Greater Nottingham New Growth Point Partnership

Greater Nottingham
Scoping Water Cycle Study

April 2009




Prepared for:

Ashfield
Broxtowe Borough Council
Erewash Borough Council
Gedling Borough Council
Nottingham City Council
Rushcliffe Borough Council
Nottinghamshire County Council

Revision Schedule

Greater Nottingham - Scoping Water Cycle Study
April 2009

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01	April 2009	Draft	**Gemma Costin** Assistant Flood Risk Specialist	**Andrew Woodliffe** Senior Flood Risk Specialist	**Jon Robinson** Associate Director
02	April 2009	Final	**Gemma Costin** Assistant Flood Risk Specialist	**Andrew Woodliffe** Senior Flood Risk Specialist	**Jon Robinson** Associate Director

Scott Wilson
Mansfield i-Centre
Oakham Business Park
Hamilton Way
Mansfield
NG18 5BR

Tel: 01623 600 660
Fax: 01623 600 661

www.scottwilson.com

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Acronyms

Abbreviation	Description
AAP	Area Action Plan
AA	Appropriate Assessment
ADC	Ashfield District Council
AMP	Asset Management Plan
BAP	Biodiversity Action Plan
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BBC	Broxtowe Borough Council
BOD	Biochemical Oxygen Demand
BW	British Waterways
CAMS	Catchment Abstraction Management Strategy
CFMP	Catchment Flood Management Plan
CSH	Code for Sustainable Homes
CSO	Combined Sewer Overflow
CLG	Communities and Local Government
DCC	Derbyshire County Council
DEFRA	Department for Environment, Food and Rural Affairs
DO	Dissolved Oxygen/Deployable Output
DPD	Development Plan Document
DWF	Dry Weather Flow
DWI	Drinking Water Inspectorate
EA	Environment Agency
EBC	Erewash Borough Council
EMRA	East Midland Regional Assembly
EU	European Union
FAS	Flood Alleviation Scheme

Abbreviation	Description
FtFT	Flow to Full Treatment
GBC	Gedling Borough Council
GI	Green Infrastructure
GNNGPP	Greater Nottingham New Growth Point Programme
GQA	General Quality Assessment
GWV	Groundwater Vulnerability
HA	Highways Agency
HMA	Housing Market Area
HRA	Habitats Regulation Assessment
IDB	Internal Drainage Board
JPAB	Joint Planning Advisory Board
l/c.d	Litres per capita per day (water consumption measurement)
LDF	Local Development Framework
LDS	Local Development Scheme
LiDAR	Light Detection and Ranging
LNR	Local Nature Reserve
LPA	Local Planning Authority
MBR	Membrane Bioreactor
N	Nitrogen
NC_IC	Nottingham City Council
NC_OC	Nottingham County Council
NE	Natural England
NGP	New Growth Point
NE	Natural England
NVZ	Nitrate Vulnerable Zone
OFWAT	The Office of Water Services
P	Phosphorous
PE	Population Equivalent
POM	Programme of Measure

Abbreviation	Description
PPS	Planning Policy Statement
PR	Price Review
PUA	Principal Urban Area
RBC	Rushcliffe Borough Council
RBMP	River Basin Management Plan
RBD	River Basin District
RPB	Regional Planning Body
RSS	Regional Spatial Strategy
RQO	River Quality Objectives
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
SPD	Supplementary Planning Documents
SPZ	Source Protection Zone
SRP	Soluble Reactive Phosphorus
SSSI	Site of Special Scientific Interest
ST	Severn Trent Water
SW	Scott Wilson
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 Study
WFD	Water Framework Directive

Abbreviation	Description
WRMP	Water Resources Management Plan
WRPZ	Water Resources Planning Zone
WRZ	Water Resources Zone
WTW	Water Treatment Works
WSI	Water Services Infrastructure
WwTW	Waste Water Treatment Works

1 Executive Summary

The draft East Midland Regional Plan (RSS8) identifies Greater Nottingham as a sub-region, having the potential to accommodate sustainable growth and set targets to guide the scale and location of growth in Greater Nottingham up to 2021. Greater Nottingham and Ashfield are to provide 58,600 new homes within this time period.

In addition to RSS8, the Greater Nottingham Authorities, together with the Hucknall wards of Ashfield have being awarded Growth Point Status. In conjunction with the Growth Point Status, the Greater Nottingham Authorities (including Ashfield) have commissioned a Scoping Water Cycle Study (WCS). The WCS forms part of a number of strategic studies and plans which will form part of the evidence base supporting the production of the LPAs respective Local Development Frameworks (LDFs). Specifically, the WCS will form an important basis of the 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. It is important to note that this document makes no decisions on the location of growth.

The Scoping WCS has been undertaken to inform and facilitate the undertaking of an Outline WCS and a Detailed WCS (where required), building upon previous and on-going work undertaken in the area, providing a holistic and wider evidence-based approach to feed into the LDF.

The Scoping WCS has undertaken an initial review of available data and provided an overview of issues relating to clean water and wastewater infrastructure capacity, water resource availability, water quality, flood risk (and drainage) and potential ecological impacts of development.

Discussions with the respective LPAs, the Environment Agency (EA), Severn Trent Water (ST) and Natural England (NE) were also undertaken to identify key issues and constraints in relation to the proposed development within Greater Nottingham and Ashfield.

The key findings from the Scoping WCS are listed below:

- The EAs view is that the study area lies within an area of 'moderate water stress'[1],
- An initial statement from ST states there are no expected treatment capacity issues in terms of treating wastewater generated from the proposed development within Greater Nottingham, however this position should be reviewed as part of the Outline WCS. Early engagement with ST as part of the Outline WCS should ensure that critical data relating to the wastewater network is obtained,
- The management of surface water has the potential to act as a constraint to development within Greater Nottingham and Ashfield due to space requirements and the need to reduce runoff rates and volumes to limit discharges,
- Water quality impacts in main rivers and small watercourses, drains and ditches in the study area should also be managed,

[1] Environment Agency; 2007; Areas of Water Stress, Final Classification; Environment Agency

- Reduced water quality, due to increased volumes of treated sewage effluent being discharged into the watercourses and poorly managed urban runoff from new development areas, could impact upon European, National and Locally important ecological sites, particularly those downstream of development sites.

As initially set out in the Scoping Study Brief, the Stage 2 – Outline Study should:

- Identify environmental risks,
- Identify if environmental resources can cope with further development,
- Demonstrate that in principle there is sufficient forecast environmental capacity,
- Demonstrate that in principle infrastructure requirements are feasible (technically, financially and legally) for the timescale of planned development,
- Provide evidence on thresholds for certain infrastructure provision.

The key recommendations of this Scoping WCS, with regards to the requirement for the Outline WCS are listed below:

- For completeness, the study area should cover the whole of the Greater Nottingham area, including the whole of Ashfield,
- The following should be included in the scope for the Outline Study (in addition to those listed above):
    - A detailed assessment of the water resource availability and demand up to 2026,
    - An assessment of the capacity of the wastewater and clean water networks, both currently and factoring in the proposed development - to identify the key constraints and required phasing of development to ensure that development does not outstrip capacity,
    - An assessment of the flood risk posed to and by proposed development and suitable mitigation options, with particular regards to surface water and sewer flooding. An assessment regarding the potential need for a Surface Water Management Plan (SWMP) should also be made,
    - An assessment of the likely surface water storage and potential SuDS requirements for proposed development,
    - An environmental assessment of the impact of proposed development upon watercourses and ecologically important sites. This includes the impacts on and requirements for increased discharges at WwTWs,
    - An assessment of the phasing of proposed development sites and key constraints, with reference to the above factors.

2 Introduction

2.1 Terms of Reference

Scott Wilson Ltd (SW) were commissioned by Greater Nottingham New Growth Points Programme (GNNGPP) to undertake a Scoping Water Cycle Study (WCS) for the combined administrative areas of the Local Planning Authorities (LPAs) that make up the GNNGPP, these being:

- The Hucknall wards of Ashfield District Council (ADC),
- Broxtowe Borough Council (BBC),
- Erewash Borough Council (EBC),
- Gedling Borough Council (GBC),
- Nottingham City Council (NCCi),
- Rushcliffe Borough Council (RBC),
- Nottinghamshire County Council (NCCo).

Only Hucknall within the District of Ashfield is contained within the GNNGPP. However the study area has been extended to include the whole of Ashfield. Consequently, the reference to the GNNGPP in this study will also relate to the whole of Ashfield.

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.

The six LPAs included in the GNNGPP require a WCS to support the 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) to allow for any additional water cycle infrastructure to be included in their draft Business Plan as part of the 2009 Price Review Process (PR09).

2.2 Project Steering Group Stakeholders

The WCS Steering Group established during the Scoping phase of the WCS should be continued and widened as part of the outline phase. The Steering Group will oversee the management and direction of the project. In addition to the GNNGPP Authorities, the Steering Group will also comprise some, or all of the following organisations:

- The Environment Agency – as the statutory planning and flood risk consultee as well as regulator for water quality,
- Severn Trent Water – as provider of wastewater infrastructure and water supply infrastructure to study area,
- Internal Drainage Boards – Newark IDB, Fairham Brook and Kingston Brook IDB,
- Natural England – as a statutory environmental consultee,
- Derbyshire County Council (in relation to the Derby Housing Market Renewal Area).

As well as close liaison with the Steering Group members, consultation will be required with the following organisations:

- Highways Agency (HA),
- Key Landowners,
- Authors of various FRAs and SFRAs.

2.3 Background Overview

The Growth Points initiative was announced in 2005 and was designed to provide support to local communities who wish to pursue large scale and sustainable growth, including new housing, through a partnership with the Government. The Government invited LPAs to submit strategic growth proposals which were sustainable, acceptable environmentally and realistic in terms of infrastructure to be assessed by Government and its agencies.

Whilst not being a statutory designation the growth point status is based upon partnership working that incorporates four key principles:

- Early delivery of housing as part of the growth plans,
- Supporting local partners to achieve sustainable growth,
- Working with local partners to ensure that infrastructure and service provision keep pace with growth,
- Ensuring effective delivery.

The Nottingham part of the growth point programme is made up of the Greater Nottingham Authorities of ADC, BBC, EBC, GBC, NCC_I, NCC_O and RBC and which is also the Nottingham Core Housing Market Area (HMA), together with the four Hucknall Wards, which lie within the travel to work area for Nottingham. However, for simplicity the entire ADC administrative area is included within the WCS study area.

Following its establishment the Greater Nottingham Joint Planning Advisory Board (JPAB) steers members of the group towards a co-ordinated approach in plan making and advancing the programme for growth. As part of this unified approach, the Nottingham Core HMA LPAs and Ashfield have established a commitment to working in partnership in producing their LDFs and in particular have aligned the timetable in the respective production of their core strategies. As part of this process, the authorities are currently revising their respective Local Development Schemes (LDS), while co-ordinated Core Strategy Issues and Options consultations are anticipated in June 2009.

2.4 Aims and Objectives

The key objectives of this first stage of the Greater Nottingham WCS, the Scoping Report, have been identified as follows:

- Identify and define the optimum study area of the WCS through consultation with infrastructure providers, taking into account likely locations for new developments and relevant water catchments. Consideration will be given to the neighbouring Derby Housing Market WCS to address any overlap between the areas,

- Identify the aims and objectives of the Phase 2 (Outline) WCS and which plans and strategies should be used to inform it, should the Scoping WCS recommend further stages of the WCS process,
- Confirm and bring together the relevant stakeholders and their responsibilities for the various elements of the water cycle,
- Identify what studies have already been undertaken, the current data availability and necessary requirements,
- Discuss the likely development scenarios and availability of planning data with relevant key stakeholders,
- Identify the availability of higher level analyses already undertaken by the Environment Agency (EA) and ST on the capacity of the environment and major infrastructure to define the key issues to be addressed,
- Identify the natural and artificial water infrastructure constraints on the scale of proposed development, and the critical issues to be addressed,
- Assess the flexibility of location within development plans,
- Confirm whether a full WCS is required/considered necessary to inform strategic planning decisions,
- Confirm whether there are any additional requirements for the Outline WCS and potentially the Detailed WCS,
- Agree the project scope and project plan for any further work determined to be required,
- Identify any likely additional disbursement costs,
- Identify any potential sources of funding for future work.

The impacts of flood risk within the study area have been assessed in the Greater Nottingham Level 2 Strategic Flood Risk Assessment (SFRA) (Black & Veatch, June 2008) and the River Leen and Day Brook Level 2 SFRA (Black & Veatch, September 2008); and Ashfield Level 1 SFRA (February 2009). Detailed findings of these studies should be reviewed during the next stage of the WCS.

3 Greater Nottingham Water Cycle Study

3.1 The Water Cycle

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'. 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.

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 (Figure 3-1). 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. '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 (WTWs), supply pipelines and pumping stations) which are used by human activity to manipulate the cycle.

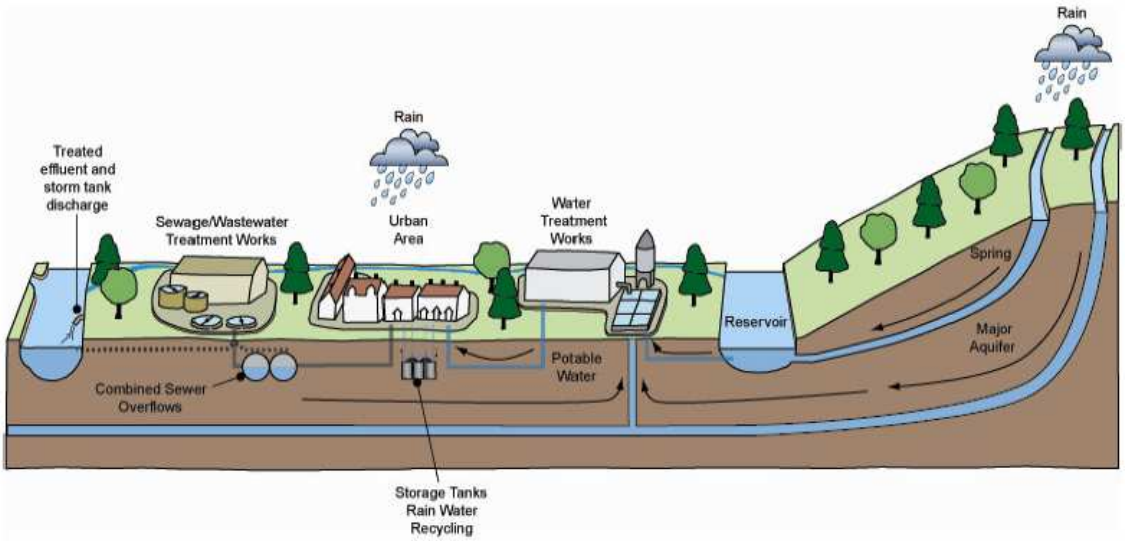

Figure 3-1: The Water Cycle
(Source: Environment Agency[2])

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

3.2 Implications for Development

In directly manipulating elements of the water cycle, humankind 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 waste water 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 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. Further development will lead to an increase in demand for water supply and a commensurate increase in the requirement for waste water 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.

