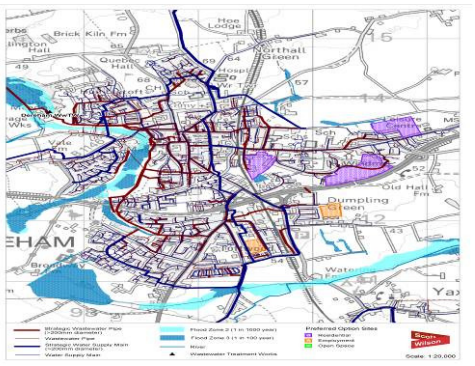
Bassetlaw Water Cycle Study
Outline Study

Non Technical Summary
November 2010



Revision Schedule

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Non Technical Summary
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Rev	Date	Details	Prepared by	Reviewed by	Approved by
01	November 2010	Draft	**Gemma Costin** Assistant Consultant	**Andrew Woodliffe** Principal Consultant	**Jon Robinson** Technical Director

Scott Wilson
Royal Court
Basil Close
Chesterfield
Derbyshire
S41 7SL

Tel 01246 209221
Fax 01246 201229

www.scottwilson.com

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1 Introduction

1.1 The Water Cycle

1.1.1 In its simplest form, the Water Cycle can be defined as:

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

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

1.1.3 In the context of this study, the 'water cycle' has a broader definition than the simple water or 'hydrological' cycle. The human influence on the water cycle introduces 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. 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. '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: water treatment works, supply pipelines and pumping stations) which are used by human activity to manipulate the cycle.

1.1.4 In directly manipulating elements of the water cycle, man affects 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 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.

1.1.5 In many parts of the UK, 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. This is especially relevant for the east of England where rainfall and hence available water for supply is the lowest in the UK. 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 is therefore at risk.

1.1.6 A Water Cycle Study (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 water infrastructure introduced to facilitate growth is planned for in a strategic manner; in so doing, the WCS can ensure that provision of water infrastructure is sufficient such that it maintains a sustainable level of manipulation of the natural water cycle.

1.2 Study Area

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

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

1.3 Growth Assessment

1.3.1 The now revoked East Midland Regional Plan identified 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. Bassetlaw Core Strategy Preferred Options Consultation (May 2010) requires an additional 7,370 new dwellings to be built by BDC to 2026.

1.3.2 As part of Bassetlaw District Council's (BDCs) overall strategy to meet future growth targets in a sustainable way, a 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 (CS) 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.

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

1.4 Outline Study - Reporting Format

1.4.1 The undertaking of an Outline WCS involves a significant amount of technical data collection, analysis and interpretation. However, it is acknowledged that the WCS key purpose is to act as a planning evidence base and hence, the Bassetlaw Outline WCS has been reported via two distinct documents:

- A Non Technical Report - to act as the principal planning reference for the WCS which summarises the overall water cycle strategy, provides the key findings of the study in relation to the LDF and the various documents which it informs and sets out planning implications of the solutions proposed from the study,
- A Technical report - setting out:
    - What solutions are required to deliver the strategy,
    - How the strategy was developed,

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

- Details of the data used,
- Detail of how the capacity and new infrastructure assessments were undertaken,
- Detailed results and findings from the assessments,
- Further discussion around the policy and legislative drivers affecting the assessments and conclusions,
- Discussion of potential policy required to deliver the infrastructure and mitigation required.

1.4.2 Its aim is to act as the technical reference for the evidence base to the LDF, giving sufficient information to the various key technical stakeholders involved in the study to demonstrate that the strategy developed is robust and achievable.

1.4.3 This report represents the Bassetlaw Outline WCS – Non-Technical Report.

1.5 Study Drivers

1.5.1 There are many key drivers to a WCS that need to be considered and these are covered in more detail in the Outline WCS Technical report. However, it is important to highlight in this non-technical report that there are two key pieces of legislation that the WCS must consider as an evidence base:

- EU Water Framework Directive (WFD),
- EU Habitats Directive (HD).

1.5.2 The key elements of both of these directives which are relevant to a WCS, are that they aim to protect (and enhance) the quality of waterbodies and the ecological species which are reliant on them. In different ways, they both set out environmental targets which need to be met in our water bodies to ensure that they continue to function both for environmental purposes, but also for human use and enjoyment.

