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North Warwickshire Borough Council

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Joint Warwickshire Partnership Water Cycle Study

Final Report
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List of Acronyms

AMP	Asset Management Plan
BAP	Biodiversity Action Plan
BGS	British Geological Society
BOD	Biochemical Oxygen Demand
BREEAM	Building Research Establishment Environmental Assessment Method
CAMS	Catchment Abstraction Management Strategy
CBA	Cost Benefit Analysis
CFMP	Catchment Flood Management Plan
CIL	Community Infrastructure Levy
CIRIA	Construction Industry Research and Information Association
CLG	Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DWF	Dry Weather Flow
EA	Environment Agency
EFI	Environmental Flow Indicator
GI	Green Infrastructure
GWR	Greywater Recycling
HMA	Housing Market Area
l/h/d	Litres/head/day (a water consumption measurement)
LCT	Limits of Conventional Treatment
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LPA	Local Planning Authority
Ml	Mega Litre (a million litres)
NBBC	Nuneaton and Bedworth Borough Council
NE	Natural England
NPPF	National Planning Policy Framework
NWBC	North Warwickshire Borough Council
OAHN	Objectively Assessed Housing Need
OFWAT	The Water Services Regulation Authority (formerly the Office of Water Services)
OR	Occupancy Rate
P	Phosphorous
Q95	The river flow exceeded 95% of the time
RAG	Red/Amber/Green Assessment
RBC	Rugby Borough Council
RBMP	River Basin Management Plan
RNAG	Reasons for Not Achieving Good
RoC	Review of Consents (under the Habitats Directive)
RQP	River Quality Planning (tool)
RWH	Rainwater Harvesting
S106	Section 106 (Town and Country Planning Act 1990)
SAC	Special Area for Conservation
SHMA	Strategic Housing Market Assessment
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
STW	Severn Trent Water
SUDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UKCIP02	United Kingdom Climate Impacts Programme 2002
UKCP09	United Kingdom Climate Projections 2009
UKTAG	United Kingdom Technical Advisory Group (to the WFD)
UKWIR	United Kingdom Water Industry Research group
UWWTD	Urban Wastewater Treatment Directive
WCS	Water Cycle Study
WDC	Warwick District Council
WFD	Water Framework Directive
WN	Water Neutrality
WRMP	Water Resource Management Plan
WRMU	Water Resource Management Unit (in relation to CAMS)
WRZ	Water Resource Zone (in relation to a water company's WRMP)
WSI	Water Services Infrastructure
WwTW	Wastewater Treatment Works

Executive Summary

The Warwickshire and Coventry study area is expected to experience a significant increase in housing provision and economic growth over the period to 2031. This growth represents a challenge in ensuring that both the water environment and water services infrastructure has the capacity to sustain this level of growth and development proposed.

The Four neighbouring local authorities within the Warwickshire study area (namely North Warwickshire Borough Council (NWBC), Nuneaton and Bedworth Borough Council (NBBC), Rugby Borough Council (RBC) and Warwick District Council (WDC) and referred to as the "Partner Authorities") together forming a study area joint partnership, have chosen to partner together to commission the preparation of a Water Cycle Study (WCS) establishing a framework for co-operation. This partnership approach will encourage collaboration and enable the water cycle across the four partner authorities administrative areas (herein referred to as the 'Study Area') to be managed more effectively and holistically throughout the plan period.

The purpose of this joint partnership detailed WCS is to form part of the evidence base for each of the local authorities Local Plan preparation, and will specifically ensure that future development does not have a damaging effect on the water environment across the study area. The WCS will also help to guide future development in terms of the most appropriate locations and appropriate timescales (with respect to water infrastructure and the water environment).

Planned future development throughout the study area has been assessed with regards to water supply capacity, wastewater capacity and environmental capacity. Any water quality issues, associated water infrastructure upgrades that may be required and potential constraints have subsequently been identified and reported. This WCS then provides information at a level suitable to demonstrate that there are workable solutions to key constraints to deliver future development for all development sites (committed and allocations), including recommendations on the policy required to deliver it.

The Wastewater Strategy

Wastewater Treatment

The WCS identifies that in total 23 Wastewater Treatment Works (WwTW) will serve the proposed future development across the study area. The table below provides an indication of the Wastewater Treatment Works (WwTWs) which are unable to accept any additional growth, and which have available capacity.

WwTW	Phasing of Development
Atherstone	Capacity for majority of planned growth, timing of permit exceedance unknown due to unknown NWBC housing trajectory
Bedworth (Marston Lane)	Capacity for all planned growth with some spare capacity for further growth
Bramcote	Capacity for planned growth with some spare capacity for further growth
Brinklow	Capacity for planned growth with some spare capacity for further growth
Bulkington	Capacity for planned growth with some spare capacity for further growth
Church Lawford	Capacity for planned growth with some spare capacity for further growth
Churchover	Capacity for planned growth up to 2021, based on Rugby Borough Council (RBC) Housing Trajectory 2015
Coleshill	Capacity for planned growth – capacity for further growth is dependent on levels of growth outside of the study area
Grendon	Capacity for planned growth with some spare capacity for further growth

WwTW	Phasing of Development
Dunchurch	Capacity for planned growth up to 2030, based on RBC Housing Trajectory 2015
Finham (Coventry)	WwTW at permit limit
Hartshill (Nuneaton)	Capacity for majority of planned growth, timing of permit exceedance unknown due to unknown NWBC housing trajectory
Hurley	Capacity for planned growth with some spare capacity for further growth
Leek Wooton	Capacity for planned growth with some spare capacity for further growth
Minworth	Capacity for planned growth – capacity for further growth is dependent on levels of growth outside of the study area
Norton Green	Capacity for planned growth with some spare capacity for further growth
Polesworth	Capacity for planned growth with some spare capacity for further growth
Rowington	Capacity for planned growth with some spare capacity for further growth
Rugby Newbold	Capacity for planned growth up to 2021, based on RBC Housing Trajectory 2015
Tamworth	Capacity for planned growth – capacity for further growth is dependent on levels of growth outside of the study area
Warton	Capacity for majority of planned growth, timing of permit exceedance unknown due to unknown NWBC housing trajectory
Warwick (Longbridge)	Capacity for planned growth – capacity for further growth is dependent on levels of growth outside of the study area
Wolston	Capacity for planned growth with some spare capacity for further growth

Seven WwTWs do not have sufficient capacity to accept all future development proposed within the plan period. Therefore solutions are required in order to accommodate the growth to ensure that the increased waste water flow discharged does not impact on the current quality of the receiving watercourses, their associated ecological sites and also to ensure that the watercourses can still meet with legislative requirements.

The detailed assessments have shown that improvements to Churchover, Hartshill (Nuneaton) and Warton WwTWs are possible using wastewater treatment technologies currently available, demonstrating that an engineering solution is feasible and hence treatment capacity should not be seen as a barrier to growth.

The phasing of developments draining to Atherstone, Dunchurch, Finham (Coventry) and Rugby Newbold WwTWs will need to be discussed between the Environment Agency, the relevant local authority and Severn Trent Water. Finham (Coventry) WwTW is shown to already be at its current permit limit with current housing. STW have stated that these WwTWs are currently over performing in terms of the level of wastewater treatment provided, and this has been further backed up by the outcomes of the detailed assessments which showed that the improvements required would require advanced treatment technologies beyond what is considered within the water industry and by the Environment Agency to be conventional technology.

Despite the over performance of these WwTWs, solutions may still need to be identified by the Environment Agency and Severn Trent Water in order to accommodate growth in these locations to ensure that the increase in treated wastewater effluent discharged does not impact on the current quality of the receiving watercourses, their associated ecological sites and also to ensure that the watercourses can still meet with legislative requirements.

The WCS has concluded that the four partner authorities, the Environment Agency, and Severn Trent Water should work together to determine if potential solutions in the study area are acceptable and hence conclude when and how much development can be accommodated across the study area in the early phases of the Local Plan delivery period.

To ensure that the planned level of development within the plan period does not result in a negative impact upon wildlife both inside and outside of designated sites, it is recommended that policy is included within the Local Plans to ensure that these matters are addressed at a strategic level.

Water Supply Strategy

Based in the growth assessed, the WCS has concluded that, allowing for the planned resource management of STW's Strategic Grid Water Resource Zone, the study area would have adequate water supply to cater for growth over the plan period.

However, the WCS has identified that there are long term limitations on further abstraction from the raw water resources supplying the study area and that there is a drive to ensure the delivery of sustainable development for the study area as a whole. Hence there are key drivers requiring that water demand is managed in the study area for all new development in order to achieve long term sustainability in terms of water resources.

In order to reduce reliance on raw water supplies from rivers and aquifers, the WCS has set out ways in which demand for water as a result of development can be minimised without incurring excessive costs or resulting in unacceptable increases in energy use. In addition, the assessment has considered how far development in the study area can be moved towards achieving a theoretical 'water neutral' position i.e. that there is no net increase in water demand between the current use and after development across the plan period has taken place. A pathway for achieving neutrality as far as practicable has been set out, including advice on:

- what measures need to be taken technologically to deliver more water efficient development;
- what local policies need to be developed to set the framework for reduced water use through development control;
- how measures to achieve reduced water use in existing and new development can be funded; and
- where parties with a shared interest in reducing water demand need to work together to provide education and awareness initiatives to local communities to ensure that people and business in the study area understand the importance of using water wisely.

Five water neutrality scenarios have been proposed and assessed to demonstrate what is required to achieve different levels of neutrality in the study area. The assessment concluded that measures should be taken to deliver the first step on the neutrality pathway; the following initial measures are therefore suggested by the WCS:

- Ensure all housing is water efficient, with new housing development meets the mandatory national standard as set out in the Building Regulations;
- Carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings. Aim to move towards delivery of 15% of the existing housing stock, with easy fit water saving devices; and,
- Establish a programme of water efficiency promotion and consumer education, with the aim of behavioural change with regards to water use.

Water Cycle Study Recommendations and Policy

The WCS should also set out recommendations for what is required, when, and where in order to address any emerging issues from investigating the key questions. These recommendations must take account of the likely phasing of development, potential environmental impacts, and the availability of funding and future management arrangements.

In order to support the further development of each of the partner authorities Local Plan's with respect to water services infrastructure and the water environment; the WCS provides a site specific assessment of the potential constraints on each of the proposed major development sites.

It is recommended that policies are developed similar to those suggested below to include within each of the Local Plan documents:

WW1 – Development Phasing in the Finham (Coventry) WwTW catchment
It is recommended that a policy should be developed by NBBC, RBC and WDC that ensures that all development proposed to drain to Finham (Coventry) WwTW up to at least 2020, is only given planning permission if the Environment Agency and STW have indicated that they are satisfied that the development can be accommodated either within the limits of capacity at the WwTW or by sufficient capacity being made available and the requirements of the WFD will not be compromised.

WW2 – Development Phasing in the Churchover WwTW catchment
It is recommended that a policy is developed by RBC that requires all development proposed to drain to Churchover WwTW post 2021 to be subject to a developer enquiry1 with STW to determine process capacity at the WwTW before granting permission.

WW3 – Development Phasing in the Dunchurch WwTW catchment
It is recommended that a policy is developed by RBC that requires all development proposed to drain to Dunchurch WwTW post 2030 to be subject to a developer enquiry with STW to determine process capacity at the WwTW before granting permission.

WW4 – Development Phasing in the Hartshill (Nuneaton) WwTW catchment
It is recommended that once a housing trajectory has been prepared by NWBC, a policy is developed by NWBC and NBBC that requires all development proposed to drain to Hartshill (Nuneaton) WwTW to be subject to a developer enquiry with STW to determine process capacity at the WwTW before granting permission.

WW5 – Development Phasing in the Rugby Newbold WwTW catchment
It is recommended that a policy is developed by RBC that requires all development proposed to drain to Rugby Newbold WwTW post 2021 to be subject to a developer enquiry with STW to determine process capacity at the WwTW before granting permission.

WW6 – Development Phasing in Warton
It is recommended that once a housing trajectory has been prepared by NWBC, a policy is developed by NWBC that requires all development proposed to drain to Warton WwTW to be subject to a developer enquiry

WW7 – Development and Sewerage Network
It is recommended that a policy is developed for development at all sites, that they should be subject to a pre-planning enquiry with STW to determine upgrades needed to prior to planning permission being granted. Assessments made within this WCS consider each site in isolation and capacity will change depending on when and where sites come forward.

WS1 – Water Efficiency in new homes and buildings
In order to move towards a more 'water neutral position' and to enhance sustainability of development coming forward, a policy should be developed that ensures all housing is as water efficient as possible, and that new housing development should meet specific water use standards of 110 l/h/d in line with the Building Regulations optional requirement. Non-domestic building should as a minimum reach 'Good' BREEAM status.

WS2 – Water Efficiency Retrofitting
In order to move towards a more 'water neutral position', policy could be developed to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 20% of the existing housing stock with easy fit water savings devices under the Medium water neutrality scenario.

WS3 – Water Efficiency Promotion
It is recommended that a policy be developed to establish a programme of water efficiency promotion and consumer education, with the aim of behavioural change with regards to water use to go beyond the Medium water neutrality scenario.

SWM1 – Sewer Separation
Developers should ensure foul and surface water from new development and redevelopment are kept separate where possible. Surface water should be discharged as high up the following hierarchy of drainage options as reasonably practicable, before a connection to the foul network is considered:

- into the ground (infiltration);
- to a surface waterbody;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

Where sites which are currently connected to combined sewers are redeveloped, the opportunity to disconnect surface water and highway drainage from combined sewers must be taken.

[1] For a fee, STW undertake a combined assessment of capacity for both the water supply and sewerage network to accept new developments.

SWM2 – Above Ground Drainage
Developers should aspire to achieve 100% above ground drainage for all future developments, where feasible. Where this is not feasible due to for example housing densities, land take, ground conditions, topography, or other circumstances, the development proposals should maximise opportunities to use SuDS measures which require no additional land take, i.e. green roofs, permeable surfaces and water butts.

SWM3 – SuDS and Green Infrastructure
Developers should ensure linkage of SuDS to green infrastructure to provide environmental enhancement and amenity, social and recreational value. SuDS design should maximise opportunities to create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space.

SWM4 – SuDS and Water Efficiency
Developers should ensure linkage of SuDS to water efficiency measures where possible, including rainwater harvesting.

SWM5 – Linkages to SWMP and SFRA
Developers should ensure SuDS design supports the findings and recommendations of the Warwickshire Surface Water Management Plan (SWMP) and the appropriate partner authority's SFRA.

SWM6 – Water Quality Improvements
Developers should ensure, where possible, that discharges of surface water are designed to deliver water quality improvements in the receiving watercourse or aquifer where possible to help meet the objectives of the Water Framework Directive.

ECO1 – Biodiversity enhancement
It is recommended that each of the partner authorities include a policy in their Local Plans which commits to seeking and securing (through planning permissions etc.) enhancements to aquatic biodiversity within their administrative area through the use of SuDS (subject to appropriate project-level studies to confirm feasibility including environmental risk and discussion with relevant authorities) in line with the Warwickshire Green Infrastructure Strategy. .

1 Introduction

1.1 Background

The Warwickshire and Coventry region is expected to experience a significant increase in housing requirement and economic growth over the period to 2031. The latest Strategic Housing Market Assessment (SHMA) has indicated the need for 88,160 new dwellings within the associated Housing Market Area (HMA) consisting of Coventry, Rugby, North Warwickshire, Nuneaton & Bedworth, Stratford-on-Avon and Warwick.

The four neighbouring local authorities (herein referred to as the "Partner Authorities") of North Warwickshire Borough Council (NWBC), Nuneaton and Bedworth Borough Council (NBBC), Rugby Borough Council (RBC) and Warwick District Council (WDC) together form the WCS study area within the wider HMA.

Each of the partner authorities are in the process of updating their evidence base to support the production of their Local Plans and/or Core Strategies to plan for the projected level of future growth across the study area, as well as the shortfall in housing provision from the wider Warwickshire and Coventry region. This Water Cycle Study (WCS) forms an important part of the evidence base that will help to ensure that development does not have a detrimental impact on the water environment in the individual partner authorities within the study area. The WCS will also help to guide the development towards the most appropriate locations (with respect to water infrastructure and the water environment) to be identified in the respective partner authorities Local Plan's.

The objective of the WCS is to identify any constraints on planned housing growth that may be imposed by the water cycle. The WCS then identifies how these can be resolved i.e. by ensuring that appropriate Water Services Infrastructure (WSI) can be provided to support the proposed development. Furthermore, it should provide a strategic approach to the management and use of water which ensures that the sustainability of the water environment in the study area is not compromised.

1.2 WCS History

Water Cycle issues relevant to the partner authorities were previously reported in a Scoping and Outline Warwickshire Sub-Regional WCS[2] which was completed in March 2010.

The Scoping and Outline report assessed the baseline conditions of various elements of the water cycle across the study area, including the natural water environment and the capacity of the WSI that would be used to support growth. In addition, the WCS undertook a high level assessment of the likely growth in town locations and the proposed levels of growth, and determined where growth would be achievable within the existing capacity of both the infrastructure and the water environment at a strategic level. The WCS identified a number of key issues and constraints including environmental risks and the requirement for new WSI and upgrades to existing WSI.

Since the publication of the Scoping and Outline Report, key planning documents have been updated and published including the latest SHMA update, and as such the evidence upon which the 2010 Scoping and Outline Report conclusions and recommendations were founded have changed. An updated WCS was therefore required and is reported in this document. For reference, a list of relevant updated planning documents has been provided in Appendix A.

1.3 Study Governance

This WCS has been carried out with the guidance of the Steering Group established at the project inception meeting comprising the following organisations:

- North Warwickshire Borough Council;
- Nuneaton and Bedworth Borough Council;
- Rugby Borough Council;
- Warwick District Council;

[2] Warwickshire Sub-Regional Water Cycle Strategy, Scoping and Outline Final Report, Halcrow, 2010

- Severn Trent Water (STW); and,
- the Environment Agency.

1.4 WCS Scope

This WCS provides information at a level suitable to ensure that there are solutions to deliver growth for the preferred development allocations, including the policy required to deliver it.

The outcome is the development of a water cycle strategy for the study area which informs the partner authorities Local Plan's, sustainability appraisals and appropriate assessments specific to the water environment and WSI issues. This will need to be considered in bringing growth forward at various sites, including guidance for developers in conforming to the requirements of the strategy.

The following sets out the key objectives of the WCS for the study area:

- provide a strategy for wastewater treatment across the study area which determines if solutions to wastewater treatment are required and if the solutions are viable in terms of balancing environmental capacity with cost;
- describe how the wastewater treatment strategy might impact phasing of development;
- determine whether any Habitats Directive designated ecological sites have the potential to be impacted by the wastewater treatment strategy via a screening process;
- determine whether additional water resources, beyond those already planned by STW are required to support growth;
- determine upgrades required to water supply infrastructure relative to potential options for growth through collaboration with STW;
- consider whether growth can be delivered and achieve a 'neutral water use' condition;
- provide a pathway to achievement of water neutrality;
- provide detail on SuDS constraints for each growth location;
- update flood risk mitigation and environmental management measures specific to sites;
- determine impact of infrastructure and mitigation provision on housing delivery phasing; and
- provide policy recommendations.

1.5 Study Drivers

There are two key overarching drivers shaping the direction of the study as a whole:

- Deliver sustainable water management – ensure that provision of WSI and mitigation is sustainable and contributes to the overall delivery of sustainable growth and development; and
- Water Framework Directive (WFD) compliance – to ensure that growth, through abstraction of water for supply and discharge of treated wastewater, does not prevent waterbodies within the study area (and more widely) from achieving the environmental objectives required of them as set out in the WFD River Basin Management Plans (RBMPs).

A full list of the key legislative drivers shaping the study is detailed in a summary table in Appendix B for reference. However, it is important to note that the key driver for this study is WFD compliance.

Other relevant studies that have a bearing on the provision of water services infrastructure for development include, but are not limited to, the following key documents:

- Each of the partner authorities respective Strategic Flood Risk Assessments (SFRAs);
- STW's Water Resource Management Plan (WRMP);
- The Warwickshire, Coventry and Solihull Biodiversity Action Plan; and,
- The Warwickshire, Coventry and Solihull sub-regional Green Infrastructure Strategy.

1.6 Key Assumptions

1.6.1 Water Use and Household Occupancy Rate

For all wastewater and water supply assessments, an assumption was made on the likely use per new household going forward in the plan periods. A starting assumption of 129l/h/d (litres per head per day) and household occupancy rate of 2.3 people per dwelling has been agreed with STW to calculate water consumption per person.

It is acknowledged that this figure exceeds the current Building Regulations requirement of 125l/h/d for all new homes. However, in their asset planning STW will continue to assume this higher water use for new homes as their analysis has shown that even when homes are built to a standard of 125l/h/d, the average household use increases over time due to various factors. STW are required under their remit to the industry regulator OFWAT, to plan for the expected actual use. Therefore, it is important that conclusions made on infrastructure capacity within this study are consistent with STW planning strategies.

This study has also considered the effect of achieving lower average per person consumption on infrastructure capacity and the water environment to assist in developing policy that supports and helps lead to a lower per capita consumption.

1.6.2 Wastewater Treatment

As a wastewater treatment provider, STW are required to use the best available techniques (defined by the Environment Agency as the best techniques for preventing or minimising emissions and impacts on the environment) to ensure emission limit values stipulated within each Wastewater Treatment Works (WwTWs) permit conditions are met.

Through application of the best available techniques in terms of wastewater treatment, the reliable limits of conventional treatment (LCT) have been determined for Biochemical Oxygen Demand (BOD)[3], ammonia and phosphate, and are provided in Table 1-1.

Table 1-1 Reliable limits of conventional treatment technology for wastewater

Water Quality Parameter	LCT
Ammonia	1.0 mg/l 95 percentile limit[4]
BOD	5.0 mg/l 95 percentile limit[4]
Phosphate	0.5 mg/l annual average[5]

1.7 Report Structure

The first stage of this document (Section 2) outlines the total proposed number of dwellings which will need to be catered for in terms of water supply and wastewater treatment. Understanding the level of growth expected informs the second stage of the study (Section 3), assessing the current wastewater treatment network in regards to both capacity and compliance with legislation and environmental permits. The results of the assessment will identify the WwTW which are at capacity or have remaining capacity. The wider, supporting environment has also been considered, including climate change and local ecology.

In parallel to the wastewater assessment, Section 4 outlines water resource planning targets, discusses current and proposed efficiencies within the water network and introduces the concept of water neutrality.

The report also covers the proposed major development sites (defined as having more than 10 dwellings) in more detail (Section 5), assessing each site by identifying local receptors such as watercourses, outlining current and future flood risks (inclusive of surface water and groundwater flood risks) and assessing the current wastewater network.

Ultimately, recommendations have been made by the WCS (Section 6) in regards to wastewater, water supply, surface water management and flood risk, ecology and stakeholder liaison.

[3] Amount of oxygen needed for the biochemical oxidation of the organic matter to carbon dioxide in 5 days. BOD is an indicator for the mass concentration of biodegradable organic compounds
[4] Considered within the water industry to be the current LCT using best available techniques
[5] Environment Agency (2015) Updated River Basin Management Plans Supporting Information: Pressure Narrative: Phosphorus and freshwater eutrophication

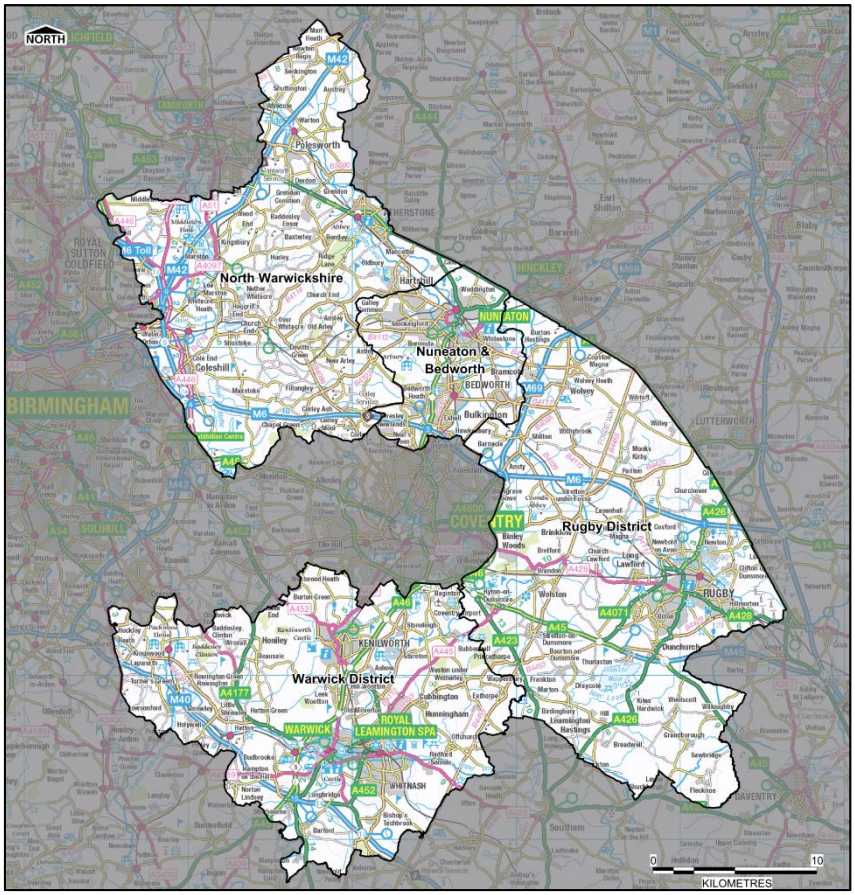
2 Proposed Growth

2.1 Preferred Growth Strategy

The purpose of the WCS is to assess the potential impact of increased development upon the water environment and WSI across the study area, including flood risk, surface water drainage, water resources, wastewater infrastructure and water quality and ecological issues. The increased development is to accommodate the minimum housing requirement for each of the partner authorities, the shortfall in housing provision from Coventry and Birmingham, and additional housing as a result of the economic uplift experienced across the wider region. This level of projected growth has required the partner authorities to revise their spatial approach of future expected development up to 2031. These growth figures therefore form the basis for the WCS.

Figure 2-1 shows the four partner authority administrative boundaries, which combined create the boundary of the sub region and WCS study area.

Figure 2-1 WCS Study Area (the Districts of North Warwickshire, Nuneaton & Bedworth, Rugby and Warwick)[6]



2.2 Housing

The total housing target to 2031 for the Coventry and Warwickshire region as identified in the Updated Assessment of Housing Need for Coventry and Warwickshire HMA is 88,160 new residential dwellings of which the total to be assessed as part of this WCS is 50,389 dwellings, which includes the Boroughs of North Warwickshire, Nuneaton & Bedworth, Rugby and the District of Warwick as illustrated in Figure 2-1.

The WCS incorporates all proposed major development sites[7] across the study area at differing stages of development, including;

[6] Contains OS data © Crown copyright and database right 2016

- Current allocations,
- Proposed allocations,
- Committed developments,
- Outstanding commitments, and
- Potential sites identified for development (alternative site options).

2.2.1 Completions and Outstanding Developments

The WCS acknowledges that since the beginning of the plan period in 2011, a number of dwellings which form part of the HMA housing requirement have already been built (completed). This WCS has assumed that wastewater flows from these properties are already accounted for in the measured flows at the WwTWs.

Table 2-1 provides a summary of dwellings completed between 2011 and June 2016 (i.e. prior to the commencement of the WCS) for each of the partner authorities. These dwellings contribute towards the housing requirements of each partner authority, but have not been included as part of the assessments within the WCS.

Table 2-1 Completed Dwellings (2011-16) per partner authority

Partner Authority	No. Dwellings
North Warwickshire Borough Council	*706*
Nuneaton & Bedworth Borough Council	1,986
Rugby Borough Council	2,201
Warwick District Council	2,102

2.2.2 North Warwickshire

The Borough lies within two housing market areas; Coventry & Warwickshire (C&W) HMA and Greater Birmingham & Black Country (GB & BC) HMA.

Under NWBC's Draft Local Plan[8], which sets out the strategy for growth within the Borough of North Warwickshire up to 2031, NWBC will be required to build the minimum housing requirement of 5,280 additional dwellings within the plan period. In addition to this minimum requirement, NWBC are also testing the potential delivery of up to a further 3,790 dwellings to cover the shortfall from the City of Birmingham as part of the GB & BC HMA. To date, 1,756 dwellings have been built within North Warwickshire since 2011.

Table 2-2 provides an overview of the number of dwellings still to be built within the plan period within major development sites (>10 dwellings) and therefore assessed as part of the WCS.

Table 2-2 NWBC Housing Allocations and Options

Type of Sites	No. Dwellings
Outstanding (with planning permission)	756
Current Allocations (Core Strategy 2014)	1,506
Proposed Draft Allocations (Draft Local Plan 2016)	5,430
Alternative Site Options	1,020
Total potential dwellings assessed	*8,712*

[7] Sites containing less than 10 dwellings are not considered major development sites and have therefore not been included for assessment as part of this WCS
[8] North Warwickshire Borough Council Draft Local Plan (August 2016)

2.2.3 Nuneaton & Bedworth

NBBC's Draft Borough Plan[9], which sets out the strategy for growth within the Borough of Nuneaton & Bedworth up to 2031, states that NBBC is required to deliver a minimum housing requirement of 14,060 dwellings within the plan period. To date, 1,986 dwellings have been built within Nuneaton & Bedworth since 2011.

Table 2-3 provides an overview of the number of dwellings still to be built within the plan period within major development sites (>10 dwellings) and therefore assessed as part of the WCS.

Table 2-3 NBBC Housing Allocations and Pipeline

Type of Sites	No. Dwellings
Strategic Allocations	9,306
Other Allocations	1,136
Housing in the Pipeline	
with Full Planning Permission	1,418
with Outline Planning Permission or Prior Notification	947
Total potential dwellings assessed	*12,807*

2.2.4 Rugby

RBC's emerging Local Plan[10], which sets out the strategy for growth within the Borough of Rugby between 2011 and 2031, states that RBC is required to deliver a minimum housing requirement of 12,400 dwellings within the plan period. To date, 2,201 dwellings have been built within Rugby since 2011.

Table 2-4 provides an overview of the number of dwellings still to be built within the plan period within major development sites (>10 dwellings) and therefore assessed as part of the WCS.