A WCS is an ideal solution to addressing 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.

3.3 Stages of a Water Cycle Study

Current EA guidance on WCS's[2] suggests that they should generally be undertaken in three stages, dependent on the status of the various LDDs, as part of the wider LDF, being prepared by LPAs for submission. To coincide with the individual LPAs' timescales for responses and submissions the WCS is being undertaken in three distinct stages: scoping, outline and detail (if required).

Figure 3-2 illustrates the three stages of the WCS and how they inform planning decisions and documents. This study undertakes the first initial scoping stage.

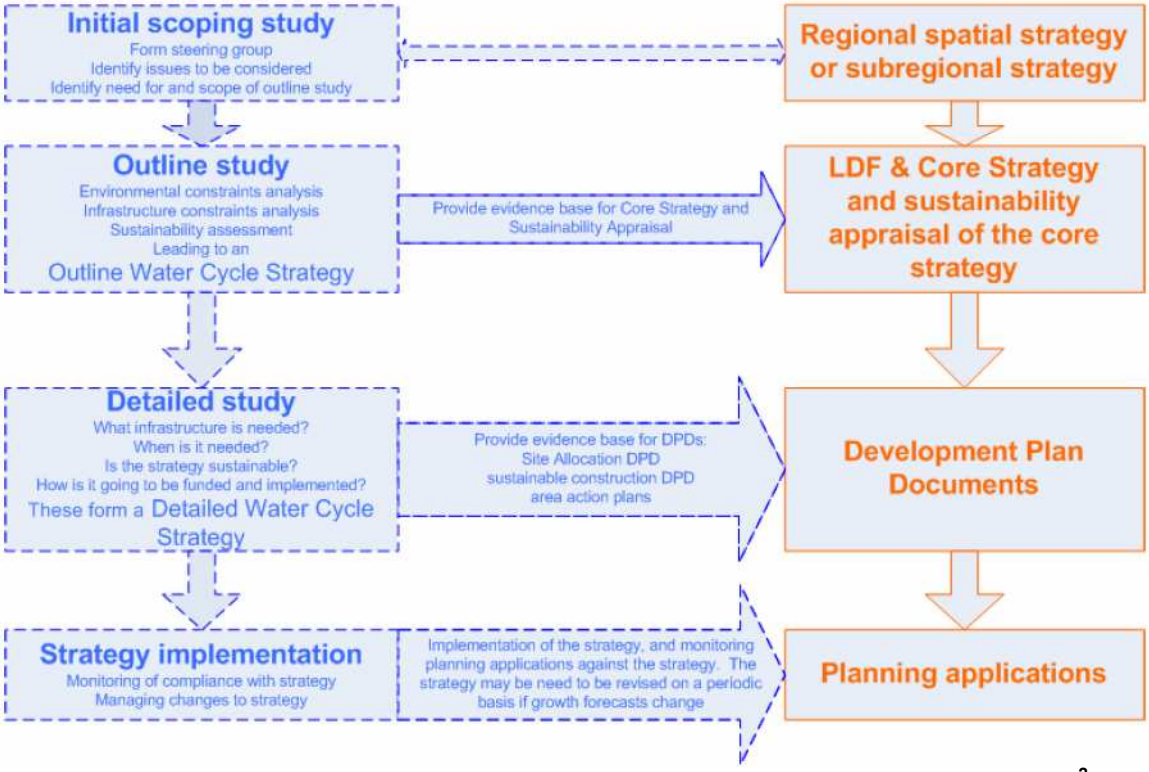

Figure 3-2 Stages of the Water Cycle Study Process (Source: Environment Agency[2])

3.3.1 Scoping Water Cycle Study

The 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.

The Scoping WCS 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 (drinkable) 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. a Special Area of Conservation (SAC) wetland site located on a river downstream of discharges from a wastewater treatment works (WwTWs),
- A town (or area) has a history of sewer flooding and hence potential restrictions on new connections from development,
- 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 to the study and concludes what issues require further investigation and therefore, what the scope of the Outline WCS should be. A Scoping WCS includes preliminary data identification, collection (where appropriate) and strategy inception.

3.3.2 Outline and Detailed Water Cycle Studies

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 allocating 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 an Outline WCS is to provide LPAs with the evidence base which ensures that water issues have been taken into account when deciding the location and intensity of development within an authority's 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).

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

The individual LPAs are at an early stage with the production of their Core Strategies with Issues and Options consultation planned for June 2009. If required, the Outline WCS will follow immediately upon completion of this Scoping WCS to ensure that water cycle issues are adequately addressed for the favoured development options.

It could be that the Outline WCS identifies that water cycle issues are not significant, and that new development can be implemented without significant new investment. If this is the case, a Detailed WCS may not be required. However, if new infrastructure is required, or an impact on the water environment cannot be ruled out as significant, a Detailed WCS will need to be undertaken for site-specific allocations, for individual authorities or for the study area as a whole.

Detailed Water Cycle Study

Once the principles outlined in Outline WCS have been agreed by the stakeholders and identified as potential options, the Detailed WCS would then build upon this. Detailed WCSs can vary significantly in scope and remit. However, it is the key purpose of a Detailed WCS 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 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.

3.4 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 GNNGPPs overall strategy to meet future growth targets set out in the RSS in a sustainable way, the WCS is one of a number of strategic studies and plans which will form part of the evidence base supporting the production of the individual LPA LDFs. Specifically, the WCS will form an important basis of each of the individual LPA Core Strategy making up part of their 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.

It is important that the findings of the WCS inform and vice versa the findings of other studies that the individual LPAs and other stakeholders are undertaking. The studies that are particularly relevant include the following:

- Draft Water Resource Management Plan (WRMP) (Severn Trent Water),
- Lower Trent and Erewash Catchment Abstraction Management Strategy (CAMS) (Environment Agency),
- Idle and Torne Catchment Abstraction Management Strategy (CAMS) (Environment Agency)
- Greater Nottingham Strategic Flood Risk Assessment (GNNGPP Authorities),
- River Leen and Day Brook Strategic Flood Risk Assessment (GNNGPP Authorities),
- Ashfield Strategic Flood Risk Assessment (Ashfield District Council),
- River Trent Catchment Flood Management Plan (CFMP) (Environment Agency),

Additionally, the findings of the WCS can be used by the individual LPAs in the preparation and revision to their Spatial Plans, Masterplans and design briefs for their administrative areas.

3.5 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 Scoping WCS has identified available information and recorded this in a catalogue. Where necessary, data has been

obtained and collated. Data requirements for the Outline WCS have been identified based on the known availability of data.

A full list of the data requested and that which was made available to the study is included in the data catalogue in Appendix A – Data Catalogue. This also includes the list of data required for the Outline WCS.

4 Development in Greater Nottingham

4.1 Greater Nottingham

The Greater Nottingham WCS study area comprises the administrative areas ADC, BBC, EBC, GBC, NCC_I and RBC as illustrated in Figure B-1 (Appendix B). It is important to note that only the four Hucknall Wards of ADC are included in the GNNGPP, but the entire administrative area has been included in the WCS study area for simplicity.

The East Midlands Regional Plan (March 2009) places Greater Nottingham within the 'Three Cities Sub-Area'. The Three Cities Sub-Area, comprising Nottingham, Derby and Leicester, contains almost half of the regions population and the three cities act as major administrative, economic and cultural centres.

The East Midlands Regional Plan (March 2009) promotes the concentration of development within and adjoining the region's five Principal Urban Areas (PUAs), one of which is Nottingham. In addition, appropriate development of a lesser scale should be located within the Sub-Regional centres, which include Ilkeston and Hucknall.

The WCS will examine of the impacts of development for the whole of Greater Nottingham covering a total study area of approximately 800 km^2. The study area has a population of approximately 637,000 and includes the Principal Urban Area (PUA) of Nottingham, which includes:

- City of Nottingham,
- Arnold,
- Beeston,
- Carlton,
- Long Eaton,
- Sandiacre,
- Stapleford,
- West Bridgford.

The study area also includes smaller towns such as Sutton-in-Ashfield, Ilkeston, Long Eaton, Stapleford, Eastwood, Hucknall, Kirkby-in-Ashfield, Arnold, Carlton and Radcliffe on Trent.

4.2 Proposals

A key target of the planned growth within Greater Nottingham is the delivery of housing. The East Midlands Regional Plan (March 2009) sets a target for the provision of 57,000 homes between 2006 and 2026 within the Nottingham Core HMA (3,600 in Hucknall and 7,600 the rest of Ashfield.. The split of housing provision between each Local Authority is presented in Table 4-1.

The East Midlands Regional Plan (March 2009) sets a target for the provision of 57,000 homes between 2006 and 2026 within the Nottingham Core HMA 3,600 in Hucknall and 7,600 the rest of Ashfield. However, the housing targets for the Nottingham Core HMA exclude those set for Ashfield, as Ashfield is covered within the 'Nottingham Outer HMA'. The Regional Plan's housing target set for Ashfield is 11,200. This constitutes a total of 68,200 homes between 2006 and 2026 for the WCS study area.

The East Midlands Regional Plan (RSS8) suggests that with regards to employment-based development, office supply is constrained in Nottingham partly due to pressure on land due to housing requirements. The availability of good quality industrial land is also constrained, particularly within the City boundaries.

It is suggested that WCSs be undertaken in partnership with LPAs, local delivery vehicles (if applicable), the Environment Agency (EA) and local water companies to ensure a sustainable and holistic approach is taken to development design. Future stages of the WCS should inform LPAs options for the location of future development. The timing of such studies should have regard to critical stages within the LDF process and the forward planning and investment decisions of major water and wastewater infrastructure providers.

Table 4-1: Total Housing Provision

Area	Total Housing Provision 2006 - 2026
Broxtowe	6,800
Erewash	7,200
Gedling	8,000
Nottingham	20,000
Rushcliffe	15,000
Ashfield	*11,200 (3,600 in Hucknall)**
Nottingham Core HMA and Hucknall	**58,600**

**Housing figures for the rest of Ashfield are not included in the total housing figures for the Nottingham Core HMA.*

4.3 National, Regional and Local Drivers & Policies

4.3.1 National Drivers and Policies

The growth within GNNGPP is driven by regional planning policy, but any growth and changes to the environment will need to comply with the main EU Directives and UK legislation and guidance on water as provided in Table 4-2.

Table 4-2 EU Directives and UK Legislation and Guidance on Water

Directive/Legislation/ Guidance	Description
Bathing Waters Directive 76/160/EEC	To protect the health of bathers, and maintain the aesthetic quality of inland and coastal bathing waters. Sets standards for variables, and includes requirements for monitoring and control measures to comply with standards.
Code for Sustainable Homes	The Code for Sustainable Homes has been introduced to drive a step-change in sustainable home building practice, providing a standard for key elements of design and construction which affect the sustainability of a new home. It will become the single national standard for sustainable homes, used by home designers and builders as a guide to development, and by home-buyers to assist in their choice of home. It will form the basis for future developments of the Building Regulations in relation to carbon emissions from, and energy use in homes, therefore offering greater regulatory certainty to developers.
Environment Act 1995	Sets out the role and responsibility of the Environment Agency.
Environmental Protection Act, 1990	Integrated Pollution Control (IPC) system for emissions to air, land and water.
Future Water, February 2008	Sets out the Government's vision for water in England in 2030. The strategy sets out an integrated approach to the sustainable management of all aspects of the water cycle, from rainfall and drainage, through to treatment and discharge, focusing on practical ways to achieve the vision to ensure sustainable use of water. The aim is to ensure sustainable delivery of water supplies, and help improve the water environment for future generations.
Groundwater Directive 80/68/EEC	To protect groundwater against pollution by 'List 1 and 2' Dangerous Substances.
Making Space for Water, 2004	Outlines the Government strategy for the next 20 years to implement a more holistic approach to managing flood and coastal erosion risks in England. The policy aims to reduce the threat of flooding to people and property, and to deliver the greatest environmental, social and economic benefit.
Planning Policy Statements and Planning Policy Guidance	Planning policy in the UK is set by Planning Policy Statements (PPSs) They explain statutory guidelines and advise local authorities and others on planning policy and operation of the planning system. PPSs also explain the relationship between planning policies and other policies which have an important bearing on issues of development and land use. These must be taken into account in preparing development plans. A water cycle study helps to balance the requirements of the various planning policy documents, and ensure that land-use planning and water cycle infrastructure provision is sustainable. The most relevant PPSs to WCS are: PPS1 – Delivering Sustainable Development; PPS3 – Housing;

Directive/Legislation/ Guidance	Description
	PPS12 – Local Development Frameworks; PPS23 – Planning and Pollution Control; and PPS25 – Development and Flood Risk.
The Pollution Prevention and Control Act (PPCA), 1999	Implements the IPPC Directive. Replaces IPC with a Pollution Prevention and Control (PPC) system, which is similar but applies to a wider range of installations.
Water Act 2003	Implements changes to the water abstraction management system and to regulatory arrangements to make water use more sustainable.
Water Framework Directive (WFD) 2000/60/EC	The WFD was passed into UK law in 2003. The overall requirement of the directive is that all river basins must achieve "good ecological status" by 2015 unless there are grounds for derogation, where this is not possible, good status should be achieved by 2021 or 2027. The WFD will, for the first time, combine water quantity and water quality issues together. An integrated approach to the management of all freshwater bodies, groundwaters, estuaries and coastal waters at the river basin level will be adopted. It will effectively supersede all water related legislation which drives the existing licensing and consenting framework in the UK. UKTAG[3], the advisory body responsible for the implementation of the WFD in the UK, has proposed water quality, ecology, water abstraction and river flow standards to be adopted in order to ensure that water bodies in the UK (including groundwater) meet the required status[4]. These are currently in draft form and will not be formalised until the final River Basin Management Plans are finalised in December 2009 (prior to EC sign off. The WCS is required to consider the longer term issues with respect to the water cycle and water environment and as such, an assessment of the impact of the interim WFD standards has been considered.
Water Resources Act, 1991	Protection of the quantity and quality of water resources and aquatic habitats.
Draft Floods and Water Bill, 2009	The draft bill will create a simpler and effective means of managing the risk of flood and coastal erosion. It will also help improve the sustainability of our water resources and protect against potential droughts.