1.5.3 Growth in Bassetlaw could impact on our waterbodies in several key ways unless key infrastructure and mitigation is developed to prevent it. More housing and employment results in:

- Generation of more wastewater, which although goes through a treatment process, still has the potential to impact detrimentally on the water quality of receiving waterbodies,
- Physical development for growth results in the generation of greater volumes of surface water which has the potential to impact on flood risk, but also the quality of receiving waterbodies,
- Provision of drinking water to growth areas requires more abstraction of raw water resources from the environment which reduces the volume of water available for habitats and species which rely on it.

1.5.4 Therefore, it is essential that the WCS considered the impact of growth on meeting these standards as set by the legislation and a key element of the Outline WCS has been to determine existing capacity in the current water infrastructure, resources and environment and to suggest what infrastructure and mitigation may be needed to ensure these standards are

met. This assessment has resulted in an Outline Water Cycle Strategy for Bassetlaw which informs Bassetlaw's LDF of the potential phasing requirements for housing to ensure that the infrastructure solutions can be implemented before housing and employment areas are developed. The Strategy also sets out who is potentially responsible for providing the solutions and maintaining them after construction.

1.6 Steering Group

1.6.1 The Outline WCS has been overseen by a Steering Group consisting of representatives from the following stakeholders:

- Bassetlaw District Council (BDC),
- Environment Agency (EA),
- Severn Trent Water (ST),

Anglian Water Services (AWS).

1.6.2 The stakeholders have provided information and expertise to the study and have guided the development of the strategy at several key stages. This input has ensured that a strategy has been developed that all key stakeholders can sign up to, allowing agreement to be reached on water environment and water infrastructure issues with respect to the growth set out in the emerging LDF.

2 Key Findings of the Outline WCS

2.1.1 The key findings from the Outline WCS include:

2.2 Water Resources and Supply

2.2.1 Virtually all the water supplies for Bassetlaw come from groundwater sources.

2.2.2 The Catchment Abstraction Management Strategy (CAMS) document produced by the EA sets out a strategy to ensure water in a catchment is not over extracted. The CAMS for the area shows the River Idle is classified as being 'Over-Abstracted', whilst the River Poulter has 'No Water Available'.

2.2.3 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).

2.2.4 Bassetlaw is served by two water companies, ST and AWS. Both companies are in water surplus (i.e. resources exceed demands). In the case of ST, this is the 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.

2.2.5 Both 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.

2.2.6 Both 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.

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

2.3 Flood Risk and Drainage

2.3.1 Surface Water Management is a key consideration when assessing development within large areas. Planning legislation (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.

2.3.2 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.

2.4 Wastewater Treatment and Collection

2.4.1 There are twenty-four WwTWs located within the study area. Eighteen of these works have been identified as potentially being impacted by proposed development within the study area and have therefore been assessed as part of the Outline WCS.

2.4.2 The wastewater network assessment showed 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.

2.4.3 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.

2.4.4 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.

2.4.5 Two of the assessed WwTWs (North Wheatley and Rampton) are already exceeding capacity and have no headroom 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. 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.

2.4.6 Under future growth conditions Gamston, Harworth and Norton WwTW are also likely to exceed their existing flow consents 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).

2.4.7 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.

2.4.8 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).

2.4.9 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.

2.4.10 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.

2.4.11 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.

2.4.12 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.

2.5 Water Quality

2.5.1 Water quality within Bassetlaw has been assessed downstream of eighteen of the twenty-four WwTWs, as these are most likely to be impacted by proposed growth within the study area. The water quality has been assessed against current (historical) water quality objectives and future WFD targets.

2.5.2 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’.

2.5.3 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.

2.6 Ecology and Biodiversity

2.6.1 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.

2.6.2 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.

3 Summary of Key Issues in Development Areas

3.1.1 The Outline WCS has identified the existing capacity of the current water environment and water cycle infrastructure and has used this assessment to determine where additional investment is required to supply new infrastructure or protect the water environment. The conclusions of each assessment are presented in Table 3-1 to give a visual assessment of issues pertaining to each development area in Bassetlaw. In addition, a summary of main constraints and issues that need to be addressed are discussed in the full technical Outline report.

