categories

Indicative Resource Availability Status	License Availability
Water Available	Water is likely to be available at all flows including low flows. Restrictions may apply.
No Water Available	No water is available for further licensing at low flows. Water may be available at higher flows with appropriate restrictions.
Over Licensed	Current actual abstraction is such that no water is available at low flows. If existing licences were used to their full allocation they could cause unacceptable environmental damage at low flows. Water may be available at high flows, with appropriate restrictions.
Over Abstracted	Existing abstraction is causing unacceptable damage to the environment at low flows. Water may still be available at high flows, with appropriate restrictions.

The classification for each of the catchments within Bassetlaw is shown in Table 4-2.

Table 4-2: CAMS Resources within Bassetlaw

WRMU/GWMU Name	Resource Availability Status			
	Individual WRMU Status	Integrated WRMU Status	Target Status in 2010/11	Target Status in 2015/16
WRMU4 - River Idle[1]	Over Abstracted	Over Abstracted	Over Licensed	Over Licensed
WRMU2 - River Upper Poulter[1]	No Water Available	No Water Available	No Water Available	No Water Available

Key: Integrated WRMU status in table refers to the availability status after downstream conditions have been taken into account and/or, in the case of groundwater, the status of an overlying river.
[1] Idle and Torne CAMS and EA comments letter (11th December 2009)

4.3.1 Water Resource Management Plans

As part of the Water Company's business planning process, each water company is required to prepare a plan showing how the growth in demand over the next 25 years will be met. Both ST and AWS prepared their draft WRMPs in April 2008. Updates to these plans have now been produced in a Statement of Response to the consultation on the draft WRMPs, and following the EAs response to the draft plans published in July 2008. These updates were published by both ST and AWS in March 2009 and these are likely to closely match the final WRMPs which are due to be published in early 2010 (subject to approval by DEFRA)[5].

Severn Trent Water - Water Resources Management Plan

The ST supply zone within which the western part of the district lies in STs East Midlands Water Resource Zone (WRZ6). The main sources of supply for ST are from groundwater sources around Worksop and Mansfield. ST has no surface water sources local to Bassetlaw. The main WTWs are located at Barnby Moor, Hayton and Chequer House (north west of Retford), Sunnyside and Manton (near Worksop) and Markham Clinton (near Mansfield).

[5] At the time of writing, AWS has just published their final WRMPs. ST have yet to puiblish their plan. A full review of both these plans should be incorporated into any future Detailed WCS.

The large deficits originally forecast for this WRZ in the draft WRMP, have now been revised in STs Statement of Response to the consultation on their draft WRMP. The Statement of Response is now showing that WRZ6 to be in surplus (i.e. water resources exceeding demands) over the entire planning period through to 2035/36. It is understood that the changes since the publication of the draft WRMP are due to revisions of the effects of climate change impacts on resources and also updated demand forecasts in the light of the recent economic circumstances. The effect of these changes will mean that STs investment plans, at least in the short to medium term (AMP5 to AMP8, 2010-30) will be mainly focused on demand management, plus some improvements in their strategic treated water mains network.

Anglian Water - Water Resources Management Plan

The AWS supply zone within which the eastern part of the district lies in AWS Lincoln Water Resources Zone (WRZ2) and is split into two planning zones (PZ):

- East Retford (PZ10),
- Everton (PZ11).

Lying within these two PZs are a number of AWS groundwater sources, most notably around Retford (Ordsall Road and Whiskers Hill), to the south of Retford (Grove, Elkesley) and in the north of Bassetlaw (Everton).

The draft AWS WRMP stated that PZ10 and PZ11 were both forecast to be in slight deficits of 1.78 Mld^{-1} and 0.46 Mld^{-1} respectively by 2035/36. In the AWS Statement of Response to the consultation on the draft WRMP, these two PZs have surpluses in the baseline forecast case. In a letter sent by the EA dated 11th December 2009, the EA has reported that both PZs are not forecast to have any supply/demand deficits throughout the planning period up to 2035.