Table 2-4 RBC Housing Commitments and Allocations

Type of Sites	No. Dwellings
Committed Sites	5,563
Proposed Allocations	3,830
New Settlements	825
Sites <10 Dwellings	-70
Total potential dwellings assessed	*10,745*

2.2.5 Warwick

The Proposed Modifications[11] to WDC's Draft Local Plan[12] sets out the strategy for growth within the District of Warwick between 2011 and 2029 and states WDC is required to deliver a minimum housing requirement of 16,776 dwellings within the plan period. The Objectively Assessed Housing Need (OAHN) for the District as identified in the SHMA update has been extended to 18,640 dwellings. This is due to the current Draft Local Plan which only extends to 2029, hence an additional two years of the annual average housing trajectory of 932 dwellings has been added). To date, 2,102 dwellings have been built within Warwick since 2011.

Table 2-5 provides an overview of the number of dwellings to be built within the plan period within major development sites (>10 dwellings) and therefore assessed as part of the WCS.

[9] Nuneaton and Bedworth Borough Council Draft Borough Plan (2015)
[10] Rugby Borough Council Local Plan - Preferred Options (December 2015)
[11] Table of Proposed Modifications to the Publication Draft Local Plan (January 2016)
[12] Warwick District Local Plan (April 2014)

Table 2-5 WDC Housing Commitments and Allocations

Type of Sites	No. Dwellings
Committed Sites	1,828
Housing Allocations	
with Full Planning Permission	658
with Outline Planning Permission or Reserved Matters	4,308
Other Allocations	7,630
Total potential dwellings assessed	*14,424*

2.3 Employment

The WCS also takes account of the projected increase in employment across the study area up to 2031; a total of approximately 22,500 new jobs. Table 2-6 provides a summary of the employment figures within the study area to be assessed.

A percentage of the projected employment growth for each partner authority has been assigned to each of the respective partner authority's allocated employment, based on the size (hectare) of each site (i.e. the larger the site, the greater the proportion of full time employment jobs allocated).

Table 2-6 Employment growth across the study area

Partner Authority	Employment Growth 2014 - 2031[13] (No. Full Time Employment)	Total Employment Land Area (ha)	No. Employment sites
North Warwickshire	3,000	87	8
Nuneaton & Bedworth	4,800	111	8
Rugby	4,800	59	3
Warwick	9,900	260	4

[13] GL Hearn (2015) Updated Assessment of Housing Need: Coventry-Warwickshire HMA

3 Wastewater Treatment Assessment

3.1 Wastewater Treatment Assessment Approach

An increase in residential and employment growth will have a corresponding increase in the volume and flow of wastewater generated within the study area and hence it is essential to consider:

- Whether there is sufficient capacity within existing treatment facilities (WwTWs) to treat the additional wastewater;
- What new infrastructure is required to provide for the additional wastewater treatment; and,
- Whether waterbodies receiving the treated flow can cope with the additional flow without affecting water quality.

There are therefore two elements to the assessment of existing capacity (and any solutions required) with respect to wastewater treatment:

- The capacity of the infrastructure itself to treat the wastewater (infrastructure capacity); and,
- The capacity of the environment to sustain additional discharges of treated wastewater (environmental capacity).

3.1.1 Wastewater Treatment in the study area

Wastewater treatment in the study area is provided via several WwTWs operated and maintained by STW, all of which discharge to surface watercourses. Each of these WwTWs is fed by a network of wastewater pipes (the sewerage system) which drains wastewater generated by property to the treatment works; this is defined as the WwTWs 'catchment'.

3.1.2 Management of WwTW Discharges

All WwTWs are issued with a permit to discharge by the Environment Agency, which sets out conditions on the maximum volume of treated flow that it can discharge and also limits on the quality of the treated flow. These limits are set in order to protect the water quality and ecology of the receiving waterbody. They also dictate how much flow can be received by each WwTW, as well as the type of treatment processes to be used at the WwTWs.

The volume element of the discharge permit determines the maximum number of properties that can be connected to a WwTW catchment. When discharge permits are issued for the first time, they are generally set with a volume 'freeboard', which acknowledges that allowance needs to be made for additional connections. This allowance is termed 'permitted headroom'. The quality conditions applied to the discharge permit are derived to ensure that the water quality of the receiving waterbody is not adversely affected, even when the maximum amount of flow is discharged. For the purposes of this WCS, a simplified assumption is applied that the permitted headroom is usable and would not affect downstream water quality. This headroom therefore determines how many properties can be connected to the WwTW before a new discharge permit would need to be issued (and hence how many properties can connect without significant changes to the treatment infrastructure).

When a new discharge permit is required, an assessment needs to be undertaken to determine what new quality conditions would need to be applied to the discharge. If the quality conditions remained unchanged, the increase in flow would result in an increase in total load of some substances being discharged to the receiving waterbody. This may have the effect of deteriorating water quality and hence in most cases, an increase in permitted discharge flow results in more stringent (or tighter) conditions on the quality of the discharge. The requirement to treat to a higher level may result in an increase in the intensity of treatment processes at the WwTWs which may also require improvements or upgrades to be made to the WwTW to allow the new conditions to be met.

In some cases, it may be possible that the quality conditions required to protect water quality and ecology are beyond that which can be achieved with conventional treatment processes and as a result, this WCS assumes that a new solution would be required in this situation to allow growth to proceed.

The primary legislative driver which determines the quality conditions of any new permit to discharge are the WFD and the Habitats Directive (HD) as described in the following subsections.

3.1.3 WFD Compliance

The overall requirement of the WFD is that all waterbodies in the UK must achieve "good status". The definition of a waterbody's 'status' is a complex assessment, that combines standards for water quality with standards for hydromorphology (i.e. habitat and flow quality) with ecological requirements.

The two key aspects of the WFD relevant to the wastewater assessment in this WCS are the policy requirements that:

- Development must not cause a deterioration in status of a waterbody[14]; and
- Development must not prevent future attainment of a waterbody's 'target status', hence it is not acceptable to allow an impact to occur just because other impacts are causing the status of a water body to already be less than its target.

Where permitted headroom at a WwTW would be exceeded by proposed levels of growth, a water quality modelling assessment has been undertaken to determine the quality conditions that would need to be applied to the new permit to ensure the two policy requirements of the WFD are met. The modelling process (assumptions and modelling tools) is described in detail in Appendix C.

3.1.4 Habitats Directive

The Habitats Directive and the Habitats Regulations has designated some sites as areas that require protection in order to maintain or enhance the rare ecological species or habitat associated with them. A retrospective review process has been on-going since the translation of the Habitats Directive into the UK Habitats Regulations called the Review of Consents (RoC). The RoC process requires the Environment Agency to consider the impact of the abstraction licences and discharge permit it has previously issued on sites which became protected (and hence designated) under the Habitats Regulations.

If the RoC process identifies that an existing licence or permit cannot be ruled out as having an impact on a designated site, then the Environment Agency are required to either revoke or alter the licence or permit. As a result of this process, restrictions on some discharge permits have been introduced to ensure that any identified impact on downstream sites is mitigated. Although the Habitats Directive does not directly stipulate conditions on discharge, the Habitats Regulations can, by the requirement to ensure no detrimental impact on designated sites, require restrictions on discharges to (or abstractions) from water dependent habitats that could be impacted by anthropogenic manipulation of the water environment.

Where permitted headroom at a WwTW would be exceeded by proposed levels of growth, a Habitats Regulations assessment exercise has been undertaken in this WCS to ensure that Habitats Directive sites which are hydrologically linked to watercourses receiving wastewater flows from growth would not be adversely affected. The scope of this assessment also includes non-Habitats Directive sites such as nationally designated Sites of Special Scientific Interest (SSSI) and Local Nature Reserves (LNRs). This assessment is reported in Section 3.4 of this chapter (Ecological Appraisal).

3.1.5 Assessment Methodology Summary

A stepped assessment approach has been developed for the WCS to determine the impact of the proposed growth on wastewater treatment capacity and the environmental capacity of the receiving watercourse. The assessment steps are outlined below:

Phase 1

i. Determine the amount of growth draining to each WwTW and calculate the additional flow generated;

ii. Calculate available headroom at each WwTW;

iii. Determine whether the growth can be accommodated within existing headroom;

Phase 2

iv. For those WwTWs where headroom is exceeded, calculate what quality conditions need to be put in place to meet the two key objectives of the WFD to ensure:

- No deterioration in receiving watercourse from its current WFD status; and,
- Future target status is not compromised by growth.

v. Determine whether any quality conditions required to meet WFD objectives would be beyond the limits of conventional treatment for WwTWs;

[14] i.e. a reduction 'High' status to 'Good' status as a result of a discharge would not be acceptable, even though the overall target of good status as required under the WFD is still maintained

vi. Where the conditions are achievable, indicate where infrastructure upgrades are required to be undertaken by STW, to meet the new permit conditions and phasing implications of these upgrades;

vii. Where the conditions are not achievable, indicate where there are alternative solutions for treatment in that catchment which would need to be perused by STW; and,

viii. Undertake an ecological site screening assessment to determine if any Habitats Directive (or other nationally or locally) designated sites are likely to be affected.

In order to complete the above steps, the following assessment techniques were developed (details of the procedures can be found in Appendix C);

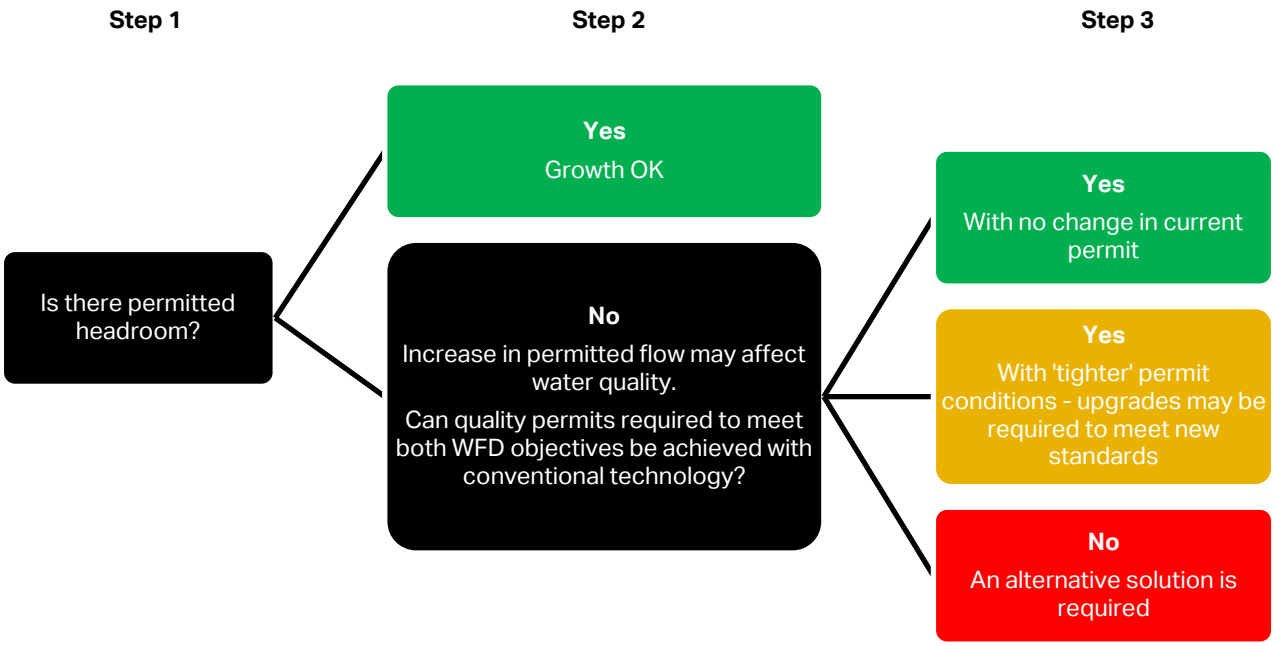
- A headroom calculation spreadsheet was developed; and,
- A water quality modelling procedure was agreed with the Environment Agency using Environment Agency software (RQP) designed for determining discharge permit conditions.

3.1.6 Assessment Results Overview

The results for each WwTW are presented in a Red/Amber/Green (RAG) Assessment for ease of planning reference. The RAG code refers broadly to the following categories and the process is set out in Figure 3-1.

- Green – WFD objectives will not be adversely affected. Growth can be accepted with no changes to the WwTW infrastructure or permit required.
- Amber – in order to meet WFD objectives, changes to the discharge permit are required, and upgrades may be required to WwTW infrastructure which may have phasing implications;
- Red - in order to meet WFD objectives changes to the discharge permit are required which are beyond the limits of what can be achieved with conventional treatment. An alternative solution needs to be sought.

Figure 3-1: RAG Assessment Process Diagram for Wastewater treatment capacity



3.2 WwTW Headroom Assessment

The assessment results are presented in this section and have been reported in the following order;

- Further detail on WwTW catchments where growth can be accepted within the current permitted flow headroom have been reported together in Section 3.2.1;
- Further detail on those WwTWs requiring a new discharge permit and hence a water quality assessment have been reported in Section 3.2.2 and 3.3.

3.2.1 WwTW with Permitted Headroom (Phase 1)

The volume of wastewater, measured as Dry Weather Flow (DWF), which would be generated from the proposed housing and employment growth over the plan period within each WwTW catchment has been calculated and compared to the treatment capacity at each WwTW. DWF is defined within the wastewater industry as the average daily flow to a WwTWs during seven consecutive days without rain (excluding public holidays) following seven days during which rainfall did not exceed 0.25 millimetres on one day.

Table 3-1 details the WwTW where existing permitted headroom is sufficient to accommodate all of the proposed growth and hence no infrastructure upgrades are required to deliver the proposed growth levels in these locations.

Growth in these catchments would not deteriorate water quality, or increase flood risk and hence there is no barrier to delivering the proposed growth levels. These catchments are Green in the RAG assessment and have not been assessed further.

Table 3-1 also includes information on how many additional homes could be connected before the headroom would be exceeded to inform each of the potential variations to the partner authority's spatial strategies. However, it should be noted that this WCS and therefore the wastewater assessment for Coleshill, Finham, Minworth and Tamworth WwTWs does not take account of existing populations and growth which are located outside of the study area, but are served by these WwTWs, and will significantly impact infrastructure capacity at these WwTWs. Growth within the study area which affects these WwTWs is relatively small and in isolation is unlikely to cause infrastructure constraints.

Table 3-1 WwTW with permitted flow headroom capacity

WwTW Catchment	District	Quantity of proposed and planned dwellings	Future 2031 DWF after Growth (m^3/d)	Headroom Assessment after Growth (2031)	
				Headroom Capacity (m^3/d)	Approx. Residual Housing Capacity[15]
Bedworth (Marston Lane)	Nuneaton & Bedworth	170	1,900	**1,000**	**3,600**
Bramcote	Rugby	100	550	**140**	**500**
Brinklow	Rugby	100	200	**70**	**250**
Bulkington	Nuneaton & Bedworth	1,000	1,600	**200**	**800**
Church Lawford	Rugby	23	70	**10**	**40**
Coleshill	North Warwickshire	1,170	64,400	**600**	**2,150**
Grendon	North Warwickshire	1,230	1,300	**200**	**700**
Hurley	North Warwickshire	40	600	**90**	**300**
Leek Wooton	Warwick	130	200	**10**	**30**

[15] Based on an Occupancy rate of 2.3 and consumption rate of 129 l/h/d

WwTW Catchment	District	Quantity of proposed and planned dwellings	Future 2031 DWF after Growth (m^3/d)	Headroom Assessment after Growth (2031)	
				Headroom Capacity (m^3/d)	Approx. Residual Housing Capacity[15]
Minworth[16]	North Warwickshire	140	388,000	**62,000**	**212,000**
Norton Green	Warwick	20	2,700	**440**	**1,500**
Polesworth	North Warwickshire	1,240	1,9040	**660**	**2,260**
Rowington	Warwick	70	400	**100**	**350**
Tamworth[17]	North Warwickshire	1,260	17,700	**6,200**	**21,100**
Warwick (Longbridge)	Warwick	10,790	34,300	**1,680**	**5,800**
Wolston	Rugby	165	1,050	**280**	**950**

3.2.2 WwTW without Permitted Headroom (Phase 2)

The calculations of flow headroom capacity found that seven WwTWs would not have sufficient headroom once all the growth within the WwTW catchment is accounted for as detailed in Table 3-2.

Table 3-2 WwTW without permitted flow headroom capacity

WwTW Catchment	District	Quantity of proposed and planned dwellings	Future 2031 DWF post-Growth (m^3/d)	Headroom Assessment post-Growth (2031)	
				Headroom Capacity (m^3/d)	Approx. Residual Housing Capacity[15]
Atherstone	North Warwickshire	2,110	4,000	**-90**	**-300**
Churchover	Rugby	165	70	**-3**	**-10**
Dunchurch	Rugby	960	1,100	**-60**	**-45**
Finham (Coventry)[18]	Nuneaton & Bedworth, Rugby and Warwick	7,690	121,100	**-6,100**	**-20,300**
Hartshill (Nuneaton)	North Warwickshire	10,540	24,600	**-2,000**	**-6,700**
Rugby Newbold	Rugby	9,170	23,100	**-1,500**	**-5,200**
Warton	North Warwickshire	150	200	**-30**	**-100**

To ensure that the increase in permitted flow required to serve the proposed growth would not impact on downstream WFD requirements, water quality modelling has been undertaken for the WwTWs listed in Table 3-2 to determine whether theoretically achievable quality conditions can be applied to a revised volumetric discharge permit in order to meet the WFD objectives of the receiving waterbody.

[16] Located outside of the study area and predominantly serves the population of Birmingham and surrounding parts of the West Midlands
[17] Located outside of the study area and also serves the population of Tamworth
[18] Also serves the population of the City of Coventry

The results of the water quality modelling are provided in Section 3.3, with detailed results from the modelling provided in Appendix C.

3.3 Water Quality Modelling (Phase 2)

The WwTWs which have been identified as having no permitted flow headroom all discharge to freshwater, inland waterbodies. Therefore, statistical based water quality modelling has been performed to check for compliance with the WFD objectives in terms of permit conditions for ammonia and phosphate. Load standstill calculations have been used to determine the future permit conditions for BOD. This approach follows Environment Agency guidelines and best practice.

A summary of the results and proposed infrastructure upgrades required are included in the following subsections for each of the WwTWs which have been identified as having no permitted flow headroom or are close to their permitted flow headroom capacity (Table 3-2). Under each WwTW, the following sub-headings are used;

- Environmental Baseline,
- WFD Compliance,
- Upgrade Requirements,
- Phasing of Upgrades, and
- RAG Assessment.

3.3.1 Atherstone WwTW

The 2010 Outline and Scoping WCS indicated that Atherstone WwTW had no hydraulic capacity, but that STW had a proposed scheme in Asset Management Plan 5 (AMP5)[19] to upgrade the WwTW to accommodate 900 additional dwellings.

Currently, the WwTW has available flow headroom in its existing discharge permit and can accept growth of approximately 1,800 dwellings, after which the discharge permit will be exceeded. Unless additional headroom can be made available at the WwTWs after 1,800 dwellings, any further growth draining to the WwTW would result in the existing volumetric permit condition to be exceeded, by a total volume of approximately 90m^3/d (equivalent to approx. 300 dwellings) by the end of the plan period.

Environmental Baseline
Atherstone WwTW discharges to a tributary of the River Anker. The River Anker currently has an overall waterbody status of 'Moderate', with the objective to reach 'Good' status by 2027. Its current overall status is limited to Moderate due to the Moderate status of invertebrates, macrophytes & phytobenthos and the Poor status of phosphate. The current status for ammonia and BOD is High.

WFD Compliance
Results from the modelling based on current wastewater flows have shown that in order to maintain the current quality of the River Anker, the ammonia permit condition on discharge quality should theoretically be tighter than it currently is, irrespective of growth. The calculations show that the permit conditions should currently be set at less than 1mg/l for ammonia[20], beyond the limits of conventional treatment.

These results suggest that Atherstone WwTW is currently treating discharge to a higher standard than the current discharge permit conditions, in terms of ammonia. If it was performing more frequently at, or closer to, the limits of the current ammonia permit conditions (i.e. a lower standard of treatment), the current downstream water quality would be expected to be much lower than it currently is, and would have deteriorated from the current status.

A second phase of modelling has subsequently been undertaken, taking into account the increased wastewater flows from the proposed growth within the WwTW catchment. These modelling results also demonstrate the requirement for a tighter ammonia permit condition of less than 1mg/l. The BOD permit condition should also be tighter[21] but this is considered to be within the limits of conventional treatment. The phosphate permit condition would not require any changes.

A third phase of modelling has assessed the impact of growth on preventing future 'Good' Ecological status being reached in the River Anker by 2027. Currently the status for the phosphate sub-element of this waterbody is set at

[19] Investment programme from April 2010 to 2015
[20] Currently at 6mg/l in the existing permit
[21] Currently at 20mg/l in the existing permit

'Poor', resulting in the waterbody not currently achieving 'Good' status. BOD and ammonia both have a status of 'High' and would remain at this status assuming the permit limits required to ensure no deterioration in status are met.

Reasons for not achieving good status (RNAGs) are outlined in the Humber RBMP. The RNAGs specific to the River Anker have been extracted, and those with relevance to development and phosphate have been provided in Table 3-3 below.

Table 3-3 Reasons for not achieving good status on the River Anker (GB104028046430) 2014

Category	Activity	Certainty (that activity is RNAG)	Classification Element	Objective
Agriculture and rural land management	Mixed agricultural	Suspected	Phosphate	Good by 2027
Urban and transport	Drainage - mixed			
Water Industry	Sewage discharge (continuous)			

The River Anker currently has high phosphorous concentrations attributable to surrounding agricultural land uses, drainage from urban areas and point sources of wastewater discharge.

The modelling has shown that a new phosphate permit condition may be required to ensure the River Anker achieves 'Good' status for phosphate in the future; however, the modelling shows that this would be required with current discharge volumes (i.e. before growth is considered). The following section outlines the possible options of upgrade requirements which could be implemented to ensure growth does not prevent future 'Good' status for phosphate being achieved.

Upgrade Requirements

The existing permit (i.e. not inclusive of growth) requires changes to the **phosphate** condition and process upgrades to ensure Good phosphate status could be achieved in the future. The requirement to change the ammonia, BOD and phosphate conditions for the new permit would require process upgrades at Atherstone WwTW by the time approximately 1,800 dwellings are built within the WwTW catchment.

The existing permit also requires changes to the **ammonia** condition and process upgrades to ensure there is no deterioration from current status. Modelling has determined that the existing ammonia permit condition would need to be equivalent to 0.2 mg/l to maintain the existing status of the River Anker. The results therefore suggest that the WwTWs is treating discharge to a higher standard than the existing permit conditions for ammonia.

Over performance of a WwTW does occur, as the WwTW will have been designed with a future design load in mind, leaving capacity for growth. In addition, the WwTW will be designed to accommodate high flows and low temperatures during winter when biological treatment processes are less efficient. This means during higher temperature periods and/or lower flow periods, there will be excess treatment capacity. Consequently, the current level of treatment at the WwTW has proved to be sufficient to maintain the current status of the receiving watercourse, and with upgrades the WwTW should be able to continue treating to this higher standard.

By the end of the plan period, the **BOD** permit condition would require tightening to 17 mg/l to maintain the existing status of the River Anker. The phosphate permit would require tightening to 0.5mg/l to ensure future Good phosphate status of the River Anker can be achieved. To achieve these tighter permit conditions, current conventional treatment technologies would be sufficient but would need to be implemented by STW at some point in the future.

In addition, there is currently a programme of phosphate reduction trials by water companies in the UK, testing whether there are technologies that can reduce phosphate at WwTWs to around 0.1 mg/l, with results due to be published in spring 2017. STW is in the process of trialling six technologies[22] for WwTWs in its region and once results of these trials have been published a potential scheme to address this problem could be implemented at the Atherstone WwTW should a limit of 0.5mg/l prove to be insufficient to ensure future 'Good' status.

Phasing of Upgrades

Although STW have stated that there are no land or other constraints preventing expansion at the WwTW, funding for these upgrades may not be available until AMP7[23] . STW's approach to wastewater treatment asset management requires that sufficient certainty is given that the quantum of development will proceed before improvements to WwTW assets can be justified and funding sought.

[22] http://utilityweek.co.uk/news/severn-trent-trials-six-technologies-to-reduce-phosphorus/1240692#.V9vSf_krJaQ
[23] STW have indicated that this WwTW has been identified for a potential upgrade scheme in AMP7 (2020 and 2025).

The information provided in this WCS represents the first stage of providing development information, and can be used by STW to ensure the provision of additional capacity is planned in their investment programme and to ensure development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

There is a high level of certainty that Atherstone WwTW has sufficient headroom capacity to accept the majority of growth, with a low level of uncertainty associated to the latter phases of development within the WwTW catchment where the current DWF permit is predicted to be exceeded by a flow of approximately 30m^3/d; relative to the size of the current DWF permit, this flow exceedance is very small.

In addition, WwTWs are designed with a future design load in mind, allowing for some treatment capacity to accommodate growth. WwTWs are also designed to accommodate the high flows and low temperatures during the winter period when biological treatment processes are less efficient. This means during higher temperature periods and/or lower flow periods, there will be excess treatment capacity. Subsequently, it may be possible to improve the current discharge quality in terms of BOD and ammonia in the short term without the need for upgrades or expansion of the WwTWs.

RAG Assessment

RAG Assessment – Atherstone WwTW
The growth in the Atherstone WwTW catchment is given an Amber status to demonstrate that a potential constraint exists and a solution to upgrade treatment processes within the limits of conventional treatment will be required to ensure growth can be delivered without compromising WFD objectives.

The timing of when this solution will be required cannot be determined until detailed information on NWBC's housing trajectory is known. The upgrades are not likely to be required until AMP7, therefore funding for the upgrades is not required immediately and can be planned for by STW as certainty around the quantum of development increases.

3.3.2 Churchover WwTW

Churchover WwTW currently has available flow headroom in its existing discharge permit and can accept growth of approximately 150 dwellings, after which the discharge permit will be exceeded. Unless additional headroom can be made available at the WwTWs after 150 dwellings, any further growth draining to the WwTW would result in the existing volumetric permit condition to be exceeded, by a total volume of approximately 3m^3/d (equivalent to approx. 10 dwellings) by the end of the plan period.

Environmental Baseline
Churchover WwTW discharges to the River Swift. The River Swift currently has an overall waterbody status of 'Moderate', with the objective to reach 'Good' status by 2027. Its current overall status is limited to Moderate due to the Moderate status of macrophytes & phytobenthos and the Poor status of phosphate. The current status for ammonia and BOD is High.

WFD Compliance
Modelling results demonstrate that in order to maintain the current quality of the River Swift, the BOD permit condition on discharge quality should theoretically be tighter[24], and is considered to be within the limits of conventional treatment.

The ammonia permit condition would not require any changes, and whilst the WwTW does not currently have a phosphate permit condition, even with growth the modelling results demonstrate the required permit conditions would not be stringent and therefore unlikely to be required.

A second phase of modelling has assessed the impact of growth on preventing future 'Good' Ecological status being reached in the River Swift by 2027. Currently the status for the phosphate sub-element of this waterbody is set at 'Poor', resulting in the waterbody not currently achieving 'Good' status. BOD and Ammonia both have a status of 'High' and would remain at this status assuming the permit limits required to ensure no deterioration in status are met.

The RNAGs, as outlined in the Severn RBMP, specific to the River Swift have been extracted, and those with relevance to development and phosphate, have been provided in Table 3-4 below.

[24] Currently at 25mg/l in the existing permit

Table 3-4 Reasons for not achieving good status on the River Swift (GB109054043940) 2014

Category	Activity	Certainty (that activity is RNAG)	Classification Element	Objective
Agriculture and rural land management	Dairy/beef field	Probable	Phosphate	Good by 2021
Water Industry	Sewage discharge (continuous)			
Water Industry	Sewage discharge (continuous)	Probable	Macrophytes and Phytobenthos Combined	Good by 2027

The River Swift currently has high phosphorous concentrations attributable to surrounding agricultural land uses and point sources of wastewater discharge. The high nutrient concentration as a result of these activities has also had an impact on the biological quality of the waterbody, specifically on the macrophytes and phytobenthos communities, preventing the waterbody from achieving 'Good' Ecological status.

The latest Severn RBMP identifies specific measures relevant to the River Swift (GB109054043940) and other WwTWs located in the waterbody catchment, stating that additional treatment to reduce concentrations of phosphate from these WwTWs will be implemented in 2020 to address the RNAGs listed in Table 3-4.

The modelling has shown that a new phosphate permit condition may be required to ensure the River Swift achieves 'Good' status for phosphate in the future; however, the modelling shows that this would be required with current discharge volumes (i.e. before growth is considered). Therefore, the assessed growth would not prevent future 'Good' phosphate status from being met.

Upgrade Requirements

The requirement to change the BOD condition for the new permit is likely to require process upgrades at Churchover WwTW by the time approximately 150 dwellings are built within the WwTW catchment, or up to and including 2021 (in line with the Severn RBMP measures stated). STW have stated that there is limited quality headroom available due to the final effluent performance, and that the concern for development will be sensitive to the size of the development proposed.

By the end of the plan period, the **BOD** permit condition would require tightening to 8mg/l or less to maintain the existing status of the River Swift. The **phosphate** permit would require tightening to 4mg/l to ensure future Good phosphate status of the River Swift can be achieved. To achieve these tighter permit conditions, current conventional treatment technologies would be sufficient but would need to be implemented by STW at some point in the future.

Phasing of Requirements

Although STW have stated that there are no land or other constraints preventing expansion at the WwTW, funding for these upgrades may not be available until AMP7[25] . STW's approach to wastewater treatment asset management requires that sufficient certainty is given that the quantum of development will proceed before improvements to WwTW assets can be justified and funding sought.

The information provided in this WCS represents the first stage of providing development information, and can be used by STW to ensure the provision of additional capacity is planned into their investment programme (into AMP7) and to ensure development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

RAG Assessment

RAG Assessment – Churchover WwTW

The growth in the Churchover WwTW catchment is given an Amber status to demonstrate that a potential constraint exists and a solution to upgrade treatment processes within the limits of conventional treatment may be required from 2021 to ensure growth can be delivered without compromising WFD objectives. As the upgrades would not be required until the beginning of AMP7, funding for the upgrades is not required immediately and can be planned for by STW as certainty on the quantum of development increases.

[25] Investment programme from April 2020 to 2025

3.3.3 Dunchurch WwTW

Dunchurch WwTW currently has available flow headroom in its existing discharge permit and can accept growth of approximately 900 dwellings, after which the discharge permit will be exceeded. Unless additional headroom can be made available at the WwTWs after 900 dwellings, any further growth draining to the WwTW would result in the existing volumetric permit condition to be exceeded, by a total volume of approximately 60m^3/d (equivalent to approx. 45 dwellings) by the end of the plan period.