4.3.2 Regional Drivers and Policies

The East Midlands Regional Plan

The East Midlands Regional Plan (March 2009) identifies Greater Nottingham as part of the Three Cities sub-area, having potential to accommodate substantial growth. The Regional Plan includes spatial policies relating to water and flooding which form part of the driver for the WCS. Those of particular mention are included in Table 4-3.

[3] The UKTAG (UK Technical Advisory Group) is a working group of experts drawn from environment and conservation agencies. It was formed to provide technical advice to the UK's government administrations and its own member agencies. The UKTAG also includes representatives from the Republic of Ireland.
[4] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008. UK Technical Advisory Group on the Water Framework Directive.

Table 4-3 Water Related Policies in East Midlands Regional Plan (March 2009)

Policy	Description
Policy 32: A Regional Approach to Water Resource and Water Quality	*"Local Authorities, developers, water companies, the Environment Agency and other relevant public bodies should work together to:* • *take water related issues into account at an early stage in the process of identifying land for development and in the phasing and implementation of development, e.g., by undertaking water-cycle studies,* • *ensure timely provision of appropriate additional infrastructure for water supply and wastewater treatment to cater for the levels of development provided for in this plan, whilst meeting surface and groundwater quality standards and avoiding adverse impacts on designated sites of nature conservation of international importance,* • *asses the scope for reducing leakage of public water supply from current levels,* • *promote improvements in water efficiency in new development and in regeneration to achieve a regional target of 25% (equivalent to an average saving of about 35 litres per person per day),* • *reduce unsustainable abstraction from watercourses and aquifers to sustainable levels,* • *protect and improve water quality and reduce the risk of pollution especially to vulnerable groundwater,* • *make provision for the development of new water resources where this represents the most sustainable solution to meeting identified water resource requirements, taking account of predictions of future climate change,* • *use sustainable drainage techniques wherever practical to help mitigate diffuse pollution and support groundwater recharge. These will be required where development is upstream of a designated nature conservation site of international importance or to improve water quality, where the need is demonstrated through water cycle studies,* • *support ware conservation measures such as winder storage reservoirs on agricultural land,* • *ensure that sewage treatment capacity is sufficient to meet the needs of development and that, where necessary improvements are in place so that development does no compromise the quality of discharged effluent".*
Policy 33: Regional Priorities for Strategic River Corridors	*"The natural and cultural environment of the Strategic River Corridors of the Nene, Trent, Soar, Welland, Witham and Derwent, along with their tributaries, and rivers which contribute to river corridors of a strategic nature in adjoining Regions, should be protected and enhanced.* *Local Authorities and other relevant public bodies should work together across regional boundaries to protect and enhance the multi-functional importance of strategic river corridors as part of the Region's Green Infrastructure, including for wildlife, landscape and townscape, regeneration and economic diversification, education, recreation, the historic environment including archaeology, and managing flood risk".*
Policy 35: A Regional Approach to Managing Flood Risk	*"Local Development Frameworks and the strategies of relevant public bodies should take account of the potential impact of climate change on flooding and land drainage. In particular, they should:* • *be informed by Strategic Flood Risk Assessments in order to evaluate actual flood risk. Priority areas for assessment include the built up areas of Derby, Nottingham and Newark,* • *include policies which prevent inappropriate development either in, or where there would be an adverse impact on, the coastal and fluvial floodplain*

Policy	Description
	areas, • *deliver a programme of flood management schemes that also maximise biodiversity, provide townscape enhancement and other public benefits; and* • *require sustainable drainage in all new developments where practicable.* *Development should not be permitted if, alone or in conjunction with other new development, it would:* • *be at unacceptable risk from flooding or create such an unacceptable risk elsewhere,* • *inhibit the capacity of the floodplain to store water,* • *impede the flow of floodwater in a way which would create an unacceptable risk elsewhere,* • *have a detrimental impact upon infiltration of rainfall to ground water storage,* • *otherwise unacceptably increase flood risk,* • *interfere with coastal processes.* *However, such development may be acceptable on the basis of conditions or agreements for adequate measures to mitigate the effects on the overall flooding regime, including provision for the maintenance and enhancement of biodiversity. Any such measures must accord with the flood management regime for that location".*

4.3.3 Local Drivers and Policies

Local Development Framework

The LDFs for the GNNGPP authorities are statutory spatial development plans that comprise a portfolio of documents including the Core Strategy and the supporting Site Allocation DPDs. The LDFs will set out the spatial strategies, policies and proposals to guide the future development and use of land in Greater Nottingham up to 2026. The GNNGPP authorities must ensure they coordinate and prepare LDF documents and policies. These include preferred development locations, infrastructure and delivery plans that have had regard to the intent and steer from national policies, the East Midlands Regional Plan, as well as local aspirations, needs and demands. The LDFs of the individual authorities should be developed in close liaison with each other. The establishment of the Joint Planning Advisory Board will ensure a joined up approach to spatial planning is adopted throughout the study area. Figure 4-1 illustrates the key documents that feed into the LDF.

Core Strategies are the overarching DPDs that provide the strategic framework for the other DPDs and SPDs. In particular, the Site-Specific Allocations and Policies DPD will set out the sites that will deliver the Core Strategies Spatial Strategy, policies and targets. All these plans must conform to the Core Strategy and help to deliver its strategic objectives and policies. The LPAs will also produce SPDs that provide further guidance to support policies in the DPDs.

It is essential that these are all informed using the findings and advice from a sound evidence base that examines economic, social and environmental needs and constraints. This must include the comprehensive planning, phasing, delivery and management of water, sewerage, flooding and drainage infrastructure, whilst not adversely affecting environmental capacity. A critical element is therefore to consider in greater detail, the risks associated from all forms of flooding and the existing state, limitations and future requirements of the Greater Nottingham water cycle system in the context of future growth.

The LDF process involves an extensive process of consultation. This overall planning process supports a two stage strategy for the water cycle study, so that important considerations are not overlooked in-between the production of a Scoping WCS and Outline WCS (which inform the draft LDDs), and the Detailed WCS which, if required, will ensure that the final LDF has sufficient detail to ensure delivery of the WCS requirements. The WCS will also make recommendations on phasing for development.

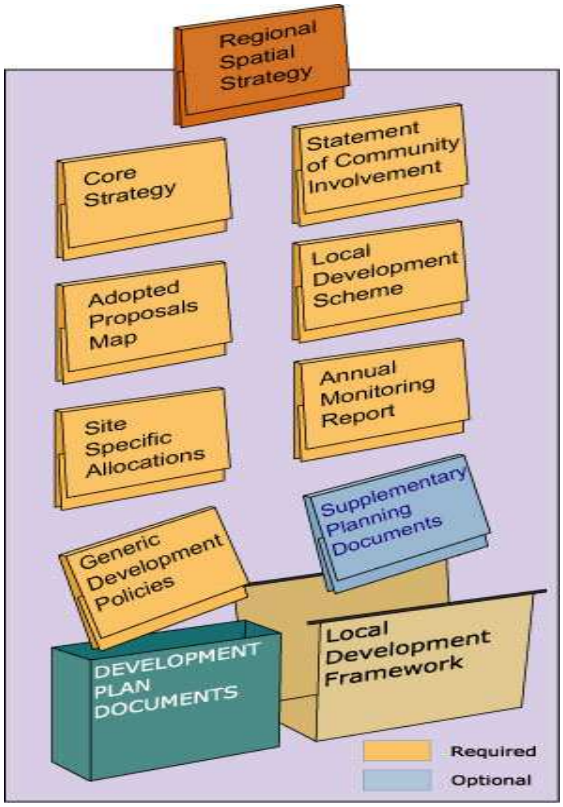

Figure 4-1 Local Development Framework Key Documents (Source: ADC)

Water Company Planning

It is important to consider the planning timelines, both for the GNNGPP authorities in terms of the LDF but also ST in terms of the funding mechanisms for new water supply and water treatment infrastructure.

There are two elements of Water Company planning that are pertinent to the Greater Nottingham WCS and specifically, with regard to integration with Spatial Planning timelines for LPAs and Regional Government.

Financial and Asset Planning

Water companies currently plan for Asset Management and the financial procurement required for this through the Asset Management Plan (AMP) process which runs in 5 year cycles. The Office of Water Services (OFWAT) is the economic regulator of the water and sewerage industry in England and Wales, and regulates this overall process.

In order to undertake maintenance of its existing assets and to enable the building of new assets (asset investment), water companies seek funding by charging customers according to

the level of investment they need to make. The process of determining how much asset investment required is undertaken in conjunction with:

- The Environment Agency (EA) as the regulator determining investment required to improve the environment,
- The Drinking Water Inspectorate (DWI) who determine where investment is required to improve quality of drinking water,
- OFWAT who along with the EA require Water Companies to plan sufficiently to ensure security of supply (of potable water) to customers during dry and normal years.

The outcome is a Business Plan which is produced by each Water Company, which sets out the required asset investment over the next 5 year period, the justification for it and the price increases required to fund it.

Overall, the determination of how much a Water Company can charge its customers is undertaken by OFWAT. OFWAT will consider the views of the Water Company, the other regulators (EA and DWI) and consumer groups such as the Consumer Council for Water, when determining the price limits it will allow a Water Company to set in order to enable future asset investment. This process is known as the Price Review (PR) and is undertaken in 5 year cycles. When OFWAT make a determination on a Water Company's business plan, the price limits are set for the proceeding five year period allowing the water company to raise the funds required to undertake the necessary investment which will also be undertaken in that 5 year planning period (the AMP period).

At the time of undertaking the Greater Nottingham Scoping WCS, Water Companies are preparing for Price Review 2009 (PR09), whereby they are currently drafting their Strategic Business Plans which seek funding for asset investment for the 5 year period covering 2010 – 2015 (known as AMP5).

It therefore follows that any new asset (or infrastructure) investment required to meet the requirements of the WCS (and hence future development in Greater Nottingham) needs to feed into the drafting of the Strategic Business Plan for PR09. OFWAT will determine the final price limits from this process in November 2009. This ultimately means that there will be no funding available to undertake significant water cycle infrastructure upgrades until 2010 at the earliest. It can also be seen that, if significant water cycle infrastructure requirements are not included in this current price review (PR09), the funding cannot be sought for it until the next Price Review towards the end of AMP5 (PR14) which would result in funding not being available until AMP6 running from 2015 -2020. Water companies are able to submit interim determinations within the 5 year AMP cycles to seek funding for unforeseen investment requirements; however it is considered that infrastructure for planned development should be planned for in sufficient time for to be included in the relevant Business Plan and Price Review.

Water Resource Planning

Water companies are now required to produce Water Resources Management Plans (WRMP) on a statutory basis covering 25 year planning horizons. WRMPs set out how a water company plans to provide and invest in existing and new water resource schemes (e.g. reservoirs, desalination) to meet increases in demand for potable supply, as a result of new development, population growth and climate change over the next 25 year period. When complete, the new statutory WRMPs will be updated in 5 yearly cycles to coincide with the Price Review and AMP process.

At the time of undertaking the Greater Nottingham Scoping WCS, ST are in the process of consulting on their draft WRMP09. This Scoping WCS has made use of the draft WRMP09 to inform the water resources assessment for growth in Greater Nottingham. However, until such time as consultation is complete and the WRMP09 is approved and published in 2009, it is not possible to state with any certainty as to what options will be taken forward.

The WCS is therefore essential for several reasons: It allows the discrepancies in the planning timeframes of ST and the GNNGPP Authorities to be reconciled through strategic planning as well as providing sufficient evidence base for the GNNGPP Authorities statutory LDF processes and robust evidence and justification for ST Strategic Business Plans for investment required in AMP5 (2010-2015) and beyond.

5 Water Cycle Environment and Infrastructure

5.1 Introduction

This section describes the environmental and infrastructure baseline within Greater Nottingham with regards to the various components of the water cycle. It is important to establish the baseline and hence spare capacity of the water environment and associated water/wastewater infrastructure because a basic assumption of the WCS is that it is preferential to maximise the use of existing facilities without causing negative effects upon the existing water environment. This is to reduce cost, reduce the impact to existing communities and to allow early phasing of some new development, negating the need to rely on longer lead in times associated with securing funding for new infrastructure through the statutory water company planning process.

Initial assessments of the potential impacts from the proposed level of growth in Greater Nottingham and recommendations for further investigation are provided in Section 6.

5.2 Data Sources

The short timescale for this Scoping WCS means that reliance has had to be placed on existing reports produced mainly by ST and EA (as per the brief). Although the best publicly available information has been used for this assessment, it must be recognised that the Periodic Review Process (AMP5), which ST are currently engaged in with regulators may mean that things may change in the future. The data sources that have been referred to during this Scoping study, as well as those that are available for future stages of the WCS are presented in Appendix A.

5.3 Water Resources and Supply

This chapter provides a summary of the water resources and water supply for the Greater Nottingham area.

The water supply for the Greater Nottingham area is provided by ST, the 2nd largest water company within England and Wales, serving 3.3 Million customers and supplying around 2,000 Million litres per day (Mld^{-1}) This figures represent the total quantity of water put into supply, including leakage. ST is also provider of wastewater services to the Greater Nottingham area.

The water company being the monopoly supplier of services operates its business under a regulated environment with the EA, OFWAT (the economic regulator) and the DWI. All of these organisations ensure that ST operates as an efficient water (and sewerage) company, and at the same time maintains (or where practical improves) the wider environment in which the company operates.

5.3.1 Climate

The average annual rainfall for the Greater Nottingham and Ashfield area is 620mm[5], less than the annual average rainfall for England of 897mm.

[5] Environment Agency; Idle and Thorne Catchment Abstraction Management Strategy – Final Document

5.3.2 Watercourses

The main watercourses in Greater Nottingham and Ashfield include the River Trent, River Erewash, River Leen, River Soar, River Derwent and the River Smite.

River Trent

The River Trent bisects the Greater Nottingham administrative area, flowing in a north-easterly direction through all of the LPAs administrative areas (except Ashfield) across a broad and low relief, alluvial floodplain. The River Trent rises in the Staffordshire Moorlands and is joined by its major tributaries in the upper catchment before flowing northeast towards the Humber Estuary. The Trent catchment is predominantly impervious with the catchment consisting largely of glacial clay and Alluvium on top of Mercia Mudstone but also of some sandstone and limestone. The River Trent has little or no hydrological interaction with the underlying aquifer however the catchment through the study area comprises extensive terrace gravels and alluvium within the river valleys which maintain its baseflow[6].

River Erewash

The River Erewash is a tributary of the River Trent comprising a moderate to low relief catchment which drains carboniferous coal measures with Permian and Triassic bedrock on the east and southern extents. The river flows from north to south forming the border between Erewash and Broxtowe into the Attenborough Lakes which discharge into the River Trent.