The list of schemes included in the Statement of Response makes reference to a new Lincoln WTW to be built within AMP5 (2010-15). The extra 20 Mld^{-1} of water from this works could therefore potentially be available to support development within the east of Bassetlaw.

4.3.2 Forecast Growth in Demands

In terms of residential population, assuming an average occupancy of 2 persons per each new property, then the growth figures for Bassetlaw would give an overall increase of approximately 11% based on an existing population of 112,000 (BDC Core Strategy Prefered Options May 2010).

Residential Demands

The estimates in growth from residential demand for the main development areas within Bassetlaw are included in Table 4-3.

To calculate these demands, it is necessary to multiply the number of new homes to be built in an area by the average occupancy rate and in turn by the average water use per person. In the case of Bassetlaw, ST metered households typically have an occupancy ratio of 2.3 and their average water consumption rate of

115 litres/head/day ($lh^{-1}d^{-1}$), whilst in the case of AWS, the occupancy ratio is lower at 2.0 but average water consumption is higher at 142 $lh^{-1}d^{-1}$.

In addition to the water company forecasts (Scenario 1), three other scenarios have been included based on the Code for Sustainable Homes (CSH), which provides a system of credits for all new buildings depending on their level of water efficiency, there being:

- 120 $lh^{-1}d^{-1}$ (Scenario 2),
- 105 $lh^{-1}d^{-1}$ (Scenario 3),
- 80 $lh^{-1}d^{-1}$ (Scenario 4).

Table 4-3 shows that for the water company forecast (Scenario 1), the total residential water demand for Bassetlaw up to 2026 would be 1.74 Mld^{-1}. Broken down into the main development areas, then the demands are highest in Worksop (0.63 Mld^{-1}), followed by Harworth / Bircotes (0.46 Mld^{-1}) and Retford (0.43 Mld^{-1}). Using the CSH estimates of water consumption, the total residential water demands would vary from 1.13 Mld^{-1} (Scenario 4 – CSH Level 5/6, 80 $lh^{-1}d^{-1}$) to 1.67 Mld^{-1} (Scenario 2 – CSH Level 1/2, 120 $lh^{-1}d^{-1}$) by 2026.

It should be noted that none of the above figures include any allowance for headroom. If an allowance for an additional 10% is added to the residential demand estimates given above, then this would raise the demand figures up to 2026 for the maximum (Scenario 1) and minimum (Scenario 4) estimates of 1.91 Mld^{-1} and 1.24 Mld^{-1} respectively.

Table 4-3: Residential Water Demands in Bassetlaw District

No.	Development Areas	Water Company	Nos. dwellings	Water Company Forecast	Code for Sustainable Homes Rating 1/2 120 $lh^{-1}d^{-1}$	Code for Sustainable Homes Rating 3/4 105 $lh^{-1}d^{-1}$	Code for Sustainable Homes Rating 5/6 80 $lh^{-1}d^{-1}$	Range of Estimates Min	Range of Estimates Max	Including an allowance for headroom	Including an allowance for headroom
				Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 4	Scenario 1	Scenario 4	Scenario 1
				(Mld^{-1}) *1	(Mld^{-1})*2	(Mld^{-1})*3	(Mld^{-1})*4	(Mld^{-1})	(Mld^{-1})	(Mld^{-1}) *5	(Mld^{-1})*5
1	Retford	AWS	1,500	0.43	0.36	0.31	0.24	0.24	0.43	0.26	0.47
2	Other settlements (1)*6		1,040	0.29	0.25	0.22	0.17	0.17	0.29	0.19	0.32
3	Worksop	ST	2,000	0.53	0.55	0.48	0.37	0.37	0.53	0.41	0.58
4	Harworth / Bircotes		1,750	0.46	0.48	0.42	0.32	0.32	0.46	0.35	0.51
5	Other settlements (2)*7		420	0.03	0.03	0.03	0.03	0.03	0.03	0.03	.03
	Bassetlaw Total		**7,370**	**1.74**	**1.67**	**1.46**	**1.13**	**1.13**	**1.74**	**1.24**	**1.88**