Environmental Baseline
Dunchurch WwTW discharges to the Thurlaston Brook, a tributary of the River Leam. The River Leam currently has an overall waterbody status of 'Moderate', with the objective to reach 'Good' status by 2027. Its current overall status is limited to Moderate due to the Moderate status of macrophytes & phytobenthos and the Poor status of phosphate. The current status for ammonia and BOD is High.

WFD Compliance
Results from the modelling based on current wastewater flows have shown that in order to maintain the current quality of the River Leam, the ammonia permit condition should theoretically be tighter than it currently is, irrespective of growth. The calculations show that the permit conditions should currently be set at less than 1mg/l for ammonia[26], beyond the limits of conventional treatment.

These results suggest that Dunchurch WwTW is currently treating discharge to a higher standard than the current discharge permit conditions, in terms of ammonia. If it was performing more frequently at, or closer to, the limits of the current permit conditions (i.e. a lower standard of treatment), the current downstream water quality would be expected to be much lower than it currently is, and would have deteriorated from the current status.

A second phase of modelling has subsequently been undertaken, taking into account the increased wastewater flows from the proposed growth within the WwTW catchment. These modelling results also demonstrate the requirement for a tighter ammonia permit condition of less than 1mg/l. The BOD permit condition should also be tighter[27], but this is considered to be within the limits of conventional treatment. The phosphate permit condition would not require any changes.

A third phase of modelling has assessed the impact of growth on preventing future 'Good' Ecological status being reached in the River Leam by 2027. Currently the status for the phosphate sub-element of this waterbody is set at 'Poor', resulting in the waterbody not currently achieving 'Good' status. BOD and ammonia both have a status of 'High' and would remain at this status assuming the permit limits required to ensure no deterioration in status are met.

The RNAG, as outlined in the Severn RBMP, specific to the River Leam have been extracted, and those with relevance to development and phosphate have been provided in Table 3-5 below.

Table 3-5 Reasons for not achieving good status on the River Leam (GB109054044130) 2014

Category	Activity	Certainty (that activity is RNAG)	Classification Element	Objective
Agriculture and rural land management	Mixed agricultural	Probable	Phosphate	Good by 2021
Water Industry	Sewage discharge (continuous)			
Agriculture and rural land management	Mixed agricultural	Probable	Macrophytes and Phytobenthos Combined	Good by 2027
Water Industry	Sewage discharge (continuous)			

The River Leam currently has high phosphorous concentrations attributable to surrounding agricultural land uses and point sources of wastewater discharge. The high nutrient concentration as a result of these activities has also had an impact on the biological quality of the waterbody, specifically on the macrophytes and phytobenthos communities, preventing the waterbody from achieving 'Good' Ecological status.

The modelling has shown that a new phosphate permit condition may be required to ensure the River Leam achieves 'Good' status for phosphate in the future; however, the modelling shows that this would be required with current

[26] Currently at 5mg/l in the existing permit
[27] Currently at 10mg/l in the existing permit

discharge volumes (i.e. before growth is considered). Therefore, the assessed growth would not prevent future 'Good' phosphate status from being met.

The latest Severn RBMP identifies a specific measure relevant to the River Leam (GB109054044130) and Dunchurch WwTW, stating that additional treatment to reduce concentrations of phosphate from the WwTW will be implemented in 2020 to address the RNAGs listed in Table 3-5.

Upgrade Requirements

The requirement to change the ammonia and BOD conditions for the new permit is likely to require process upgrades at Dunchurch WwTW by the time approximately 900 dwellings (up to year 2030) are built within the WwTW catchment.

The existing permit also requires changes to the **ammonia** condition and process upgrades to ensure there is no deterioration from current status. Modelling has determined that the existing ammonia permit condition would need to be equivalent to 0.5 mg/l to maintain the existing status of the River Leam. The results therefore suggest that the WwTWs is treating discharge to a higher standard than the current permit conditions for ammonia.

Over performance of a WwTW does occur, as the WwTW will have been designed with a future design load in mind leaving capacity for growth. In addition, the WwTW will be designed to accommodate high flows and low temperatures during winter when biological treatment processes are less efficient. This means during higher temperature periods and/or lower flow periods, there will be excess treatment capacity. Consequently, the current level of treatment at the WwTW has proved to be sufficient to maintain the current status of the receiving watercourse, and with upgrades the WwTW should be able to continue treating to this higher standard.

By the end of the plan period, the **BOD** permit condition would require tightening to 7 mg/l or less to maintain the existing status of the River Anker. To achieve this tighter permit condition, current conventional treatment technologies would be sufficient.

Phasing of Upgrades

STW have stated that there are no land or other constraints preventing expansion at the WwTW, and have confirmed that the WwTW is subject to investment in AMP6[28] to address quality issues and increase treatment capacity.

The major development site which has the most impact on this WwTW is the proposed new settlement consisting of approximately 825 dwellings (to be built between 2020 and 2031) located at Lodge Farm in the district of Rugby. The currently undeveloped site is not connected to the sewer network, but STW state that wastewater from this site would be pumped to Dunchurch WwTW. STW's approach to wastewater treatment asset management requires that sufficient certainty is given that the quantum of development will proceed before improvements to WwTW assets can be justified and funding sought.

The information provided in this WCS represents the first stage of providing development information, and can be used by STW to ensure the provision of additional capacity is planned into their investment programme (into AMP8) and to ensure development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed. There is a high level of certainty that Dunchurch WwTW has sufficient headroom capacity to accept growth during most of the plan period, with only a low level of uncertainty towards the very end of the plan period where the current DWF permit is predicted to be exceeded by a flow of approximately 60m^3/d. Relative to the size of the current DWF permit, the flow exceedance is small.

RAG Assessment

RAG Assessment – Dunchurch WwTW

The growth in the Dunchurch WwTW catchment is given an Amber status to demonstrate that a potential constraint exists and a solution to upgrade treatment processes on the limits of conventional treatment may be required from 2030 to ensure growth can be delivered without compromising WFD objectives. As the upgrades would not be required until the start of AMP9, funding for the upgrades is not required immediately and can be planned for by STW as certainty on the quantum of development increases.

[28] Investment programme from April 2015 to 2020.

3.3.4 Finham (Coventry) WwTW

Historic Situation
The 2010 Outline and Scoping WCS indicated that Finham WwTW had no hydraulic capacity, and stated that any development to the north and south of the M6 in the district of Nuneaton & Bedworth draining to the WwTW should only be built following the installation of appropriate infrastructure. Due to known hydraulic capacity issues at Finham WwTW and the long flow pathway to the WwTW, it was suggested to drain wastewater to Bedworth WwTW instead.

The 2010 WCS also made clear that the phosphate permit conditions required at the WwTW to ensure future 'Good' Ecological status of the River Sowe would require treatment processes considered to be beyond the limits of conventional treatment, irrespective of growth, and that the phasing of development would be heavily influenced by the provision of adequate infrastructure.

Current Situation
The latest volumetric headroom assessment has demonstrated that Finham WwTW does not currently have sufficient volumetric headroom under its current permit to accommodate expected wastewater flows. In addition, according to data provided by STW, the WwTW already has very limited capacity in its current DWF permit. STW have confirmed there is limited headroom based on current quality performance, but have stated that the WwTW is subject to investment in AMP6 to address quality issues and increase treatment capacity to accommodate growth for the next 25 years.

Therefore, until additional headroom can be made available in the catchment, any growth draining to the WwTW would result in the existing volumetric permit condition being exceeded further, and by a total volume of approximately 6,100m^3/d (equivalent to approx. 20,300 dwellings) by the end of the plan period.

Environmental Baseline
Finham WwTW discharges to the River Sowe. The River Sowe currently has an overall waterbody status of 'Moderate', with the alternative objective to maintain 'Moderate' status by 2021. Its current overall status is limited to Moderate due to the Moderate status of macrophytes & phytobenthos and phosphate. The current status for ammonia and BOD is High.

WFD Compliance
Results from the modelling based on current wastewater flows have shown that in order to maintain the current quality of the River Sowe, the permit conditions on discharge quality should theoretically be tighter than they currently are, irrespective of growth. The calculations show that the permit conditions should currently be set at less than 1mg/l for ammonia[29] and less than 0.5mg/l for phosphate[30], both beyond the limits of conventional treatment.

These results suggest that Finham WwTW is currently treating discharge to a higher standard than the current discharge permit conditions, in terms of ammonia and phosphate. If it was performing more frequently at, or closer to, the limits of the current permit conditions (i.e. a lower standard of treatment), the current downstream water quality would be expected to be much lower than it currently is, and would have deteriorated from the current status.

A second phase of modelling has subsequently been undertaken, taking into account the increased wastewater flows from the proposed growth within the WwTW catchment. These modelling results also demonstrate the requirement for a tighter ammonia and phosphate permit condition. The BOD permit condition should also be tighter[31], but this is considered to be within the limits of conventional treatment.

A third phase of modelling was not required to assess the impact of growth on preventing future 'Good' Ecological status being reached in the River Sowe due to an 'alternative objective' of 'Moderate' Ecological status being set by the Environment Agency in place of an objective to reach 'Good' Ecological status. The alternative objective has been set due to an unfavourable balance between costs and benefits to resolve the less than Good status of phosphate as well as macrophytes and phytobenthos. A detailed explanation for the reason behind the alternative objective has been provided in Appendix D.

BOD and ammonia both have a status of 'High' and would remain at this status assuming the permit limits required to ensure no deterioration in status are met.

The RNAG, as outlined in the Severn RBMP, specific to the River Sowe have been extracted, and those with relevance to development and phosphate have been provided in Table 3-6 below.

[29] Currently at 3mg/l in the existing permit
[30] Currently at 1mg/l in the existing permit
[31] Currently at 15mg/l in the existing permit

Table 3-6 Reasons for not achieving good status on the River Sowe (GB109054044540) 2014

Category	Activity	Certainty (that activity is RNAG)	Classification Element	Objective
Agriculture and rural land management	Mixed agricultural	Suspected	Phosphate	Moderate by 2021
Urban and transport	Drainage - mixed	Suspected		
Water Industry	Sewage discharge (continuous)	Probable		
Agriculture - Livestock	Dairy/beef field	Probable	Macrophytes and Phytobenthos Combined	Moderate by 2021
Water Industry	Sewage discharge (intermittent)	Probable		
Water Industry	Sewage discharge (continuous)	Probable		
Urban and transport	Drainage - mixed	Probable		

The River Sowe currently has high phosphorous concentrations attributable to surrounding agricultural land uses, drainage from urban areas and point sources of wastewater discharge. The high nutrient concentration as a result of these activities has also had an impact on the biological quality of the waterbody, specifically on the macrophytes and phytobenthos communities, preventing the waterbody from achieving 'Good' Ecological status.

The latest Severn RBMP identifies a specific measure relevant to the River Sowe (GB109054044540) and Finham WwTW, stating that additional treatment to reduce concentrations of phosphate from the WwTW will be implemented in 2020 to address the RNAGs listed in Table 3-6. However, whilst the River Sowe currently has an alternative 'Moderate' Ecological status objective to be maintained by 2021, the requirement for this measure to assist the waterbody towards achieving 'Good' Ecological status is not relevant, and this measure will therefore assist towards ensuring no further deterioration from 'Moderate' status.

Upgrade Requirements
To treat all of the flow expected from development by the end of the plan period, the requirement to change the ammonia, BOD and phosphate conditions for the new permit will require process upgrades immediately at Finham WwTW to ensure there is no deterioration in current status. Until such time as process upgrades are delivered and a new permit secured, development may need to be restricted to a rate to be agreed with STW to ensure that any additional flow can be treated and discharged without impacting on water quality targets in the River Sowe.

The theoretical quality conditions for **ammonia** and **phosphate** are considered to be beyond the limits of conventional treatment (under both a pre-growth and growth inclusive scenario). It was determined that the ammonia permit condition would need to be equivalent to 0.6 mg/l, and that the phosphate permit condition would need to be equivalent to 0.2 mg/l to maintain the existing status of the River Sowe. The results therefore suggest that the WwTW is treating discharge to a higher standard than the current permit conditions for ammonia and phosphate.

Over performance of a WwTW does occur, as the WwTW will have been designed with a future design load in mind leaving capacity for growth. In addition, the WwTW will be designed to accommodate high flows and low temperatures during winter when biological treatment processes are less efficient. This means during higher temperature periods and/or lower flow periods, there will be excess treatment capacity. Consequently, the current level of treatment at the WwTW has proved to be sufficient to maintain the current status of the receiving watercourse, and with upgrades the WwTW should be able to continue treating to this higher standard.

In addition, there is currently a programme of phosphate reduction trials by water companies in the UK, testing whether there are technologies that can reduce phosphate at WwTWs to around 0.1 mg/l, with results due to be published in spring 2017. STW is in the process of trialling six technologies[32] for WwTWs in its region and once results of these trials have been published a potential scheme to address this problem could be implemented at the Finham WwTW.

By the end of the plan period, the **BOD** permit condition would require tightening to 14 mg/l to maintain the existing status of the River Sowe. To achieve this tighter permit condition, current conventional treatment technologies would be sufficient.

Phasing of Upgrades
STW have stated that there are no land or other constraints preventing expansion at the WwTW, but have identified that there are probable issues relating to the future effluent quality at the WwTW. STW have confirmed that the WwTW is

[32] http://utilityweek.co.uk/news/severn-trent-trials-six-technologies-to-reduce-phosphorus/1240692#.V9vSf_krJaQ

currently subject to investment in AMP6[33] to address quality issues and increase treatment capacity, to accommodate growth for the next 25 years.

Short Term (Now to 2020)
Information provided by STW confirms that the WwTW currently has limited hydraulic capacity, and calculations as part of the WCS also demonstrate this. It has been noted in the Coventry City WCS[34] that STW intend to undertake further investigation into the available capacity of the existing volumetric permit, before applying to the Environment Agency for an increase to the permit.

The onus is on STW to maintain standards set within the WwTWs environmental permit, however until a new permit is applied for and subsequently granted by the Environment Agency, rigorous water quality monitoring will be required alongside early phasing of growth in order to ensure WFD objectives are not compromised. Communication from the partner authorities including Nuneaton & Bedworth, Rugby and Warwick with STW will be important to confirm which sites are due to come forward for development and the quantum of development proposed. The information provided in this WCS represents the first stage of providing development information, and can be used by STW to ensure the provision of additional capacity is planned into their investment programme and to ensure development is not delayed. In addition, it is recommended that until a committed scheme is implemented, either:

a. permissions are restricted to a per annum completion rate to be mutually agreed between the Environment Agency and STW; or
b. for each forthcoming application, potential developers contact STW as early as possible to confirm flow rates and intended connection points (via STW pre-planning enquiry) to demonstrate that there is either sufficient headroom or viable interim treatment solutions (such as tankering) until a permanent treatment solution is put in place.

STW have confirmed that in most instances additional wastewater treatment capacity can be provided with two to three years, and infrastructure upgrades to the wastewater distribution system within 18 months to two years[35].

Long Term (2020 – 2031)
The Coventry City WCS[34] states that the current investment and upgrade works being undertaken will be completed by 2020, and that the WwTW will be able to accommodate all planned growth at least up to 2020. Although there is no requirement for STW to design or plan upgrades for a WwTW for a timescale up to 2031, following consultation with STW as part of this WCS, STW confirmed that sufficient funding has been allocated to upgrade the WwTWs as necessary in order to accommodate future development located both within and outside of the study area for the next 25 years.

By the end of the plan period, Coventry City Council is proposing a total of approx. 24,000 new dwellings which will fall within the WwTW catchment as identified in the Coventry City WCS[34], equivalent to approximately an additional 7,500m^3/d[36] of flow by 2031. Additional flow as calculated as part of this WCS from growth which also falls within the WwTW catchment, but located outside of Coventry in North Warwickshire, Nuneaton & Bedworth and Warwick, has been calculated as approximately an additional 2,400m3/d by 2031.

RAG Assessment

RAG Assessment – Finham WwTW
The growth in the Finham WwTW catchment is given an Amber status to demonstrate that despite potential infrastructure and environmental constraints, a theoretical treatment solution exists and funding for the necessary upgrades has been allocated. STW will need to apply for a revised volumetric discharge permit to cater for the growth, and this may restrict the phasing of growth in the short term (up to 2020). The required solution is to upgrade treatment processes beyond the current limits of conventional treatment in order to ensure growth can be delivered without compromising WFD objectives, however the over performance of the WwTW treatment processes ensures this does not happen.

For planning applications coming forward within the Finham WwTW catchment, it is recommended that potential developers contact STW as early as possible to confirm flow rates and intended connection points to ensure there is sufficient capacity at the WwTW to accept wastewater flows. The Environment Agency will also need sufficient evidence that developments will not cause the WwTWs permit to be exceeded in order to be confident that they do not need to raise objections to planning applications to ensure WFD compliance.

[33] Investment programme from April 2015 to 2020.
[34] City of Coventry WCS (2015)
[35] Personal communication received via email (July 2016)
[36] Based on occupancy rate of 2.4 and consumption rate of 130l/h/d as applied in the City of Coventry WCS (2015)

3.3.5 Hartshill (Nuneaton) WwTW

The 2010 Outline and Scoping WCS indicated that Hartshill WwTW would require a new discharge permit and upgrades to its treatment process capacity to accommodate growth.

Currently, the WwTW has available flow headroom in its existing discharge permit and can accept growth of approximately 3,800 dwellings, after which the volumetric discharge permit will be exceeded. Unless additional headroom can be made available at the WwTWs after 3,800 dwellings, any further growth draining to the WwTW would result in the existing volumetric permit condition to be exceeded, by a total volume of approximately 2,000m^3/d (equivalent to approx. 6,700 dwellings) by the end of the plan period.

Environmental Baseline
Hartshill WwTW discharges to the River Anker. The River Anker currently has an overall waterbody status of 'Moderate', with the objective to reach 'Good' status by 2027. Its current overall status is limited to Moderate due to the Moderate status of invertebrates, macrophytes & phytobenthos and the Poor status of phosphate. The current status for ammonia and BOD is High.

WFD Compliance
Modelling results demonstrate that in order to maintain the current quality of the River Anker, the BOD permit condition on discharge quality should theoretically be tighter[37], and is considered to be within the limits of conventional treatment. The ammonia permit condition should also be theoretically tighter[38], and is considered to be at the limit of conventional treatment. The phosphate permit condition would not require any changes.

A second phase of modelling has assessed the impact of growth on preventing future 'Good' Ecological status being reached in the River Anker by 2027. Currently the status for the phosphate sub-element of this waterbody is set at 'Poor', resulting in the waterbody not currently achieving 'Good' status. BOD and ammonia both have a status of 'High' and would remain at this status assuming the permit limits required to ensure no deterioration in status are met.

The RNAG, as outlined in the Humber RBMP, specific to the River Anker have been extracted, and those with relevance to development and phosphate have been provided in Table 3-7 below.

Table 3-7 Reasons for not achieving good status on the River Anker (GB104028046430) 2014

Category	Activity	Certainty (that activity is RNAG)	Classification Element	Objective
Agriculture and rural land management	Mixed agricultural	Probable	Phosphate	Good by 2027
Water Industry	Sewage discharge (continuous)			
Urban and transport	Drainage – mixed			
Agriculture and rural land management	Mixed agricultural	Suspected	Macrophytes and Phytobenthos Combined	Good by 2027
Water Industry	Sewage discharge (continuous)			
Urban and transport	Drainage – mixed			

The River Anker currently has high phosphorous concentrations attributable to surrounding agricultural land uses, drainage from urban areas and point sources of wastewater discharge. The high nutrient concentration as a result of these activities has also had an impact on the biological quality of the waterbody, specifically on the macrophytes and phytobenthos communities, preventing the waterbody from achieving 'Good' Ecological status.

The modelling has shown that a new phosphate permit condition may be required to ensure the River Anker achieves 'Good' Ecological status in the future; however, the modelling shows that this would be required with current discharge volumes (i.e. before growth is considered). Therefore, the assessed growth would not prevent future 'Good' Ecological status from being met.

Upgrade Requirements
The existing permit (i.e. not inclusive of growth) requires changes to the phosphate condition and process upgrades to ensure Good Ecological status could be achieved in the future. The requirement to change the BOD and ammonia

[37] Currently at 15mg/l in the existing permit
[38] Currently at 3mg/l in the existing permit

conditions for the new permit is likely to require process upgrades at Hartshill WwTW by the time approximately 3,800 dwellings are built within the WwTW catchment.

The theoretical quality condition for **ammonia** is considered to be slightly beyond the limits of conventional treatment (under both a pre-growth and growth inclusive scenario). Whilst this limit is theoretically below the limits which could be achieved with conventional treatment, due to limitations within the basic Monte Carlo simulation performed, it is considered that applying a discharge limit of 1mg/l for ammonia would likely be sufficient.

By the end of the plan period, the **BOD** permit condition would require tightening to 13mg/l to maintain the existing status of the River Anker. To achieve this tighter permit condition, current conventional treatment technologies would be sufficient.

Phasing of Upgrades
Although STW have stated that there are no land or other constraints preventing expansion at the WwTW, there is marginal concern associated with future effluent quality subject to the quantity of development within the catchment. In addition, funding for these upgrades may not be available until AMP7[39] STW's approach to wastewater treatment asset management requires that sufficient certainty is given that the quantum of development will proceed before improvements to WwTW assets can be justified and funding sought.

The information provided in this WCS represents the first stage of providing development information, and can be used by STW to ensure the provision of additional capacity is planned into their investment programme (into AMP7) and to ensure development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

RAG Assessment

RAG Assessment – Hartshill WwTW
The growth in the Hartshill WwTW catchment is given an Amber status to demonstrate that a potential constraint exists and a solution to upgrade treatment processes within the limits of conventional treatment will be required to ensure growth can be delivered without compromising WFD objectives.

The timing of when this solution will be required cannot be determined until detailed information on NWBC's housing trajectory is known. The upgrades are not likely to be required until AMP7, therefore funding for the upgrades is not required immediately and can be planned for by STW as certainty around the quantum of development increases.

3.3.6 Rugby Newbold WwTW

Historic Situation
The 2010 Outline and Scoping WCS indicated that Rugby Newbold WwTW had no hydraulic capacity, and stated that this would have a significant impact on the phasing of development. The 2010 WCS also made clear that the phosphate permit conditions required at the WwTW to ensure future 'Good' Ecological status of the River Avon would require treatment processes considered to be significantly beyond the limits of conventional treatment, irrespective of growth.

Current Situation
The latest volumetric headroom assessment has demonstrated that Rugby Newbold WwTW currently has sufficient flow headroom under its existing volumetric discharge permit and can accept growth of approximately 4,000 dwellings (up to and including 2021), after which the volumetric discharge permit will be exceeded. Unless additional headroom can be made available at the WwTW after 4,000 dwellings, any further growth draining to the WwTW would result in the existing volumetric permit condition to be exceeded, by a total volume of approximately 1,500m^3/d (equivalent to approx. 5,200 dwellings) by the end of the plan period.

Environmental Baseline
Rugby Newbold WwTW discharges to the River Avon. The River Avon currently has an overall waterbody status of 'Moderate', with the objective to reach 'Good' status by 2021. Its current overall status is limited to Moderate due to the Moderate status of phosphate. The current status for ammonia and BOD is High.

WFD Compliance
Results from the modelling based on current wastewater flows have shown that in order to maintain the current quality of the River Avon, the permit conditions on discharge quality should theoretically be tighter than they currently are,

[39] Investment programme from April 2020 to 2025

irrespective of growth. The calculations show that the permit conditions should currently be set at 1mg/l for ammonia[40], considered to be the limit of conventional treatment, and less than 0.5mg/l for phosphate[41], considered to be beyond the limits of conventional treatment.

These results suggest that Rugby Newbold WwTW is currently treating discharge to a higher standard than the current discharge permit conditions, in terms of ammonia and phosphate. If it was performing more frequently at, or closer to, the limits of the current permit conditions (i.e. a lower standard of treatment), the current downstream water quality would be expected to be much lower than it currently is, and would have deteriorated from the current status.

A second phase of modelling has subsequently been undertaken, taking into account increased wastewater flows from the proposed growth within the catchment. These modelling results demonstrate the requirement for a tighter ammonia and phosphate permit condition. The BOD permit condition should also be tighter[42], but this is considered to be within the limits of conventional treatment.

A third phase of modelling has assessed the impact of growth on preventing future 'Good' Ecological status being reached in the River Avon by 2021. Currently the status for the phosphate sub-element of this waterbody is set at 'Poor', resulting in the waterbody not currently achieving 'Good' status. BOD and ammonia both have a status of 'High' and would remain at this status assuming the permit limits required to ensure no deterioration in status are met.

The RNAG, as outlined in the Severn RBMP, specific to the River Avon have been extracted, and those with relevance to development and phosphate have been provided in Table 3-8 below.

Table 3-8 Reasons for not achieving good status on the River Avon (GB109054043920) 2014

Category	Activity	Certainty (that activity is RNAG)	Classification Element	Objective
Agriculture and rural land management	Dairy/beef field	Probable	Phosphate	Good by 2021
Urban and transport	Drainage – mixed			
Water Industry	Sewage discharge (continuous)			

The River Avon currently has high phosphorous concentrations attributable to surrounding agricultural land uses, drainage from urban areas and point sources of wastewater discharge.

The latest Severn RBMP identifies specific measures relevant to the River Avon (GB109054043920) and Rugby Newbold WwTW, stating that additional treatment to reduce concentrations of phosphate from the WwTW will be implemented in 2020 to address the RNAGs listed in Table 3-8.

Upgrade Requirements

The requirement to change the ammonia, BOD and phosphate conditions for the new permit will require process upgrades at Rugby Newbold WwTW by the time approximately 4,000 dwellings are built within the WwTW catchment, or up to and including 2021.

The theoretical quality condition for **ammonia** is considered to be on the limits of conventional treatment. It was determined that the ammonia permit condition would need to be equivalent to 1 mg/l to maintain the existing status of the River Avon. To achieve this tighter permit condition, current conventional treatment technologies would be sufficient.

The theoretical quality condition for **phosphate** is considered to be beyond the limits of conventional treatment (under both a pre-growth and growth inclusive scenario). The modelling has demonstrated that the current phosphate permit condition would need to be equivalent to 0.4 mg/l, to maintain the existing status of the River Avon. The results therefore suggest that the WwTW is treating discharge to a higher standard than the current permit condition for phosphate.

Over performance of a WwTW does occur, as the WwTW will have been designed with a future design load in mind leaving capacity for growth. In addition, the WwTW will be designed to accommodate high flows and low temperatures during winter when biological treatment processes are less efficient. This means during higher temperature periods

[40] Currently at 5mg/l in the existing permit
[41] Currently at 1mg/l in the existing permit
[42] Currently at 15mg/l in the existing permit

and/or lower flow periods, there will be excess treatment capacity. Consequently, the current level of treatment at the WwTW has proved to be sufficient to maintain the current status of the receiving watercourse, and with upgrades the WwTW should be able to continue treating to this higher standard.

In addition, there is currently a programme of phosphate reduction trials by water companies in the UK, testing whether there are technologies that can reduce phosphate at WwTWs to around 0.1 mg/l, with results due to be published in spring 2017. STW is in the process of trialling six technologies[43] for WwTWs in its region and once results of these trials have been published a potential scheme to address this problem could be implemented at the Rugby Newbold WwTW.

By the end of the plan period, the **BOD** permit condition would require tightening to 13 mg/l to maintain the existing status of the River Avon. To achieve this tighter permit condition, current conventional treatment technologies would be sufficient.

Phasing of Upgrades
STW have stated that the WwTWs currently has limited headroom based on current quality performance and that there is marginal concern associated with future effluent quality subject to the quantity of development within the catchment. STW have also confirmed that the WwTW is currently subject to investment in AMP6[44] to address quality issues and increase treatment capacity, but have stipulated that there is limited potential to provide additional capacity as a result of physical constraints to the site.

STW's approach to wastewater treatment asset management requires that sufficient certainty is given that the quantum of development will proceed before improvements to WwTW assets can be justified and funding sought. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

The information provided in this WCS represents the first stage of providing development information, and can be used by STW to ensure the provision of additional capacity is planned in their investment programme (into AMP7) and to ensure development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

RAG Assessment

RAG Assessment – Rugby Newbold WwTW
The growth in the Rugby Newbold WwTW catchment is given an Amber status to demonstrate that a potential constraint exists and a theoretical treatment solution will be required from 2021. The required solution is to upgrade treatment processes beyond the current limits of conventional treatment in order to ensure growth can be delivered without compromising WFD objectives, however the over performance of the WwTW treatment processes ensures this does not happen.

The WwTW is currently undergoing upgrades between now and 2020, which may provide the necessary treatment solution prior to 2021. If further upgrades are required, these would not be required until AMP7, and funding for the upgrades can be planned for by STW as certainty on the quantum of development increases.

3.3.7 Warton WwTW

Warton WwTW currently has available flow headroom in its existing discharge permit and can accept growth of approximately 50 dwellings, after which the volumetric discharge permit will be exceeded. Unless additional headroom can be made available at the WwTWs after 50 dwellings, any further growth draining to the WwTW would result in the existing volumetric permit condition to be exceeded, by a total volume of approximately 30m^3/d (equivalent to approx. 100 dwellings) by the end of the plan period.

Environmental Baseline
Warton WwTW discharges to the Bramcote Brook, a tributary of the River Anker. The River Anker currently has an overall waterbody status of 'Moderate', with the objective to reach 'Good' status by 2027. Its current overall status is limited to Moderate due to the Moderate status of invertebrates, macrophytes & phytobenthos and the Poor status of phosphate. The current status for ammonia and BOD is High.

[43] http://utilityweek.co.uk/news/severn-trent-trials-six-technologies-to-reduce-phosphorus/1240692#.V9vSf_krJaQ
[44] Investment programme from April 2015 to 2020.

WFD Compliance
Modelling results demonstrate that in order to maintain the current quality of the River Anker, the BOD permit condition on discharge quality should theoretically be tighter[45], and is considered to be within the limits of conventional treatment. The WwTW does not currently have permit conditions for ammonia or phosphate, however, the modelling results suggest that future permit conditions within the limits of conventional treatment should be considered to ensure no deterioration.

A second phase of modelling has assessed the impact of growth on preventing future 'Good' Ecological status being reached in the River Anker by 2027. Currently the status for the phosphate sub-element of this waterbody is set at 'Poor', resulting in the waterbody not currently achieving 'Good' status. BOD and Ammonia both have a status of 'High' and would remain at this status assuming the permit limits required to ensure no deterioration in status are met.

The Warton WwTW discharges into the same River Anker WFD waterbody as Hartshill WwTW, therefore, the RNAGs provided in Table 3-7 are relevant to Warton WwTW.