River Leen

The River Leen comprises a moderate to low relief catchment flowing from Gedling through the centre of Nottingham City towards its confluence with the River Trent near Lenton and has complicated baseflow hydrology. The River Leen drains from the Permian Mudstone and Sherwood Sandstone outcrops as it flows south, crossing the boundary between the two units several times before reaching the River Trent to the south-west of Nottingham.

In the past, the Greater Nottingham area contained a large number of springs, many of which were located to the mudstone/sandstone boundary and drained into local river systems including the Rivers Leen and Trent. However, many tributaries of these rivers and related springs have now dried up.

River Soar

The River Soar is a major tributary of the River Trent flowing generally northwards through the East Midlands. The River Soar flows generally northwards along the south-western border of Rushcliffe where it is joined by Kingston Brook and continues towards its confluence with the River Trent at Trentlock between Long Eaton and Ratcliff on Soar.

The source of the river originates near Hinckley in Leicestershire proceeding to flow north east through Leicester where it is joined by the Grand Union Canal, River Sence, River Wreake and Rothley Brook upstream of the Greater Nottingham area.

[6] National River Flow Archives, http://www.nwl.ac.uk/ih/nrfa/station_summaries/028/009.html Accessed 30/03/2009

The River Soar catchment is largely characterised by clay and alluvium, which are known as rapidly responsive to rainfall events[7]. A review of the National River Flow Archive (NRFA) database[8] highlighted that the predominant geology in the upper catchment of the River Soar is characterised by Keuper Marl interspersed with beds of Triassic Sandstone and has a moderate to low relief.

River Derwent

Within Greater Nottingham, the River Derwent flows south to the west of Little Eaton before re-entering the study area as it continues to flow south eastwards from Derby to the south of Borrowash and Draycott.

The source of the River Derwent originates in the Peak District at Bleaklow to the east of Glossop and flows south eastwards through the Upper Derwent Valley sourcing a number of reservoirs (Howden, Derwent and Ladybower). It then continues through numerous villages of rural Derbyshire where it is joined by the River Wye at Rowsley and the River Amber at Ambergate continuing south before being redirected eastwards at Derby. The Derwent, a major tributary of the River Trent reaches their confluence east of Shardlow.

River Smite

The River Smite flows north eastwards through the eastern area of Rushcliffe in proximity to the settlements of Barnstone, Aslockton and Flawborough. The river is joined by the River Whipling east of Aslockton and is a tributary of the River Devon flowing northwards immediately north east of the study area boundary.

Other Watercourses

In addition to these major watercourses, there is an extensive system of streams and smaller watercourses. Some of the notable smaller watercourses in the study area include:

- Day Brook,
- River Whipling,
- Kingston Brook,
- Fairham Brook,
- Nethergate Brook,
- Dover Beck,
- Ouse Dyke,
- Crock Dumble,
- Baker Lane Brook,
- Lambley Dumble,
- Woodborough Brook,
- Tinkers Leen,
- Tottle Brook,
- Robins Wood Dyke,
- Beauvale Brook,
- Boundary Brook,
- Nut Brook,
- Ock Brook,
- Golden Brook.

[7] River Trent Catchment Flood Management Plan – Scoping Report, Environment Agency, November 2006, Page 38.
[8] National River Flow Archives, http://www.nerc-wallingford.ac.uk/ih/nrfa/station_summaries/028/093.html, Accessed 30/03/2009.

There is also a network of used and disused canals in the region (including the Nottingham Canal, Beeston Canal, Erewash Canal and the Grantham Canal) which were developed through the region following the Industrial Revolution and many of which are still in regular use to this day.

In addition to these other watercourses (waterbodies) within the study area, other notable watercourses in Ashfield include:

- River Idle,
- River Maun,
- River Meden,
- Skegby Brook,
- Cauldwell Brook,
- Bagthorpe Brook.

5.3.3 Geology and Groundwater

The Greater Nottingham area is underlain by a Major Aquifer, a Minor Aquifer and a Non-Aquifer. A summary of the different aquifer types underlying Greater Nottingham is shown in Figure 5-1.

Much of region in the north of Greater Nottingham is underlain by the unconfined Permo-Triassic Sherwood Sandstone, a major aquifer[9] with little or no drift protection and is therefore vulnerable to pollution. This Major Aquifer is peppered with a series of Source Protection Zones (SPZs) from which abstractions take place from the underlying Sandstone Aquifer. In the north-west of Greater Nottingham lies an area of Permian Magnesian Limestone, a minor aquifer[10] and which is separated from the Sherwood Sandstones by a layer of Permian Marls which act as an aquiclude[11]. The Sherwood Sandstones, in both their confined and unconfined areas, have been extensively developed for both public water supply and industrial uses within Greater Nottingham.

Sherwood Sandstones of the majority of Nottingham City and most of the area to the east and west of the Greater Nottingham region are overlain and confined by Mercia Mudstones, a non-aquifer[12].

[9] A Major Aquifer is Highly Permeable strata usually with a known or probable presence of significant fracturing
[10] Minor Aquifers are fractured or potentially fractured rocks which do not have a high primary permeability of other formations of variable permeability.
[11] An aquiclude is an impermeable layer which will impede flow between two aquifer units.
[12] A Non aquifer is a formation with negligible permeability that is generally considered as containing insignificant quantities of groundwater.

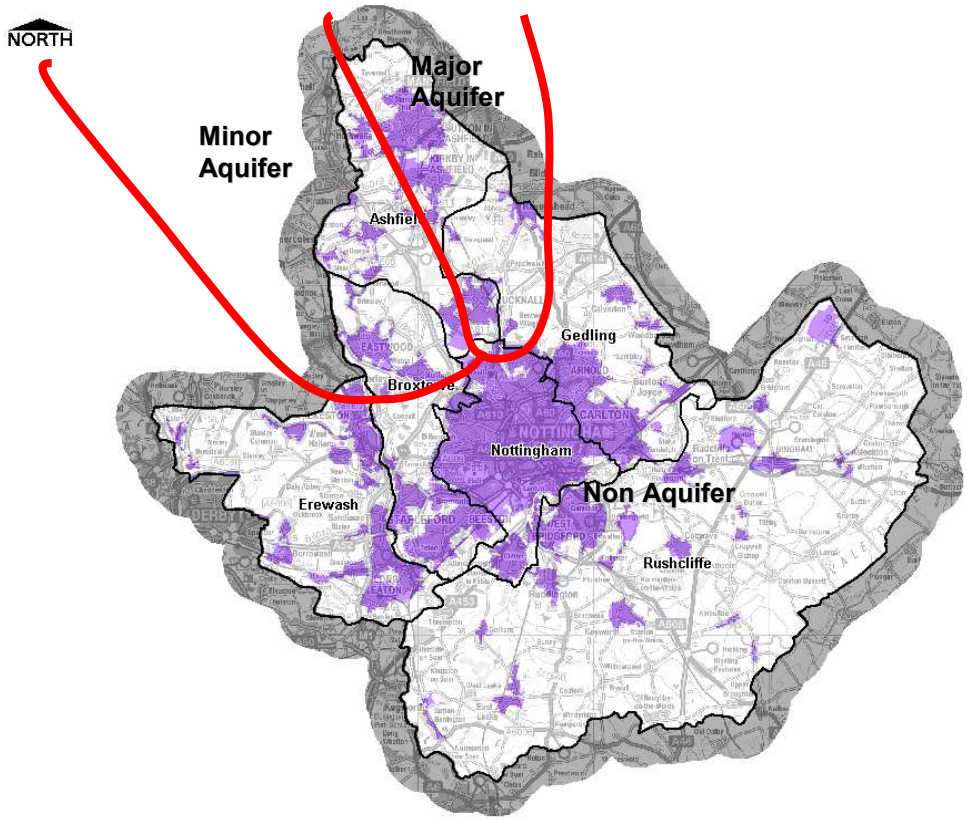

Figure 5-1: Location of Main Aquifers around Greater Nottingham

5.3.4 Types of Abstraction Sources

With the presence of a major aquifer beneath Nottingham, it is to be expected that the Permo-Triassic Sandstones is an important source of water supply. Throughout the long industrial history of Nottingham, this aquifer has been heavily exploited and consequently major changes to the groundwater flow and quality have occurred. To meet the increased growth in demand over the centuries, a connection to the City has also been made from Derwent Reservoirs in the Peak District.

ST currently obtains approximately 50% of Greater Nottingham's water supply from surface water abstractions and 50% from groundwater abstractions.

5.3.5 Groundwater Abstractions

The EAs public register of abstraction licences shows over 60 licensed sources within the Greater Nottingham area. An examination of trends in abstraction in Nottingham shows that at least within the Wollaton Groundwater Unit, abstraction has significantly reduced since 1979. Most of the decline has been due to abstractions ceasing from a few large industrial sources. This feature which can be seen in Figure 5-2, which shows openings in the total catchment areas to the east of the city. The response of groundwater levels to these changes in abstraction are discussed further in section 5.5.3.

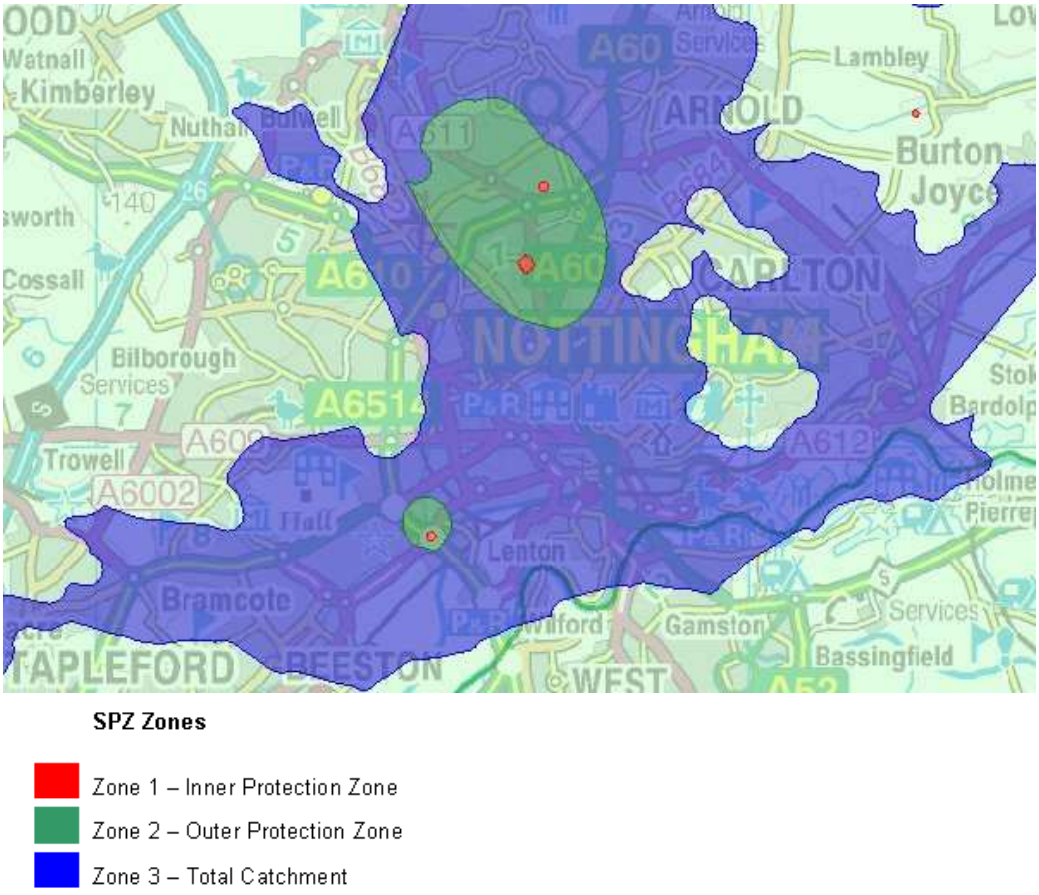

Figure 5-2: Location of Source Protection Zones around Greater Nottingham
(Source: Environment Agency)

In general, there are more licensed sources within the unconfined Sandstones than the confined section of the aquifer. The EA SPZ maps for the major licensed sources beneath Nottingham show that virtually every part of both the unconfined and confined aquifer is currently utilised (with the exception of boreholes shut down) and therefore an 'over-licensed' status can be expected when the CAMS for Groundwater Units within this area are published by the EA.

ST operates nine borehole sources within the Greater Nottingham area. The total licensed quantities from these sources are approximately 130 Mld^{-1}. However, the actual amount of water abstracted is likely to be much less than this, mainly due to water quality problems at a number of these sources.

Nitrate in groundwater supplies is a major issue facing ST. The main source of nitrate is likely to be form agricultural inputs, which may or may not change in the future. The issue will be 'key' to achieving compliance with the Water Framework Directive in the future (see section 5.5.3).

5.3.6 Surface Water Abstractions

To supplement the groundwater supplies to the Greater Nottingham, ST transfers water into the area from the Derwent Catchment by two different methods. The first method is a 'direct' transfer from the Derwent Reservoirs, via an aqueduct (in this case an enclosed pipeline) direct to local Water Treatment Works (WTWs). The second method is by indirect transfer, which

involves making releases from the Howden, Derwent and Ladybower reservoir systems into the River Derwent. This allows the water to flow down the river system and is then abstracted at WTWs to the north of Derby, before being pumped across to the Nottingham area.

The 'indirect' transfer method of abstraction is considered to be more environmentally friendly as it safeguards the river better than abstracting water out of the headwaters of Derwent Catchment and transferring it directly to the Nottingham area. Abstractions from the Derwent Catchment are the subject of a review by the EA due to the important conservation and amenity value of this river system.

The ST abstraction licences within Derwent Catchment permit up to 186 Mld^{-1} to be abstracted from this reservoir system.

5.4 Catchment Abstraction Management Strategies

The EA manages water resources at the local level through the use of Catchment Abstraction Management Strategy (CAMS). The Greater Nottingham area lies partly within the Idle and Torne CAMS and partly within the Trent Corridor CAMS. The Nottingham area also receives water from the Derbyshire Derwent catchment by the methods as described in Section 5.3.

Within the various CAMS, the EAs assessment of the availability of water resources is based on a classification system that gives a resource availability status and indicates:

- 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 5-1. 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 5-1: 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 the different catchment areas around Greater Nottingham is shown in Table 5-2.