*1 Assuming 115 l/h/d supplied for ST areas and 142 l/h/d for AWS areas. The respective occupancy rates for each WC is 2.3 (ST) and 2.0 (AWS) assumed (OFWAT 2007-08)

*2 Code for Sustainable Homes - Water consumption targets for Code 1/2 homes and an assuming occupancy rate of 2.3 (OFWAT 2007-08)

*3 Code for Sustainable Homes - Water consumption targets for Code 3/4 homes

*4 Code for Sustainable Homes - Water consumption targets for Code 5/6 homes

*5 Allowance for headroom in-line with WCS Methodology

*6 Other settlements (1) – includes Beckingham, Clarborough Hayton, Elkesley, Mission, Misterton, Nether Langwith, North Leverton, North Wheatley, Rampton and Tuxford

*7 Other settlements (2) – Includes Blyth, Carlton- in-Lindrick and Langold.

Non Residential Demands

Information provided by BDC is that a need for 80 ha of employment land has been identified up to 2026. At present, no information is available on the location and type of employment to be created and therefore any estimates of non-residential demand should only be considered provisional at this stage.

The United Kingdom Water Industry has traditionally used complex econometric forecasting models to assess what may happen to the demands from industry in the future. For the Outline WCS, Scott Wilson has based its estimates of non-residential demand on the relationship which exists between non-residential and residential water demands as reported by OFWAT. In the case of ST and AWS, average non-residential metered demand is around 58% and 48% of their respective residential metered demand. Assuming the parts of Bassetlaw lying within the ST and AWS areas to be similar to the wider areas served by these water companies, then the non-residential demand will be approximately half (50%) of the residential demand.

Based on these assumptions, a figure of 0.5 Mld^{-1} (based on Scenario 1, water company forecast) is indicated for the non-residential demand within Bassetlaw. Apportionment of this amount to the individual settlements is not possible at this stage, as no information on the locations of employment sites has been provided by BDC.

Total Water Demands

An estimate of the combined residential and non-residential demand figures for Bassetlaw, based on the water company forecast consumption figures (Scenario 1), would give a maximum total demand figure up to 2026 of 2.38 Mld^{-1}. The total demand figure for the minimum scenario (scenario 4) is 1.74 Mld^{-1}, both of these figures include an allowance for headroom.

4.3.3 Water Efficiency

Current situation

A comparison with average water use by different groups of ST and AWS customers are shown in Table 4-4.

Table 4-4: Summary of Water Usage

Customer type	ST	AWS	Industry Average
	($lh^{-1}d^{-1}$)		
Metered	115	142	131
Unmetered	141	158	151
Overall	134	150	145
Source: OFWAT report 2007-08			

ST has one of the lowest metered consumption figures of any United Kingdom Water Company and last year this figure was 115 $lh^{-1}d^{-1}$, with AWS metered customers having a figure of 142 $lh^{-1}d^{-1}$. These compare with an industry average for Water and Sewerage Companies of 131 $lh^{-1}d^{-1}$.

In terms of the levels of meter penetration, this presently stands at 28% for the whole area covered by ST and 60% for AWS. These compare with a United Kingdom Water Company average of 25%.

The current levels of leakage as reported by the two companies are 26% for ST and 18% for AWS, as a proportion of their distribution input[6] figure (based on 2007-08). These figures compare with an industry average of 27% (OFWAT 2007-08).

Severn Trent Water - Future Water Efficiency Plan

A summary of STs water efficiency measures included in their draft WRMP are as follows:

- Water Metering – ST are actively encouraging customers to opt for a water meter. No targets have been set for 2020, but it is assumed that 66% of customers are to be metered by 2035,
- Tariffs – no changes are planned,
- Water Efficiency – good practice guidance is followed where possible (OFWAT, 2006),
- Leakage – ST are proposing to operate at below the Economic Level of Leakage[7] (ELL) in their areas of most stressed areas.

STs Statement of Response has incorporated the most recent evidence and predicts that greater uptake of the free meter option will take place between 2010 and 2015, and also in the longer term. The Statement of Response also mentions a trial to install a meter on a 'change of occupier' which will be applied across most of ST areas, including WRZ 6 (the East Midlands).