The River Anker currently has high phosphorous concentrations attributable to surrounding agricultural land uses, drainage from urban areas and point sources of wastewater discharge. The high nutrient concentration as a result of these activities has also had an impact on the biological quality of the waterbody, specifically on the macrophytes and phytobenthos communities, preventing the waterbody from achieving 'Good' Ecological status.

The modelling has shown that a new phosphate permit condition may be required to ensure the River Anker achieves 'Good' Ecological status in the future; however, the modelling shows that this would be required with current discharge volumes (i.e. before growth is considered). Therefore, the assessed growth would not prevent future 'Good' Ecological status from being met.

Upgrade Requirements
The requirement to change the BOD condition, and potentially implement ammonia and phosphate conditions for the new permit will require process upgrades at Warton WwTW by the time approximately 50 dwellings are built within the WwTW catchment.

By the end of the plan period, the **BOD** permit condition would require tightening to 34mg/l, and new permit conditions for **ammonia** and **phosphate** of 3mg/l and 5mg/l respectively are recommended, to maintain the existing status of the River Anker. To achieve these tighter permit condition, current conventional treatment technologies would be sufficient but would need to be implemented by STW at some point in the future.

Phasing of Upgrades
Although STW have stated that there are no land or other constraints preventing expansion at the WwTWs, there is marginal concern for future effluent quality issues due to the small size of the WwTW catchment and that even limited development could be significant for the quality treatment capacity at the WwTW. In addition, funding for these upgrades has not been confirmed by STW.

STW's approach to wastewater treatment asset management requires that sufficient certainty is given that the quantum of development will proceed before improvements to WwTW assets can be justified and funding sought. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

The information provided in this WCS represents the first stage of providing development information, and can be used by STW to ensure the provision of additional capacity is planned into their investment programme (into AMP7) and to ensure development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

[45] Currently at 40mg/l in the existing permit

RAG Assessment

RAG Assessment – Warton WwTW
The growth in the Warton WwTW catchment is given an Amber status to demonstrate that a potential constraint exists and a solution to upgrade treatment processes within the limits of conventional treatment may be required to ensure growth can be delivered without compromising WFD objectives.

The timing of when this solution will be required cannot be determined until detailed information on NWBC's housing trajectory is known. The upgrades are not likely to be required until AMP7, therefore funding for the upgrades is not required immediately and can be planned for by STW as certainty around the quantum of development increases.

3.4 Ecological Appraisal

3.4.1 Introduction

There is one statutory, and seventeen non-statutory designated sites that have been identified as potentially being hydrologically connected to WwTW discharge points that have been identified as being unable to meet expected development needs without a change to the discharge permit (Atherstone, Hartshill, Warton, Finham, Dunchurch, Churchover and Rugby Newbold). These designated sites are:

- Alvecote Pools SSSI,
- Bretford Meadows (SP47I1),
- Ensor's Pool SAC,
- Flood Meadow beside the River Anker (SP39I4),
- Frankton Meadows (SP46E3),
- Hartshill Sewage Works (SP39H3),
- Marton Meadow (SP46E2),
- Polesworth Abbey Green Park (SK20R2),
- Polesworth Abbey Marsh (SK20R5) ,
- River Anker (SK20LI6s),
- River Anker Meadows (SP39I1 and SP39I2),
- River Avon (SP15Li8f),
- River Leam (SP36Li20h),
- River Mease SAC,
- River Sowe (SP37G3),
- River Swift (SP57Li25e),
- Swift Valley (SP57D7), and
- Welches Meadow and Leam Valley (SP36H1).

All other designated sites identified within the study area are either remote from watercourses into which WwTW's discharge treated effluent, or are downstream of WwTWs that are able to meet future growth within the limit of their existing permits with no deterioration downstream. The ecological background to the statutory designated site, including the details of the interest features and relevant condition assessments are provided in Table 3-9. In general, no information is available detailing the designated features of non-statutory designated sites.

3.4.2 Impact on Designated Sites

Table 3-9 identifies that the following seven WwTW do not have sufficient headroom capacity to accommodate the proposed increase in development within the WwTW catchments and their volumetric permit will be exceeded:

- Atherstone
- Hartshill
- Warton (discharges to Bramcote Brook)

- Finham (Coventry)
- Dunchurch
- Churchover
- Rugby Newbold

These seven WwTW therefore pose implications for downstream water quality (and thus ecology). It should be noted that Finham (Coventry) WwTW is already in exceedance of its capacity even without the potential new development planned for its catchment in the Local Plans. The Local Plans development as currently distributed does exacerbate that situation slightly.

Table 3-9 illustrates wildlife sites that contain linking pathways to each relevant WwTW.

Table 3-9 Wildlife site with pathways linking to WwTW that are expected to increases their permitted discharge volumes

WwTW	Wildlife site	Comments
Atherstone	River Anker Meadows (SP39I1 and SP39I2)	205m downstream
	River Anker (SK20LI6s)	476m downstream
	Polesworth Abbey Marsh (SK20R5) and Polesworth Abbey Green Park (SK20R2)	8.3km downstream. 8.8km downstream.
	Alvecote Pools SSSI	12km downstream.
Hartshill	Hartshill Sewage Works (SP39H3)	On site but former lagoons unconnected with current effluent discharge pathway
	River Anker (SK20LI6s)	100m downstream
	Flood Meadow beside the River Anker (SP39I4)	1.8km downstream
	River Anker Meadows (SP39I1 and SP39I2)	3.1m downstream
	Polesworth Abbey Marsh (SK20R5) and Polesworth Abbey Green Park (SK20R2)	11.4km downstream. 11.9km downstream.
	Alvecote Pools SSSI	23km downstream.
Warton (discharges to Bramcote Brook)	River Anker (SK20LI6s)	1.3km downstream
	Alvecote Pools SSSI	1.5km downstream.
Finham (Coventry)	River Sowe (SP37G3)	Receiving watercourse
	River Avon (SP15Li8f)	2.3km downstream
Dunchurch	River Leam (SP36Li20h)	2km downstream
	Frankton Meadows (SP46E3)	8km downstream
	Marton Meadow (SP46E2)	10km downstream
	Welches Meadow and Leam Valley (SP36H1)	13km downstream
	River Avon (SP15Li8f)	18km downstream
Churchover	River Swift (SP57Li25e)	Receiving watercourse
	Swift Valley (SP57D7)	3.1km downstream
	River Avon (SP15Li8f)	3.8km downstream
	Bretford Meadows (SP47I1)	13km downstream
Rugby Newbold (discharges to Avon)	River Avon (SP15Li8f)	Receiving watercourse
	Bretford Meadows (SP47I1)	10km downstream

The only internationally important wildlife sites that are geographically close to this part of Warwickshire are the River Mease SAC and Ensor's Pool SAC. However, impacts on these sites can be screened out for the following reasons:

- River Mease SAC – The River Anker drains to the River Tame which then drains to the River Trent 400m downstream of the confluence of the Trent and Mease. Therefore, no problematic STWs (i.e. those which would need to increase their current consented discharge volumes) discharge into watercourses that will drain into River Mease SAC.
- Ensor's Pool SAC – in consultation over this project the Environment Agency commented that: 'An investigation was carried out into the main inputs to the pool. It was discovered that there are no permitted discharges and that the SAC is predominantly fed via land drains from a farm'. As such, there is no connection between wastewater treatment in the study area and this SAC.

3.4.3 Atherstone WwTW

Modelling has identified that planned development within the WwTW catchment (approximately 2,100 new dwellings and employment space) will result in an exceedance of existing DWF by 2%.

This WwTW flows into the River Anker Meadows 205m downstream from the discharge point, and the River Anker itself 476m from the discharge point. Table 3-9 also identifies that treated effluent from this WwTW subsequently flows into Polesworth Abbey Marsh and Polesworth Abbey Green Park non statutory designated sites and, eventually, Alvecote Pools SSSI. Alvecote Pools SSSI is designated for its wetland habitats, plants, invertebrates and bird populations (see Appendix E for full details).

Vegetation within freshwater/inundated components of the above mentioned designated sites will be particularly sensitive to **phosphate** concentrations. In most freshwater environments phosphates are the primary growth-limiting macro nutrient as they are naturally scarce. Increases in phosphate levels in freshwater environments can result in the death of aquatic plants and animals via the process of eutrophication. In both freshwater and terrestrial systems, species able to thrive on increased levels of phosphate will out-compete less competitive plant species. At present, phosphate levels are within current permitted limits and no change to current permit levels will be required; even with planned levels of development, this will not be exceeded. The current WFD status is 'Poor', with a target of 'Good' by 2027 which it is currently not meeting and will not do in the future. The level of growth planned will not cause the 'Good' WFD target to be missed, although it will of course contribute. The required future WFD target is not achievable within the LCT. Improvements will be required in the future to achieve this target to deal with existing levels of phosphates as a result of historical/existing development levels even without the planned level of development.

The current effluent quality levels required for **ammonia** are already in exceedance of consented discharge volumes and currently beyond LCT. Even relatively low levels of ammonia can be toxic to plants and animals resulting in death.

The **BOD** is currently within consented levels; however the level of planned development will result in an increase in BOD. Elevated levels of BOD can result in lower oxygen levels that can also result in death to plants and animals. The increased levels of BOD can be addressed via consent tightening within the limits of conventionally applied treatment processes.

To ensure that the planned level of development within the Plan period does not result in a negative impact upon designated sites or riverine habitats it is recommended that Policy is included within the Plan to ensure that these matters are addressed and water quality will be improved to suitable WFD levels. This may include the requirement for infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure (in line with the delivery of development) to ensure that the WwTW can accommodate the increased capacity (this is not an exhaustive list).

For ammonia levels, a view must be taken in conjunction with the water company and the Environment Agency as to the significance of the exceedance due to Local Plan development, given that the vast majority of this exceedance already exists. The same applies to achieving 'Good' WFD phosphate target by 2027, if the majority of the future exceedance stems from existing development as the required WFD target is not achievable within LCT, this may result in a conclusion that the overall future exceedance in discharge volumes for ammonia and phosphate means that no further housing should be permitted within this catchment without a new treatment solution (e.g. a new WwTW) due to the potential for effects on downstream ecology.

3.4.4 Churchover WwTW

Modelling has identified that planned development within the WwTW catchment (approximately 160 new dwellings) will result in an exceedance of existing DWF by 5%. Modelling has identified that future levels of ammonia will not exceed the current permitted discharge volumes even after planned development, so is not discussed further. Current nutrient levels are not available for this WwTW.

This WwTW discharges directly into the River Swift. Table 3-9 also identifies that treated effluent from this WwTW ultimately also reaches the Swift Valley, River Avon, and Bretford Meadows non statutory designated sites.

Modelling has identified that planned future growth within the catchment of this WwTW will result in increased **phosphate** above existing permitted levels. To ensure that the planned level of development within the catchment of this WwTW does not adversely impact upon designated wildlife sites, consent tightening within limits of conventionally applied treatment processes will be required. The future WFD target of 'Good' by 2027 can be met and will continue to be met even as a result of future planned development.

Similarly to phosphates, modelling has identified that planned future growth within the catchment of this WwTW will result in increased **BOD** levels above existing permitted levels. Elevated levels of BOD can result in lower oxygen levels

that can also result in death to plants and animals. The increased levels of BOD can be addressed via consent tightening within the limits of conventionally applied treatment processes.

To ensure that the planned level of development within the plan period does not result in a negative impact upon designated sites or riverine habitats it is recommended that Policy is included within the Plan to ensure that these matters are addressed and water quality will be improved to suitable WFD levels. This may include the requirement for infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure (in line with the delivery of development) to ensure that the WwTW can accommodate the increased capacity (this is not an exhaustive list).

3.4.5 Dunchurch WwTW

Modelling has identified that planned development within the WwTW catchment (approximately 960 new dwellings and employment space) will result in an exceedance of existing DWF by 6%.

The effluent from this WwTW flows into the River Leam non statutory designated site 2km downstream from the discharge point. Table 3-9 also identifies that treated effluent from this WwTW subsequently reaches Frankton Meadows, Marton Meadow, Welches Meadow and Leam Valley, and River Avon non statutory designated sites.

Plants within freshwater environments of the above mentioned designated sites will be sensitive to **phosphate** levels. Present phosphate levels are within current permitted limits. Even with planned levels of development, this will not be exceeded and no change to current permit levels will be required. It should be noted that the current WFD status is 'Poor', with a target of 'Good' by 2027. The level of growth planned will not result in the 'Good' WFD target being missed as improvements will be required in the future to achieve this target to deal with existing levels of phosphates as a result of historical/ existing development levels even without the planned level of development. This required future WFD target is not achievable within LCT with or without planned future development.

The current effluent quality required for levels of **ammonia** are already in exceedance of consented discharge volumes and currently beyond LCT. Even relatively low levels of ammonia can be toxic to plants and animals resulting in death. In terrestrial environments nitrification of ammonia results in increased levels of nitrogen, and thus resulting in increased plant growth of those plant species that can readily take advantage of increased levels of nitrogen, outcompeting less competitive plant species. To address this issue (with or without future planned development), the WwTW must treat ammonia to a higher standard than its permit currently states (beyond LCT).

Modelling has identified that the **BOD** is currently within consented levels; however the level of planned development will result in an increase in BOD. Elevated levels of BOD can result in lower oxygen levels that can also result in death to plants and animals. The increased levels of BOD can be addressed via consent tightening within the limits of conventionally applied treatment processes.

To ensure that the planned level of development within the Plan period does not result in a negative impact upon designated sites or riverine habitats it is recommended that Policy is included within the Plan to ensure that these matters are addressed and water quality will be improved to suitable WFD levels. This may include the requirement for infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure (in line with the delivery of development) to ensure that the WwTW can accommodate the increased capacity (this is not an exhaustive list).

For ammonia levels, a view must be taken in conjunction with the water company and the Environment Agency as to the significance of the exceedance due to Local Plan development, given that the vast majority of this exceedance already exists. The same applies to achieving 'Good' WFD phosphate target by 2027, if the majority of the future exceedance stems from existing development. As the required targets are not achievable within LCT, this may result in a conclusion that the overall exceedance in discharge volumes for ammonia and phosphate means that no further housing should be permitted within this catchment without a new treatment solution (e.g. a new WwTW) due to the potential for effects on downstream ecology.

3.4.6 Finham (Coventry) WwTW

Modelling has identified that planned development within the WwTW catchment (approximately 7,700 new dwellings and employment space) will result in an exceedance of existing DWF by 5%. This WwTW is already at its current volumetric permit.

This WwTW discharges directly into the River Sowe non statutory designated site and the River Avon non statutory designated site lies 2.3km downstream from the discharge point.

Current **phosphate** levels are already in exceedance of permitted limits and currently beyond LCT. As such, any future development within this WwTW catchment will only exacerbate phosphate levels emitted from this WwTW. To address

this issue, the WwTW must treat phosphate to a higher standard than its permit currently states (beyond LCT). It should be noted that the current WFD status is 'Moderate', with the target remaining 'Moderate' to 2027. The level of growth planned will not prevent the 'Moderate' WFD target being met as improvements to the WwTW will be required in the future to achieve this target to deal with existing levels of phosphates as a result of historical/existing development levels even without the planned level of development.

As with phosphates, the current effluent quality required for levels of **ammonia** are already in exceedance of consented discharge volumes and currently beyond LCT even before the planned level of development. Even relatively low levels of ammonia can be toxic to plants and animals resulting in death. In terrestrial environments nitrification of ammonia results in increased levels of nitrogen, and thus resulting in increased plant growth of those plant species that can readily take advantage of increased levels of nitrogen, outcompeting less competitive plant species.

BOD is currently within consented levels; however the level of planned development will result in an increase in BOD. Elevated levels of BOD can result in lower oxygen levels that can also result in death to plants and animals. The increased levels of BOD as a result of future planned growth can be addressed via consent tightening within the limits of conventionally applied treatment processes.

To ensure that the planned level of development within the plan period does not result in a negative impact upon designated sites or riverine habitats it is recommended that Policy is included within the Plan to ensure that these matters are addressed and water quality will be improved to suitable WFD levels. This may include the requirement for infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure (in line with the delivery of development) to ensure that the WwTW can accommodate the increased capacity (this is not an exhaustive list).

For ammonia and phosphate levels, a view must be taken in conjunction with the water company and the Environment Agency as to the significance of the exceedance due to Local Plan development, given that the vast majority of this future exceedance already exists. The same applies to achieving 'Moderate' WFD phosphate target by 2027, if the majority of the future exceedance stems from existing development. This may result in a conclusion that the overall exceedance in discharge volumes for ammonia and phosphate means that no further housing should be permitted within this catchment without a new treatment solution (e.g. a new WwTW) due to the potential for effects on downstream ecology.

3.4.7 Hartshill (Nuneaton) WwTW

Modelling has identified that planned development within the WwTW catchment (approximately 10,500 new dwellings and employment space) will result in an exceedance of existing DWF by 9%.

The WwTW effluent drains into the River Anker non statutory designated site 100m downstream from the point of discharge. It is noted that Hartshill WwTW non designated site is located within the footprint of the WwTW, but this wildlife site is former lagoons unconnected with the current effluent discharge pathway. Table 3-9 also identifies that treated effluent from this WwTW ultimately reaches Flood Meadow beside the River Anker, River Anker Meadows, Polesworth Abbey Marsh, and Polesworth Abbey Green Park non statutory designated sites, and (eventually) Alvecote Pools SSSI approximately 23km downstream. Of course, by the time Alvercote Pools has been reached substantial dilution of effluent has taken place.

Plants within freshwater environments of the above mentioned designated sites will be sensitive to **phosphate** levels. Modelling has identified that at future phosphate levels will be within current permitted limits and no change to current permit levels will be required; even with planned levels of development, this will not be exceeded. The current WFD status is 'Poor', with a target of 'Good' by 2027. This required future WFD target is not achievable within LCT. The level of growth planned will not result in the 'Good' WFD target being missed as improvements will be required in the future to achieve this target to deal with existing levels of phosphates as a result of historical/ existing development levels even without the planned level of development.

Modelling has identified that future levels of **ammonia** will be in exceedance of consented discharge volumes as a result of planned development and will be beyond LCT. Even relatively low levels of ammonia can be toxic to plants and animals resulting in death. In terrestrial environments nitrification of ammonia results in increased levels of nitrogen, and thus resulting in increased plant growth of those plant species that can readily take advantage of increased levels of nitrogen, outcompeting less competitive plant species. To address this issue, the WwTW must treat ammonia to a higher standard than its permit currently states (beyond LCT).

Modelling has identified that planned future growth within the catchment of this WwTW will result in increased **BOD** levels above existing permitted levels. Elevated levels of BOD can result in lower oxygen levels that can also result in death to plants and animals. The increased levels of BOD can be addressed via consent tightening within the limits of conventionally applied treatment processes.

To ensure that the planned level of development within the Plan period does not result in a negative impact upon designated sites or riverine habitats it is recommended that Policy is included within the Plan to ensure that these matters are addressed and water quality will be improved to suitable WFD levels. This may include the requirement for infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure (in line with the delivery of development) to ensure that the WwTW can accommodate the increased capacity (this is not an exhaustive list).

For ammonia levels, a view must be taken in conjunction with the water company and the Environment Agency as to the significance of the exceedance due to Local Plan development, given that the vast majority of this exceedance already exists. The same applies to achieving 'Good' WFD phosphate target by 2027, if the majority of the future exceedance stems from existing development. As the required targets are no achievable within LCT, this may result in a conclusion that the overall exceedance in discharge volumes for ammonia and phosphate means that no further housing should be permitted within this catchment without a new treatment solution (e.g. a new WwTW) due to the potential for effects on downstream ecology.

3.4.8 Rugby Newbold WwTW

Modelling has identified that planned development within the WwTW catchment (approximately 9,200 new dwellings and employment space) will result in an exceedance of existing DWF by 7%.

This WwTW discharges directly into the River Avon non statutory designated site. Table 3-9 also identifies that treated effluent from this WwTW ultimately reaches Bretford Meadows non statutory designated site, 10km downstream from the discharge point.

Current **phosphate** levels are already in exceedance of permitted discharge volume and are currently already beyond LCT, even without the addition of future planned development. To address this issue, the WwTW must treat phosphate to a higher standard than its permit currently states (beyond LCT). It should be noted that the current WFD status is 'Moderate', with the target of 'Good' to 2027. This required future WFD target is not achievable within LCT, with or without future planned development. The level of growth planned will not result in the 'Moderate' WFD target being missed as improvements to the WwTW will be required in the future to achieve this target to deal with existing levels of phosphates as a result of historical/existing development levels even without the planned level of development.

Current effluent quality required for levels of **ammonia** are already in exceedance of consented discharge volumes, but can currently be addressed through consent tightening within limits of conventionally applied treatment processes. Even relatively low levels of ammonia can be toxic to plants and animals resulting in death. In terrestrial environments nitrification of ammonia results in increased levels of nitrogen, and thus resulting in increased plant growth of those plant species that can readily take advantage of increased levels of nitrogen, outcompeting less competitive plant species. Modelling has identified that the planned development within this WwTW catchment will result in a further increase in ammonia levels resulting in an exceedance in discharge volumes that will be beyond LCT.

Currently levels of **BOD** are not in excess of consented discharge volumes, however, modelling has identified that planned future growth within the catchment of this WwTW will result in increased BOD levels above existing permitted levels. Elevated levels of BOD can result in lower oxygen levels that can also result in death to plants and animals. The future increased levels of BOD as a result of planned development can be addressed via consent tightening within the limits of conventionally applied treatment processes.

To ensure that the planned level of development within the Plan period does not result in a negative impact upon designated sites or riverine habitats it is recommended that Policy is included within the Plan to ensure that these matters are addressed and water quality will be improved to suitable WFD levels. This may include the requirement for infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure (in line with the delivery of development) to ensure that the WwTW can accommodate the increased capacity (this is not an exhaustive list).

For phosphate and ammonia levels, a view must be taken in conjunction with the water company and the Environment Agency as to the significance of the exceedance due to Local Plan development, given that the vast majority of this exceedance already exists. The same applies to achieving 'Good' WFD phosphate target by 2027, if the majority of the future exceedance stems from existing development. As the required targets are not achievable within LCT, this may result in a conclusion that the overall exceedance in discharge volumes for phosphate means that no further housing should be permitted within this catchment without a new treatment solution (e.g. a new WwTW) due to the potential for effects on downstream ecology.

3.4.9 Warton WwTW

Modelling has identified that planned development within the WwTW catchment (approximately 150 new dwellings) will result in an exceedance of existing DWF by 17%.

This WwTW discharges to Bramcote Brook, with treated effluent entering the River Avon non statutory designated site 1.3km downstream from the point of discharge and reaching Alvecote Pools SSSI 1.5km from the point of discharge. Table 3-9 also identifies that treated effluent from this WwTW eventually reaches Bretford Meadows non statutory designated sites, 10km downstream from the discharge point.

Future **phosphate** levels as a result of planned development will be in exceedance of permitted discharge volume. This can be addressed through consent tightening within limits of conventionally applied treatment processes. Plants within freshwater and terrestrial environments will be sensitive to **phosphate** levels. It should be noted that the current WFD status is 'Poor', with the target of 'Good' to 2027. This future WFD target is not achievable within LCT with or without future planned development. The level of growth planned will not result in the 'Good' WFD target being missed as improvements to the WwTW will be required in the future to achieve this target to deal with existing levels of phosphates as a result of historical/ existing development levels even without the planned level of development.

As with phosphate, modelling has identified that future effluent quality required for levels of **ammonia** will be in exceedance of consented discharge volumes as a result of planned development, but can be addressed through consent tightening within limits of conventionally applied treatment processes. Even relatively low levels of ammonia can be toxic to plants and animals resulting in death. In terrestrial environments nitrification of ammonia results in increased levels of nitrogen, and thus resulting in increased plant growth of those plant species that can readily take advantage of increased levels of nitrogen, outcompeting less competitive plant species.

Similar to phosphate and ammonia, future levels of **BOD** will be in excess of consented discharge volumes following planned development. Elevated levels of BOD can result in lower oxygen levels that can also result in death to plants and animals. The increased levels of BOD can be addressed via consent tightening within the limits of conventionally applied treatment processes.

To ensure that the planned level of development within the Plan period does not result in a negative impact upon designated sites or riverine habitats it is recommended that Policy is included within the Plan to ensure that these matters are addressed and water quality will be improved to suitable WFD levels. This may include the requirement for infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure (in line with the delivery of development) to ensure that the WwTW can accommodate the increased capacity (this is not an exhaustive list).

For phosphate levels, a view must be taken in conjunction with the water company and the Environment Agency as to the significance of the future exceedance due to Local Plan development and the 'Good' WDF target, given that the vast majority of this exceedance already exists. As the required targets are no achievable within LCT, this may result in a conclusion that the overall exceedance in discharge volumes for phosphate means that no further housing should be permitted within this catchment without a new treatment solution (e.g. a new WwTW) due to the potential for effects on downstream ecology.

3.4.10 Impacts on Ecology outside Designated Sites

Whilst the above assessment is primarily focused on the impact on ecologically designated sites, the following section discusses ecology outside of designated sites. The limitations of a WCS make it impossible for such a discussion to be exhaustive or spatially very specific.

In addition to impacts on designated sites, a range of other UK or Warwickshire, Coventry and Solihull BAP species or otherwise protected/notable species that are found in Warwickshire can be affected by wastewater discharge. These include:

- Water vole (protected through Wildlife & Countryside Act 1981 and a UK BAP species),
- Grass snake (partially protected through Wildlife & Countryside Act 1981),
- Adder (partially protected through Wildlife & Countryside Act 1981 and a UK/ Warwickshire, Coventry and Solihull BAP species),
- Common toad (UK BAP species),
- Great crested newt (legally protected through Conservation of Habitats & Species Regulations 2010, Wildlife & Countryside Act 1981 and a UK BAP species),
- Birds such as bittern, kingfisher (protected through Wildlife & Countryside Act 1981 and a UK BAP species), lapwing and snipe (Warwickshire, Coventry and Solihull BAP species),
- Fish (UK/ Warwickshire, Coventry and Solihull BAP),
- Invertebrates such as white clawed crayfish (protected through Wildlife & Countryside Act 1981 and a UK/ Warwickshire, Coventry and Solihull BAP species), and

– Otter (legally protected through Conservation of Habitats & Species Regulations 2010, Wildlife & Countryside Act 1981 and a UK/ Warwickshire, Coventry and Solihull BAP species).

Similarly important habitats (all listed in the Warwickshire, Coventry and Solihull BAP) include:

– Fen and Swamp,
– Lakes and Reservoirs,
– Ponds,
– Quarries,
– Reed beds,
– Rivers and Streams, and
– Scrub and Carr.

All of these habitats and species are present (or possibly present) in Warwickshire County.

It is not possible within the scope of this commission to undertake a detailed investigation and evaluation of the impacts of the changes in water quality/flow and infrastructure to be delivered under the water cycle study on wildlife generally, since it would be necessary to undertake detailed species surveys of each watercourse and utilise detailed flow and quality data/modelling which has not been available for this commission for most watercourses.

Seven WwTWs in Warwickshire will require at least a change to their permit in order to comply with the WFD requirements for no deterioration downstream:

– Atherstone,
– Churchover,
– Dunchurch,
– Finham (Coventry),
– Hartshill (Nuneaton),
– Rugby Newbold, and
– Warton.

Levels of development identified during the Plan period have potential (albeit probably only cumulatively with the existing exceedances) to have an adverse effect on wildlife of the receiving freshwater habitats and watercourses downstream and avoidance measures will be required as already outlined.

3.4.11 Ecological Opportunities Associated with Proposed Development Locations

To ensure that the planned level of development within the Plan period does not result in a negative impact upon wildlife with inside and outside of designated sites it is recommended that Policy is included within the Plan to ensure that these matters are addressed at a strategic level and water quality at these locations will be improved to suitable WFD levels and consent levels. This may include the requirement for new infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure to ensure that the WwTWs can accommodate the increased capacity (this is not an exhaustive list) and not result in a detrimental impact upon wildlife features. Where exceedance of consent is so high it is deemed that consent targets are not achievable within LCT, it may result in a conclusion that the overall exceedance in discharge volumes for phosphate means that no further housing should be permitted within this catchment without a new treatment solution (e.g. a new WwTW) due to the potential for effects on downstream ecology. Further to recommended policy it is recommended that:

– Where ecological risks resulting from proposed water cycle changes have been identified, these are considered within the relevant flood risk and surface water management proposals. These opportunities and the reduction of identified risks can be incorporated into the detailed design of the developments and local green infrastructure plans.
– The analysis indicates that particular caution is required when allocating housing to the following WwTW catchments on the basis that they are already in exceedance of consents and have historic poorer water quality, particularly if a change to existing discharge consent parameters would be required:
  - Atherstone,
  - Dunchurch,
  - Finham (Coventry), and
  - Rugby Newbold.

3.5 Wastewater Summary

Table 3-10 provides a summary of the RAG assessment of the WwTWs within the study area which have been assessed as not having sufficient headroom to accommodate growth.

Table 3-10 Wastewater treatment works summary

WwTW	Watercourse	WFD ID	Is Headroom available for all planned growth to 2031?	Is a permit update possible – within LCT?	Feasible solution?	Overall RAG
Atherstone	Tributary of River Anker	GB104028046430	No, but permit exceedance is small	No, but WwTW is known to over perform in terms of wastewater treatment	Possibly – but WwTW is known to over perform in terms of wastewater treatment	Upgrades required but timing unknown
Churchover	River Swift	GB109054043940	No (headroom only up to 2021)	Yes	Yes	Upgrades required by 2021
Dunchurch	Thurlaston Brook, a tributary of the River Leam	GB109054044130	No (headroom only up to 2030)	No, but WwTW is known to over perform in terms of wastewater treatment	Possibly – but WwTW is known to over perform in terms of wastewater treatment	Upgrades required by 2030
Finham (Coventry)	River Sowe	GB109054044540	Currently limited headroom	No, but WwTW is known to over perform in terms of wastewater treatment	Phosphate reduction technology trials currently underway and significant funding allocated for upgrades	Short term (to 2020): Limited headroom capacity requiring careful development phasing. Long term (beyond 2020): STW have allocated sufficient funds for the necessary upgrades.
Hartshill (Nuneaton)	River Anker	GB104028046430	No (headroom only up to 3,800 dwellings)	Yes	Yes	Upgrades required but timing unknown
Rugby Newbold	River Avon	GB109054043920	No (headroom only up to 2021)	No, but WwTW is known to over perform in terms of wastewater treatment	Possibly – but WwTW is known to over perform in terms of wastewater treatment	Upgrades and revised permit required by 2021
Warton	Bramcote Brook, a tributary of the River Anker	GB104028046460	No (headroom only up to 50 dwellings)	Yes	Yes	Upgrades required but timing unknown

4 Water Supply Strategy

4.1 Introduction

Water supply for the study area is provided by STW. An assessment of the existing environmental baseline with respect to locally available resources in the aquifers and the main river systems has been completed to update the previous findings of the Warwickshire Sub-Regional WCS Scoping and Outline WCS[2]. The assessment has been based on the Environment Agency's Catchment Abstraction Management Strategies (CAMS). The study area falls within two CAMS;

- The Tame, Anker and Mease CAMS; and,
- The Warwickshire Avon CAMS.