Table 5-2: Water Resources within Catchment around Greater Nottingham

WRMU/GWMU name	Associated main river	Resource availability status			
		Individual WRMU status	Integrated WRMU status	Target status in 2012	Target status in 2018
WRMU - River Trent[1]	Trent	Water Available	Water Available	Water Available	Water Available
GWMU[1]	Trent	Under review	Under review	Under review	Under review
WRMU4 - River Idle[2]	Idle	Over Abstracted	Over Abstracted	Over Licensed	Over Licensed
GWMU[2]	Idle	Under review	Under review	Under review	Under review
WRMU1 - River Upper Meden	Upper Meden	Water Available	No Water Available	No Water Available	No Water Available
GWMU[2]	Upper Meden	Under review	Under review	Under review	Under review
WRMU1 – Upper Derwent[3]	Derwent	Over Licensed	Over Licensed	Over Licensed	Over Licensed

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] Trent Corridor CAMS
[2] Idle and Torne CAMS
[3] Derbyshire Derwent CAMS

A groundwater model of the East Midlands and South Yorkshire, including Greater Nottingham, is currently under development by the EA. This will update and replace the existing Nottinghamshire-Doncaster groundwater model. This work was originally due to be completed in 2008 and its findings were to be used to assist the EA with the implementation of its strategy for managing groundwater resources in both the Trent, Idle and Torne catchments. More details of the groundwater resource situation should be sought during the Outline WCS.

According to the EA, the Greater Nottingham area lies within a zone of 'moderate' water stress. The basis of this assessment is the current water resources situation and the level of demand expected in the future. The aim of the water stress indicator is to make sure that water companies and water users do not disregard the environmental consequences of the abstractions taking place in their area.

5.5 Severn Trent Water - Water Supply Strategy

For the purposes of water resources planning, Nottingham is situated within STs East Midlands Water Resource Zone (WRZ) - Number. 6. This zone covers the three counties of Derbyshire, Nottinghamshire and Leicestershire. Nottingham lies in the centre of WRZ 6. Figure 5-3 shows STs various WRZs. Also shown on this figure is the network of strategic treated water transfer grid (shown as a solid black line), which enables the transfer of water from Derbyshire into Warwickshire, or back into Leicestershire if required.

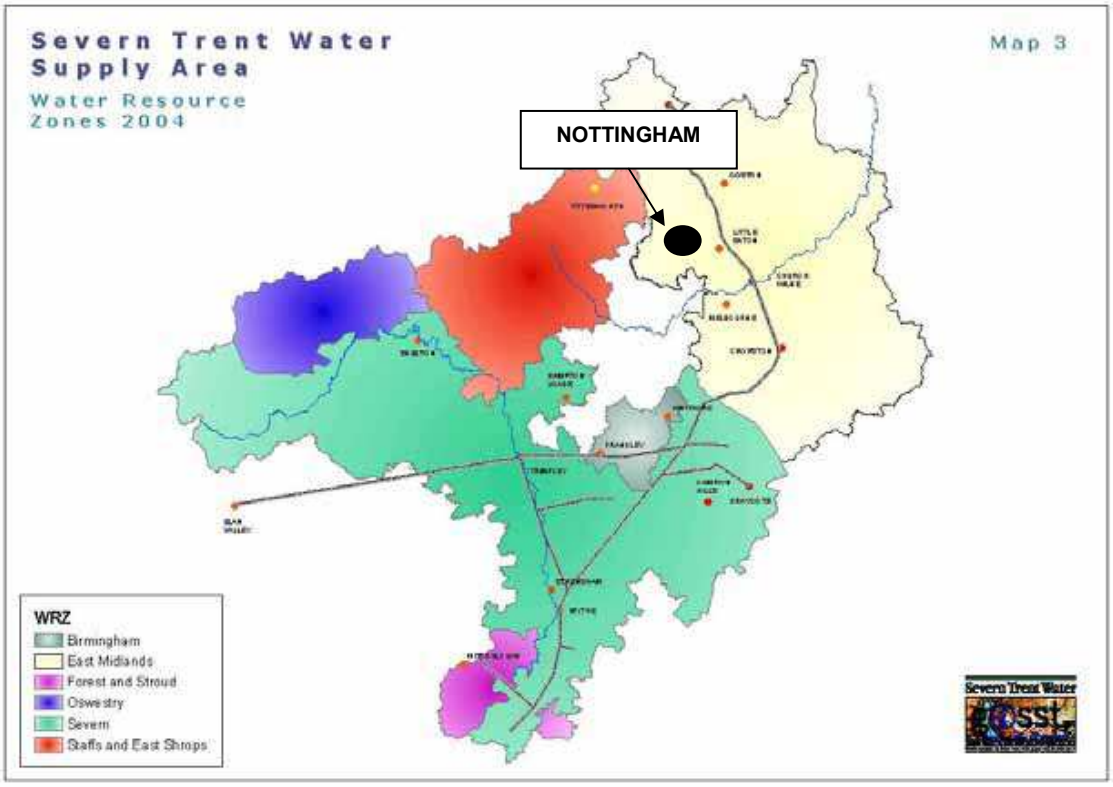

Figure 5-3: Severn Trent Water Resource Zones and Strategic Water Transfer Grid

5.5.1 Growth Forecasts – Draft and Final WRMPs

The forecasts contained within STs draft WRMP (April 2008), and in some cases revised in STs response to consultation (February 2009) indicates the following growth over the next 25 years within WRZ 6:

- The East Midlands (WRZ 6) originally indicated a significant (water resource) deficit (i.e. demand greater than supply) from 2016. This has now changed to show a surplus of resources over the entire planning period through to 2035. It is understood that these changes are the result of revised assessment of climate change impacts on resources and also updated demand forecasts in the light of comments received on the draft WRMP, Until the final WRMP is published (subject to approval by DEFRA), these figures cannot be considered final
- STs draft WRMP growth forecasts include for both RSS figures and New Growth Point Strategy. The combined growth in Derby, Leicester and Nottingham is for 81,500 new homes and estimate an increase in domestic (water resource) demand of between 22 Ml/d and 28 Ml/d (based on a consumption of 135 l/h/d and between 2 and 2.5 persons per property). The statement of response February 2009 contains reference to the fact that demand forecasts have reduced but no other details are provided,
- The total population of WRZ 6 is currently 2,900,000 rising to 3,200,000 by 2035. Again, no further details are provided in the statement of response (February 2009). Currently the population within the Greater Nottingham area is approximately 761,400 and set to grow to nearly 824,00 by 2026,

5.5.2 Water Efficiency

As a result of the changes described above, the emphasis for STs final WRMP is expected to focus, at least in the short term, on demand management and improved water efficiency.

At the present time, STs metered customers, which represent 27% of its customer base, use 117 l/h/d and its un-metered customers use 146 l/h/d. The overall average figure is 138 l/h/d (OFWAT 2006/07). A comparison with average water company customers is shown in Table 5-3.

Table 5-3: Summary of water usage by various groups of water customers

Customer type	2006-07 report*[1]	Average Customer*[2]
Metered	117 l/h/d	152 l/h/d
Unmetered	146 l/h/d	133 l/h/d
Overall	138 l/h/d	146 l/h/d

Source: OFWAT 2006/07
*1 ST's customers *2 English and Welsh customers

A summary of the STs approach to water efficiency included in their draft WRMP (April 2008) is as follows:

- Water Metering – ST intend to actively encourage customers to opt for a water meter. No targets have been set for 2020, but 66% will be metered by 2035,
- Tariffs – no changes are planned in this area,
- Water Efficiency – Good practice guidance is followed where possible (OFWAT 2006),
- Leakage – ST are proposing to operate at sub ELL (Economic Level of Leakage) in their areas of most stressed areas, this includes the Greater Nottingham area.

STs statement of response to their draft WRMP (February 2009) has incorporated the most recent evidence which predicts that greater uptake of the free meter option will take place between 2010 and 2015, and also in the longer term. Until the final WRMP is published in April 2009, then no further details are available. The statement of response also mentions that the trial to install a meter on a 'change of occupier', which was earmarked for only one WRZ, will now instead be extended to all zones in effort to increase metering.

5.5.3 Potential Risks to Supply

The potential risks to STs supply may come from a number of areas, including:

- Groundwater quality within its aquifers – ST forecast that by 2035 increasing nitrate concentrations will mean that many of its groundwater sources will no longer be suitable for water supplies (August 2008). The main source of nitrate is from agricultural inputs, (which may or may not change in the future),
- Rising groundwater levels – these have been observed in some parts of the Nottingham area, with the flooding of basements being noted in and around Nottingham city centre. An assessment of groundwater levels undertaken by researchers from the University of Sheffield found no consistent pattern, in some place groundwater levels were rising, whilst in others they were falling. It is not clear whether the areas where abstractions have ceased have seen a rise in groundwater levels. No specific information has been provided by the Council so far to contradict the University of Sheffield research. Leakage from water mains and sewer networks may explain some of the responses observed,

- Climate change – this principally affects surface water systems, such as the Derwent Reservoirs. Although the effects of climate change on Deployable Output are likely to be less extreme than originally thought in the draft WRMP, it is nonetheless the case that the situation will need to be monitored closely in the coming years ahead,
- Review of Consents process – STs draft WRMP (April 2008) mentioned that the aquifer in Nottinghamshire is under pressure from abstractions and that two low flow sites have had compensation discharges introduced. River abstractions from the Upper Derwent River were also under review to safeguard the conservation and amenity value of this river. It is not known what the outcome of the review has been and whether any further investigations will be required at these sites,
- Water Framework Directive (WFD) – STs Business Plan (August 2008) contains details of catchment solutions, to be implemented instead of and in parallel to treatment solutions, for both nitrate and other water quality problems. The work proposed for 2005-10 should help influence and inform how ST implements the WFD River Basin Management Plan Cycles.

5.5.4 Next stage – Outline Strategy

The next stage of the WCS will include:

- A full assessment of the additional demand from the new growth (both from the extra homes and jobs),
- A review of the spare licence quantities available form sources within Greater Nottingham and its surrounding areas,
- A review of the options for meeting the extra water demand required, including in the area of demand management,
- Developing an assessment tool which grades the level of infrastructure required to support growth and the relative scale of investment required.

5.6 Flood Risk

The aim of identifying the potential sources of flood risk to the study area is to assess the risk of all forms of flooding to and from the development, in order to identify any potential development constraints with respect to flood risk. PPS25 emphasises the need for a risk-based approach to be adopted by LPAs through the application of the ***Source-Pathway-Receptor*** model.

The model firstly identifies the ***Sources*** of flooding to and from the development. The identification is based on a review of local conditions and consideration of the effects of climate change. The nature and likely extent of flooding arising from any one source is considered, e.g. whether such flooding is likely to be localised or widespread. The presence of a flood source does not always infer a risk.

The exposure ***Pathway*** or 'flooding mechanism' determines the risk to the receptor and the effective consequence of exposure, e.g. sewer flooding does not necessarily increase the risk of flooding unless the sewer is local to the site and ground levels encourage surcharged water to accumulate.

The varying effect of flooding on the ***Receptors*** depends largely on the sensitivity of the target. Receptors include any people or buildings within the range of the flood source, which are connected to the source by a pathway.

In order for there to be a flood risk, all the elements of the model must be present. Furthermore effective mitigation can be provided by removing one element of the model, e.g. by removing the pathway or receptor. With regard to fluvial flood risk, this can be achieved by moving the proposed development wholly into Flood Zone 1.

The other major potential source of flooding is surface water flooding, which can occur as a result of a number of factors. During periods of prolonged rainfall events and intense downpours, overland flow from adjacent higher ground may 'pond' in low-lying areas of land without draining into watercourses, surface water drainage systems or the ground. In general, surface water drainage systems are only required to be designed to contain a 1 in 30 year rainfall event (as a maximum). During higher intensity events, surface water drainage systems become overwhelmed often resulting in surface water flooding.

One of the main issues with surface water flooding is that in areas with no history, relatively small changes to hard surfacing and surface gradients can cause flooding (garden loss and reuse of brownfield sites). As a result, continuing development could mean that surface water flooding can become more frequent and although not on the same scale as fluvial flooding, it can still cause significant disruption. The utilisation of SUDS can mitigate against surface water flooding.

A review of flood risk in the WCS is essential to ensure that the risk of flooding to new development and that new development is steered away from high risk areas (EA Flood Zone 2 and Flood Zone 3). It will also ensure that any flood mitigation measures are planned in a strategic manner. It is also essential that there is no deterioration to existing neighbouring communities' standards of protection, or subsequent increases in flood risk.

5.6.1 Watercourses and Associated Flood Risk

As previously noted, the main water-bodies flowing through the Greater Nottingham study area include the River Trent, River Derwent, River Erewash, River Leen, River Soar and the River Smite. The EA Flood Zones for each of the watercourses are shown in Figure B-3 (Appendix B) and are summarised below.

River Trent

Severe flooding can occur from the reach of the River Trent through Greater Nottingham during times of high flows, this can be exacerbated when these high flows coincide with high tides in the Humber Estuary downstream which prevent free discharge. The potential effects are also made worse by predominant low-lying nature of the land in much of the River Trent floodplain, which is easily inundated and difficult to drain.

Flow in the River Trent along the reach through Greater Nottingham is influenced by public water supply abstraction, groundwater abstraction, recharge and effluent returns.

There are extensive areas of Flood Zone 2 and Flood Zone 3 extending out from both banks through southern part of Nottingham, into the settlements of Long Eaton, Toton, Attenborough, Rylands, Beeston, Clifton, Wilford, West Bridgford, Lenton, Adbolton, Colwick, Netherfield, Radcliffe on Trent, Stoke Bardolph and Burton Joyce. There are also numerous smaller

settlements and agricultural land that lie within the wide River Trent floodplain through the Greater Nottingham study area.

Flood defences are present along significant reaches of the River Trent. Following the EA's Fluvial Trent Flood Risk Management Strategy (March 2005), plans for two Flood Alleviation Schemes (FAS) have been progressed. These are the West Bridgford FAS and the Nottingham Trent Left Bank FAS. The West Bridgford FAS was completed in September 2007 and has reduced flood risk to 5,636 properties in the West Bridgford area, by improving the standard of protection to the 1 in 100 year (1% annual probability) event. The Left Bank FAS is still at planning stage and construction has not yet commenced. The construction period is 3 years and the scheme is designed to protect the existing population from flooding up to a 1 in 100 year flood event. The proposed improvements do not remove the risk of flooding to the conurbation.

River Derwent

The highest flood risk area for the River Derwent is in the lower reaches, which is currently protected to a standard of less than 1%. The Derwent floodplain extends into EBC in the south west of the study area where it poses a flood risk to the settlements of Little Eaton, Borrowash, Draycott and Sawley.