Anglian Water – Future Water Efficiency Plan

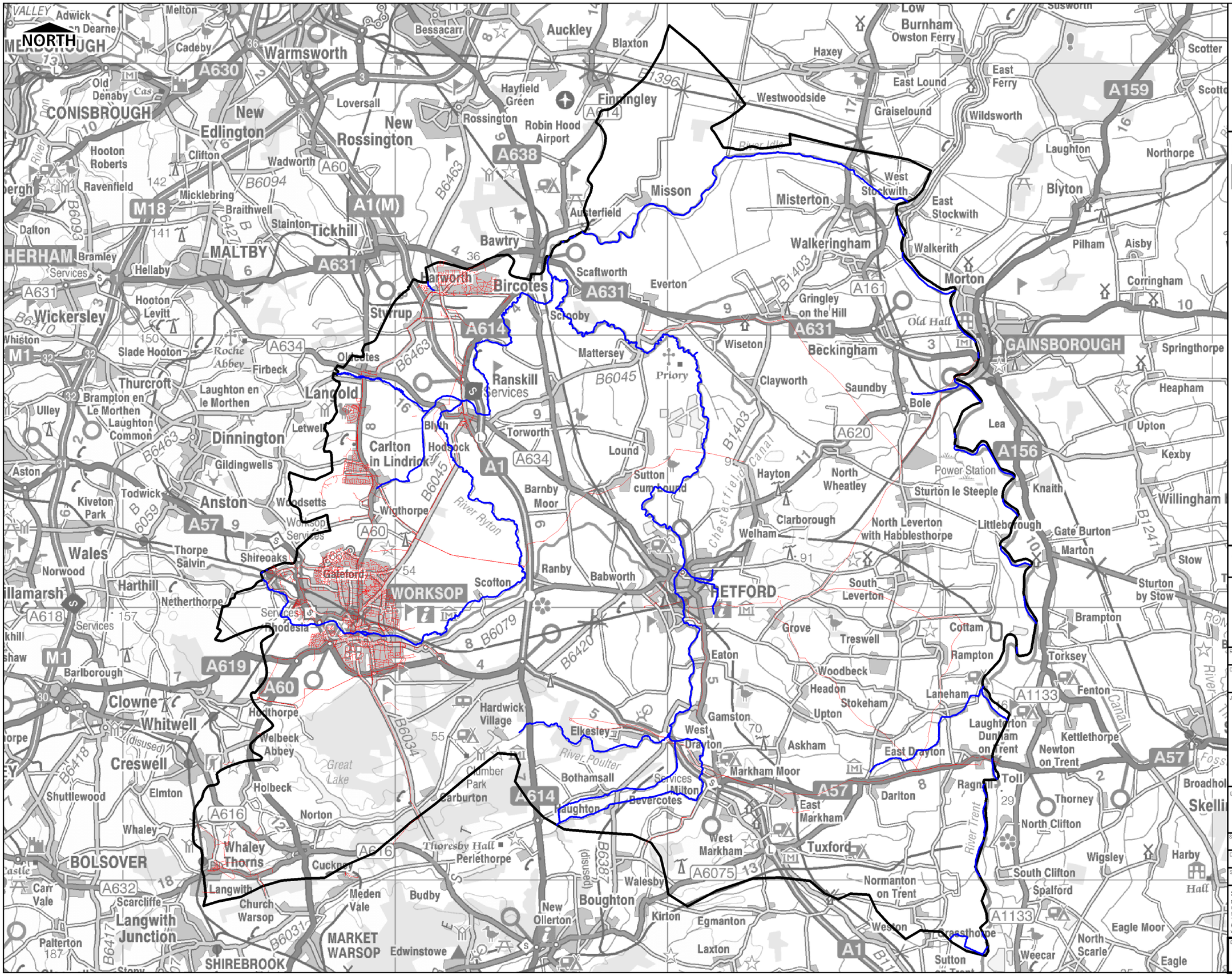
A summary of AWS water efficiency measures included in their draft WRMP and in their Statement of Response are as follows:

- Water Metering – AWS is actively encouraging customers to opt for a water meter. A targeted enhanced metering programme to improve metering levels in certain 'key' areas up to 75% by 2015 and 90% by 2035 has been proposed. The Statement of Response does not identify Bassetlaw as one of the 'key' areas, presumably because of the current surpluses in available water in this area,
- Tariffs – no changes are planned. AWS view is that water is not like other commodities and that people will continue to use what they need, therefore changes in tariffs will not alter people's water usage habits,
- Water Efficiency – good practice guidance is followed where possible (OFWAT, 2006),
- Leakage – AWS is proposing to continue to operate at or below the ELL, this is despite the expected increase of around 20% on the current leakage levels which is expected to occur as a result of extension to the distribution network over the next 25 years.

[6] Distribution input – The amount of water put into supply, including water not actually delivered i.e. leakage and water taken illegally.
[7] Economic Level of Leakage - The level of *leakage* for which the cost of achieving and then maintaining that level is exactly offset by savings in capital and operating costs.

4.4 Water Supply Network and Pumping Stations

Limited information has been provided by ST on its water supply network within the western part of Bassetlaw and by AWS within the eastern part of Bassetlaw. The information presented in this section comes mainly from the respective draft WRMPs and previous WRMPs, which are now a publically available source of information. Figure 4-1 shows the water supply network supplied by ST and AWS, with Table 4-5 and Table 4-6 providing a summary of the water sources available to supply growth in Bassetlaw.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BASSETLAW DISTRICT COUNCIL
NORTH NOTTINGHAMSHIRE
Legend
Bassetlaw Boundary
Main River
Water Supply
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Revision Details
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FINAL
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OUTLINE
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Drawing Title
WATER SUPPLY
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FIGURE 4-1

Table 4-5: Severn Trent Water- Water Sources

WTW	Groundwater Licence No.	Licensed Daily Quantity (Mld^{-1})	Licensing Comments	Water Supply Comments
Barnby Moor	3/28/74/55/G (2x boreholes)	10	Aggregated with the Hayton licence (See below)	Feed to Worksop, Carlton-in-Lindrick and Harworth / Bircotes
Hayton	3/28/74/66/1/G (x3 boreholes, A-C)	16.5	Licence aggregated with Barnby Moor, so that between both licences not more than 16.5 Ml/d, 400 Ml in any period of 28 days nor 4,382,000 per year can be abstracted.	See above
Sunnyside	3/28/75/8/G (x2 boreholes, new & old)	3.86	1414 Ml/yr	See above
Chequer House	3/28/75/54/G (x2 boreholes, A & B)	14	During April – October inclusive abstraction of >11.364 Ml/d shall not be for more than 10 days in a 30 consecutive day period	See above
Manton	3/28/75/111/G	14	This licence is for compensation to the River Ryton, not for public water supply	See above
Markham Clinton	3/28/72/25/G (3x boreholes, A-C)	22.73	8296 Ml/d	See above
Total		**81.09**		

Table 4-6: Anglian Water Services - Water Sources

WTW	Groundwater Licence No.	Licensed Daily Quantity (Mld^{-1})	Licensing Comments	Water Supply Comments
Retford	3/28/74/3/G (x3 boreholes, Ordsall Road 1&2, Whiskers Hill)	16.37	4978 Ml/yr (but group aggregate annual totals)	Feed to Retford
Grove	3/28/74/5/G (x4 boreholes)	16.37	4978 Ml/yr (but group aggregate annual totals)	See above
Elkesley	3/28/73/1/G (x7 boreholes)	27.28	8296 Ml/yr (but group aggregate annual total)	Feed to Retford/Tuxford
Everton	3/28/74/4/G (x6 boreholes, A-F)	13.64	4150 Ml/yr (but group aggregate annual totals)	Feed to Scatworth, Misterton, Walkeringham and Beckingham
Total		**73.66**		

From Table 4-5 and Table 4-6 it can be seen that both ST and AWS currently hold a large number of groundwater licences locally, many of which have large licensed volumes associated with them. Although the existence of an abstraction licence does not in itself guarantee that water will be available at the time it is required, for example at times of drought it may not be possible to abstract the full licence quantity. However, given the fact that extra demands from the proposed new developments within Bassetlaw are between 1.8 Mld^{-1} and 2.6 Mld^{-1} (by 2026) across the entire district, it is considered likely that there will be sufficient spare licence capacity available in order to meet these extra demands.