This study has also used the final version of STW's 2014 WRMP[46] to determine available water supply against predicted demand and has considered how water efficiency can be further promoted and delivered for new homes beyond that which is planned for delivery in STW's WRMP.

4.1.1 Water Resource Planning

Water companies have historically undertaken medium to long term planning of water resources in order to demonstrate that a there is a long-term plan for delivering sustainable water supply within its operational area to meet existing and future demand.

WRMPs are a key document for a WCS as they set out how demand for water from growth within a water company's supply area can be met, taking into account the need to for the environment to be protected. As part of the statutory approval process, the plans must be approved by both the Environment Agency and Natural England (as well as other regulators) and hence the outcomes of the plans can be used directly to inform whether growth levels being assessed within a WCS can be supplied with a sustainable source of water supply.

Water companies manage available water resources within key zones, called Water Resource Zones (WRZ). These zones share the same raw resources for supply and are interconnected by supply pipes, treatment works and pumping stations. As such the customers within these zones share the same available 'surplus of supply' of water when it is freely available; but also share the same risk of supply when water is not as freely available during dry periods (i.e. deficit of supply). Water companies undertake resource modelling to calculate if there is likely to be a surplus of available water or a deficit in each WRZ by 2040, once additional demand from growth and other factors such as climate change are taken into account.

4.2 Catchment Management Strategies (CAMS)

An assessment of the existing environmental baseline with respect to locally available resources in the aquifers and the main river systems has been completed based on the Environment Agency's CAMS.

The Environment Agency manages water resources at the local level through the use of CAMS. Within the CAMS, the Environment Agency's assessment of the availability of water resources is based on a classification system that gives a resource availability status which indicates:

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

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

[46] Severn Trent Water Final Water Resources Management Plan (2014 https://www.severntrent.com/content/ConMediaFile/1705

Table 4-1 CAMS water resource availability status categories

Indicative Resource Availability Status	License Availability
Water available for licensing	There is more water than required to meet the needs of the environment. New licences can be considered depending on local and downstream impacts.
Restricted water available for licencing	Full Licensed flows fall below the Environmental Flow Indictors (EFIs). If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licences would be granted. It may also be appropriate to investigate the possibilities for reducing fully licensed risks. Water may be available if you can 'buy' (known as licence trading) the entitlement to abstract water from an existing licence holder.
No water available for licencing	Recent actual flows are below the EFI. This scenario highlights water bodies where flows are below the indicative flow requirement to help support Good Ecological Status (as required by the Water Framework Directive (Note: we are currently investigating water bodies that are not supporting GES / GEP). No further consumptive licences will be granted. Water may be available if you can buy (known as licence trading) the amount equivalent to recently abstracted from an existing licence holder.

The classification for each of the Water Resource Management Units (WRMU) in the study area has been summarised for surface waterbodies in Table 4-2 and groundwater bodies in

Table 4-3.

Table 4-2 CAMS surface waterbody resource availability classification

River – WRMU	CAMS Area	Surface Water (flow exceedance scenarios)			
		Q30	Q50	Q70	Q95
AP1 Tame upstream of the Blythe	Tame, Anker and Mease				
AP3 River Cole					
AP4 River Blythe					
AP6 Bourne Brook					
AP1 Rugby (Upper River Avon and River Swift)	Warwickshire Avon				
AP2 Stoneleigh (River Sowe and Sherbourne)					
AP3 Stareton (River Avon)					
AP4 Leamington (Rivers Leam and Itchin)					

Table 4-3 CAMS groundwater body resource availability classification

Groundwater Management Unit	CAMS Area	Water resource availability	Licence restriction
Meriden	Tame, Anker and Mease		Closed due to over abstraction
Nuneaton			Tame, Anker and Mease
Warwick	Warwickshire Avon		Closed due to over abstraction
Whitley			Closed due to new abstractions as all resources have been licenced
Coventry			Closed due to new abstractions as all resources have been licenced

All rivers are defined as having no water available for licencing during periods of low flow (Q70-Q95). Three sites have restricted water available for licencing during periods of higher flow (Q30-Q50). This analysis indicates that there is potential for local abstractions at Tame upstream of the Blythe, River Cole, River Blythe, Stareton, Stoneleigh and Rugby during periods of higher flow. This may be beneficial to supplying water resources. In the case of groundwater, the Meriden groundwater management unit is completely closed for abstraction closed.

4.3 Water Resource Planning in the study area

In reviewing STW's Final 2014 WRMP and through liaison with STW it has been established that the growth figures assessed for this WCS study are catered for in the 2040 prediction of supply and demand deficits in the relevant WRZs under average conditions. Therefore, conclusions on available water supply from STW's Final 2014 WRMP can be used directly in this study to inform and support each partner authority's Local Plan.

4.4 Demand for Water

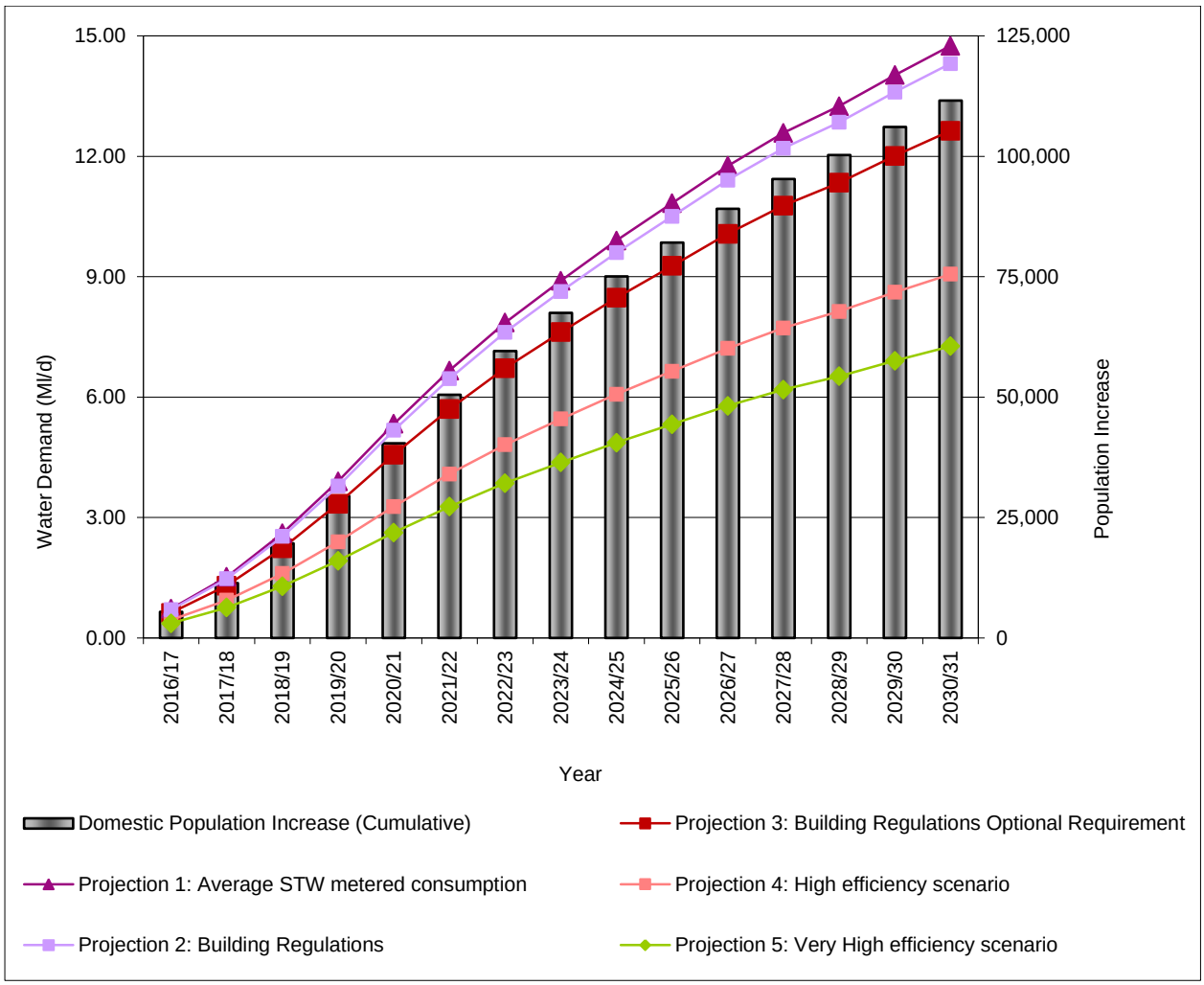
Likely increases in demand in the study area have been calculated using five different water demand projections based on different rates of water use for new homes that could be implemented through potential future policy.

The projections were derived as follows:

- **Projection 1 – Average STW metered consumption –** New homes would use 129l/h/d, this reflects the planning consumption used by STW to maintain security of supply;
- **Projection 2** – **Low Scenario (Building Regulations) –** New homes would conform to (and not use more than) Part G of the Building Regulations requirement of 125 l/h/d;
- **Projection 3 – Medium Scenario (Building Regulations Optional Requirement)** – Only applies where a condition that the new home should meet the optional requirement is imposed as part of the process of granting planning permission. Where it applies, new homes would conform to (and not use more than) Part G of the Building Regulations optional requirement of 110 l/h/d;
- **Projection 4 – High Scenario** – New homes would achieve 80 l/h/d (previously based on CSH Level 5/6); and,
- **Projection 5** – **Very High Scenario –** New homes would include both greywater recycling and rainwater harvesting reducing water use to a minimum of 62 l/h/d.

Using these projections, the increase in demand for water could range between 7.27 and 14.76 Ml/d by 2031. The projections are shown in Figure 4-1. See Appendix G for partner authority specific demand for water projections.

Figure 4-1 Range of water demands across plan period in the study area depending on efficiency levels of new homes



4.4.1 Planned Water Availability Summary

The final 2014 WRMP for STW has been used to summarise water availability to meet the projected demand for the Warwickshire study area covering the planning period to 2040.

4.4.1.1 Strategic Grid Water Resource Zone (WRZ)

The Strategic Grid WRZ includes the two main abstraction catchments covering the sub region. There are water resource issues affecting both groundwater and surface water. Aquifers are under pressure in a number of areas. The River Severn is a major source of water with five key water supply abstractions with potential to impact on a number of SPA, cSAC and Ramsar sites.

For this WRZ, STW predict that by the end of the study areas plan period in 2031 (AMP 9) there will be a supply-demand surplus of 83.29 Ml/d during the Dry Year Annual Average. The measures which are proposed by STW to maintain the supply-demand balance show that the available supplies will be sufficient to meet expected demand.

4.4.1.2 Supply-Demand Strategy

STW have identified a number of schemes that will benefit the Strategic Grid WRZ. The strategy is to:

- increase Uckington output in the Shelton zone to facilitate Upper Worfe flow augmentation which will be re-abstracted into the Strategic Grid zone from the River Severn (2015-2020);
- Whitacre aquifer storage and recovery to utilise spare resource and treatment capacity during periods of low demand (2020-2025);
- implement the following schemes to maximise the sustainable use of existing resources:
  - Trimpley-Worcestershire groundwater conjunctive use (2020-2025);
  - Draycote reservoir 6% expansion (2020-2025);
  - Bromsgrove groundwater licence transfer (2020-2025);

- Upper and Lower Worfe flow augmentation (2020-2025);
- continue to reduce leakage; and,
- carry out measures to help customers become more water efficient and reduce their demand.

This strategy ensures that STW maintain a headroom surplus throughout the planning period.

4.5 Water Efficiency Plan

Through a series of demand management measures and improvement of existing resources (which have been approved at a strategic level by the Environment Agency, Natural Resources Wales and Natural England), STW is predicting a supply surplus of available water in 2040 within the WRZ located within the study area, which would provide sufficient water to supply the levels of growth within the study area.

4.6 Drivers and Justification for Water Efficiency

The study area comprises of a number of different authorities that each have different environments and plans for future development. It is important to ensure that development and other additional factors do not have a damaging effect on the water environment for individual and the partner authorities within the sub region.

4.6.1 Managing Climate Change and Availability of Water

It is predicted that climate change will further reduce the available water resources in the study area as rainfall patterns change to less frequent, but more extreme, rainfall events. Climate change and sustainability reductions of abstraction licences are thought to be the most significant risk to water supplies from 2020 and beyond in the Strategic Grid WRZ.

STW recognise in their Climate Change adaptation report that the effects of climate change will be a key challenge over the 25 year plan period with the need to increase resilience of assets to cope with greater weather extremes. Similarly within their 2014 WRMP, STW highlight that climate change and the Restoring Sustainable Abstraction (RSA) programme are the most significant risks to long term supply/demand balance.

Customers expect STW to provide a continuous supply of water, but the resilience of the supply systems have the potential to be affected by the impact of climate change with severe weather-related events, such as flooding.

In planning for future water resources availability, STW have accounted for the impacts of climate change within their supply-demand forecasts.

4.6.1.1 Impact on Supplies

STW have undertaken analysis of the impacts of climate change on the future availability of their water resources on both their groundwater and surface water sources, and incorporated these results into their assessment of deployable output. The analysis involved processing 20 'smart' sampled[47] UKCP09 projections through a number of recognised climate change model methods, for the groundwater and surface water sources in the WRZs considered the most vulnerable to the potential impacts of climate change. The results identified a more significant impact on surface water source yield (reservoir and direct intake) than for groundwater. The results were then processed through the STW Aquator Water Resource model to determine what impact they would have on the Dissolved Oxygen (DO) of each STW WRZ. The Strategic Grid WRZ is impacted by a reduction in surface water flows and reduced reservoir refill.

The impact of climate change on water resources over the plan period within the Strategic Grid WRZ is estimated at a decrease of 55.5 Ml/d, whilst the combined impact from confirmed and likely sustainability reductions, and climate change is estimated at a decrease of 100.5 Ml/d by 2040.

4.6.1.2 Impact on Demand

The main impact of climate change on demand is related to periods of extremely hot and dry weather that will increase the peak demand for water. STW have accounted for the impact on the peak demand and the longer duration effect of a dry year through applying factors to the household and non-household water consumption rate in their supply-demand modelling.

Although STW have planned for the anticipated impacts of climate change, the view of STW and other water companies is that, in order to manage the effects of climate change effectively, the single most cost effective step in water resources climate change resilience is to manage demand downwards. The reduction in demand will also help to reduce carbon emissions which aids in reducing impacts of climate change.

[47] using a Latin Hypercube Sampling method.

4.6.2 Sustainability Reductions

The STW 2014 WRMP highlights that the Natural Resources Wales' RoC on the River Wye is a significant risk to short term and long term supply/demand balance. After reviewing alternative operating scenarios for the Elan Valley system with Natural Resources Wales, the Environment Agency and members of the Usk and Wye Abstractors Group, STW calculated the loss of deployable output from this scheme to be 40Ml/d for the Strategic Grid WRZ. However, it is predicted that STW can accommodate this loss by 2020 through plans to reduce leakage and commercial demand. The other abstraction licence reduction schemes across the zone will amount to a further loss of 5Ml/d.

4.7 Water Neutrality

4.7.1 What is Water Neutrality?

Water neutrality is a concept whereby the total demand for water within a planning area after development has taken place is the same (or less) than it was before development took place[48]. If this can be achieved, the overall balance for water demand is 'neutral', and there is considered to be no net increase in demand as a result of development. In order to achieve this, new development needs to be subject to planning policy which aims to ensure that where possible, houses and businesses are built to high standards of water efficiency through the use of water efficient fixtures and fittings, and in some cases rainwater harvesting and greywater recycling.

It is theoretically possible that neutrality can be achieved within a new development area, through the complete management of the water cycle within that development area. In addition to water demand being limited to a minimum, it requires:

- all wastewater to be treated and re-used for potable consumption rather than discharged to the environment;
- maximisation of rainwater harvesting (in some cases complete capture of rainfall falling within the development) for use in the home; and
- abstraction of local groundwater or river flow storage for treatment and potable supply.

Achieving 'total' water neutrality within a development remains an aspirational concept and is usually only considered for an eco-town or eco-village type development, due to the requirement for specific catchment conditions to supply raw water for treatment and significant capital expenditure. It also requires specialist operational input to maintain the systems such as wastewater re-use on a community scale. Total neutrality for a single development site is yet to be achieved in the UK.

For the majority of new development, in order for the water neutrality concept to work, the additional demand created by new development needs to be offset in part by reducing the demand from existing population and employment. Therefore, a 'planning area' needs to be considered where measures are taken to reduce existing or current water demand from the current housing and employment stock. The planning area in this case is considered to be the study area as a whole.

4.7.2 Twin-Track Approach

Attainment of water neutrality requires a 'twin track' approach whereby water demand in new development is minimised as far as possible, whilst at the same time taking measures, such as retrofitting of water efficient devices on existing homes and business to reduce water use in existing development.

In order to reduce water consumption and manage demand for the limited water resources within the study area, a number of measures and devices are available[49]. Generally, these measures fall into two categories due to cost and space constraints, as those that should be installed in new developments and those which could be retrofitted. Appendix F provides more detail on the different types of device or system along with the range of efficiency savings they could lead to.

4.7.3 Achieving Total Neutrality – is it feasible?

When considering neutrality within an existing planning area, it is recognised by the Environment Agency[50] that achievement of total water neutrality (100%) for new development is often not possible, as the levels of water savings required in existing stock may not be possible for the level of growth proposed. A lower percentage of neutrality may therefore be a realistic target, for example 50% neutrality.

This WCS therefore considers four water neutrality targets and sets out a 'pathway' for how the most likely target (or level of neutrality) can be achieved. Section 4.7.6 discusses the pathway concept in more detail, and highlights the

[48] Water Neutrality is defined more fully in the Environment Agency report 'Towards water neutrality in the Thames Gateway' (2007)
[49] Source: Water Efficiency in the South East of England, Environment Agency, April 2007.
[50] Environment Agency (2009) Water Neutrality, an improved and expanded water management definition

importance of developing local policy in the study area for delivering aspirations like water neutrality as well as understanding the additional steps required beyond 'business as usual' required to achieve it.

4.7.4 Water Neutrality Scenarios

The existing level of metering within the STW Strategic Grid WRZ is 42%. STW's future target for meter penetration[51] on domestic water meters is 60% by 2031. As stated in the STW WRMP, meter installation will continue to the target of 68% of domestic water supplies to be metered by 2040. Therefore, the water neutrality scenarios could, in line with STW's WRMP, assume that 68% is achieved earlier than 2040 and instead by the end of the plan period allowing a further possible 8% meter penetration within the existing housing stock by 2031.

4.7.4.1 Very High Scenario

The scenario has been developed as a context to demonstrate what is required to achieve the full aspiration of water neutrality. In reality, achieving 100% meter penetration across the study area is unlikely, due to a proportion of existing properties which either have complicated plumbing or whose water is supplied by bulk (i.e. flats), making it difficult for meter installation.

The key assumptions for this scenario are that water neutrality is achieved; however it is considered as aspirational only as it is unlikely to be feasible based on:

- Existing research into financial viability of such high levels of water efficiency measures in new homes; and
- Uptake of retrofitting water efficiency measures considered to be at the maximum achievable (30%) in the study area.

It would require:

- Meter installation into all existing residential properties (100% meter penetration);
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the extremely high percentage of retrofitting measures required;
- Strong local policy within the Local Plan's on restriction of water use in new homes on a local authority scale which is currently unprecedented in the UK; and
- All new development to include water recycling facilities across the study area which is currently limited to small scale development in the UK.

4.7.4.2 High Scenario

The key assumptions for this scenario are that a high water neutrality percentage[52] is achieved but requires significant funding and partnership working, and adoption of new local policy which is currently unprecedented in the UK.

It would require:

- Meter installation up to the maximum planned (up to 2040) as per STW WRMP by 2031 (68% meter penetration);
- Uptake of retrofitting water efficiency measures to be very high (25%) in relation to studies undertaken across the UK; and
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures required.

It is considered that, despite being at the upper scale of percentage uptake of retrofitting measures, it is technically and politically feasible to obtain this level of neutrality if a fully funded joint partnership approach could be developed.

4.7.4.3 Medium Scenario

The key assumptions for this scenario are that the water neutrality percentage[53] achieved is at least 50% of the total neutrality target and would require funding and partnership working, and adoption of new local policy which has only been adopted in a minimal number of Local Plans in the UK.

It would require:

- Meter installation as per STW WRMP by 2031 (60% meter penetration);

[51] proportion of properties within the STW Strategic Grid WRZ which have a water meter installed
[52] WN percentage refers to the percentage of water use savings made by various measures against the total new demand if the business as usual demand were to continue
[53] WN percentage refers to the percentage of water use savings made by various measures against the total new demand if the business as usual demand were to continue

– Uptake of retrofitting water efficiency measures to be reasonably high (20%) in the study area; and
– A significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures required.

It is considered that it is technically and politically feasible to obtain this level with a relatively modest funded joint partnership approach and with new developers contributing relatively standard, but high spec water efficient homes.

4.7.4.4 Low Scenario

The key assumptions for this scenario are that the water neutrality percentage[54] achieved is low but would require small scale level of funding and partnership working, and adoption of new local policy which is likely to be easily justified and straightforward for developers to implement.

It would require:

– Meter installation as per STW WRMP by 2031 (60% meter penetration);
– Uptake of retrofitting water efficiency measures to be fairly low (15%); and
– A relatively small funding pool and a partnership working not moving too far beyond 'business as usual' for stakeholders.

It is considered that it is technically and politically straightforward to obtain this level with a small funded joint partnership approach and with new developers contributing standard, but water efficient homes with a relative low capital expenditure.

4.7.5 Neutrality Scenario Assessment Results

To achieve total water neutrality (WN), the demand post growth must be the same as, or less than existing demand. Based on estimates of population size, existing demand in the study area was calculated to be 56.0 Ml/d.

For each neutrality option and scenario, an outline of the required water efficiency specification was developed for new houses, combined with an estimate of the savings that could be achieved through metering and further savings that could be achieved via retrofitting of water efficient fixtures and fittings in existing property. This has been undertaken utilising research undertaken by groups and organisations such as Waterwise, UKWIR55, the Environment Agency and OFWAT to determine realistic and feasible efficiency savings as part of developer design of properties, and standards for non-residential properties (Appendix F).

For each neutrality scenario, total demand was then calculated at three separate stages for housing as follows:

– Stage 1 – total demand post growth without any assumed water efficiency retrofitting for the differing levels of water efficiency in new homes;
– Stage 2 – total demand post growth with effect of metering applied for the differing levels of water efficiency in new homes; and,
– Stage 3 – total demand post growth with metering and water efficient retrofitting applied to existing homes for the differing levels of water efficiency in new homes. The results are provided in Table 4-4. If neutrality is achieved, the result is displayed green. If neutrality is not achieved, but is within 5%, the result is displayed amber, and red if neutrality above the 5% threshold is not achieved. The percentage of total neutrality achieved per scenario is also provided.

Table 4-4 Results of the Neutrality Scenario Assessments

WN Scenario	New Homes demand projections	Demand from Growth (Ml/d)	Total demand post growth* (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	% Neutrality Achieved
Baseline	**Projection 1: Average STW metered consumption**	14.76	70.72	**68.53**	**-**	15%
Low	**Projection 2a: Building Regulations**	14.31	70.27	**68.08**	**-**	18%

[54] WN percentage refers to the percentage of water use savings made by various measures against the total new demand if the business as usual demand were to continue
[55] UKWIR – The United Kingdom Water Industry Research group, attended and part funded by all major UK water companies

WN Scenario	New Homes demand projections	Demand from Growth (Ml/d)	Total demand post growth* (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	% Neutrality Achieved
	Projection 2b:Building Regulations + retrofit	14.31	70.27	**68.08**	**67.93**	19%
Medium	**Projection 3a: Building Regulations optional requirement**	12.64	68.59	**66.41**	-	29%
	Projection 3b: Optional requirement + retrofit	12.64	68.59	**66.41**	**60.55**	35%
High	**Projection 4: High efficiency**	9.06	65.02	**61.87**	**58.61**	82%
Very High	**Projection 5: Very High efficiency**	7.27	63.23	**56.18**	**52.27**	100%

* prior to demand management for existing housing stock

The results show that total neutrality is only achieved by applying the Very High WN scenario, requiring new homes to use water at a rate of 62 l/h/d. The Medium WN scenario would give a minimum of 29% neutrality which would require only new homes to be designed to use water at a rate of 110 l/h/d (Projection 3a). A further 6% neutrality (up to 35%) could be achieved through retrofitting 20% of the existing housing stock with water efficiency fittings equivalent to the optional requirement standard.

See Appendix G for partner authority specific neutrality scenario assessment results.

4.7.6 Financial Cost Considerations

There are detailed financial and sustainability issues to consider in deciding on water neutrality policies for both new homes and retrofitting existing homes.

The Department for Communities and Local Government (DCLG) published the Housing Standards Review in March 2015. A cost impacts report[56] formed part of this publication, providing the costs of the proposed standards, including the proposed Building Regulations optional requirement water efficiency standard.

The financial cost of complying with the optional requirement standard in new homes, as an extra over the mandatory requirement, is provided in Table 4-5. These costs reflect the most common current practice which is to use flow restricting devices to reduce water use by taps and showers.

Table 4-5 Building Regulation optional requirement (110 l/h/d) standard cost summary

Property type	Cost (extra over the mandatory requirement)
Apartment or terrace home	£6
Semi-detached or detached home	£9

4.7.7 Preferred Strategy – Delivery Pathway for the study area

It can be seen from the results in Table 4-4 that water neutrality can be achieved under a Very High WN scenario. While this is achievable in theory, this would come with significant cost both to the developer, but also a funded partnership through the significant need for retrofitting of existing homes and enhanced metering. It is recommended that a water neutrality target of Medium (Projection 3a and 3b) be set for the study area as a whole in order to balance the objective of achieving a more water neutral position as well as limiting the cost implications of implementing such an initiative.

56 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/353387/021c_Cost_Report_11th_Sept_2014_FINAL.pdf

In order to achieve this WN target and enhance sustainable development moving forward, policy should be developed that ensures all new housing is as water efficient as possible and that objectives are set that new housing development is required to achieve the Building Regulations optional requirement water use of 110 l/h/d. Non-domestic buildings should as a minimum reach 'Good' BREEAM status. Further details of how a target of 110 l/h/d can be achieved are detailed in Appendix F.

To further promote 'water neutrality' in the study area, it is recommended policy be developed by each partner authority to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 20% of the existing housing stock with easy fit water savings devices, equivalent to the fittings as described for use in new dwellings under the Building Regulations optional requirement.

It is considered that, it is technically and politically straightforward to obtain this level with a small funded joint partnership approach and with new developers contributing standard, but water efficient homes with a relative low capital expenditure.

Depending on the success of the first step to neutrality, higher WN scenarios could be aspired to by further developing policies and partnership working to deliver greater efficiencies.

See Appendix G for partner authority specific preferred strategy delivery pathway.

4.7.8 Delivery Requirements – Policy

In order to meet the medium water neutrality target scenario given above, specific planning policy will be required and recommendations are presented in Section 6.

When considering planning applications for new development (regardless of size), the planning authority and statutory consultees should consider whether the proposed design of the development has incorporated water efficiency measures, including (but not necessarily limited to) garden water butts, low flush toilets, low volume baths, aerated taps, and water efficient appliances.

Undertaking retrofitting and water audits must work in parallel with the promotion and education programme. Further recommendations on how to achieve it are included in Section 4.7.9 including recommended funding mechanisms.

4.7.9 Delivery Requirements – Partnership Approaches

Housing association partners should be targeted with a programme of retrofitting water efficient devices, to showcase the policy and promote the benefits. This should be a collaborative scheme between the partner authorities, STW, and Waterwise. In addition, RWH/GWR schemes could be implemented into larger council owned and maintained buildings, such as schools or community centres. RWH could be introduced to public toilets.

The retrofitting scheme should then be extended to non-Council owned properties, via the promotion and education programme.

A programme of water audits should be carried out in existing domestic and non-domestic buildings, again showcased by council owned properties, to establish water usage and to make recommendations for improving water efficiency measures. The water audits should be followed up by retrofitting water efficient measures in these buildings, as discussed above. In private non-domestic buildings water audits and retrofitting should be funded by the asset owner, the cost of this could be offset by the financial savings resulting from the implementation of water efficient measures. Funding options for domestic properties are discussed above.

In order to ensure the uptake of retrofitting water efficient devices for non-council properties, the partner authorities should implement an awareness and education campaign, which could include the following:

- working with STW to help with its water efficiency initiative, which has seen leaflets distributed directly to customers and at events across the region each year;
- a media campaign, with adverts/articles in local papers and features on a local news programme;
- a media campaign could be supplemented by promotional material, ranging from those that directly affect water use e.g. free cistern displacement devices, to products which will raise awareness e.g. fridge magnets with a water saving message;
- encouraging developers to provide new residents with 'welcome packs', explaining the importance of water efficiency and the steps that they can take to reduce water use;

- working with retailers to promote water efficient products, possibly with financial incentives as were undertaken as part of the Preston Water Initiative[57];
- carrying out educational visits to schools and colleges, to raise awareness of water efficiency amongst children and young adults;
- working with neighbourhood trusts, community groups and local interest groups to raise awareness of water efficiency; and,
- carrying out home visits to householders to explain the benefits of saving water, this may not be possible for the general population of the study area, but rather should be used to support a targeted scheme aimed at a specific residential group.

4.7.9.1 Responsibility

The recommendations above are targeted at the partner authorities and STW, as these are the major stakeholders, although the Environment Agency and other statutory consultees can also influence future development to ensure the water neutrality target is achieved.

It is therefore suggested that responsibility for implementing water efficiency policies be shared as detailed in Table 4-6.