River Erewash

The floodplain of the River Erewash poses a risk of flooding to the settlements of Jacksdale, Eastwood, Ilkeston, Trowell, Stapleford, Sandiacre and Long Eaton. Generally, the flooding pathway is overtopping of raised embankments and overland flow. Flood levels in the River Erewash near to Sandiacre and Stapleford may be increased by high water levels backing up from the River Trent.

River Leen

The Ashfield District SFRA highlights that development in Hucknall could have significant implications to flood risk downstream in Nottingham. The key settlements at risk of flooding from the River Leen have been identified as those of Papplewick, Bulwell, Old Basford, New Basford, Whitemoor, Radford and Lenton.

River Soar

The River Soar poses a risk of flooding to areas of agricultural land and settlements along the western boundary of Rushcliffe including Sutton Bonington, Normanton on Soar and Stanford on Soar. Kingston Brook, a tributary of the River Soar flows westwards through Rushcliffe posing a particular flood risk to areas of East Leake and Kingston on Soar.

River Smite

The settlements of Colston Bassett, Barnstone, Aslockton and Flawborough lie within the largely rural River Smite floodplain through Rushcliffe.

Other Watercourses

Fairham Brook - a tributary of the River Trent flowing generally north westwards through Rushcliffe and its smaller tributary of Roehoe Brook pose a risk of flooding to the village of Widmerpool. Nethergate Brook, a small tributary of Fairham Brook also poses a risk of fluvial flooding to the centre of Clifton.

Day Brook - a tributary of the River Leen, Day Brook poses a flood risk to the settlement of Arnold between Daybrook an Old Basford, as identified in the River Leen and Day Brook SFRA.

Car Dyke - extends north eastwards from Bingham through a largely rural area towards the River Dean located immediately north east of the Rushcliffe boundary. The floodplain of Car Dyke is not considered to pose a significant risk of flooding to adjacent settlements within this area of Rushcliffe.

River Whipling - a tributary of the River Smite, poses a risk of flooding to the rural eastern area of Rushcliffe. However no significant risk is apparent to any urban settlements.

Dover Beck - a main watercourse running south eastwards in proximity to, but outside the eastern boundary of Gedling. Multiple tributaries of this watercourse flow generally eastwards through the Gedling area. The broad extent of Flood Zone 2 and Flood Zone 3 of these watercourses in relation to settlements in this area is minimal; although those of ***Lambley Beck*** ***Dumble Beck*** and ***Cocker Beck*** do coincide with the village of Lambley, and those of Woodborough Brook also coincide with the village of Woodborough, posing a potential flood risk to these settlements.

Bagthorpe Brook - a tributary of the River Erewash poses a risk of fluvial flooding to the settlement of Westwood, south of Jacksdale in Ashfield.

Beauvale Brook and ***Gilt Brook*** - pose a risk of fluvial flooding to the northern and south eastern urban edges of Eastwood (in Broxtowe) respectively before discharging into the River Erewash.

Nut Brook and ***Stanley Brook*** - pose a risk of flooding to mainly agricultural land in the vicinity of West Hallam before proceeding to pose a risk to the urban settlements of Kirk Hallam and Stanton towards the River Erewash (in Erewash).

Ock Brook - poses a risk of fluvial flooding through the centre of the settlements of Ockbrook and Borrowash, and Golden Brook poses a risk of flooding to the western and eastern edges of Breaston, both in the EBC area.

Baker Lane Brook – presents a risk of flooding to properties in Hucknall

5.6.2 Canals

The Nottingham, Erewash, Beeston, Grantham and Erewash canals are all situated within the study area. Flood risk posed by the canals is at present un-quantified but they can represent as a potential flood risk. Flooding resulting from overtopping of the Nottingham Canal has previously been recorded in Cossall (in Broxtowe).

5.6.3 Surface Water Flooding

Surface water flooding is a serious issue in built up areas within Greater Nottingham due to the extensive coverage of impermeable area. This is particularly true within Nottingham City. It is imperative that the WCS considers (using available data as a basis) the potential increase in flood risk caused by new development and seeks to identify mitigation measures wherever feasible.

Level 2 SFRAs were completed for all six districts of the Greater Nottingham area in July 2008. In addition to this are the Level 2 SFRA for the River Leen and Day Brook catchments, completed in September 2008 and the Ashfield District Level 1 SFRA, completed in 2009. All of the SFRAs have been undertaken in accordance with Planning Policy Statement 25[13] (PPS25) and the Practice Guide[14]. The SFRAs provide information on the flood risk from fluvial, tidal, surface, ground and artificial water sources and will be used by each council to apply the Sequential Test.

The SFRAs will be used to support the emerging LDFs for the Greater Nottingham Authorities and will also be an invaluable source of information for the later stages of the Greater Nottingham WCS.

The initial review of the SFRAs has identified the key flood risk issues in the study areas and indicates further review of flood risk, particularly with regards to surface water and sewer flooding, should be undertaken as part of the Outline WCS.

5.7 Wastewater Treatment and Collection

ST are responsible for the operation and maintenance of the existing foul sewerage system and surface water drainage network within Greater Nottingham and Ashfield. However, ST are not responsible for soakaways, land drainage, highways drainage, SuDS or septic systems.

It is clearly useful to identify areas where new development could put pressure on the sewage treatment infrastructure and where there is a particular problem with nutrient enrichment. Nitrates and phosphates come from a range of sources, principally agriculture and treated sewage effluent. If some wastewater treatment works (WwTWs) increase in size they may be required to significantly reduce the amount of phosphate they discharge. Key to assessing wastewater capacity is not just the location of proposed development, but the type and the timing (start, duration, phasing etc.) of development. At that point any additional investment can be identified and then the critical path identified from when the assets are required and how long they will take to deliver.

As part of future stages of the WCS, it will be important to fully assess existing wastewater infrastructure and also determine any spare capacity of local WwTWs. This would be required as a sound starting point for more detailed work as it is preferable to maximise the use of existing facilities, where feasible, and also develop strategic upgrade solutions. By maximising existing infrastructure, costs may be minimised and potentially the most sustainable options would be encouraged (e.g. minimising initial carbon footprint of new development). Adopting such an approach may also reduce impact on existing neighbouring communities and allow the early phasing of some new development, which would not have to rely on longer lead-in times associated with securing funding for new infrastructure through the statutory water company planning process.

There are over thirty (30) significant WwTWs in the Greater Nottingham area, which vary greatly in size and capacity. Capacity is quoted in terms of population equivalents, composed of the number of people within the catchment area combined with the estimated output from industrial and commercial premises. The principal WwTW within the Greater Nottingham area

[13] Planning Policy Statement 25 'Development and Flood Risk' – Department for Communities and Local Government, December 2006.
[14] Planning Policy Statement 25 ' Development and Flood Risk', Practice Guide – Department for Communities and Local Government, June 2008.

is Stoke Bardolph which serves a population equivalent of more than 200,000 and discharges to the River Trent.

At this stage of the WCS process for Greater Nottingham, ST have issued the following holding statement with regards to the wastewater network:

> *"In general terms we do not anticipate any particular issues with the waste water systems however the key to future performance is the effective management of surface water run-off. We would expect surface water on new developments to be managed in a sustainable manner in line with the Government's new Water Strategy, Future Water, which sets out a vision for more effective management of surface water to deal with the dual pressures of climate change and housing development. We would not expect surface water to be conveyed to the foul or combined sewerage system and where practical we support the removal of surface water already connected to foul or combined sewer.*
>
> *Key to assessing water and waste water capacity is not just the location of proposed development, but the type and the timing (start, duration, phasing etc). At that point any additional investment can be identified and then the critical path identified from when the assets are required and how long they will take to deliver".*

However, given the scale of proposed development, further detailed discussions with ST will be required as part of the Outline WCS. Factoring in the impacts of the effects of climate change and proposed development will have implications on the volumetric capacity (sewer network and WwTWs), treatment capacity (WwTWs) and environmental capacity (receiving watercourses) of the wastewater system in Greater Nottingham.

A vital piece of data that will be required to assess the wastewater network as part of the Outline WCS and potentially any Detailed WCS will be the Nottingham Sewerage Strategy, undertaken by Framework Consultants on behalf of ST in the AMP4 period. This should provide an overview and also more detailed information regarding wastewater capacity, constraints and issues in Nottingham and the surrounding areas.

Early discussions with ST as part of the Outline WCS will be critical to the timely delivery of the study.

Urban Waste Water Treatment Directive

The Urban Wastewater Treatment Directive (UWWTD) is designed to make sure all wastewater in the EU is treated to the appropriate standard. An essential element of the Directive is that quality standards for effluent fall into categories depending on size of the treatment works and the sensitivity of the receiving water. As populations grow in each sewerage catchment, some sewage treatment works may exceed the Urban Waste Water Treatment Directive threshold that requires nutrient removal.

For works discharging into a Sensitive Area (Eutrophic) a population equivalent exceeding 10,000 will require phosphate removal to a standard of 2mg/l (as an annual average). If however the population equivalent is increased to exceed 100,000, then a tighter standard of 1 mg/l (as an annual average) phosphorous is required. It is clear that growth in some areas

could result in tighter limits on the quality of the effluent and this could have implications for investment in new sewage treatment infrastructure.

Fresh Water Fish Directive

The Fresh Water Fish Directive (FWFD) is designed to protect fish from harmful chemicals such as ammonia. The East Midlands has a significant number of rivers designated under this Directive. Many sewage treatment works on rivers such as the Trent have already had major investment in order to meet the tight ammonia standards required by the FWFD. Any new discharges into these rivers must also meet the FWFD standards. There are implications for the capacity of current works and the cost of investment in new works.

In 2005, the East Midlands Regional Assembly (EMRA), ST and the EA reviewed the capacity of WwTWs in the East Midlands to accommodate further housing. Several water quality determinands and pressures were included in the analyses of river and groundwater quality, but only Biological Oxygen Demand (BOD) and flow parameters were included in the analyses of WwTW capacity. The conclusion was that there were potential regional and specific constraints.

This information should be reviewed in relation to specific data on volumetric and process capacity, together with any planned upgrades WWTWs in the Outline WCS. To date, no information pertaining to WwTW has been received from Severn Trent. Efforts should be made to remedy this situation as a matter of urgency for the Outline WCS.

Although the individual impact of potential increases in discharges from WwTWs are potentially important, and should be assessed, water quality problems such as excessive phosphorus are a catchment problem and any analysis or responses should be considered as such.

5.8 Water Quality

There are three main ways that development can impact water quality, in this case primarily on surface water, but groundwater should also be considered:

- Over abstraction of water, which can reduce water flow, affecting hydromorphology and chemistry of watercourses for aquatic and riparian habitats, and impacting available seasonal dilution of pollutants,
- Alterations to timing and magnitude of runoff from impervious surfaces (usually managed by attenuation features such as SuDS). Potential increased sources and transport of pollutants from sources such as roads and gardens,
- Increases in treated wastewater effluent, and potential discharges from storm discharges.

Discharge of new or additional treated wastewater from the proposed Greater Nottingham growth areas could have a detrimental impact on the water quality of receiving waters. A review of water quality in the WCS is therefore essential to ensure that:

- The water related environment has the capacity to absorb further discharges to the receiving watercourse,

- There is no unacceptable deterioration in the quality of the water related environment as a result of the development,
- Any water quality mitigation measures are planned in a strategic manner.

The aim of assessing the current and potential water quality of watercourses within and surrounding the development site is to identify the current water quality situation and the potential impacts the development may have on this and the surrounding water environment.

5.8.1 Recent Water Quality Standards

In England and Wales, one of the key tasks of the Environment Agency is to protect the quality of fresh, coastal marine, surface and ground water. A variety of standards, targets and guidelines are used to guide actions and investment to protect and improve water quality by calculating the potential impacts of industry, point sources and more recently, agriculture. Most of the standards (for example those concerning bathing waters, habitats, shellfish and freshwater fish) support the requirements of European Directives transposed to England and Wales. Others, such as River Quality Objectives (RQOs), stem from past regulation in England and Wales, but are nevertheless a particularly useful measure, and a good historical record. These chemical and biological grades and standards are currently in a state of change with the introduction of new methods as part of the Water Framework Directive (WFD). However, given that these standards are only very recently changed (and will still be used to describe water quality before 2009) a brief description is provided, before describing WFD standards.

River Quality Objectives

In recent decades, the principal non-statutory RQO system has been the River Ecosystem (RE) Classification scheme which comprised five hierarchical classes in order of decreasing quality. Each stretch of river was given a RE target such that if the river achieves this target it means that the river was of adequate quality to support the required ecosystem.

General Quality Assessment Scheme

Whereas the EA used RQOs for planning purposes (i.e. for setting water quality targets and assessing compliance with those targets), the General Quality Assessment (GQA) scheme was designed to provide an assessment of the general state of water quality and changes through time. The GQA scheme comprised several separate aspects of water quality, falling under chemical (inc. nutrients) and biological monitoring and assessment.

Chemistry

The chemical grading gave an indication of river water quality primarily in respect to organic pollution. River reaches were sampled a minimum of 12 times a year for the parameters shown in Table 5-5 and data collected over three years are used in order to give the required precision to assign grades. . River reaches were assessed against all three parameters and a GQA grade was assigned based on the lowest-graded parameter. The locations for sampling were usually up and downstream of point sources such as sewage treatment work discharges to help assess compliance with consents.

Table 5-5: Environment Agency chemical GQA grades in watercourses

GQA Grade	Dissolved Oxygen (% saturation) 10 percentile	BOD mg/l 90 percentile	Ammonia mg-N/l 90 percentile
A	80	2.5	0.25
B	70	4	0.6
C	60	6	1.3
D	50	8	2.5
E	20	15	9.0
F	<20	>15	>9.0

Biology

The biological grading compared macro invertebrates in the river with the likely assemblage which would be expected to be found if the river was not impacted. Flow and morphology were taken into account in this assessment.

Nutrients

As well as the chemical and biological quality, river systems were also sampled to determine the concentration of nutrients in given reaches. Excessive nutrients (especially phosphorus) can allow eutrophication if other factors are not limiting. This allows nuisance species such as algae to proliferate at an undesirable level and at the expense of other aquatic life which rely on the system (fish and aquatic plants); the overall effect is to reduce biodiversity. The two most important nutrients in terms of eutrophication are nitrogen (N) and phosphorus (P) and these were each assessed using a separate GQA grade.

A grade from 1 to 6 was derived for both phosphate and nitrate based on the average concentration over the previous three years. There are no 'good' or 'bad' concentrations for nutrients in rivers in the way that is used to describe chemical and biological quality. Rivers in different parts of the country have naturally different concentrations of nutrients. 'Very low' nutrient concentrations, for example, are not necessarily good or bad; the classifications merely state that concentrations in this river are very low relative to other rivers.