How straightforward this is to achieve will depend essentially on the existing mains network and associated pumping stations and potentially the ability to transfer water within each Water Companies area or between the two Water Companies.

A brief summary for each of the main growth areas and where they may get their extra water from is given in Section 4.4.1 to Section 4.4.4.

4.4.1 Worksop

Up to 2,000 new homes are due to built in Worksop by 2026 and ST are the water supply company covering this area. It is likely that increased growth in demand will be met from groundwater sources near to Worksop, either from Sunnyside (2 boreholes) or Manton (1 borehole).

4.4.2 Harworth / Bircotes

Up to 1,750 new homes are due to built in Harworth / Bircotes by 2026 and ST are the water supply company covering this area. It is likely that increased growth in demand will be met from groundwater sources to the north west of Retford, namely at Barnby Moor (2 boreholes), Hayton (3 boreholes) and Chequer House (2 boreholes). The groundwater sources within Worksop may also be able to support some of the new developments in Harworth / Bircotes.

4.4.3 Retford

Up to 1,500 new homes are due to built here by 2026 and AWS are the water supply company covering this area. It is likely that increased growth in demand will be met from groundwater sources within Retford, either from Ordsall Road (2 boreholes) or Whiskers Hill (1 Borehole).

4.4.4 Other settlements

It is proposed that up to 60 new homes are to be built in each of a further twenty two settlements (a total of 1,440). Due to their location, approximately 450 of these new homes are likely to be supplied by AWS, with the remaining 990 homes likely to be supplied by ST. Depending on the local water mains network, a variety of sources may be used to supply the water needs of these settlements.

Further work will be required during any Detailed WCS or in the development of DPDs and/or AAPs to fully asses the constraints within the mains water supply network. This will require access to both the ST and AWS network models with coverage of the development areas within Bassetlaw. In addition, a review of WTWs

capacities will be required to ensure that sufficient treatment capacities are available to meet the extra growth expected within the district.

4.5 Potential Risks to Water Supplies

Potential risks to water company supplies which may affect Bassetlaw, include:

- Groundwater Quality within Aquifers – this is a major concern to ST, who predict that increasing nitrate concentrations will mean that many of its groundwater sources will no longer be suitable for water supply. A failure to fund and implement a series of AMP5 schemes to treat and blend high nitrate water could put pressure on the supply / demand gap. As part of STs commitment to the Water Framework Directive (WFD) River Basin Management Plans (RBMPs) and as part of their AMP5 plans, they are proposing to implement catchment solutions instead of and in parallel to treatment solutions, for both nitrate and other water quality problems. This will involve working closely with both the EA and Natural England to manage catchments to reduce the need for higher levels of treatment in future,

- Climate Change – the effects of climate change on water resources is based on information contained in the respective draft WRMPs. In general, the effects of climate change on groundwater resources is considered to be small (typically <1% reduction in the DO figure for any given area). Since the majority of Bassetlaw is supplied from groundwater, then the likely impacts are also considered to be small. Both ST and AWS will have taken into account the affects of climate change in their water demand and headroom calculations undertaken for their final WRMP,

- Water Supply Resilience – all new (and existing) water supplies should be resilient, whereby if the standard means of water provision is interrupted (be that from physical or chemical mechanisms) then there are alternative means by which supplies of potable water can be maintained. In general, the water supply system (to Bassetlaw) is well connected, allowing the re-distribution of potable water. This is something which must be incorporated into the design of any new development area,

- Review of Consents Process – this relates to investigations being undertaken by the EA on various abstractions and their impacts on designated sites. Any reductions in abstractions resulting from this process will reduce the amount of headroom available to meet future growth. As far as we aware, there are no such sources presently under investigation within Bassetlaw. ST have a number of sites under investigation elsewhere within its supply area and they have made a commitment not to include any new water resource investment options that could impact on those sites still under investigation by this process. AWS also has a number of sources under investigation elsewhere within its supply area.