Table 3-1: Water Cycle Development Issue Summary

Potential Growth Area	Dwellings (and employment land)	Wastewater		Water Resource	Water Quality and Environment
		WwTW Volumetric & Process Capacity	Network Capacity		
Beckingham	60	G	O	G	G
Blyth	60	O	G	G	G
Carlton-in-Lindrick	300	O	O	G	O
Clarborough Hayton	60	G	O	G	G
Cuckney	60	O	G	G	G
Dunham	60	O	G	G	G
East Markham	60	G	G	G	G
Elkesley	60	G	G	G	G
Everton	60	G	G	G	G
Gamston	60	O	G	G	G
Gringley-on-the-Hill	60	G	G	G	G
Harworth/Bircotes	1,750 (28 Ha)	O	O	G	G
Langold	60	O	G	G	G
Lound	60	O	O	G	G
Mattersey	60	G	G	G	G
Misson	60	G	G	G	G
Misterton	250	G	O	G	G
Nether Langwith	60	G	G	G	G
North Leverton	60	G	G	G	G
North/South Wheatley	60	O	O	G	G
Rampton	60	O	O	G	G
Ranskill	60	G	G	G	G
Retford	1,500 (16 Ha)	O	O	G	O
Sutton (Cum Lound)	60	O	O	G	G
Sturton-le-Steeple	60	G	G	G	G
Tuxford	250	G	G	G	G
Walkeringham	60	G	G	G	G
Worksop	2,000 (36 Ha)	O	G	G	O

Key

G	Spare capacity, minimum investment required, minimal issues.
O	Strategic scale mitigation or water cycle infrastructure will be required.
R	Major investment required / major limitation.

4 Strategy for Worksop

Growth Summary

4.1.1 The Bassetlaw Core Strategy Issues and Options Consultation (May 2010) identified Worksop as having potential for economic growth, Workshop is targeted with providing 2000 new homes and 36ha or employment land to 2026.

Wastewater Treatment and Transmission Infrastructure

4.1.2 Wastewater generated within Worksop is currently treated at Manton WwTW. Worksop is targeted with providing the largest level of growth in Bassetlaw. Development to the east of the town is likely to provide less impact and potential upgrades to the existing sewer network as wastewater from here will be able to connect to the larger strategic main to the southeast of the town that drains directly to Worksop WwTW.

4.1.3 ST has confirmed that the potential impact of the proposed development on sewerage infrastructure is low, but this will need to be confirmed by hydraulic modelling and pumping station capacity checks.

4.1.4 Analysis indicates that there is limited spare hydraulic capacity at this site. Notwithstanding this ST do not envisage any physical constraints that would prevent additional capacity being provided to meet future development being proposed in Worksop. Provision of additional capacity is likely to take 2-3 years to provide but this would only be initiated once planned development proposals have been confirmed by BDC.

Water Quality and Environment

4.1.5 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'. It is likely that the current quality consents at Manton WwTW are likely to be exceeded with future growth and the EA may require tightening of consents to maintain water quality. Consents for BOD, Ammonia and Phosphorus will need to be tightened.

4.1.6 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.

4.1.7 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. The River Ryton currently has high levels of nitrates and phosphates which need to be monitored as it is currently rated poor under the WFD for phosphates, and moderate ecological status.

Water Resources

4.1.8 ST's water resource planning for the next 25 years (the WRMP) shows that Worksop will have a slight surplus of water surplus by 2026 and therefore significant investment in new water resources is unlikely to be required. The demand generated by the proposed growth in Worksop will be been catered for in ST's existing and planned resource, and hence available resources are adequate to meet the small increase in demand without affecting any HD or WFD standards in local water bodies. 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).

4.1.9 Adequate water supply mains pass through, or are located close to all proposed development sites in Worksop. However, the developers would be responsible for funding local connections on a house by house basis.

Horizon	Volumetric Capacity	Network Capacity	Water Resources	Water Quality
0 – 500				
500 – 1,000				
1,000 – 1,500				
1,500 – 2,000				

5 Strategy for Retford

Growth Summary

5.1.1 The Bassetlaw Core Strategy Issues and Options Consultation (May 2010) identified Retford as having potential for economic growth, Retford is targeted with providing 1500 new homes and 16ha or employment land to 2026.