Watercourse quality is assessed at several locations along the length of typical rivers. Usually, these are downstream of WwTW's. For the purposes of this scoping study, an overview of water quality status is usually provided. In this case, basic water quality grades for chemistry (GQA), biology and nutrients were extracted for the year 2007 and summarised in Table 5-6.

A detailed analysis is precluded at this stage, however, the key points are the generally satisfactory chemistry grades. Only the Day Brook is graded E (Bad). Concentrations of nutrients (nitrate and phosphate) tend to be high in most watercourses. This is true of the majority of lowland watercourses, and is of particular concern with regards to phosphate which can cause eutrophication in the absence of other limiting factors.

Care is needed when interpreting this data which is based on a high-level assessment of available information for the year 2007. River water quality can be variable and at this stage only one-year's GQA Grades is presented. Ideally, trends should be assessed against likely pressures such as point source (STW, factories and other licensed discharges) and diffuse sources (agriculture, roads, rural and some urban areas).

Recently, all watercourses in the UK have been assessed according to standards under the Water Framework Directive. An overview of the WFD is provided in Section 5.8.2, which also includes a high-level assessment of waterbody status in the Greater Nottingham region.

Table 5.6 GQA chemistry, biology and nutrient grades for selected rivers and monitoring sites in the Greater Nottingham area

River	Chemistry	Biology	Nitrates	Phosphates	Year
O/F From Day Bk Pool To R. Leen					
Day Brook	E	-	4	5	2007
A6005 Rd Br Toton To Conf. R. Trent					
River Erewash	C	B	6	5	2007
Fb Stapleford To A6005 Rd Br. Toton					
River Erewash	B	C	6	5	2007
Shipley Gate To A6096 Ilkeston					
River Erewash	C	D	6	5	2007
A609 Rd Bridge To Conf. With R. Trent					
River Leen	B	-	4	5	2007
Conf. With Day Bk To A609 Rd Bridge					
River Leen	B	B	5	3	2007
Papplewick To B683 Rd Bridge					
River Leen	A	B	5	2	2007
Conf. With Dolby Bk To Stroom Dyke					
River Smite	B	-	4	5	2007
Stroom Dyke To Conf. With R. Whipling					
River Smite	B	B	6	6	2007
Conf. Long Whatton Bk To Conf. R. Trent					
River Soar	B	-	6	6	2007
Conf. R. Soar To Nottingham Stw					
River Trent	A	C	5	5	2007
Nottingham Stw To A6097 Gunthorpe Br					
River Trent	B	C	5	5	2007

5.8.2 Water Framework Directive

The Water Framework Directive (WFD) passed into UK law in 2003. The competent authority responsible for its implementation is the EA. The overall requirement of the WFD is that all waterbodies must achieve 'good ecological status by 2015 unless there are grounds for

derogation. Standards have been significantly changed, but these are being applied in tandem with the GQA and RQO schemes from 2007 to 2009.

The WFD will improve the integration of water issues and combines (or in some cases, repeals) previous water legislation and in certain areas strengthens legislation. An integrated approach to the management of all freshwater, groundwater, estuaries and coastal waters at the river basin level has been adopted.

This legislation has several well-defined objectives:

- To prevent further deterioration, to protect and enhance the status of water resources,
- To promote sustainable water use,
- To enhance protection and improvement of the aquatic environment through specific measures for the progressive reduction of discharges,
- Ensures the progressive reduction of pollution of groundwater and prevents its further pollution,
- Contributes to mitigating the effects of floods and droughts.

The ultimate objective is for all waterbodies to achieve at least 'good ecological status' by 2015. The status is based on biological (phytoplankton, macroalgae, benthos and fishes), hydromorphological and physio-chemical quality elements, with the biological elements being especially important.

All waterbodies have been designated a status based on their ecological, and chemical quality. The status ranges from 'poor' to 'very good'. In addition, the risks to each waterbody have been assessed and graded from point sources (e.g. WwTW discharges; factory discharges); diffuse sources (e.g. agriculture; road runoff); morphology and flow (e.g. over abstraction; weirs and culverts) and others (e.g. recreation; channel modification). The WFD requires risks to the environment caused by anthropogenic pressures, to be managed in addition to their impacts; there is a fundamental difference in terms of the management approach required to meet these needs. Managing impact is 'reactive' and is typical of the way we have managed the environment to date. Managing risk is 'proactive' requiring the ability to identify where an impact might occur (or is occurring) and prevent it from happening in the future.

5.8.3 River Basin Management Plans

In response to these aspects, the EA has drafted River Basin Management Plans (RBMPs) for the 11 River Basins of the UK. The draft RBMPs were published in December 2008 and these comprehensive documents contain status, risks, and objectives for each waterbody, together with a Programme of Measures (POMs) which are actions required for each waterbody to meet 'good ecological status'. These are categorised actions by sectors including Central Government, the EA, Water Industry, Agriculture, Industry and specifically in relation to this study, Local Government.

Draft Humber River Basin Management Plan and Waterbody Classification

Under the WFD, Greater Nottingham falls within the Humber River Basin District (RBD). The draft Humber RBMP was published in December 2008 and sets out detailed proposals for the next six years and beyond, to be refined as an iterative response model. Amongst the

components of the Draft Humber RBMP is to 'lower the impact of transport and built environments'.

The main causes of the problem have been linked to:

- Flood defences,
- Housing growth, leading to pressures on water quality and water resources,
- Leaks from sewerage systems and private WwTWs,
- Discharge of industrial waste containing organic matter,
- Using fertilisers and pesticides in parks and gardens,
- Run-off from roads, driveways, car parks, car washing, contaminated land.

The draft Humber RBMP also notes that:

> *"The main responsibility for implementing measures that will contribute to lowering the impact of transport and the built environment will fall on a number of different sectors including urban and transport, the water industry and the construction industry. A significant lead will have to be provided by Local Government, particularly LPAs. The Regional Planning Body (RPB) will have a significant role to play in ensuring that the RSS and proposed Integrated Regional Strategy actively seek to endorse the requirements of the WFD and promote sustainable development across the River Basin District".*

The majority of Greater Nottingham falls within the Lower Trent and Erewash catchment. The draft RBMP provides a good overview of this catchment, status, risks and pressures and this is repeated in full in Box 5.1.

Annex A (Current States of Waters) of the draft Humber RBMP states that in the 'Lower Trent and Erewash' unit (which includes the River Trent and its tributaries), currently 5% of its surface waterbodies in good or potentially good status. It is anticipated that by 2015 this compliance will increase to 7% and by 2027 this will have reached 66%. It also notes that currently 10% of the surface waterbodies in the unit have not been assessed.

5.8.4 River Trent

The River Trent between Willington (in Derbyshire) and Gainsborough (in Lincolnshire) is a designated cyprinid fishery under the EC Freshwater Fish Directive 78/659/EEC, and as such has specific water quality targets to adhere to. Since the late 1990's water quality has improved considerably in the River Trent and there is now a balanced and diverse fish stock including roach, dace, chub, barbell, perch, carp and bream. In addition, following a salmon release programme since 1998 in the River Dove, the River Trent has become an important corridor for adult salmon returning to their spawning grounds.

Tighter standards under the WFD are likely to require a tightening of consents and reduction in diffuse sources entering the River Trent.

5.8.5 Potential Impact on Water Quality

Future stages of the Greater Nottingham WCS will identify any specific water quality and hydromorphological constraints to development, and whether development scenarios might cause a failure of any statutory draft water quality objectives, as set out in the draft RBMPs under the WFD in addition to any guideline values.

It is also important to note that revised water quality monitoring and associated standards are currently being implemented. Since WCSs are primarily tools to guide development and associated water infrastructure in the short and medium term, we consider it important that, wherever possible, the draft new water quality and ecological standards published in the draft RBMPs will be used in the WCS water quality assessment. This will allow an indication of possible changes to water quality status compared to existing standards, and hence any changes in water infrastructure that might be appropriate. Scott Wilson were one of the first to begin to include such an assessment in their WCSs and our approach has been welcomed by the EA.

Since the concentration of a substance is a function of dilution, it will be important to review flow of watercourses; historical, current and projected. The EA CAMS document will be reviewed to indicate pressures on flow from water resources abstraction.

Box 5.1 Description of the Trent and Erewash catchment

The Lower Trent and Erewash catchment covers an area of 2045km^2, extending from the River Dove confluence with the River Trent, south west of the City of Derby, to the Humber Estuary. The catchment covers part of the county of Nottinghamshire together with areas of Derbyshire, Leicestershire, Lincolnshire and South Yorkshire. Nottingham and South Nottinghamshire have been identified as part of the Three Cities, Three Counties new Growth Point and the housing growth that will be part of the sustainable urban extensions will present challenges to water resources in the future. Urban centres within this catchment include Nottingham, south west Derby, Newark, Gainsborough and Scunthorpe.

The rivers Dove, Derwent, Soar, Idle and Torne are major tributaries of this stretch of the River Trent, and they have been considered as separate catchments in this report. The Lower Trent and Erewash catchment includes the remaining tributaries of the River Trent, including the Rivers Erewash, Leen, Greet, Devon and Eau and the Bottesford and Dover Becks. The stretch of the River Trent upstream of the Lower Trent and Erewash catchment is considered in the Tame, Anker and Mease catchment.

Passing through southern Derbyshire, the River Trent is not navigable; it is by-passed by the Trent and Mersey Canal. The river through this reach has been subject to limited modification and offers a range of habitat features. Downstream of Shardlow the Trent becomes navigable, deepened by locks and weirs. Through the city of Nottingham the river takes on a harder urban character, flanked by formal embankments and riverside developments.

Downstream of Nottingham the river widens as it flows towards the market town of Newark. Downstream of Newark, as the Trent flows northwards, the river is flanked on both banks by low-lying, flat land with networks of land drainage ditches and dykes to enable arable agriculture. The sand and gravel deposits adjacent to the River Trent have been developed, with a series of quarries throughout the catchment. Some former gravel pits have since been redeveloped, providing recreational facilities and wetland areas for wildlife. Many collieries have closed in recent years due to the decline in coal mining which means that minewater needs to be carefully managed. The rising minewater in the catchment will require the implementation of new mine water pumping stations by the Coal Authority to prevent pollution of the major aquifer in the area.

The River Erewash is a major tributary of the River Trent within this catchment, flowing in a southerly direction through a series of urban areas including Ilkeston and Long Eaton, located to the west of Nottingham. Rather than flow directly into the River Trent, the River Erewash flows into the lake area of Attenborough Nature Reserve, a wetland area designated as a Site of Special Scientific Interest, created from a former sand and gravel quarry.

The River Leen rises in the Newstead area, north of Nottingham, flowing southwards through the series of ornamental lakes in the grounds of Newstead Abbey. The Leen then enters the City of Nottingham where the river has been heavily modified – the channel having been canalised and culverted throughout much of its course through the urban area. The remaining tributaries in the Lower Trent and Erewash catchment are typically more rural in character and generally dominated by arable agriculture.

Currently 5% of surface water bodies in this catchment are achieving either good or potentially good status. We (i.e. the Environment Agency) are proposing that by 2015, 7% compliance will be achieved, and this would have improved to 66% by 2027. To date 10% of water bodies have not yet been assessed.

Source: Environment Agency, (2008)

5.9 Ecology and Biodiversity

This high level assessment includes an overview of hydrologically sensitive sites in the study area as well as National, Local and other hydrologically linked designated sites (i.e. Sites of Special Scientific Interest (SSSI) and Local Nature Reserves (LNRs)) to assess potential impacts of development.

The major issues that could have an adverse effect on the water environment that could arise due to new development are:

- Potential reductions in watercourse flow rates and levels, to such a degree that damage is caused to downstream designated sites,
- Potential increases in watercourse flow rates and levels in downstream sites, which would be most notable at low flows as a result of the potential additional wastewater volumes entering the river,
- Potential increases in nutrient load (and potentially concentration) at downstream sites, coupled with an increase in total oxidised nitrogen, potential lowering of dissolved oxygen and an increase in biological oxygen demand.

A Habitats Regulation Assessment (HRA) as required under the Habitats Directive will need to be undertaken as part of the planning approval process for any development where the potential impacts on habitats cannot be screened out, a HRA will be required to assess the potential development sites or growth areas as part of emerging Core Strategies and LDFs. This is the duty of the LPA.

Until development design and area is agreed in detail following review of all planning considerations, it is not possible to complete a full Appropriate Assessment (AA) as part of a Scoping WCS, which would determine the full impact on designated European Sites. This will be a requirement of the following stages of the WCS. Therefore as part of this Scoping WCS, an initial ecological review of the area has been undertaken to ascertain whether there are any ecological constraints to the proposed development.

In practice, HRA of projects can be broken down into three discrete stages, each of which effectively culminates in a test. The stages are sequential, and it is only necessary to progress to the following stage if a test is failed. The stages are:

Stage 1 – Likely Significant Effect Test - This is essentially a risk assessment, typically utilising existing data, records and specialist knowledge. The purpose of the test is to decide whether 'full' Appropriate Assessment is required. The essential question is as follows:

> *"is the project, either alone or in combination with other relevant projects and plans, likely to result in a significant adverse effect upon European sites"?*

If it can be demonstrated that significant effects are unlikely, no further assessment is required.

Stage 2 – Appropriate Assessment - If it cannot be satisfactorily demonstrated that significant effects are unlikely, a full "Appropriate Assessment" will be required. In many ways this is analogous to an Ecological Impact Assessment, but is focussed entirely upon the

designated interest features of the European sites in question. Bespoke survey work and original modelling and data collation are usually required. The essential question here is:

> *"will the project, either alone or in combination with other relevant projects and plans, actually result in a significant adverse effect upon European sites, without mitigation"?*

If it is concluded that significant adverse effects will occur, measures will be required to either avoid the impact in the first place, or to mitigate the ecological effect to such an extent that it is no longer significant. Note that, unlike standard Ecological Impact Assessment, compensation for significant adverse effects (i.e. creation of alternative habitat) is not permitted at the Appropriate Assessment stage.

Stage 3 – Imperative Reasons of Overriding Public Interest (IROPI) Test - If a project will have a significant adverse effect upon a European site, and this effect cannot be either avoided or mitigated, the project cannot proceed unless it passes the IROPI test. In order to pass the test it must be objectively concluded that no alternative solutions exist. The project must be referred to Secretary of State on the grounds that there are IROPI as to why the plan should nonetheless proceed. The case will ultimately be decided by the European Commission.

Greater Nottingham consists of a rich and diverse natural environment and as such there are numerous designated sites in the area, including the twenty-two SSSIs listed in Table 5-4 and shown in Figure B-4 (Appendix B).