5 Flood Risk and Drainage

5.1 Potential Flood Risk from Development

If new development is planned for Greenfield sites, or upstream of areas with known flood risk, it is essential that any additional surface water and wastewater generated due to the increase in permeable area is mitigated to an appropriate standard such as Greenfield runoff rate to avoid increasing flood risk elsewhere. This could be achieved through careful development layout and the use of SUDS.

5.1.1 National Flood Risk Policy: PPS25

Planning Policy Statement 25 (PPS25): Development and Flood Risk[8] requires that all new development should ensure that runoff rates and runoff volumes from new development are not increased above that of the existing land use. For any development on currently undeveloped land, there will be a requirement to ensure that runoff rates and volumes are no greater than the Greenfield rates for the design event with return period of 1 in 100 years (with an allowance for climate change) and smaller rainfall events up to this level.

It is important to note that whilst the majority of the proposed development sites are on existing brownfield sites, the latest EA guidance states that runoff should be limited to that of Greenfield rates, thereby requiring less runoff to watercourses and/or adjacent development areas than that currently experienced.

PPS25 also advocates the use of the sequential approach. The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. It can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments (except water-compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

The Sequential Test refers to the application of the sequential approach by an LPA. This allows the determination of site allocations based on flood risk and their vulnerability. Development should be directed towards Flood Zone 1 wherever possible, and then sequentially to Flood Zone 2 and Flood Zone 3.

The application of the sequential approach aims to manage the risk from flooding by avoidance. This will help prevent the promotion of sites that are inappropriate on flood risk grounds. The application of the Exception Test through a Level 2 SFRA will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers and mitigation measures are provided.

The LPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and applied the Sequential Test and where necessary the Exception Test (see Appendix D of PPS25) in the site allocation process. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development based on past trends.

[8] Planning Policy Statement 25: Development and Flood Risk, Communities and Local Government, December 2006

Further detailed information regarding the application of the Sequential approach can be found in the Bassetlaw SFRA.

The following points highlight key national, regional and local flood risk policy guidance.

5.1.2 National

In accordance with PPS25, all sites should be allocated in accordance with the Sequential Test to reduce the flood risk and ensure that the vulnerability classification of the proposed development is appropriate to the Flood Zone classification,

FRAs should be undertaken for all developments within Flood Zones 2 and 3 and sites with identified flooding sources (according to PPS25 Annex E) to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area,

FRAs are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1,000 m^2,

Flood Risk to development should be assessed for all forms of flooding (in accordance with PPS25 Annex E),

According to PPS25, it is recommended that where floodplain storage is removed, the development should provide compensatory storage on a level for level and volume for volume basis to ensure that there is no loss in flood storage capacity.

5.1.3 Sub-Regional / Local

As stated in PPS25, surface water flooding should be investigated in detail as part of site specific FRAs for developments and early liaison with the EA and the relevant LPA for appropriate management techniques should be undertaken.

As stated in PPS25, groundwater flooding should be investigated in more detail as part of site specific FRAs.

5.2 Residual Risk Management

Residual risk in a generic sense can be defined as being the remaining risk following the implementation of all reasonable risk avoidance, reduction and mitigation measures. In a flood risk context, this residual risk pertains to that remaining after flood avoidance and alleviation measures have been put in place. Examples of such residual risks include overtopping or breaching of flood walls or embankments.

Residual risk management therefore aims to prevent or mitigate the consequences of flooding that can occur despite the presence of flood alleviation measures.

Application of the Sequential Test as part of PPS25 aims to preferentially develop or relocate potential development sites into areas with low flood risk. Where this is not realistically possible, some development sites may be located in higher flood risk areas, such as PPS25 defined Flood Zones 2 and Flood Zone 3. As a