Wastewater Treatment and Transmission Infrastructure

5.1.2 Wastewater in Retford drains from south to north through the town to Retford WwTW. The majority of wastewater from Retford is pumped to the works.

5.1.3 There are known internal and external flooding problems downstream of south Retford. An internal flooding problem is currently being assessed as part of ST's sewer flooding capital investment programme.

5.1.4 Development to the north of Retford (particlaurly in the vicinity of Bolham Lane sewage pumping station) may impact the storm sewer overflow on Bolham Lane, and as such this may need to be assessed to ensure its performance is not unduly affected. However subject to hydraulic modelling it is not envisaged that development in this area would have any major capacity implications.

5.1.5 ST considers the potential impact of the proposed development at these sites on the sewerage infrastructure as medium.

Water Quality and Environment

5.1.6 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'. Tightening of consents for BOD and Phosphorus are likely to need to be tightened with future growth.

5.1.7 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.

5.1.8 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. The River Idle currently has high levels of phosphates and nitrates which need to be monitored. The River Idle is designated a heavily modified waterbody under the WFD and has poor ecological and biological status.

Water Resources

5.1.9 AWS's water resource planning for the next 25 years (the WRMP) shows that Retford will have a slight surplus of water surplus by 2026 and therefore significant investment in new water resources is unlikely to be required. The demand generated by the proposed growth in Worksop will be been catered for in AWS's existing and planned resource, and hence available resources are adequate to meet the small increase in demand without affecting any HD or WFD standards in local water bodies. 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).

5.1.10 Adequate water supply mains pass through, or are located close to all proposed development sites in Retford. However, the developers would be responsible for funding local connections on a house by house basis.

Horizon	Volumetric Capacity	Network Capacity	Water Resources	Water Quality
0 – 375				
375 – 750				
750 – 1,125				
1,125 – 1,500				

6 Strategy for Harworth

Growth Summary

6.1.1 The Bassetlaw Core Strategy Issues and Options Consultation (May 2010) identified Worksop as having potential for economic growth, Workshop is targeted with providing 1,750 new homes and 28ha or employment land to 2026.

Wastewater Treatment and Transmission Infrastructure

6.1.2 Wastewater generated within Harworth is currently treated at Harworth WwTW.

6.1.3 A substantial growth of 1,750 dwellings coupled with a large allocation of employment land and uncertainties at present as to the location and level of development throughout the town means that further hydraulic capacity modelling will be required to confirm capacity in the existing sewerage network.

6.1.4 Development located to the east of the town is likely to require detailed hydraulic modelling to confirm hydraulic capacity and assessment regarding pumping requirements (potentially due to topography) and existing external flooding/capacity problems i.e. in the vicinity of Snipe Wood Park/Brookside Road. Additional storm flows are likely to require attenuation to avoid flooding to receiving watercourses.

6.1.5 Development to the west of the town (immediately upstream of Harworth WwTW) will be able to drain by gravity to the works but may require localised upsizing to accommodate the additional wastewater. There is a known highway flooding problem in Beech Road which (subject to detailed hydraulic modelling) may need localised upsizing if additional wastewater was to be drained through this part of the network. There are existing surface water sewers in the western area and whilst hydraulic modelling would be required to assess spare capacity it is unlikely that there is sufficient capacity to accept a development of this size without use of SUDS or other measures to reduce surface water run-off.

6.1.6 Any development in West Harworth which is likely to drain to Church Entrance swage pumping station/combined sewer overflow off Church Walk, would require hydraulic modelling/pumping capacity checks to ensure the additional developments do not have a detrimental impact on the pumping station or sewer overflow performance.

6.1.7 ST considers that the potential impact of development in the town on sewerage infrastructure to be medium (particularly where development is located to the east of the town).

Water Quality and Environment

6.1.8 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'. It is likely that some changes in consents may be necessary for BOD and Ammonia as growth progresses.

6.1.9 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.

6.1.10 The River Torne is designated a heavily modified waterbody under the WFD and has moderate ecological status. The River Torne currently has high levels of nitrates which need to be monitored.