Table 5-4: SSSI's in Greater Nottingham

Sites of Special Scientific Interest	
Gotham Hill Pasture	Sellers Wood
Rushcliffe Golf Course	Bulwell Wood
Normanton Pastures	Sledder Wood Meadows
Kinoulton Marsh and Canal	Freizeland Grassland
Barnstone Railway Cutting	Bagthorpe Meadows
Orston Plaster Pits	Annesley Woodhouse Quarry
Wilford Clay Pit	Bogs Farm Quarry
Holme Pit	Kirkby Grives
Colwick Cutting	Linby Quarries
Attenborough Gravel Pits	Teversal Pastures
Willwell Cutting	Breadsall Railway Cutting
Morley Moor	

Some of these sites are hydrologically linked and are dependant on water level and volume. It is therefore imperative that development is planned in such a way that it does not have an impact upon these sites. Table 5-5 gives further information regarding these sensitive sites.

Table 5-5: Hydrologically Sensitive Sites

Site	Description
Sellers Wood	The site is geologically diverse and this has contributed to the development of a diverse range of habitats and species. Oak-birch-bracken and ash-wych elm woodland types are both present, the former on acidic sandy soils at the southern end and the latter on Magnesian Limestone to the north. There has been a long history of human intervention, leading to the development of several ponds in the old clay pits and hummocky terrain, left over where limestone was previously excavated. The wetland is now a valuable habitat, especially as it is bordered by some botanically-rich grassland.
Kinoulton Marsh and Canal	The site includes some of the richest marsh and open water habitats remaining in Nottinghamshire. In the centre of the site the grassland grades into grazed marsh. In wetter areas the community contains abundant lesser waterparsnip Berula erecta, celery-leaved buttercup Ranunculus sceleratus and tubular waterdropwort Oenanthe fistulosa. Parsley water-dropwort O. lachenalii and Cyperus spurge Carex pseudocyperus also occur.. At the water's edge and in shallow water the plant community is characterised by the presence of great willowherb Epilobium hirsutum, fleabane Pulicaria dysenterica, water forget-me-not Myositis scorpioides, gipsywort Lycopus europaeus, Oenanthe fistulosa, Berula erecta and water plantain Alisma plantago-aquatica, while in deeper water the emergent vegetation comprises stands of branched bur-reed Sparganium erectum, bulrush Typha latifolia and, locally, flowering rush Butomus umbellatus. The open water of the canal possesses a rich aquatic flora including Canadian waterweed Elodea canadensis, spiked water-milfoil Myriophyllum spicatum, hornwort Ceratophyllum demersum, The diversity of wetland and terrestrial habitats present provides suitable feeding and breeding conditions for a wide range of birds, amphibia and insects.
Annesley Woodhouse Quarry	Small area of marsh at the western side of the reserve is dominated by meadowsweet, hard rush and float grass and supports many wetland plants including marsh marigold, fen bedstraw, marsh valerian, adder's tongue fern and ragged robin. A range of birds breed on the site, including willow warbler and redpoll. The sunny grassland slopes provide habitat for a wide range of invertebrates, such as butterflies. Species recorded include common blue, meadow brown and small heath.
Sledder Wood	Ponds lying within the southern part of Sledder Wood which contain well developed marsh and open water plant communities.
Orston Plaster Pits	To the north-west lie a number of waterfilled clay pits which vary in character but typically possess emergent stands of bulrush Typha latifolia, lesser bulrush T. angustifolia and common reed Phragmites australis, and also strong colonies of amphibious bistort Polygonum amphibium and water plantain Alisma plantago-aquatica. The aquatic flora reflects the calcium-rich status of the water and is characterised by the presence of thread-leaved water crowfoot Ranunculus trichophyllus, horned pondweed Zannichellia palustris and stonewort Chara sp. Adjacent areas of scrub provide additional interest while the mix of habitats present provides feeding and breeding conditions for a wide range of birds and insects.
Wilford Clay Pit	This 4.3 hectare site, a disused claypit, has a variety of habitats including marshland, pools, calcareous grassland and areas of scrub and woodland.

Site	Description
	Damper grassland and marsh areas hold large populations of southern marsh-orchid, as well as yellow sedge, false fox-sedge, common fleabane, and field horsetail. Some of the wetter areas have developed into scrub and woodland, with species such as goat willow, sallow and alder. Open water and its margins support further plants, including bulrush, common spike-rush, grey club-rush, purple loosestrife, fennel pondweed and water plantain.
Attenborough Gravel Pit	This complex of flooded gravel pits and islands covers 145 hectares and provides an ideal habitat for a wide range of plants, birds and other wildlife. The process of recolonisation over some 40 years has created a wide range of aquatic and waterside habitats. Between the ponds are drier areas of scrub and grassland as well as areas of native willow and old stream courses. New species of plants and invertebrates are continually being recorded as part of the recolonisation process. The reserve has a wide range of fish and invertebrates including great diving beetle, damselflies, dragonflies (including the four-spotted chaser and southern and migrant hawkers), and zebra and swan mussels. Amphibians include the smooth newt. The reserve is best known for its birds. The area is an important site for winter wildfowl and often holds a high proportion of the County's shoveler and diving ducks, with larger numbers of mallard, teal, and occasionally wigeon. Scarcer wildfowl such as sawbills and sea ducks are recorded regularly and cormorants are common.
Bogs Farm Quarry	The site comprises unimproved acid-loam grassland, marsh, flushes, open water pools and a wooded dumble and is of Regional importance.

5.9.1 Nottinghamshire Biodiversity Action Plan

The GNNGPP Authorities are a signatory to the Nottinghamshire Biodiversity Action Plan (BAP), which contains action plans for a range of habitats and species that require conservation action.

The Greater Nottingham area contains a number of the priority habitats identified in the Nottinghamshire BAP. It is important that any future development does not impact on priority habitats and again, this should be considered throughout the WCS. BAP habitats located within the study area, which may be affected are:

- Lowland Heath,
- Coastal Floodplain Grazing Marsh (fluvial floodplain and coastal floodplain are covered by this term),
- Lowland Mixed Deciduous Woodland,
- Lowland Dry Acidic Grassland,
- Wet Woodland,
- Lowland Calcarous Grassland,
- Lowland Meadows.

The SSSIs that are potentially at risk from development and therefore require more detailed consideration in the WCS are those that are downstream of development areas. These sites include:

- Sellers Wood,
- Kinoulton Marsh and Canal,
- Sledder Wood,
- Orston Plaster Pits,
- Wilford Clay Pit,
- Attenborough Gravel Pits,
- Bogs Farm Quarry.

6 Conclusions and Progression of WCS

The key findings from the Scoping WCS include:

- The Environment Agency's view is that the study area lies within an area of 'moderate water stress'[15],
- An initial statement from ST states there are no expected treatment capacity issues in terms of treating wastewater generated from the proposed development within Greater Nottingham, however this position should be reviewed as part of the Outline WCS. Early engagement with ST as part of the Outline WCS should ensure that critical data relating to the wastewater network is obtained,
- The management of surface water has the potential to act as a constraint to development within Greater Nottingham and Ashfield due to space requirements and the need to reduce runoff rates and volumes to limit discharges,
- Water quality impacts in main rivers and small watercourses, drains and ditches in the study area should also be managed,
- Reduced water quality, due to increased volumes of treated sewage effluent being discharged into the watercourses and poorly managed urban runoff from new development areas could impact upon European, National and Locally important ecological sites, particularly those downstream of development sites.

6.1 Outline WCS

The next stage of the WCS is to progress to the Outline Stage. The Outline WCS will build on the findings of this Scoping WCS and consider 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 will be undertaken during consideration of allocation sites such that it can inform the decision process in terms of where development will be targeted.

The key aim of the Outline study is to provide the GNNGPP Authorities with the evidence base which ensures that water issues have been taken into account when deciding the location and intensity of development within each authority's planning area as part of the development of the Core Strategy. It also gives ST an evidence base to its business plans which determine how much they can charge customers to invest in upgrades and the provision of new infrastructure required to service proposed development.

If significant new infrastructure is required, or an impact on the water environment cannot be ruled out as significant, a detailed water cycle study will need to be undertaken for site specific allocations, or for the GNNGPP Authorities as a whole.

As initially set out in the Scoping Study Brief, the Stage 2 – Outline Study should:

- Identify environmental risks,
- Identify if environmental resources can cope with further development,

[15] Environment Agency; 2007; Areas of Water Stress, Final Classification; Environment Agency

- Demonstrate that in principle there is sufficient forecast environmental capacity,
- Demonstrate that in principle infrastructure requirements are feasible (technically, financially and legally) for the timescale of planned development,
- Provide evidence on thresholds for certain infrastructure provision.

The key recommendations of this Scoping WCS, with regards to the requirement for the Outline WCS are listed below:

- For completeness, the study area should cover the whole of the Greater Nottingham area, including the whole of Ashfield,
- The following should be included in the scope for the Outline Study (in addition to those listed in the above):
- A detailed assessment of the water resource availability and demand up to 2026,
- An assessment of the capacity of the wastewater and clean water networks, both currently and factoring in the proposed development - to identify the key constraints and required phasing of development to ensure that development does not outstrip capacity,
- An assessment of the flood risk posed to and by proposed development and suitable mitigation options, with particular regards to surface water and sewer flooding. An assessment regarding the potential need for a Surface Water Management Plan (SWMP) should also be made,
- An assessment of the likely surface water storage and potential SuDS requirements for proposed development,
- An environmental assessment of the impact of proposed development upon watercourses and ecologically important sites. This includes the impacts on and requirements for increased discharges at WwTWs,
- An assessment of the phasing of proposed development sites and key constraints, with reference to the above factors.

6.2 Project Steering Group Stakeholders

The WCS Steering Group established during the Scoping phase of the WCS should be continued and widened as part of the outline phase. The Steering Group will oversee the management and direction of the project. The Steering Group will be made up of representatives of some, or all of the following organisations:

- GNNGPP Authorities:
  - Ashfield District Council,
  - Broxtowe Borough Council,
  - Erewash Borough Council,
  - Gedling Borough Council,
  - Nottingham City Council,

  - Rushcliffe Borough Council,
  - Nottinghamshire County Council,
- The Environment Agency – as the statutory planning and flood risk consultee as well as regulator for water quality,
- Severn Trent Water – as provider of wastewater infrastructure and water supply infrastructure to study area,
- Internal Drainage Boards – Newark IDB, Fairham Brook and Kingston Brook IDB,
- Natural England – as a statutory environmental consultee,
- Derbyshire County Council (in relation to the Derby Housing Market Renewal Area).

As well as close liaison with the Steering Group members, consultation will be required with the following organisations:

- Highways Agency (HA),
- Key Landowners,
- Authors of various FRAs and SFRAs.

Having due regard to the planning timeframes there will need to be stakeholder agreement on what infrastructure will be required (as recommended by the WCS) as well as when it will be required and how it will be funded. The best way to achieve this is to ensure that the key stakeholders are involved at an early stage of the Outline WCS.

The data available to undertake the Outline stages of the WCS is listed in Appendix A.

Appendix A – Data Catalogue

Donor	Data	Data Details	Version (if applicable)
Greater Nottingham Authorities	Strategic Flood Risk Assessment	Greater Nottingham SFRA	Jun-08
		River Leen and Day Brook SFRA	Sep-08
	Strategic Housing Market Assessment	Nottingham Core Strategic Housing Market Assessment	Apr-07
Ashfield District Council	Local Plan GIS Layers	Allotments	
		Amber Business Park	
		Amended Green Belt	
		Ancient Monuments	
		Ancient Woodland	
		Conservation Areas	
		Countryside	
		County Council Highway Schemes	
		District Shopping Centre	
		Employment Land Allocations	
		Fackley and Teversal Village	
	Other GIS Layers	Ashfield Boundary	
		Main Road	
		Planning Wards	
		Railway	
	Strategic Flood Risk Assessment	Ashfield District Council Draft SFRA	Jun-08
Environment Agency	Catchment Abstraction Management Strategies	Derbyshire Derwent CAMS	Jan-06
		Idle and Thorne CAMS	Mar-07
		Idle and Thorne CAMS Update	Mar-08
		Soar CAMS	Jul-06
		Trent Corridor CAMS	Dec-03
	Catchment Flood Management Plans	Trent CFMP (Draft Report)	Oct-07
	River Basin Management Plan	Humber RBMP	Dec-08
	Water Cycle Study Guidance	Water Cycle Study Guidance	

Donor	Data	Data Details	Version (if applicable)
East Midlands Regional Assembly	Regional Flood Risk Appraisal	East Midlands RFRA	Jul-06
	RSS	East Midlands Regional Plan	Mar-09
Gedling Borough Council	GIS Layers	Housing Allocations	
		Gedling Borough Boundary	
		Calverton Colliery Redevelopment	
		Inappropriate Employment Sites	
		New Employment Sites	
		Protected Employment Sites	
		Conservation Areas	
		Important Open Space	
		Scheduled Ancient Monuments	
		Special Character Areas	
		Green Belt	
		Green Belt Infill	
		Historic Parks and Gardens	
		Safeguarded Land	
		Statatory Environmental Designations (SSSI, Nature Reserves, Mature Landscaped Areas)	

Donor	Data	Data Details	Version (if applicable)
Nottingham City Council	Housing Planning Permissions	Current planning permissions for housing development	
	Local Plan	Nottingham Local Plan	Nov-05
	Development Briefs	Various	
	Sustainable Urban Extensions	Appraisal of Sustainable Urban Extensions in Greater Nottingham	Jun-08
	Strategic Housing Land Availability Assessment	Nottingham Core SHLAA	2008 - 2009
	GIS Layers	10k Mapping	
		50k Mapping	
		Landfill Sites	
		Local Plan GIS	
		Major Roads	
		Mastermap	
		Open spaces	
		rivers	
		SFRA River Leen and Day Brook	
		SFRA Greater Nottingham	
		Transport	
Nottinghamshire County Council	Waste Local Plan	Nottinghamshire and Nottingham Waste Local Plan	Jan-02
	Strategic Housing Land Availability Assessment	Strategic Housing Land Availability Assessment (for all NCC LPAs)	
Natural England	GIS Layers	Special Area of Conservation	Oct-06
		Special Protection Area	Oct-06
		Sites of Special Scientific Interest	Oct-06
Rushcliffe Borough Council	GIS Layers	Borough Boundary	
		SSSI	
		LNR	
		Wards (2003)	

Donor	Data	Data Details	Version (if applicable)
Severn Trent Water	Water Resources Management Plan	Severn Trent Water: draft Water Resources Management Plan	May-09
	Waste Water	Waste water treatment works location maps	

Appendix B – Maps