Table 4-6 Responsibility for implementing water efficiency

Responsibility	Responsible stakeholder
Ensure planning applications are compliant with the recommended policies	Partner Authorities
Fitting water efficient devices in accordance with policy	Developers
Provide guidance and if necessary enforce the installation of water efficient devices through the planning application process	Partner Authorities
Ensure continuing increases in the level of water meter penetration	STW
Retrofit devices within council owned housing stock	Partner Authorities
Retrofit devices within privately owned housing stock (via section 106 agreements)	Developers
Promote water audits and set targets for the number of businesses that have water audits carried out. Allocate a specific individual or team within each of the local authorities to be responsible for promoting and undertaking water audits and ensuring the targets are met. The same team or individual could also act as a community liaison for households (council and privately owned) and businesses where water efficient devices are to be retrofitted, to ensure the occupants of the affected properties understand the need and mechanisms for water efficiency.	Partner Authorities
Educate and raise awareness of water efficiency	Partner Authorities and STW

A major aim of the education and awareness programme, as outlined by Policy Recommendation WS5, is to change peoples' attitude to water use and water saving and to make the general population understand that it is everybody's responsibility to reduce water use. Studies have shown that the water efficiencies in existing housing stock achieved by behavioural changes, such as turning off the tap while brushing teeth or reducing shower time, can be as important as the installation of water efficient devices.

4.7.9.2 Retrofitting funding options

In addition to possible resistance from existing householders, the biggest obstacle to retrofitting is the funding mechanism.

Water companies are embarking on retrofit as part of their response to meeting OFWAT's mandatory water efficiency targets. These programmes are funded out of operational expenditure. If a company has, or is forecasting, a supply-demand deficit over the planning period, water efficiency programmes can form part of a preferred option(s) set to

[57] Preston Water Efficiency Report, Waterwise, March 2009, www.waterwise.org.uk

overcome the deficit. However, these options are identified as part of the company's water resource management plans and will have to undergo a cost-benefit analysis.

The partner authorities could consider developer contributions to the Community Infrastructure Levy (CIL) or through S106 agreements.

Part 11 of the Planning Act 2008[58] (c. 29) ("the Act") provides for the imposition of a charge to be known as Community Infrastructure Levy (CIL). This is a new local levy that authorities can choose to introduce to help fund infrastructure in their area. CIL will help pay for the infrastructure required to serve new development, and although CIL should not be used to remedy pre-existing deficiencies, if the new development makes the deficiency more severe than the use of CIL is appropriate.

Section 106 (S106) of the Town and Country Planning Act 1990[59] allows a local planning authority (LPA) to enter into a legally-binding agreement or planning obligation with a landowner in association with the granting of planning permission, known as a Section 106 Agreement. These agreements are a way of delivering or addressing matters that are necessary to make a development acceptable in planning terms. They are increasingly used to support the provision of services and infrastructure, such as highways, recreational facilities, education, health and affordable housing.

However, there are considerable existing demands on developer contributions and it is unlikely that all of the retrofitting required across the study area could be funded through these mechanisms; they therefore need to look beyond developer contributions, possibly to the water companies, for further funding sources. Some councils offer council tax rebates to residents who install energy efficient measures (rebates jointly funded by the Council and Energy Company)[60]. The partner authorities should consider a similar scheme, although this would require the agreement of STW.

4.7.9.3 Retrofitting monitoring

During delivery stage, it will be important to ensure sufficient monitoring is in place to track the effects of retrofitting on reducing demand form existing housing stock. The latest research shows that retrofitting can have a significant beneficial effect and can be a cost effective way of managing the water supply-demand balance[61]. However, it is acknowledged that savings from retrofitting measures do diminish with time. This means that a long-term communication strategy is also needed to accompany any retrofit programme taken forward. This needs to be supported by monitoring, so that messages can be targeted and water savings maintained in the longer-term. The communication and monitoring message also applies to new builds to maintain continued use of water efficient fixtures and fittings.

[58] http://www.legislation.gov.uk/ukpga/2008/29/contents
[59] http://www.legislation.gov.uk/ukpga/1990/8/contents
[60] Cambridge (and surrounding major growth areas) WCS Phase 2, Halcrow, 2010
[61] Waterwise (2011): Evidence base for large-scale water efficiency, Phase II Final report

5 Major Development Site Assessment

5.1 Introduction

Following the assessment of wastewater treatment capacity and water resources, this section of the WCS addresses infrastructure capacity issues, flood risk, surface water management and SuDS suitability for each of the major development sites (sites containing more than 10 dwellings). The results are presented for each of the major development sites in Appendix H.

5.2 Assessment Methodologies

5.2.1 Wastewater Network

The wastewater strategy to cater for growth requires an assessment of the capacity of the wastewater network (sewer system) to accept and transmit wastewater flows from new development to the WwTW for treatment.

The capacity of the existing sewer network is an important consideration for growth, as in some cases the existing system is already at, or over its design capacity. Further additions of wastewater from growth can result in sewer flooding in the system (affecting property or infrastructure) or can increase the frequency with which overflows to river systems occur, resulting in ecological impact and deterioration in water quality.

As the wastewater undertaker for the study area, STW has a general duty under Section 94 of the Water Industry Act 1991 to provide effectual drainage which includes providing additional capacity as and when required to accommodate planned development. However this legal requirement must also be balanced with the price controls as set by the regulatory body OFWAT which ensure STW has sufficient funds to finance its functions, and at the same time protect consumers' interests. The price controls affect the bills that customers pay and the sewerage services consumers receive, and ultimately ensure wastewater assets are managed and delivered efficiently.

Consequently, to avoid potential inefficient investment STW generally do not provide additional capacity until there is certainty that the development is due to commence. Where development proposals are likely to require additional capacity upgrades to accommodate new development flows, it is highly recommended that potential developers contact STW as early as possible to confirm flow rates and intended connection points. This will ensure the provision of additional capacity is planned into STW's investment programme to ensure development is not delayed.

STW have undertaken an internal assessment of the capacity of the network system using local operational knowledge.

The results are presented for each of the major development sites in Appendix H. A RAG assessment has been undertaken; a key indicating the coding applied to each assessment is provided in Table 5-1.

Table 5-1 Key for wastewater network RAG assessment

There are no known network constraints downstream of this site. Development is likely to be possible without upgrades.	**Pumping station or pipe size may restrict growth; a pre-development enquiry is recommended before planning permission is granted, and network modelling by STW may be required to assess the scope of any capacity improvements.**	**There is limited capacity in the network; network modelling by STW will be required to assess the scope of any capacity improvements to determine an appropriate solution required to prevent further CSO discharges or sewer flooding.**

5.2.2 Water Supply

In addition to available water resources, there is a requirement to consider whether there is the infrastructure capacity to move water to where the demand will increase.

An assessment of the capacity of the water supply system has not been considered necessary for the WCS as it is not expected to be a constraint to development. The water distribution network is a pressurised system, and therefore allows more flexibility with regards to water supply. Consequently, STW do not assess water supply as part of a WCS, but the development site information provided will be used to inform STW's future planning. As developments are constructed, STW can undertake detailed modelling at the specific location, but as infrastructure improvements and

local reinforcement can usually be undertaken within 18 months to 2 years, water capacity is not expected to be a constraint to development.

5.2.3 Flood Risk

5.2.3.1 Fluvial

The flood risk to each of the major development sites has been considered using the Environment Agency Flood Maps. The percentage of development site area within each Flood Zone has been provided. The Strategic Flood Risk Assessment's (SFRA) for each of the partner authorities have been used to help identify the risk of fluvial flooding at each development site.

5.2.3.2 Surface Water Flood Risk

Surface water flooding has been reviewed each of the major development sites using the Risk of Flooding from Surface Water (RoFSW)[62] mapping produced by the Environment Agency. The Warwickshire Surface Water Management Plan (SWMP) has been used to identify if a development site falls within a Surface Water Flooding Hotspot'.

The Warwickshire County Council Surface Water Management Plane (SWMP) developed a comprehensive understanding of surface water flood risk in Warwickshire. It was important to capture where surface water flooding has occurred in the past, but also to identify where surface water flooding may be more likely to occur in the future and so historic and predictive (modelled) datasets were used.

The analysis identified 'Surface Water Hotspots' across the county which met the following threshold requirements as defined in the Warwickshire Local Flood Risk Management Strategy.

1) Flooding that poses a threat to the safety of the public or may directly result in serious injury or death.
2) Five or more residential properties internally flooded.
3) Two or more commercial properties internally flooded.
4) One or more piece of critical infrastructure affected that impact on the wider area.
5) Flooding that places vulnerable individuals or vulnerable communities at risk e.g. hospitals, care and nursing homes, schools, secure units, etc.
6) Where one or more residential property has flooded internally from the same source on five or more occasions within the last five years.

These Hotspots were categorised based upon the data source:

- Historic Surface Water Flood Risk Hotspot;
- Predictive Surface Water Flood Risk Hotspot; and
- Combined (Historic and Predictive) Surface Water Flood Risk Hotspot.

For this WCS the SWMP outputs have been cross referenced with the proposed allocation sites, and it has been recorded where there is a presence of a surface water hotspot (also noting the classification of hotspot).

5.2.4 Surface Water Management

Surface water drainage methods that take account of run-off rates, water quality, pollution control, biodiversity and amenity issues are collectively referred to as Sustainable Drainage Systems (SuDS). Sustainable surface water management takes account of long term environmental and social factors in designing a surface water drainage system that avoids the problems of flooding, pollution or damage to the environment that may occur with conventional surface water management systems.

The National Planning Policy Framework (NPPF) sets out that proposed development should ensure runoff rates from the development are no greater than pre-development rates and for developments requiring a flood risk assessment, discharge should be reduced to mitigate against the impacts of climate change.

The government published a ministerial statement (HCWS161)[63] on sustainable drainage systems on 18th December 2014 whereby decisions on planning applications relating to major development must ensure that sustainable drainage systems for the management of runoff are put in place, unless demonstrated to be inappropriate. Additionally,

[62] Previously referred to as the updated Flood Map for Surface Water (uFMfSW)
[63] http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/

applicants must demonstrate that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for ongoing maintenance.

5.2.4.1 Policy recommendations:

- Encourage rural and urban best practices in land-use and land-management to restore more sustainable natural floodplains and to reduce run-off.
- Encourage developers to contribute towards upstream flood storage to reduce the reliance of hard engineered solutions to manage flood risk on their site. The Environment Agency promotes a whole catchment approach to managing flood risk, and will proactively work to implement sustainable flood management schemes.
- Ensure that the run-off from all proposed development is minimised. For example, SuDS must be encouraged and targeted within planning approvals. Encourage the retro-fitting of SuDS where surface water flooding is already a problem.
- SuDS should be designed to support green infrastructure within developments, providing additional water quality and biodiversity benefits. There should be a presumption against underground storage of water.

5.2.5 SuDS and Groundwater Protection

When considering infiltration SuDS, developers should consider the following with respect to protection of groundwater quality in the study area. The water environment is potentially vulnerable and there is an increased potential for pollution from inappropriately located and/or designed infiltration SuDS.

The Environment Agency support the use of SuDS for new discharges and state that where infiltration SuDS are to be used for surface run-off from roads, car parking and public or amenity areas, a suitable series of treatment steps should be provided to prevent the pollution of groundwater[64]. Where infiltration SuDS are proposed for anything other than clean roof drainage in a Source Protection Zone 1 (SPZ1) the Environment Agency will require a risk assessment to demonstrate that pollution of groundwater would not occur.

SPZ's within the study area should therefore be taken into account when planning SuDS as part of developments. The following considerations should be taken into account with respect to infiltration SuDS:

- Soakaways and other infiltration SuDS must not be constructed in contaminated ground. The use of infiltration drainage would only be acceptable if a phased site investigation (in line with CLR11, 'Model Procedures for the Management of Land Contamination') showed the presence of no significant contamination. The use of non-infiltration SUDS may be acceptable subject to agreement with the Environment Agency. More information on SuDS is available in the SuDS Manual produced by Warwickshire County Council.
- The Environment Agency considers that deep boreholes and other deep soakaways systems are not appropriate in areas where groundwater constitutes a significant resource. Deep soakaways increase the risk of groundwater pollution.

5.2.6 Main Rivers

Under the Water Resources Act, the Environment Agency is the permitting Authority for main rivers, and any works in, over, under or near a main river or a flood defence will need a flood risk activity permit. A main river is a watercourse that is shown on a main river map and includes any structure or appliance for controlling or regulating the flow of water into, in or out of the channel.

Developers need to obtain an Environmental Permit to ensure that their activities do not cause or make existing flood risk worse, interfere with Environment Agency work, and do not adversely affect the local environment, fisheries or wildlife.

5.2.6.1 Policy recommendations:

- Watercourses should not be culverted or straightened, as these activities cause deterioration of their quality.
- Where watercourses have in the past been culverted or straightened, reinstatement to a more natural landscape should form part of the development.
- Each development should enhance the quality of the local watercourse.
- A minimum easement of 8 meters from the top of bank of a main river is required to allow maintenance of the watercourse. Where possible a larger easement should be provided.

[64] Environment Agency (2013) Groundwater protection: Principles and practice (GP3)

6 Water Cycle Strategy Recommendations

6.1 Policy Recommendations Overview

6.1.1 Wastewater

WW1 – Development Phasing in the Finham (Coventry) WwTW catchment
It is recommended that a policy should be developed by NBBC, RBC and WDC that ensures that all development proposed to drain to Finham (Coventry) WwTW up to at least 2020, is only given planning permission if the Environment Agency and STW have indicated that they are satisfied that the development can be accommodated either within the limits of capacity at the WwTW or by sufficient capacity being made available, and that the requirements of the WFD will not be compromised.

WW2 – Development Phasing in the Churchover WwTW catchment
It is recommended that a policy is developed by RBC that requires all development proposed to drain to Churchover WwTW post 2021 to be subject to a developer enquiry[65] with STW to determine process capacity at the WwTW before granting permission.

WW3 – Development Phasing in the Dunchurch WwTW catchment
It is recommended that a policy is developed by RBC that requires all development proposed to drain to Dunchurch WwTW post 2030 to be subject to a developer enquiry with STW to determine process capacity at the WwTW before granting permission.

WW4 – Development Phasing in the Hartshill (Nuneaton) WwTW catchment
It is recommended that once a housing trajectory has been prepared by NWBC, a policy is developed by NWBC and NBBC that requires all development proposed to drain to Hartshill (Nuneaton) WwTW to be subject to a developer enquiry with STW to determine process capacity at the WwTW before granting permission.

WW5 – Development Phasing in the Rugby Newbold WwTW catchment
It is recommended that a policy is developed by RBC that requires all development proposed to drain to Rugby Newbold WwTW post 2021 to be subject to a developer enquiry with STW to determine process capacity at the WwTW before granting permission.

WW6 – Development Phasing in Warton
It is recommended that once a housing trajectory has been prepared by NWBC, a policy is developed by NWBC that requires all development proposed to drain to Warton WwTW to be subject to a developer enquiry

WW7 – Development and Sewerage Network
It is recommended that a policy is developed for development at all sites, that they should be subject to a pre-planning enquiry with STW to determine upgrades needed to prior to planning permission being granted. Assessments made within this WCS consider each site in isolation and capacity will change depending on when and where sites come forward.

6.1.2 Water Supply

WS1 – Water Efficiency in new homes and buildings
In order to move towards a more 'water neutral position' and to enhance sustainability of development coming forward, a policy should be developed that ensures all housing is as water efficient as possible, and that new housing development should meet specific water use standards of 110 l/h/d in line with the Building Regulations optional requirement. Non-domestic building should as a minimum reach 'Good' BREEAM status.

WS2 – Water Efficiency Retrofitting
In order to move towards a more 'water neutral position', policy could be developed to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 20% of the existing housing stock with easy fit water savings devices under the Medium water neutrality scenario.

[65] For a fee, STW undertake a combined assessment of capacity for both the water supply and sewerage network to accept new developments.

WS3 – Water Efficiency Promotion
It is recommended that a policy be developed to establish a programme of water efficiency promotion and consumer education, with the aim of behavioural change with regards to water use to go beyond the Medium water neutrality scenario.

6.1.3 Surface Water Management and Flood Risk

SWM1 – Sewer Separation
Developers should ensure foul and surface water from new development and redevelopment are kept separate where possible. Surface water should be discharged as high up the following hierarchy of drainage options as reasonably practicable, before a connection to the foul network is considered:

- into the ground (infiltration);
- to a surface waterbody;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

Where sites which are currently connected to combined sewers are redeveloped, the opportunity to disconnect surface water and highway drainage from combined sewers must be taken.

SWM2 – Above Ground Drainage
Developers should aspire to achieve 100% above ground drainage for all future developments, where feasible. Where this is not feasible due to for example housing densities, land take, ground conditions, topography, or other circumstances, the development proposals should maximise opportunities to use SuDS measures which require no additional land take, i.e. green roofs, permeable surfaces and water butts.

SWM3 – SuDS and Green Infrastructure
Developers should ensure linkage of SuDS to green infrastructure to provide environmental enhancement and amenity, social and recreational value. SuDS design should maximise opportunities to create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space.

SWM4 – SuDS and Water Efficiency
Developers should ensure linkage of SuDS to water efficiency measures where possible, including rainwater harvesting.

SWM5 – Linkages to SWMP and SFRA
Developers should ensure SuDS design supports the findings and recommendations of the Warwickshire Surface Water Management Plan (SWMP) and the appropriate partner authority's SFRA.

SWM6 – Water Quality Improvements
Developers should ensure, where possible, that discharges of surface water are designed to deliver water quality improvements in the receiving watercourse or aquifer where possible to help meet the objectives of the Water Framework Directive.

6.1.4 Ecology

ECO1 – Biodiversity enhancement
It is recommended that each of the partner authorities include a policy in their Local Plans which commits to seeking and securing (through planning permissions etc.) enhancements to aquatic biodiversity within their administrative area through the use of SuDS (subject to appropriate project-level studies to confirm feasibility including environmental risk and discussion with relevant authorities) in line with the Warwickshire Green Infrastructure Strategy.

6.2 Further Recommendations

6.2.1 Stakeholder Liaison

It is recommended that key partners in the WCS maintain regular consultation with each other as development proposals progress.

6.2.2 WCS Periodic Review

The WCS should remain a living document, and (ideally) be reviewed on an annual basis as development progresses and changes are made to the various studies and plans that support it; these include:

- five yearly reviews of STW's WRMP (the next full review is due in 2019, although interim reviews are undertaken annually); and
- Periodic review 2019 (PR19) (STW's business plan for AMP7 – 2020 to 2025).

Appendix A. Relevant Planning Documents to the WCS

Partner Authority Relevance	Category	Document Name	Publication Date
All	Water	Warwickshire sub-regional Water Cycle Study Scoping and Outline Report	2010
All	Environment	Severn River Basin District Management Plan (RBMP)	2015
All	Environment	Humber River Basin District Management Plan (RBMP)	2015
North Warwickshire and Rugby	Flood Risk	Stratford-on-Avon, Warwickshire County Council, North Warwickshire and Rugby Strategic Flood Risk Assessment (SFRA)	2013
Warwick	Flood Risk	Warwick District Council SFRA	2013
Nuneaton & Bedworth	Flood Risk	Nuneaton and Bedworth Borough Council Level 2 SFRA	2012
All	Housing	Updated Assessment of Housing Need: Coventry-Warwickshire HMA	2015
Warwick	Employment	Warwick District Employment Land Review Update	2015
North Warwickshire	Employment	Employment Land Review Update	2013
Nuneaton & Bedworth	Employment	Employment Land Review 2014	2014
All	Flood Risk	Warwickshire Surface Water Management Plan	2015
All	Environment	Warwickshire, Coventry and Solihull sub-regional Green Infrastructure Strategy	2013
All	Water	Severn Trent Water Water Resource Management Plan 2014	2014
All	Climate Change	United Kingdom Climate Projections 2009 (UKCP09)	2009
All	Water	Warwickshire Avon abstraction licensing strategy	2013
All	Water	Tame, Anker and Mease abstraction licensing strategy	2013

Appendix B.Legislative Drivers Shaping the WCS

Directive/Legislation/Guidance	Description
Birds Directive 2009/147/EC	Provides for the designation of Special Protection Areas.
Building Regulations Approved Document G – sanitation, hot water safety and water efficiency (March 2010)	The current edition covers the standards required for cold water supply, water efficiency, hot water supply and systems, sanitary conveniences and washing facilities, bathrooms and kitchens and food preparation areas.
Eel Regulations 2009	Provides protection to the European eel during certain periods to prevent fishing and other detrimental impacts.
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.
Flood & Water Management Act 2010	The Flood and Water Management Act 2010 is the outcome of a thorough review of the responsibilities of regulators, local authorities, water companies and other stakeholders in the management of flood risk and the water industry in the UK. The Pitt Review of the 2007 flood was a major driver in the forming of the legislation. Its key features relevant to this WCS are: • To give the Environment Agency an overview of all flood and coastal erosion risk management and unitary and county councils the lead in managing the risk of all local floods. • To encourage the uptake of sustainable drainage systems by removing the automatic right to connect to sewers and providing for unitary and county councils to adopt SuDS for new developments and redevelopments. • To widen the list of uses of water that water companies can control during periods of water shortage, and enable Government to add to and remove uses from the list. • To enable water and sewerage companies to operate concessionary schemes for community groups on surface water drainage charges. • To make it easier for water and sewerage companies to develop and implement social tariffs where companies consider there is a good cause to do so.
Future Water, February 2008	Sets the Government's vision for water in England to 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.
Habitats Directive 92/44/EEC and Conservation of Habitats & Species Regulations 2010	To conserve the natural habitats and to conserve wild fauna and flora with the main aim to promote the maintenance of biodiversity taking account of social, economic, cultural and regional requirements. In relation to abstractions and discharges, can require changes to these through the Review of Consents (RoC) process if they are impacting on designated European Sites. Also the legislation that provides for the designation of Special Areas of Conservation provides special protection to certain non-avian species and sets out the requirement for Appropriate Assessment of projects and plans likely to have a significant effect on an internationally designated wildlife site.

Directive/Legislation/Guidance	Description
Land Drainage Act 1991	Sets out the statutory roles and responsibilities of key organisations such as Internal Drainage Boards, local authorities, the Environment Agency and Riparian owners with jurisdiction over watercourses and land drainage infrastructure.
Making Space for Water, 2004	Outlines the Government's 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.
National Planning Policy Framework	Planning policy in the UK is set by the National Planning Policy Framework (NPPF). The NPPF revokes most of the previous Planning Policy Statements and Planning Policy Guidance. However, NPPF does not revoke the PPS25 Practice Guide. NPPF advises local authorities and others on planning policy and operation of the planning system. A WCS helps to balance the requirements of various planning policy documents, and ensure that land-use planning and water cycle infrastructure provision is sustainable.
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.
Ramsar Convention	Provides for the designation of wetlands of international importance
Urban Waste Water Treatment Directive (UWWTD) 91/271/EEC	This Directive concerns the collection, treatment and discharge of urban waste water and the treatment and discharge of waste water from certain industrial sectors. Its aim is to protect the environment from any adverse effects caused by the discharge of such waters.
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 overall requirement of the directive is that all river basins must achieve 'good ecological status' by 2015 or by 2027 if there are grounds for derogation. The WFD, for the first time, combines 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 has been adopted. It effectively supersedes all water related legislation which drives the existing licensing and permitting framework in the UK. The Environment Agency is the body responsible for the implementation of the WFD in the UK. The Environment Agency have been supported by UKTAG[66], an advisory body which 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[67]. These have recently been finalised and issued within the River Basin Management Plans (RBMP).
Natural Environment & Rural Communities Act 2006	Covering Duties of public bodies – recognises that biodiversity is core to sustainable communities and that Public bodies have a statutory duty that states that "every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity

[66] 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.
[67] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008, UK Technical Advisory Group on the Water Framework Directive.

Directive/Legislation/Guidance	Description
Water Resources Act 1991	Protection of the quantity and quality of water resources and aquatic habitats. Parts have been amended by the Water Act 2003.
Wildlife & Countryside Act 1981 (as amended)	Legislation that provides for the protection and designation of SSSIs and specific protection for certain species of animal and plant among other provisions.

Appendix C. WwTW Capacity Assessment Results

C.1 Modelling assumptions and input data

Several key assumptions have been used in the water quality and permit modelling as follows:

- the wastewater generation per new household is based on an assumed Occupancy Rate (OR) of 2.3 people per house and an average consumption of 129 l/h/d (as set out in Section 1.6);
- WwTW current flows were taken as the current observed dry weather flow (DWF) (taken as the highest Q90 from 2012-2014 inclusive). Future 2031 flows were calculated by adding the volume of additional wastewater generated by new dwellings (using an OR of 2.3, a consumption value of 129l/h/d) to the current observed DWF value;
- WwTW current discharge quality was taken as the current permitted limits for each water quality element. Figures for the mean and standard deviation of each element were calculated based on these permit levels using RQP 2.5 software (discussed further below).
- River flow data for the RQP modelling has been provided by the Environment Agency based on outputs from the SIMCAT model – data was provided as mean flow and Q95[68]. The receiving watercourse that had the WFD status was used to determine the location to extract the river flow data as there was a lack of monitoring data.
- Raw water quality data for modelling was provided by Environment Agency water quality planners. The WFD 'no deterioration' target for each WwTW are the downstream status, for each water quality element, based on river monitoring data collected between 2006 and 2016. Actual data was used in preference over the published status in the RBMP. The mean value and standard deviation was calculated, using this raw data for BOD, Ammonia and Phosphate where available for both the upstream (of the WwTW) and downstream (the discharge) inputs. Details are provided below along with the full results and outputs from the water quality modelling in Appendix
- For the purposes of this study, the limits of conventionally applied treatment processes are considered to be:
  - 5mg/l for BOD;
  - 1mg/l for Ammoniacal-N; and
  - 0.5mg/l for Phosphate.

C.2 Assessment techniques

Modelling of the quality permits required to meet the two WFD requirements has been undertaken, using RQP 2.5 (River Quality Planning), the Environment Agency's software for calculating permit conditions. The software is a monte-carlo based statistical tool that determines what statistical quality is required from discharges in order to meet defined downstream targets, or to determine the impact of a discharge on downstream water quality compliance statistics.

The first stage of the modelling exercise was to establish the discharge permit standards that would be required to meet 'No Deterioration'. This would be the discharge permit limit that would need to be imposed on STW at the time the growth causes the flow permit to be exceeded. No deterioration is an absolute requirement of the WFD and any development must not result in a decrease in quality downstream from the current status.

The second stage was to establish the discharge permit standards that would be required to meet future Good Status under the WFD in the downstream waterbody. This assessment was only carried out for WwTWs discharging to waterbodies where the current status is less than Good (i.e. currently Moderate, Poor or Bad). This would be the discharge permit standard that may need to be applied in the future, subject to the assessments of 'technical feasibility' and 'disproportionate cost. Such assessments would be carried out as part of the formal Periodic Review process overseen by OFWAT in order to confirm that the proposed improvement scheme is acceptable.

Step 1 – 'No Deterioration'

A calculation was undertaken to determine if the receiving watercourse can maintain 'No Deterioration' downstream from the current quality with the proposed growth within limits of conventional treatment technology, and what permit limits would be required. If 'No Deterioration' could be achieved, then a proposed discharge permit standard was calculated which will be needed as soon as the growth causes the WwTW flow permit to be exceeded, see C.3.

[68] Defined as the flow value exceeded 95% of the time i.e. a representation of low flows

Step 2 – Meeting Future 'Good' Status

For all WwTW where the current downstream quality of the receiving watercourse *is less than good*, a calculation was undertaken to determine if the receiving watercourse could achieve future 'Good Status', with the proposed growth within limits of conventional treatment technology and what permit limits would be required to achieve this.

The assessment of attainment of future 'Good Status' assumed that other measures will be put in place to ensure 'Good Status' upstream, so that the modelling assumed upstream water quality is at the midpoint of the 'Good Status' for each element and set the downstream target as the lower boundary of the 'Good Status' for each element.

If 'Good' could be achieved with growth with permits achievable within the limits of conventional treatment, then a proposed discharge permit standard which may be needed in the future has been given in C.3.

If the modelling showed that the watercourse could not meet future 'Good' status with the proposed growth within limits of conventional treatment technology, a further assessment step three was undertaken.

Step 3 – Is Growth the Factor Causing failure to meet future 'Good Status'?

In order to determine if it is growth that is causing the failure to attain future 'Good Status' downstream, the modelling in step 2 was repeated, but without the growth in place (i.e. using current flows) as a comparison.

If the watercourse could not meet 'Good Status' without growth (assuming the treatment standard were improved to the limits of conventional treatment technology), then it is not the growth that would be preventing future 'Good Status' being achieved and the 'No Deterioration' permit standard given in C.3. (Step 1) above would be sufficient to allow the proposed growth to proceed.

If the watercourse could meet 'Good Status' without growth, then it is the growth that would be preventing future 'Good Status' being achieved. Therefore consideration needs to be given to whether there are alternative treatment options that would prevent the future failure to attain 'Good Status'.

The methodology is designed to look at the impact of proposed growth alone, and whether the achievement of 'Good Status' will be compromised. It is important that STW have an understanding of what permits may be necessary in the future. The RBMP and Periodic Review planning processes will deal with all other issues of disproportionate costs.