Water Resources

6.1.11 ST's water resource planning for the next 25 years (the WRMP) shows that Harworth will have a slight surplus of water surplus by 2026 and therefore significant investment in new water resources is unlikely to be required. The demand generated by the proposed growth in Worksop will be been catered for in ST's existing and planned resource, and hence available resources are adequate to meet the small increase in demand without affecting any HD or WFD standards in local water bodies. It is likely that increased growth in demand will be met from groundwater sources to the north west of Retford, namely at Barnaby 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.

6.1.12 Adequate water supply mains pass through, or are located close to all proposed development sites in Harworth. However, the developers would be responsible for funding local connections on a house by house basis.

Horizon	Volumetric Capacity	Network Capacity	Water Resources	Water Quality
0 – 437.5				
437.5 – 875				
875 – 1,312.5				
1,312.5 – 1,750				

7 Strategy for Carlton-in-Lindrick

Growth Summary

7.1.1 The Bassetlaw Core Strategy Issues and Options Consultation (May 2010) identified Carlton-in Lindrick as having potential for economic growth, Carlton-in Lindrick is targeted with providing 300 new homes to 2026.

Wastewater Treatment and Transmission Infrastructure

7.1.2 Wastewater generated within Carlton-in-Lindrick drains 1.5 km northeast and is currently treated at Hodsock WwTW.

7.1.3 Development to the north of the village will be upstream of the main outfall sewer to Hodsock WwTW. There are no known sewer flooding problems downstream of this area.

7.1.4 Development to the south of the village will be located at the upstream end of the network draining to Hodsock WwTW. ST have reported that there are several known internal flooding problems on Doncaster Road where the main sewer runs through the centre of the town. This sewer would be affected by the development to the south (and potentially west) of the village. This could increase base flows which will exacerbate flooding along Doncaster Road and as such further hydraulic modelling will be required to assess the capacity issues and identify the scope of any improvements.

7.1.5 Development to the east of the village may also be impacted by/exacerbate the known internal flooding events in Doncaster Road and therefore hydraulic modelling would be required to assess the impact of any proposed development in this vicinity.

7.1.6 ST considers that the potential impact of development in the town on sewerage infrastructure to be medium (particularly where development is located to the west, south or east of the town).

Water Quality and Environment

7.1.7 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’.

7.1.8 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.

7.1.9 Water Quality in Hodsock Brook is has currently been assessed as poor under the WFD in terms of phosphorus content and has moderate ecological status.

Water Resources

7.1.10 ST’s water resource planning for the next 25 years (the WRMP) shows that Carlton-in Lindrick will have a slight surplus of water surplus by 2026 and therefore significant investment in new water resources is unlikely to be required. The demand generated by the proposed growth in Carlton-in Lindrick will be been catered for in ST’s existing and planned resource, and hence available resources are adequate to meet the small increase in demand without affecting any HD or WFD standards in local water bodies. It is likely that increased growth in demand will be met from groundwater sources near to Carlton-in Lindrick, either from Sunnyside (2 boreholes) or Manton (1 borehole).

7.1.11 Adequate water supply mains pass through, or are located close to all proposed development sites in Carlton-in Lindrick. However, the developers would be responsible for funding local connections on a house by house basis.

Horizon	Volumetric Capacity	Network Capacity	Water Resources	Water Quality
0 – 75				
75 – 150				
150 – 225				
225 – 300				

8 Strategy for Tuxford

Growth Summary

8.1.1 The Bassetlaw Core Strategy Issues and Options Consultation (May 2010) identified Tuxford as having potential for economic growth. Tuxford is targeted with providing 250 new homes to 2026.

Wastewater Treatment and Transmission Infrastructure

8.1.2 Wastewater generated within Tuxford is currently treated at East Markham WwTW.

8.1.3 The south of Tuxford is located in a sub-catchment which drains to a small sewage pumping station at Ashvale Road. There are no known sewer flooding problems in the catchment.

8.1.4 The west of Tuxford drains by gravity directly to East Markham STW (located to the east of the village). There are no known sewer flooding problems in this part of the network.

8.1.5 ST has confirmed that the potential impact on sewerage infrastructure from new development is low and subject to hydraulic modelling no capacity issues are envisaged provided surface water is managed sustainably and not connected to the foul/combined sewer.

Water Quality and Environment

8.1.6 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'.

8.1.7 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.