C.3 Assessment Tables

'NO DETERIORATION' ASSESSMENT

	Atherstone WwTW			Churchover WwTW			Dunchurch WwTW		
	BOD	Ammonia	Phosphate	BOD	Ammonia	Phosphate	BOD	Ammonia	Phosphate
Receiving WFD Watercourse	Anker from Wem Brook to River Sence			Swift source to conf Avon			Leam - conf Rains Bk to conf R Itchen		
No Deterioration target	High	High	Poor	High	High	Poor	High	High	Poor
River quality target (90%ile or AA)	4.0	0.30	1.00	4.0	0.30	1.00	4.0	0.30	1.00
LCT	5	1	0.5	5	1	0.5	5	1	0.5
Current Consent									
Current DWF (m3/day)	4274			28			885		
Consent limits (95%ile or AA)	20.0	6.00	2.00	25.0	15.00	-	10.0	5.00	0.70
Current effluent quality required (95%ile or AA)	**20.0**	**0.2**	**21.9**	Not required			**10.0**	**0.5**	**2.4**
Consent already exceeded?	ammonia - currently beyond LCT			No			ammonia - currently beyond LCT		
Discharge Quality Required									
Future DWF (m3/day)	5051			88			1294		
Effluent quality required (95%ile or AA)	**17.2**	**0.2**	**19.0**	**7.9**	**68.0**	**171.1**	**6.8**	**0.5**	**2.0**
Will Growth prevent WFD objective of 'No Deterioration' from being achieved ?	No - current level of treatment is shown to maintain the High ammonia status, despite theoretically needing to be beyond the LCT			No			No - current level of treatment is shown to maintain the High ammonia status, despite theoretically needing to be beyond the LCT		

'IMPROVEMENT TO GOOD STATUS' ASSESSMENT

	Atherstone WwTW			Churchover WwTW			Dunchurch WwTW		
			Phosphate			Phosphate			Phosphate
River Downstream of Discharge									
WFD Status target			Good by 2027			Good by 2021			Good by 2021
River quality target (90%ile or AA)			0.069			0.069			0.069
Discharge Quality Required - Current									
Current DWF (m3/day)	4274			28			885		
Effluent quality required (95%ile or AA)			**0.5**			**12.0**			**0.1**
Discharge Quality Required - Future									
Future DWF (m3/day)	5051			88			1294		
Effluent quality required (95%ile or AA)			**0.5**			**3.9**			**0.1**
Will Growth prevent WFD Good Status from being achieved ?	No - but theoretically would require phosphate permit slightly beyond LCT			No			No		

Key to 'Effluent Quality Required'
Green Value – no change to current permit required
Amber Value – permit tightening required, but within limits of conventionally applied treatment processes
Red Value – not achievable within limits of conventionally applied treatment processes

'NO DETERIORATION' ASSESSMENT

	Finham (Coventry) WwTW			Hartshill (Nuneaton) WwTW			Rugby Newbold WwTW		
	BOD	Ammonia	Phosphate	BOD	Ammonia	Phosphate	BOD	Ammonia	Phosphate
Receiving WFD Watercourse	Sowe - conf Withy Bk to conf R Avon			Anker from Wem Brook to River Sence			Avon - ClaycotonYelvertoft Bk to conf R Sowe		
No Deterioration target	High	High	Moderate	High	High	Poor	High	High	Moderate
River quality target (90%ile or AA)	4.0	0.30	0.25	4.0	0.30	1.00	4.0	0.30	0.25
LCT	5	1	0.5	5	1	0.5	5	1	0.5
Current Consent									
Current DWF (m3/day)	148375			26863			25539		
Consent limits (95%ile or AA)	15.0	3.00	1.00	15.0	3.00	1.00	15.0	5.00	1.00
Current effluent quality required (95%ile or AA)	**15.0**	**0.6**	**0.2**	Not required			**15.0**	**1.0**	**0.4**
Consent already exceeded?	ammonia and phosphate - currently beyond LCT			No (ammonia is borderline)			Phosphate - currently beyond LCT		
Discharge Quality Required									
Future DWF (m3/day)	151411			30798			28930		
Effluent quality required (95%ile or AA)	**14.7**	**0.6**	**0.2**	**13.1**	**1.0**	**3.3**	**13.2**	**1.0**	**0.3**
Will Growth prevent WFD objective of 'No Deterioration' from being achieved ?	No - current level of treatment is shown to maintain the High ammonia status and Moderate phosphate status, despite theoretically needing to be beyond the LCT			No - ammonia permit required is on the LCT with growth			No - ammonia permit is on the LCT with growth. Current level of treatment is shown to maintain the Moderate phosphate status, despite theoretically needing to be beyond the LCT		

'IMPROVEMENT TO GOOD STATUS' ASSESS

	Finham (Coventry) WwTW			Hartshill (Nuneaton) WwTW			Rugby Newbold WwTW		
			Phosphate			Phosphate			Phosphate
River Downstream of Discharge									
WFD Status target			Moderate by 2021			Good by 2027			Good by 2021
River quality target (90%ile or AA)			0.25			0.069			0.069
Discharge Quality Required - Current									
Current DWF (m3/day)				26863			25539		
Effluent quality required (95%ile or AA)						**0.1**			**0.1**
Discharge Quality Required - Future									
Future DWF (m3/day)				30798			28930		
Effluent quality required (95%ile or AA)						**0.1**			**0.1**
Will Growth prevent WFD Good Status from being achieved ?	N/A			No			No		

Key to 'Effluent Quality Required'
Green Value – no change to current permit required
Amber Value – permit tightening required, but within limits of conventionally applied treatment processes
Red Value – not achievable within limits of conventionally applied treatment processes

'NO DETERIORATION' ASSESSMENT

	Warton WwTW		
	BOD	Ammonia	Phosphate
Receiving WFD Watercourse	Anker from River Sence to River Tame		
No Deterioration target	High	High	Poor
River quality target (90%ile or AA)	4.0	0.30	1.00
LCT	5	1	0.5
Current Consent			
Current DWF (m3/day)	204		
Consent limits (95%ile or AA)	40.0	-	-
Current effluent quality required (95%ile or AA)	Not required		
Consent already exceeded?	No		
Discharge Quality Required			
Future DWF (m3/day)	259		
Effluent quality required (95%ile or AA)	**34.5**	**2.6**	**4.9**
Will Growth prevent WFD objective of 'No Deterioration' from being achieved ?	No		

'IMPROVEMENT TO GOOD STATUS' ASSESS

	Warton WwTW		
			Phosphate
River Downstream of Discharge			
WFD Status target			Good by 2027
River quality target (90%ile or AA)			0.069
Discharge Quality Required - Current			
Current DWF (m3/day)	204		
Effluent quality required (95%ile or AA)			**0.2**
Discharge Quality Required - Future			
Future DWF (m3/day)	259		
Effluent quality required (95%ile or AA)			**0.2**
Will Growth prevent WFD Good Status from being achieved ?	No		

Key to 'Effluent Quality Required'
Green Value – no change to current permit required
Amber Value – permit tightening required, but within limits of conventionally applied treatment processes
Red Value – not achievable within limits of conventionally applied treatment processes

Appendix D. Reason for Alternative Objective

Where certain conditions apply and are met then alternative objectives have been set for water bodies; these involve taking an extended time period to reach the objective or meeting a lower status or a combination of both. In some water bodies it is recognised that time constraints on putting actions in place, or the time taken for the environment to respond once actions are implemented, mean that the objective will only be achieved over more than one river basin management planning cycle. An objective of less than good status is set where:

- there is currently no solution to the problem
- the costs of taking action exceed the benefits
- background conditions in the environment mean achieving good status is not possible

D.1 Justification for 'Moderate' Ecological Status Objective for River Sowe

Section 5.4 of the Severn RBMP Part 2: River basin management planning overview and additional information[69] sets out the specific circumstances for the particular elements and the justification behind the alternative objective. The individual sub-elements 'Macrophytes and Phytobenthos Combined' and 'Phosphate' of the River Sowe (GB109054044540) waterbody have had an alternative objective of 'Moderate' status to be achieved by 2021 and 2027. This has then been applied to the overall waterbody, which has an objective of 'Moderate' Ecological status by 2021 and 2027.

The reason the alternative objective has been set is described as '**Disproportionately expensive - Unfavourable balance of costs and benefits**'.

The explanation for the use of this exemption, as detailed in Table 6 of the Severn RBMP, is provided below.

Engineering measures and technologies to improve water quality of discharges from sewage treatment works can have high costs relative to other measures within a catchment bundle of measures. Although these measures can be technically feasible, the cost of implementation can exceed the benefits to be gained from achieving good status. This is especially true in cases where improvements are limited to an individual water body which limits the overall relative benefit in the catchment. In these circumstances a less stringent objective has been set under Article 4(5). This exemption has been used when the environmental and socioeconomic needs served by the sewage treatment works to dispose of sewage cannot be achieved by other means which are a significantly better environmental option not entailing disproportionate costs, as required by article 4(5)(a).

[69] https://www.gov.uk/government/publications/part-2-river-basin-management-planning-overview-and-additional-information

Appendix E. Background to Wildlife Sites

E.1 Alvecote Pools Site of Special Scientific Interest (SSSI)[70]

The site consists of a series of shallow pools which have arisen as a result of colliery subsidence. They lie along the course of the River Anker, in North Warwickshire, astride the Warwickshire/ Staffordshire border. The site is one of the most extensive and diverse wetland areas in the county and supports a regionally important bird community attracting between 115 and 126 different species of bird every year.

As well as the open waters of the River Anker, the Coventry Canal and the pools themselves, there are a wide variety of other habitats present. These include fen, bog, reed bed, alder/willow carr, scattered woodland, pasture and areas of colliery waste. In the open waters numerous aquatic plants occur. Pools are surrounded by a mixture of grassland and scrub. In the area known as Pooley Fields there has been extensive colonisation of colliery spoil by many mosses, liverworts, fungi and lichens, several of which are rare in the Midlands.

A great variety of aquatic and terrestrial invertebrates live in and around these diverse wetland communities. These include land and water bugs (89 species recorded), beetles (322), dragonflies (13) and spiders (121).

E.2 River Mease Special Area for Conservation (SAC)[71]

The River Mease arises in North West Leicestershire and flows westwards through Derbyshire and Staffordshire for around 25 kilometres across a largely rural and agricultural landscape to its confluence with the Trent at Croxall. It is a small tributary of the River Trent system and represents a relatively unmodified lowland river with a diverse range of in-channel features, including riffles, pools, shoals, vegetated channel margins and bank side tree cover.

The SAC is designated for:

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation ('Rivers with floating vegetation often dominated by water-crowfoot')
- White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*
- Bullhead Cottus gobio
- Spined loach Cobitis taenia
- Otter Lutra lutra

E.3 Ensor's Pool SAC[72]

Ensor's Pool lies on the western edge of Nuneaton in the north of Warwickshire and formed in an abandoned clay pit. It is about 220 metres long, 50 metres wide with an average depth of eight metres and is fed by groundwater. The pool overlies Etruria Marl which was extracted for brickmaking earlier this century. Ensor's Pool has traditionally held a very large and healthy population of native white-clawed crayfish *Austropotamobius pallipes* estimated at 50,000 individuals.

As such, the SAC is designated for:

- White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*

A white-clawed crayfish monitoring survey undertaken at Ensor's Pool in 2015 [73] did not identify the presence of white clawed crayfish, which was in great contrast to the survey results from previous years. This indicates that the population of white-clawed crayfish at Ensor's Pool is currently extinct, likely as a result of crayfish plague. The intention will be to reintroduce white-clawed crayfish to this site, once the cause for the previous extinction is addressed.

[70] Natural England (1987) Citation Alvecote Pools SSSI
[71] JNCC (2015) Natura 2000 – Standard Data Form: River Mease SAC
[72] JNCC (2015) Natura 2000 – Standard Data Form: Ensor's Pool SAC
[73] Natural England (2015). IPENS065: White-clawed crayfish survey for Ensor's Pool SSSI/SAC (Warwickshire)

Appendix F.Water Neutrality

Water Neutrality is defined in Section 4.7. This appendix provides supplementary information and guidance behind the processes followed.

F.1 Twin-Track Approach

Attainment of water neutrality requires a 'twin track' approach whereby water demand in new development is minimised as far as possible. At the same time measures are taken, such as retrofitting of water efficient devices on existing homes and business to reduce water use in existing development.

In order to reduce water consumption and manage demand for the limited water resources within the study area, a number of measures and devices are available[74], including:

- cistern displacement devices;
- flow regulation;
- greywater recycling;
- low or variable flush replacement toilets;
- low flow showers;
- metering;
- point of use water heaters;
- pressure control;
- rainwater harvesting;
- variable tariffs;
- low flows taps;
- water audits;
- water butts;
- water efficient garden irrigation; and,
- water efficiency promotion and education.

The varying costs and space and design constraints of the above mean that they can be divided into two categories, measures that should be installed for new developments and those which can be retrofitted into existing properties. For example, due to economies of scale, to install a rainwater harvesting system is more cost effective when carried out on a large scale and it is therefore often incorporated into new build schools, hotels or other similar buildings. Rainwater harvesting is less well advanced as part of domestic new builds, as the payback periods are longer for smaller systems and there are maintenance issues. To retrofit a rainwater harvesting system can have very high installation costs, which reduces the feasibility of it.

However, there are a number of the measures listed above that can be easily and cheaply installed into existing properties, particularly if part of a large campaign targeted at a number of properties. Examples of these include the fitting of dual-flush toilets and low flow showers heads to social housing stock, as was successfully carried out in Preston by Reigate and Banstead Council in conjunction with Sutton and East Surrey Water and Waterwise[75].

F.2 The Pathway Concept

The term 'pathway' is used here as it is acknowledged that, to achieve any level of neutrality, a series of steps are required in order to go beyond the minimum starting point for water efficiency which is currently mandatory for new development under current and planned national planning policy and legislation.

- There are no statutory requirements for new housing to have a low water use specification as previous government proposals to make different levels compulsory have been postponed pending government review. For non-domestic development, there is no statutory requirement to have a sustainability rating with the Building Research Establishment Environmental Assessment Method (BREEAM), only being mandatory where specified by a public body in England such as:
- Local Authorities incorporating environmental standards as part of supplementary planning guidance;
- Department of Health for new healthcare buildings and refurbishments;
- Department for Education for all projects valued at over £500K (primary schools) and £2million (secondary schools);

[74] Source: Water Efficiency in the South East of England, Environment Agency, April 2007.
[75] Preston Water Efficiency Report, Waterwise, March 2009, www.waterwise.org.uk

– English Partnerships (now incorporated into the Homes and Communities Agency) for all new developments involving their land; and

– Office of Government Commerce for all new buildings.

Therefore, other than potential local policies delivered through a Local Plan, the only water efficiency requirements for new development are through the Building Regulations[76] where new homes must be built to specification to restrict water use to 125l/h/d or 110l/h/d where the optional requirement applies. However, the key aim of the Localism Act is to decentralise power away from central government towards local authorities and the communities they serve. It therefore creates a stronger driver for local authorities to propose local policy to address specific local concerns. New local level policy is therefore key to delivering aspirations such as water neutrality and the Localism Act provides the legislative mechanism to achieve this in the study area.

In addition to the steps required in new local policy, the use of a pathway to describe the process of achieving water neutrality is also relevant to the other elements required to deliver it, as it describes the additional steps required beyond 'business as usual' that both developers and stakeholders with a role (or interest) in delivering water neutrality would need to take, for example:

– the steps required to deliver higher water efficiency levels on the ground (for the developers themselves); and

– The partnership initiative that would be required beyond that normally undertaken by local authorities and water companies in order to minimise existing water use from the current housing and business stock.

Therefore, the pathway to neutrality described in this section of the WCS requires a series of steps covering:

– technological inputs in terms of physically delivering water efficiency measures on the ground;

– local planning policies which go beyond national guidance; and

– partnership initiatives and partnership working.

The following sections outline the types of water efficiency measures which have been considered in developing the technological pathway for the water neutrality target scenarios.

F.3 Improving Efficiency in Existing Development

F.3.1 Metering

The installation of water meters in existing housing stock has the potential to generate significant water use reductions because it gives customers a financial incentive to reduce their water consumption. Being on a meter also encourages the installation and use of other water saving products, by introducing a financial incentive and introducing a price signal against which the payback time of new water efficiency measures can be assessed. Metering typically results in a 5-10 per cent reduction from unmetered supply, which equates to water savings of approximately 65l per household per day, assuming an occupancy rate of 2.3[77] for existing properties.

In 2009, DEFRA instructed Anna Walker (the Chair of the Office of Rail Regulation) to carry out an independent review of charging for household water and sewerage services (the Walker Review)[78]. The typical savings in water bills of metered and unmetered households were compared by the Walker review, which gives an indication of the levels of water saving that can be expected (see Table F-1).

Table F-1: Change in typical metered and unmetered household bills

2009-10 Metered	2009-10 Unmetered	2014-15 Metered	2014-15 Unmetered	% change Metered	% change Unmetered
348	470	336	533	-3	13

F.3.2 Low or Variable Flush Toilets

Toilets use about 30 per cent of the total water used in a household[79]. An old style single flush toilet can use up to 13 litres of water in one flush. New, more water-efficient dual-flush toilets can use as little as 2.6 litres[80] per flush. A

[76] Part G of the Building Regulations
[77] 2.3 is used for existing properties and new properties. This figure was agreed with STW prior to the assessment
[78] Independent Walker Review of Charging and Metering for Water and Sewerage services, DEFRA, 2009, http://www.defra.gov.uk/environment/quality/water/industry/walkerreview/
[79] http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/house_and_garden/toilet_flushing.html
[80] http://www.lecico.co.uk/

study carried out in 2000 by Southern Water and the Environment Agency[81] on 33 domestic properties in Sussex showed that the average dual flush saving observed during the trial was 27 per cent, equivalent to a volumetric saving of around 2.6 litres per flush. The study suggested that replacing existing toilets with low or variable flush alternatives could reduce the volume of water used for toilet flushing by approximately 27 per cent on average.

F.3.3 Cistern Displacement Devices

These are simple devices which are placed in the toilet cistern by the user, which displace water and therefore reduce the volume that is used with each flush. These can be easily installed by householders and are very cheap to produce and supply. Water companies and environmental organisations often provide these for free.

Depending on the type of device used (which can vary from a custom made device, such bag filled with material that expands on contact with water, to a household brick) the water savings can be up to 3 litres per flush.

F.3.4 Low Flow Taps and Showers

Flow reducing aerating taps and shower heads restrict the flow of water without reducing water pressure. Thames Water estimates that an aerating shower head can cut water use by 60 per cent with no loss of performance[82].

F.3.5 Pressure Control

Reducing pressure within the water supply network can be an effective method of reducing the volume of water supplied to customers. However, many modern appliances, such as Combi boilers, point of use water heaters and electric showers require a minimum water pressure to function. Careful monitoring of pressure is therefore required to ensure that a minimum water pressure is maintained. For areas which already experience low pressure (such as those areas with properties that are included on a water company's DG2 Register), this is not suitable. Limited data is available on the water savings that can be achieved from this method.

F.3.6 Variable tariffs

Variable tariffs can provide different incentives to customers and distribute a water company's costs across customers in different ways.

The Walker review assessed variable tariffs for water, including:

- rising block tariff;
- a declining block tariff;
- a seasonal tariff; and,
- time of day tariff.

A rising block tariff increases charges for each subsequent block of water used. This can raise the price of water to very high levels for customers whose water consumption is high, which gives a financial incentive to not to consume additional water (for discretionary use, for example) while still giving people access to low price water for essential use.

A declining block tariff decreases charges for each subsequent block of water used. This reflects the fact that the initial costs of supply are high, while additional supply has a marginal additional cost. This is designed to reduce bills for very high users and although it weakens incentives for them to reduce discretionary water use, in commercial tariffs it can reflect the economies of scale from bulk supplies.

A seasonal tariff reflects the additional costs of summer water supply and the fact that fixed costs are driven largely by the peak demand placed on the system, which is likely to be in the summer.

Time-of-day tariffs have a variable cost per unit supply according to the time of the day when the water is used; this requires smart meters. This type of charging reflects the cost of water supply and may reduce an individual household's bill; it may not reduce overall water use for a customer.

F.3.7 Water Efficient Appliances

Washing machines and dishwashers have become much more water efficient over the past twenty years. An old washing machine may use up to 150 litres per cycle, whereas modern, efficient machines may use as little as 35 litres per cycle. An old dishwasher could use up to 50 litres per cycle, whereas modern models can use as little as 10 litres.

[81] The Water Efficiency of Retrofit Dual Flush Toilets, Southern Water/Environment Agency, December 2000
[82] http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/9047.htm

However, this is partially offset by the increased frequency with which these are now used. It has been estimated[83] that dishwashers, together with the kitchen tap, account for about 8-14 per cent of water used in the home.

The Water Efficient Product Labelling Scheme provides information on the water efficiency of a product (such as a washing machine) and allows the consumer to compare products and select the most efficient product. The water savings from installation of water efficient appliances vary depending on the type of machine used.

F.3.8 Non-Domestic Properties

There is also the potential for considerable water savings in non-domestic properties. Depending on the nature of a business, water consumption may be high, for example food processing businesses. Even in businesses where water use is not high, such as B1 Business or B8 Storage and Distribution, there is still the potential for water savings using the retrofitting measures listed above. Water audits are useful methods of identifying potential savings and implementation of measures and installation of water saving devices could be funded by the asset owner; this could be justified by significant financial savings which can be achieved through implementation of water efficient measures. Non-domestic buildings such as warehouses and large scale commercial (e.g. supermarkets) property have significant scope for rainwater harvesting on large roof areas.

F.3.9 Water Efficiency in New Development

The use of efficient fixtures and fittings as described above also apply to the specification of water use in the building of new homes. The simplest way of demonstrating the reductions that use of efficient fixtures and fitting has in new builds is to consider what is required in terms of installation of the fixtures and fittings at different ranges of specification to ensure attainment of water use requirements under the Building Regulations or the optional requirement. The Cambridge WCS[84] gave a summary of water use savings that can be achieved by the use of efficient fixtures and fittings, as shown below in Table F-2.

Table F-2: Summary of water savings borne by water efficiency fixtures and fittings

Component	Building Regs 125 l/h/d[85]	Building Regs Optional Target 110 l/h/d[86]	80 l/h/d	62 l/h/d
Toilet flushing	18.75	12.32	8.4 + 8.4 c	8.4 + 8.4 c
Taps	22.69	20.46	18 a	18 a
Shower	39.77	31.81	18	18
Bath	18.52	17.02	22.4 b	22.4 b
Washing machine	15.61	15.61	7.65 + 7.65 c	7.65 + 7.65 c
Dishwasher	4.1	4.1	3.6	3.6
Recycled water	0	0	-16.1	-32.2
External use	5	5		
Total per head	124	106	78	61.9
TOTAL PER HOUSEHOLD	**282.5**	**241.3**	**171.6**	**136.18**

a Combines kitchen sink and wash hand basin

b 120 litre bath

c rainwater/greywater harvesting

Table F-2 highlights that in order to achieve water use around 80 l/h/d, water re-use technology (rainwater harvesting and/or greywater recycling) needs to be incorporated into the development.

[83] Water Efficiency Retrofitting: A Best Practice Guide, Waterwise, 2009, www.waterwise.org.uk
[84] Cambridge (and surrounding major growth areas) WCS Phase 2, Halcrow, 2010
[85] Figures calculated using the water efficiency calculator for new dwellings and maximum fittings consumption level provided in the Building Regulations Approved Document G
[86] Figures calculated using the water efficiency calculator for new dwellings and maximum fittings consumption optional requirement level provided in the Building Regulations Approved Document G

In using the BRE Water Demand Calculator[87], the experience of AECOM BREEAM/CHS assessors is that it is theoretically possible to get close to 80l/h/d through the use of fixture and fittings, but that this requires extremely high specification efficiency devices which are unlikely to be acceptable to the user and will either affect the saleability of new homes or result in the immediate replacement of the fixtures and fittings upon habitation. This includes baths at capacity below 120 litres, and shower heads with aeration which reduces the pressure sensation of the user. For this reason, it is not considered practical to suggest that 80l/h/d can be reached without some form of water recycling.

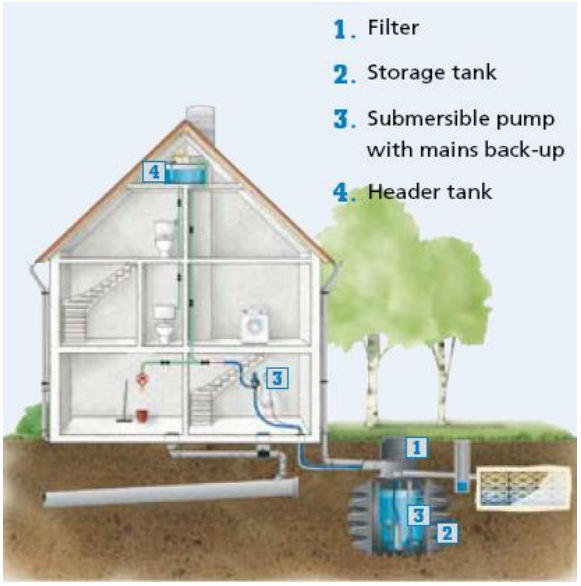
F.3.10 Rainwater Harvesting

Rainwater harvesting (RWH) is the capture and storage of rain water that lands on the roof of a property. This can have the dual advantage of both reducing the volume of water leaving a site, thereby reducing surface water management requirements and potential flooding issues, and be a direct source of water, thereby reducing the amount of water that needs to be supplied to a property from the mains water system.

RWH systems typically consist of a collection area (usually a rooftop), a method of conveying the water to the storage tank (gutters, down spouts and pipes), a filtration and treatment system, a storage tank and a method of conveying the water from the storage container to the taps (pipes with pumped or gravity flow). A treatment system may be included, depending on the rainwater quality desired and the source. Figure D-1 below gives a diagrammatic representation of a typical domestic system[88].

The level to which the rainwater is treated depends on the source of the rainwater and the purpose for which it has been collected. Rainwater is usually first filtered to remove larger debris such as leaves and grit. A second stage may also be incorporated into the holding tank; some systems contain biological treatment within the holding tank, or flow calming devices on the inlet and outlets that will allow heavier particles to sink to the bottom, with lighter debris and oils floating to the surface of the water. A floating extraction system can then allow the clean rainwater to be extracted from between these two layers[89].

Figure D-1: A typical domestic rainwater harvesting system



A sustainable water management strategy carried out for a proposed EcoTown development at Northstowe[90], approximately 10 km to the north west of Cambridge, calculated the size of rainwater storage that may be required for different occupant numbers, as shown below in Table F-3.

[87] http://www.thewatercalculator.org.uk/faq.asp
[88] Source: Aquality Intelligent Water management, www.aqua-lity.co.uk
[89] Aquality Rainwater Harvesting brochure, 2008
[90] Sustainable water management strategy for Northstowe, WSP, December 2007

Table F-3: Rainwater Harvesting Systems Sizing

Number of occupants	Total water consumption	Roof area (m^2)	Required storage tank (m^3)	Potable water saving per head (l/d)	Water consumption with RWH (l/h/d)
1	110	13	0.44	15.4	94.6
1	110	10	0.44	12.1	97.9
1	110	25	0.88	30.8	79.2
1	110	50	1.32	57.2	52.8
2	220	25	0.88	15.4	94.6
2	220	50	1.76	30.8	79.2
3	330	25	1.32	9.9	100.1
3	330	50	1.32	19.8	90.2
4	440	25	1.76	7.7	102.3
4	440	50	1.76	15.4	94.6

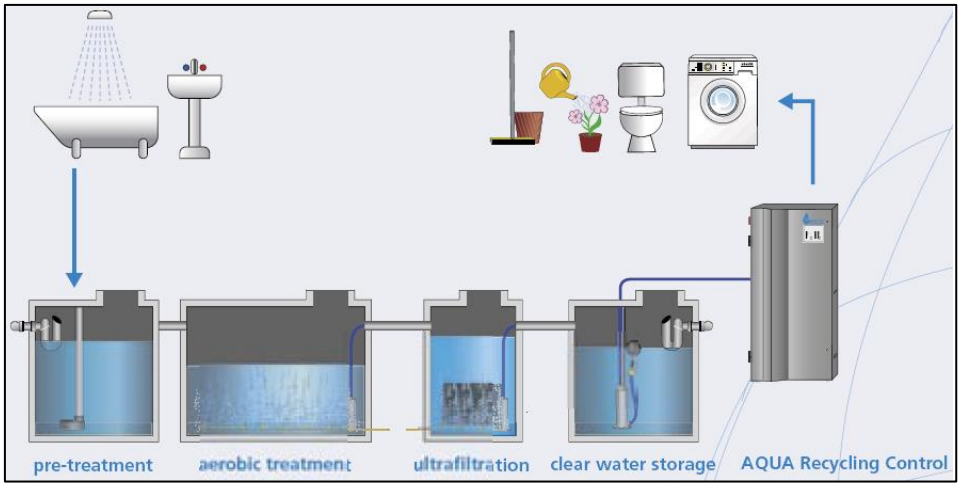
A family of four, with an assumed roof area of $50m^3$, could therefore expect to save 61.6 litres per day if a RWH system were installed.

F.3.11 Greywater Recycling

Greywater recycling (GWR) is the treatment and re-use of wastewater from shower, bath and sinks for use again within a property where potable quality water is not essential e.g. toilet flushing. Recycled greywater is not suitable for human consumption or for irrigating plants or crops that are intended for human consumption. The source of greywater should be selected by available volumes and pollution levels, which often rules out the use of kitchen and clothes washing waste water as these tend to be most highly polluted. However, in larger system virtually all non-toilet sources can be used, subject to appropriate treatment.

The storage volumes required for GWR are usually smaller than those required for rainwater harvesting as the supply of greywater is more reliable than rainfall. In domestic situations, greywater production often exceeds demand and a correctly designed system can therefore cope with high demand application and irregular use, such as garden irrigation. Figure F-2 below gives a diagrammatic representation of a typical domestic system[91].

Figure F-2 A typical domestic greywater recycling system



Combined rainwater harvesting and greywater recycling systems can be particularly effective, with the use of rainwater supplementing greywater flows at peak demand times (e.g. morning and evenings).

The Northstowe sustainable water management strategy calculated the volumes of water that could be made available from the use GWR. These were assessed against water demand calculated using the BRE Water Demand Calculator[92].

[91] Source: Aquality Intelligent Water management, www.aqua-lity.co.uk
[92] http://www.thewatercalculator.org.uk/faq.asp

Table F-4 demonstrates the water savings that can be achieved by GWR. If the toilet and washing machine are connected to the GWR system a saving of 37 litres per person per day can be achieved.

Table F-4: Potential water savings from greywater recycling

Appliance	Demand with Efficiencies (l/h/day)	Potential Source	Greywater Required (l/h/day)	Out As	Greywater available (80% efficiency) (l/h/day)	Consumptions with GWR (l/h/day)
Toilet	15	Grey	15	Sewage	0	0
Wash hand basin	9	Potable	0	Grey	7	9
Shower	23	Potable	0	Grey	18	23
Bath	15	Potable	0	Grey	12	15
Kitchen Sink	21	Potable	0	Sewage	0	21
Washing Machine	17	Grey	17	Sewage	0	0
Dishwasher	4	Potable	0	Sewage	0	4
TOTAL	**103**		**31**		**37**	**72**

The treatment requirements of the GWR system will vary, as water which is to be used for flushing the toilet does not need to be treated to the same standard as that which is to be used for the washing machine. The source of the greywater also greatly affects the type of treatment required. Greywater from a washing machine may contain suspended solids, organic matter, oils and grease, detergents (including nitrates and phosphates) and bleach. Greywater from a dishwasher could have a similar composition, although the proportion of fats, oils and grease is likely to be higher; similarly for wastewater from a kitchen sink. Wastewater from a bath or shower will contain suspended solids, organic matter (hair and skin), soap and detergents. All wastewater will contain bacteria, although the risk of infection from this is considered to be low[93].Treatment systems for GWR are usually of the following four types:

- basic (e.g. coarse filtration and disinfection);
- chemical (e.g. flocculation);
- physical (e.g. sand filters or membrane filtration and reverse osmosis); and,
- biological (e.g. aerated filters or membrane bioreactors).