8.1.8 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. Tuxford Beck has been assessed under the WFD as having moderate ecological and biological status. This should not be allowed to deteriorate with additional growth.

Water Resources

8.1.9 AWS's water resource planning for the next 25 years (the WRMP) shows that Retford will have a slight surplus of water surplus by 2026 and therefore significant investment in new water resources is unlikely to be required. The demand generated by the proposed growth in Worksop will be been catered for in AWS's existing and planned resource, and hence available resources are adequate to meet the small increase in demand without affecting any HD or WFD standards in local water bodies. It is likely that increased growth in demand will be met from groundwater sources within Tuxford. It is likely that increased growth in demand will be met from groundwater sources near to Tuxford, from Elkesley (7 boreholes).

8.1.10 Adequate water supply mains pass through, or are located close to all proposed development sites in Tuxford. However, the developers would be responsible for funding local connections on a house by house basis.

Horizon	Volumetric Capacity	Network Capacity	Water Resources	Water Quality
0 – 62.5				
62.5 – 125				
125 – 187.5				
187.5 – 250				

9 Strategy for Misterton

Growth Summary

9.1.1 The Bassetlaw Core Strategy Issues and Options Consultation (May 2010) identified Misterton as having potential for economic growth, Misterton is targeted with providing 250 new homes to 2026.

Wastewater Treatment and Transmission Infrastructure

9.1.2 Wastewater from Misterton drains from the northwest to the southeast and is pumped from Marsh Lane pumping station to Walkeringham WwTW.

9.1.3 Development to the northwest of the village would drain to Cornley Road sewage pumping station and are then pumped to Station Street and then gravity drained to the terminal pumping station at Marsh Lane. There is a known highway flooding problem off March Lane so hydraulic modelling would be required to ensure this problem is not unduly exacerbated.

9.1.4 Development to the south of the village would drain to a sewer serving the south of the village which drain by gravity to the terminal pumping station at Marsh Lane which pumps all of Misterton to the sewage works at Walkeringham. There are no known sewer flooding problems on this 225mm sewer.

9.1.5 Due to the proposed number of dwellings being proposed in the village there it is envisaged that some capacity improvements may be required at the sewage pumping stations depending on the location of the development sites. However provided surface water is managed sustainably and is not connected to the foul/combined sewers then this impact will be reduced.

9.1.6 ST has confirmed that the overall potential impact of development on sewerage infrastructure is medium.

Water Quality and Environment

9.1.7 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'.

9.1.8 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.

9.1.9 Water from Walkeringham WwTW drains to the River Trent between Carlton-on-Trent and Laughton Lane. It has been assessed under the WFD and has poor ecological status and poor biological status and has a high concentration of phosphates.

Water Resources

9.1.10 AWS's water resource planning for the next 25 years (the WRMP) shows that Retford will have a slight surplus of water surplus by 2026 and therefore significant investment in new water resources is unlikely to be required. The demand generated by the proposed growth in Worksop will be been catered for in AWS's existing and planned resource, and hence available resources are adequate to meet the small increase in demand without affecting any HD or WFD standards in local water bodies. It is likely that increased growth in demand will be met from groundwater sources within Misterton. It is likely that increased growth in demand will be met from groundwater sources near to Misterton, from Everton (6 boreholes).

9.1.11 Adequate water supply mains pass through, or are located close to all proposed development sites in Misterton. However, the developers would be responsible for funding local connections on a house by house basis.

Horizon	Volumetric Capacity	Network Capacity	Water Resources	Water Quality
0 – 62.5				
62.5 – 125				
125 – 187.5				
187.5 – 250				

10 Water Efficiency Guidance

10.1.1 Given the scarcity of available raw resources in the region, it is key that the Water Cycle Strategy process considers options for how demand from new development can be managed via effective policy to ensure that future demand for new water supply is minimised; and a high level of water efficiency for new homes as part of the solution.

Water Efficiency in New Homes – Developer Guidance

10.1.2 New homes can be fitted with a range of fixtures and fittings to reduce demand, in addition, new developments can have community wide measures to reduce the demand in water, this can range from rainwater harvesting to grey water recycling2.

10.1.3 The Code for Sustainable Homes (CSH) sets out the maximum water demand required to meet the different levels of the code and gives examples how this level of efficiency can be reached. This provides a flexible outline for improving the overall sustainability of a house. **Table 10-1** outlines the water demand that needs to be achieved to reach each of the sustainability levels.

Table 10-1 Code for Sustainable Homes – Water consumption targets for the different code levels and examples of how these targets can be attained in new build

Code for sustainable homes levels.	Amount of Water (litres per person per day)	Examples of how to achieve water efficiency level.
1	120	Install efficient equipment within the home – 18l max volume dishwasher and 60l max volume washing machine. Install 4/6l dual flush toilets. Install 6-9l/min showers. Educate users about how to be efficient water users. Installation of water meters.
2	120	
3	105	As above. In addition, install water butts and equipment to use rainwater in the garden. Install aerating fixtures into bathrooms and kitchens. Include surface water management in the surrounding development.
4	105	
5	80	As above, in addition: Grey water recycling, reduction of surface water from the development. Provide water audits for people to show them where they can reduce water usage.
6	80	

10.1.4 The examples of water efficiency are an outline of the possible ways to improve water efficiency. There are many more possibilities that are site specific. Many of these are shown in the Ofwat water efficiency initiatives[3] for water and sewerage companies. Other steps which should be considered in new builds include: rainwater harvesting from roofs and paved areas (through the use of permeable surfaces); grey water recycling (with some mains support) which can provide enough water to run all toilets, a washing machine and outside taps.

[2] the use of wash water from showers and sinks in toilets after on site treatment
[3] OFWAT, 2006, Water Efficiency Initiatives – Good Practice Register Water Sewerage Companies (England and Wales) – 2006,http://www.ofwat.gov.uk/aptrix/ofwat/publish.nsf/AttachmentsByTitle/goodpracticeregister_2007.pdf/$FILE/goodpracticeregister_2007.pdf Accessed 28-03-08.

11 Infrastructure funding

11.1 Infrastructure responsibility

11.1.1 Both water supply (and treatment) and wastewater treatment are the responsibility of AWS and ST within the study area. At present, the Water Industry Act 1991, and agreements between the industries regulator (Ofwat) and water companies prevent developers contributing towards the provision of water resource schemes (which are also to be used to serve other and existing development), water treatment and upgrades to *existing* wastewater treatment facilities.

11.1.2 It is possible that new wastewater treatment facilities which are proposed solely for a development area can be funded by developers and in some cases, later adopted by the a water company. Developers can also consider funding the development of a new water resource (and water treatment facility) proposed to serve a new development specifically, which again, could be later adopted by the incumbent water company.

11.1.3 In addition, flood risk infrastructure required to service a development can be entirely funded from developer contributions. Delivery of SuDS will be the responsibility of the developer; however the 'approving body' under the Flood and Water Management Act 2010 must approve the SuDS prior to construction. In most cases, ongoing maintenance of SuDS will also be the responsibility of the approving body under the Flood and Water Management Act as part of wider surface water management responsibilities.

11.1.4 Delivering water efficiency in new homes will be the responsibility of the developer and the cost (of construction and maintenance) will be borne solely by the developer.

11.1.5 In summary, developer contributions can be sought for wastewater and water supply mains, and flood risk infrastructure, *and (*in rarer cases) where new wastewater treatment facilities and water resource schemes are required solely for new development.

11.1.6 The full Technical Report for the outline study provides further detail of who is responsible for funding, delivering and maintaining each element of infrastructure proposed in the Water Cycle Strategy.

12 Policy and Recommendations

12.1 Developer Checklist

12.1.1 A developer checklist has been provided and is reported in the full Technical Report for the Outline WCS. The checklist includes for all the necessary steps that a developer would need to take to meet with the key water based legislative and policy requirements.

12.1.2 The overall intention is that all developers would be asked to use the water cycle developer checklist as part of the planning application process and to submit a completed version with their planning applications. The EA is a statutory consultee with regards to flood risk and the water environment and as such, will need to sign up to the checklist as will the partner authorities, Natural England and the water and wastewater undertaker.

12.2 Further Work Suggestions

12.2.1 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, once residential and employment growth figures have been finalised following the full public consultation on the Issues and Options for Bassetlaw.

12.2.2 Water Resources

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

12.2.3 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).

12.2.4 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.

12.2.5 Water Quality

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

12.2.6 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.