Table F-5 below gives further detail on the measures required in new builds and from retrofitting, including assumptions on the predicted uptake of retrofitting from the existing housing and commercial building use.

[93] Centre for the Built Environment, www.cbe.org.uk

Table F-5: Water Neutrality Scenarios – specific requirements for each scenario

WN Scenario	New development requirement			Retrofitting existing development	
	New development Water use target (l/h/d)	Water Efficient Fixtures and Fittings	Water Recycling technology	Metering Penetration assumption	Water Efficient Fixtures and Fittings
Low (Building Regulations)	125	- WC 6/4 litres dual flush or - 4.5 litres single flush - Shower 10 l/min - Bath 185 litres - Basin taps 6 l/min - Sink taps 8 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	60%	None
Low (Building Regulations + Retrofit)	125	- WC 6/4 litres dual flush or - 4.5 litres single flush - Shower 10 l/min - Bath 185 litres - Basin taps 6 l/min - Sink taps 8 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	60%	15% take up across study area: - WC 6/4 litres dual flush or - 4.5 litres single flush - Shower 10 l/min - Bath 185 litres - Basin taps 6 l/min - Sink taps 8 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram
Medium (Building Regulations Optional Requirement)	110	- WC 4/2.6 litres dual flush - Shower 8 l/min - Bath 170 litres - Basin taps 5 l/min - Sink taps 6 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	60%	None
Medium (Building Regulations Optional Requirement + Retrofit)	110	- WC 4/2.6 litres dual flush - Shower 8 l/min - Bath 170 litres - Basin taps 5 l/min - Sink taps 6 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	100%	20% take up across study area: - WC 4/2.6 litres dual flush - Shower 8 l/min - Bath 170 litres - Basin taps 5 l/min - Sink taps 6 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram
High	78	- 3-4.5litre dual flush toilet; - High spec aeration taps; - high spec low flow shower head; - 120 litre capacity bath; - high spec low flow shower head	Rainwater harvesting	100%	25% take up across study area: - 3-4.5 litre dual flush toilet or cistern device fitted; - high spec aerated taps fitted - high spec low flow shower head fitted

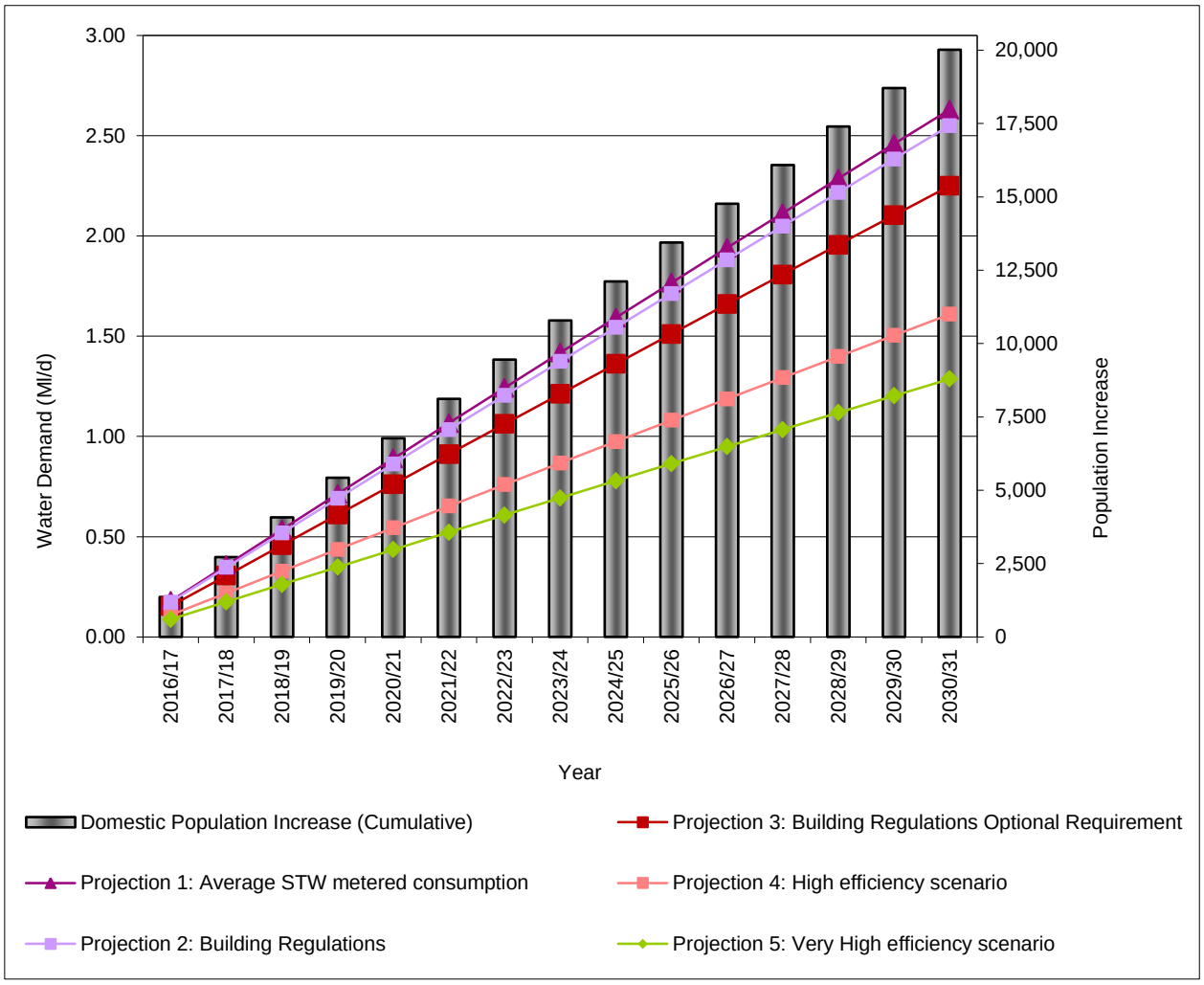
WN Scenario	New development requirement			Retrofitting existing development	
	New development Water use target (l/h/d)	Water Efficient Fixtures and Fittings	Water Recycling technology	Metering Penetration assumption	Water Efficient Fixtures and Fittings
		- High efficiency dishwasher - High efficiency washing machine			
Very High	62	- 3-4.5litre dual flush toilet; - High spec aeration taps; - high spec low flow shower head; - 120 litre capacity bath; - high spec low flow shower head - High efficiency dishwasher - High efficiency washing machine	Rainwater harvesting and Greywater recycling	100%	30% take up across study area: - 3-4.5 litre dual flush toilet or cistern device fitted; - high spec aerated taps fitted - high spec low flow shower head fitted

Appendix G. North Warwickshire Specific Water Supply Strategy

G.1 Demand for Water

Five different water demand projections have been used to calculate the potential increases in water demand in North Warwickshire. These have been based on different rates of water use that could be implemented through future policies.

Using these projections, the increase in demand for water could range between 1.3 and 2.6 Megalitres/day (Ml/d) by 2031. The projection for North Warwickshire is shown below.



G.2 Neutrality Scenario Assessment Results

To achieve total water neutrality (WN), the demand post growth must be the same as, or less than existing demand. Based on estimates of population size, existing demand was calculated to be 8.10 Ml/d for North Warwickshire.

If neutrality is achieved, the result is displayed green. If neutrality is not achieved, but is within 5%, the result is displayed amber, and red if neutrality above the 5% threshold is not achieved. The percentage of total neutrality achieved per WN scenario is also provided.

WN Scenario	New Homes demand projections	% of existing properties to be retrofitted	Demand from Growth (Ml/d)	Total demand post growth (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	% Neutrality Achieved
Baseline	Projection 1: STW Average metered consumption	0	2.63	10.73	**10.42**	-	12%
Low	Projection 2a: Building Regulations	0	2.55	10.65	**10.34**	-	15%
	Projection 2b: Building Regulations + retrofit	15	2.55	10.65	**10.34**	**10.32**	16%
Medium	Projection 3a: Building Regulations optional requirement	0	2.25	10.35	**10.04**	-	26%
	Projection 3b: Optional requirement + retrofit	20	2.25	10.35	**10.04**	**9.91**	31%
High	Projection 4: High efficiency	25	1.61	9.71	**9.26**	**8.79**	74%
Very High	Projection 5: Very High efficiency	30	1.29	9.39	**8.38**	**7.82**	100%

The results show that total neutrality is only achieved by applying the Very High WN scenario, requiring new homes to use water at a rate of 62 l/h/d respectively. The Medium WN scenario would give a minimum of 26% neutrality which would require only new homes to be designed to use water at a rate of 110 l/h/d (Projection 3a). A further 5% neutrality (up to 31%) could be achieved through retrofitting 20% of the existing housing stock with water efficiency fittings equivalent to the optional requirement standard.

G.3 Preferred Strategy - Delivery Pathway for North Warwickshire

It can be seen from the above results that water neutrality can only be achieved under a Very High WN scenario. While this is achievable in theory, it is anticipated that this would come with significant cost. It is recommended that a WN target of Medium (Projection 3a and 3b) be set for the borough in order to balance the objective of achieving a more water neutral position as well as limiting the cost implications of implementing such an initiative.

In order to achieve this target and enhance sustainable development moving forward, policy should be developed that ensures all new housing is as water efficient as possible and that objectives are set that new housing development is required to achieve the Building Regulations optional requirement water use of 110 l/h/d. Non-domestic buildings should as a minimum reach 'Good' BREEAM status.

To further promote 'water neutrality' in the borough, it is recommended a policy be developed to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 20% of the existing housing stock with easy fit water savings devices, equivalent to the fittings as described for use in new dwellings under the Building Regulations optional requirement.

It is considered that, it is technically and politically straightforward to obtain this level with a small funded joint partnership approach and with new developers contributing standard, but water efficient homes with a relative low capital expenditure.

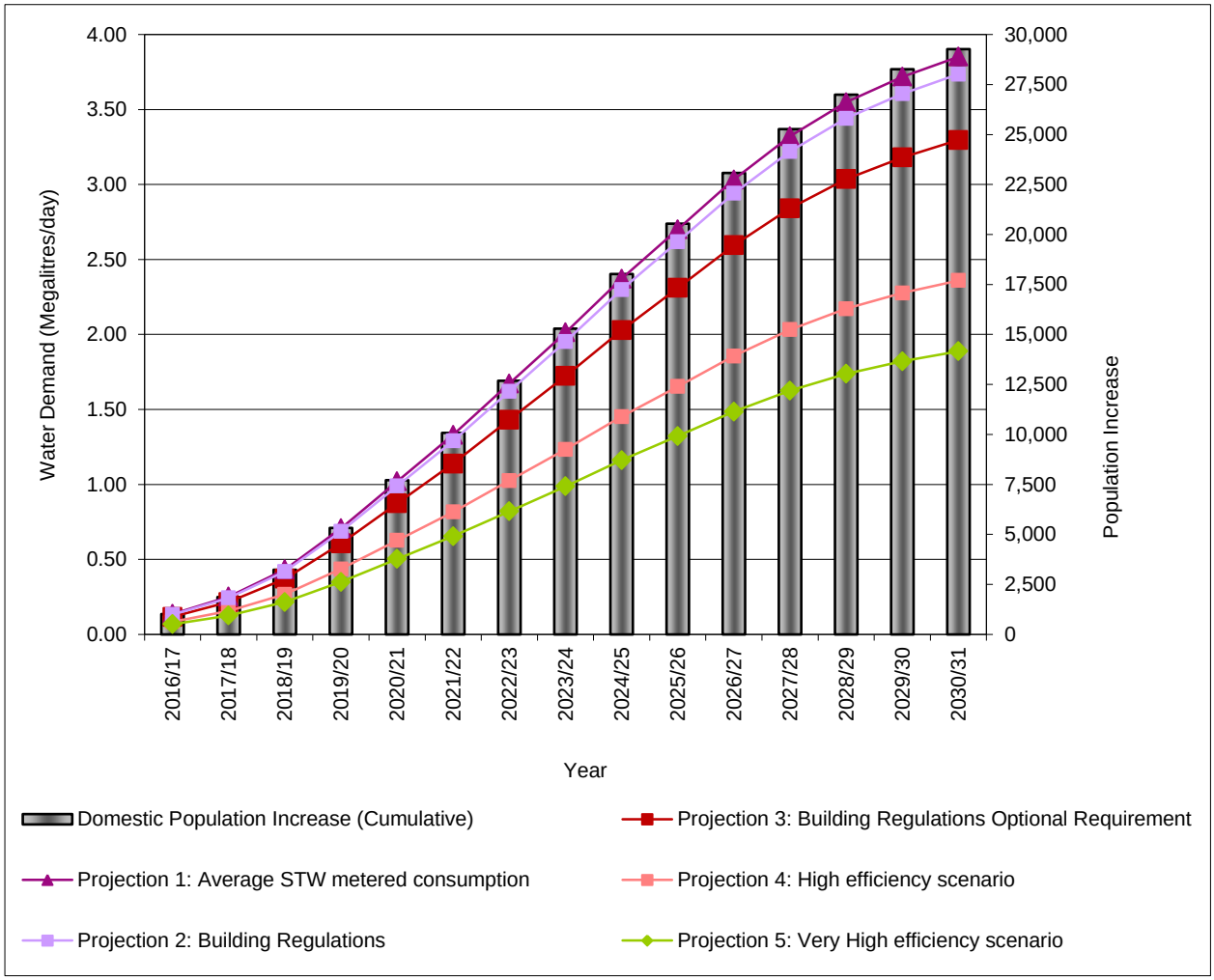
Depending on the success of the first step to neutrality, higher WN scenarios could be aspired to by further developing policies and partnership working to deliver greater efficiencies.

Appendix G.Nuneaton and Bedworth Water Supply Strategy

G.4 Demand for Water

Five different water demand projections have been used to calculate the potential increases in water demand in Nuneaton and Bedworth. These have been based on different rates of water use that could be implemented through future policies.

Using these projections, the increase in demand for water could range between 1.9 and 3.9 Megalitres/day (Ml/d) by 2031. The projection for Nuneaton and Bedworth is shown below.



G.5 Neutrality Scenario Assessment Results

To achieve total water neutrality (WN), the demand post growth must be the same as, or less than existing demand. Based on estimates of population size, existing demand was calculated to be 16.29Ml/d for Nuneaton and Bedworth.

If neutrality is achieved, the result is displayed green. If neutrality is not achieved, but is within 5%, the result is displayed amber, and red if neutrality above the 5% threshold is not achieved. The percentage of total neutrality achieved per WN scenario is also provided.

WN Scenario	New Homes demand projections	% of existing properties to be retrofitted	Demand from Growth (Ml/d)	Total demand post growth (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	% Neutrality Achieved
Baseline	Projection 1: STW Average metered consumption	0	3.85	20.15	19.51	-	17%
Low	Projection 2a: Building Regulations	0	3.74	20.03	19.39	-	20%
	Projection 2b: Building Regulations + retrofit	15	3.74	20.03	19.39	19.35	21%
Medium	Projection 3a: Building Regulations optional requirement	0	3.30	19.59	18.95	-	31%
	Projection 3b: Optional requirement + retrofit	20	3.30	19.59	17.52	17.30	38%
High	Projection 4: High efficiency	25	2.36	18.66	16.59	15.74	88%
Very High	Projection 5: Very High efficiency	30	1.89	18.18	16.12	15.09	100%

The results show that total neutrality is only achieved by applying the High and Very High WN scenario, requiring new homes to use water at a rate of 80 l/h/d and 62 l/h/d respectively. The Medium WN scenario would give a minimum of 31% neutrality which would require only new homes to be designed to use water at a rate of 110 l/h/d (Projection 3a). A further 7% neutrality (up to 38%) could be achieved through retrofitting 20% of the existing housing stock with water efficiency fittings equivalent to the optional requirement standard.

G.6 Preferred Strategy - Delivery Pathway for Nuneaton and Bedworth

It can be seen from the above results that water neutrality can be achieved under either a High or Very High WN scenario. While this is achievable in theory, it is anticipated that this would come with significant cost. It is recommended that a WN target of Medium (Projection 3a and 3b) be set for the borough in order to balance the objective of achieving a more water neutral position as well as limit the cost implications of implementing the initiative.

In order to achieve this target and enhance sustainable development moving forward, policy should be developed that ensures all new housing is as water efficient as possible and that objectives are set that new housing development is required to achieve the Building Regulations optional requirement water use of 110 l/h/d. Non-domestic buildings should as a minimum reach 'Good' BREEAM status.

To further promote 'water neutrality' in the borough, it is recommended a policy be developed to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 20% of the existing housing stock with easy fit water savings devices, equivalent to the fittings as described for use in new dwellings under the Building Regulations optional requirement.

It is considered that, it is technically and politically straightforward to obtain this level with a small funded joint partnership approach and with new developers contributing standard, but water efficient homes with a relative low capital expenditure.

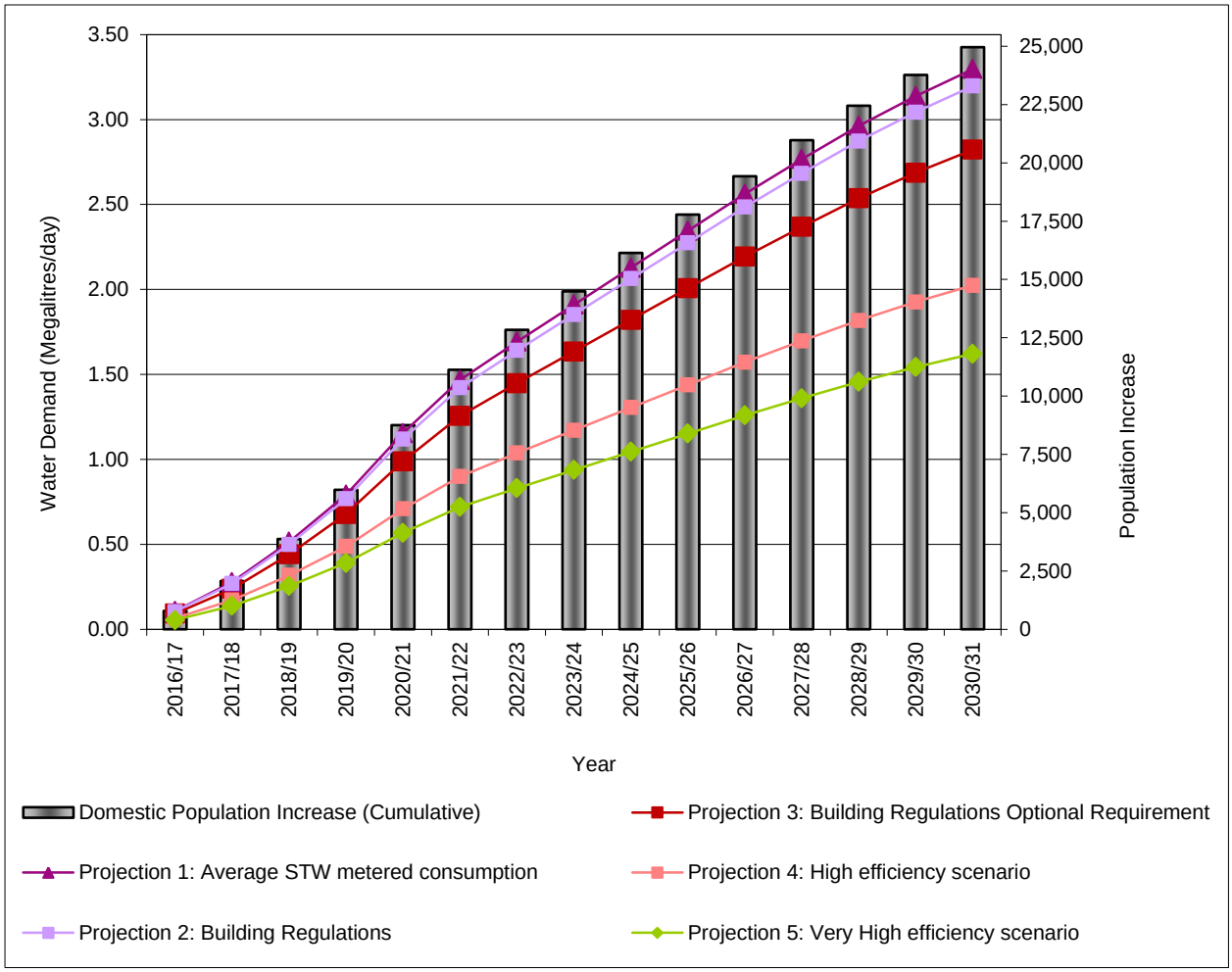
Depending on the success of the first step to neutrality, higher WN scenarios could be aspired to by further developing policies and partnership working to deliver greater efficiencies.

Appendix G.Rugby Water Supply Strategy

G.7 Demand for Water

Five different water demand projections have been used to calculate the potential increases in water demand in Rugby. These have been based on different rates of water use that could be implemented through future policies.

Using these projections, the increase in demand for water could range between 1.6 and 3.3 Megalitres/day (Ml/d) by 2031. The projection for Rugby is shown below.



G.8 Neutrality Scenario Assessment Results

To achieve total water neutrality (WN), the demand post growth must be the same as, or less than existing demand. Based on estimates of population size, existing demand was calculated to be 13.34 Ml/d for Rugby.

WN Scenario	New Homes demand projections	% of existing properties to be retrofitted	Demand from Growth (Ml/d)	Total demand post growth (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	% Neutrality Achieved
Baseline	Projection 1: STW Average metered consumption	0	3.30	16.64	16.12	-	16%
Low	Projection 2a: Building Regulations	0	3.20	16.54	16.02	-	19%
	Projection 2b: Building Regulations + retrofit	15	3.20	16.54	16.02	15.99	20%
Medium	Projection 3a: Building Regulations optional requirement	0	2.82	16.17	15.65	-	30%
	Projection 3b: Optional requirement + retrofit	20	2.82	16.17	14.50	14.30	36%
High	Projection 4: High efficiency	25	2.02	15.37	13.70	12.97	85%
Very High	Projection 5: Very High efficiency	30	1.62	14.97	13.30	12.42	100%

The results show that total neutrality is only achieved by applying the High and Very High WN scenario, requiring new homes to use water at a rate of 80 l/h/d and 62 l/h/d respectively. The Medium WN scenario would give a minimum of 30% neutrality which would require only new homes to be designed to use water at a rate of 110 l/h/d (Projection 3a). A further 6% neutrality (up to 36%) could be achieved through retrofitting 20% of the existing housing stock with water efficiency fittings equivalent to the optional requirement standard.

G.9 Preferred Strategy - Delivery Pathway for Rugby

It can be seen from the above results that water neutrality can be achieved under either a High or Very High WN scenario. While this is achievable in theory, it is anticipated that this would come with significant cost. It is recommended that a water neutrality target of Medium (Projection 3a and 3b) be set for the borough in order to balance the objective of achieving a more water neutral position as well as limiting the cost implications of implementing such an initiative.

In order to achieve this target and enhance sustainable development moving forward, policy should be developed that ensures all new housing is as water efficient as possible and that objectives are set that new housing development is required to achieve the Building Regulations optional requirement water use of 110 l/h/d. Non-domestic buildings should as a minimum reach 'Good' BREEAM status.

To further promote 'water neutrality' in the borough, it is recommended a policy be developed to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 20% of the existing housing stock with easy fit water savings devices, equivalent to the fittings as described for use in new dwellings under the Building Regulations optional requirement.

It is considered that, it is technically and politically straightforward to obtain this level with a small funded joint partnership approach and with new developers contributing standard, but water efficient homes with a relative low capital expenditure.

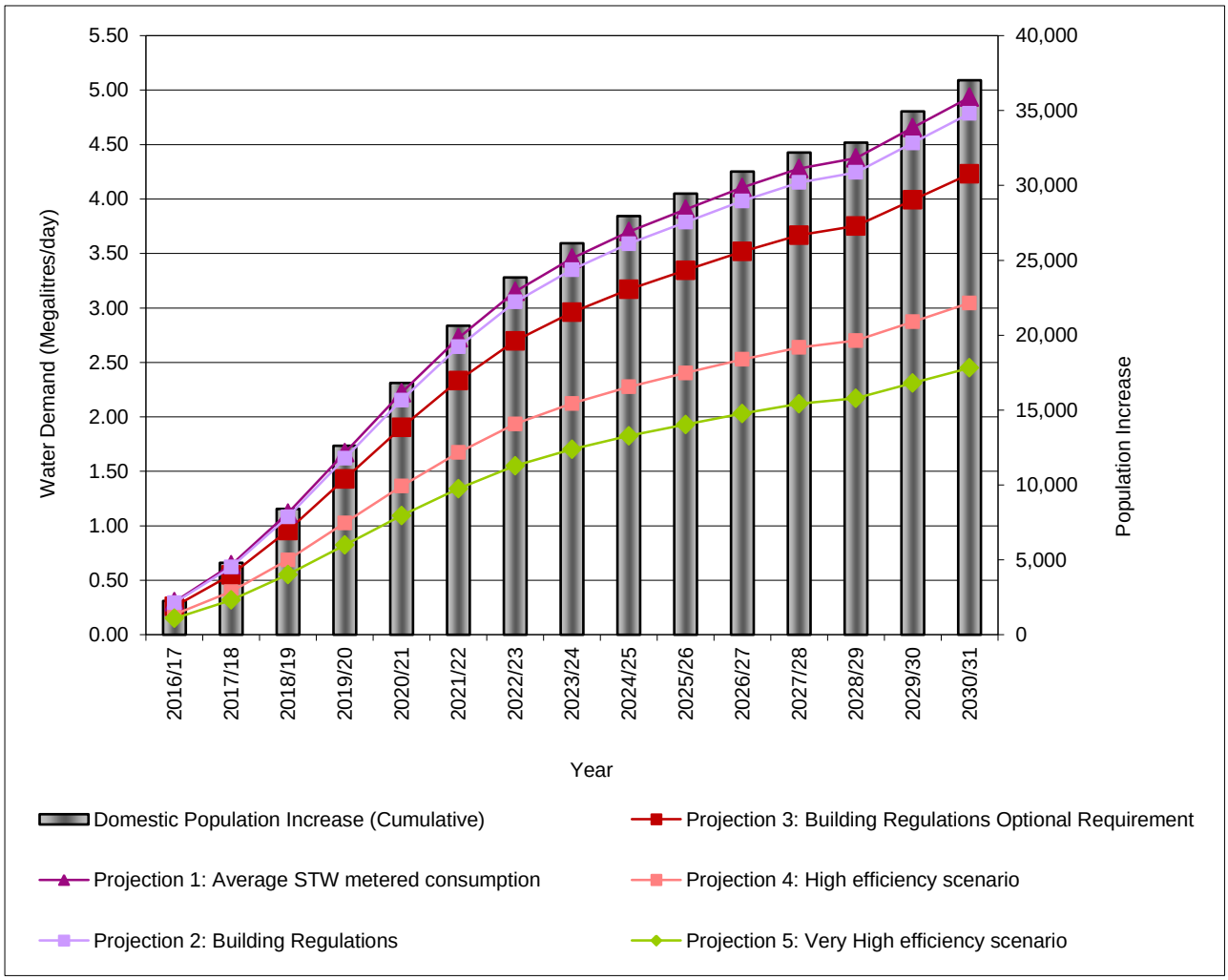
Depending on the success of the first step to neutrality, higher WN scenarios could be aspired to by further developing policies and partnership working to deliver greater efficiencies.

Appendix G.Warwick Water Supply Strategy

G.10 Demand for Water

Five different water demand projections have been used to calculate the potential increases in water demand in Warwick. These have been based on different rates of water use that could be implemented through future policies.

Using these projections, the increase in demand for water could range between 2.5 and 4.9 Megalitres/day (Ml/d) by 2031. The projection for Warwick is shown below.



G.11 Neutrality Scenario Assessment Results

To achieve total water neutrality (WN), the demand post growth must be the same as, or less than existing demand. Based on estimates of population size, existing demand was calculated to be 18.05 Ml/d for Warwick.

If neutrality is achieved, the result is displayed green. If neutrality is not achieved, but is within 5%, the result is displayed amber, and red if neutrality above the 5% threshold is not achieved. The percentage of total neutrality achieved per WN scenario is also provided.

WN Scenario	New Homes demand projections	% of existing properties to be retrofitted	Demand from Growth (Ml/d)	Total demand post growth (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	% Neutrality Achieved
Baseline	Projection 1: STW Average metered consumption	0	4.93	22.99	**22.27**	-	14%
Low	Projection 2a: Building Regulations	0	4.79	22.84	**22.12**	-	17%
	Projection 2b:Building Regulations + retrofit	15	4.79	22.84	**22.12**	**22.07**	19%
Medium	Projection 3a: Building Regulations optional requirement	0	4.23	22.28	**21.57**	-	29%
	Projection 3b: Optional requirement + retrofit	20	4.23	22.28	**19.98**	**21.29**	34%
High	Projection 4: High efficiency	25	3.05	21.10	**18.79**	**19.01**	81%
Very High	Projection 5: Very High efficiency	30	2.45	20.50	**18.20**	**16.94**	100%

The results show that total neutrality is only achieved by applying the Very High WN scenario, requiring new homes to use water at a rate of 62 l/h/d. The Medium WN scenario would give a minimum of 29% neutrality which would require only new homes to be designed to use water at a rate of 110 l/h/d (Projection 3a). A further 5% neutrality (up to 34%) could be achieved through retrofitting 20% of the existing housing stock with water efficiency fittings equivalent to the optional requirement standard.

G.12 Preferred Strategy - Delivery Pathway for Warwick

It can be seen from the above results that water neutrality can be achieved under a Very High WN scenario. While this is achievable in theory, it is anticipated that this would come with significant cost. It is recommended that a WN target of Medium (Projection 3a and 3b) be set for the district in order to balance the objective of achieving a more water neutral position as well as limiting the cost implications of implementing such an initiative.

In order to achieve this WN target and enhance sustainable development moving forward, policy should be developed that ensures all new housing is as water efficient as possible and that objectives are set that new housing development is required to achieve the Building Regulations optional requirement water use of 110 l/h/d. Non-domestic buildings should as a minimum reach 'Good' BREEAM status.

To further promote 'water neutrality' in the district, it is recommended a policy be developed to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 20% of the existing housing stock with easy fit water savings devices, equivalent to the fittings as described for use in new dwellings under the Building Regulations optional requirement.

It is considered that, it is technically and politically straightforward to obtain this level with a small funded joint partnership approach and with new developers contributing standard, but water efficient homes with a relative low capital expenditure.

Depending on the success of the first step to neutrality, higher WN scenarios could be aspired to by further developing policies and partnership working to deliver greater efficiencies.

Appendix H. Major Development Site Assessments

Site Details						Surface Water Flood Risk		Fluvial Flood Risk				Groundwater Protection				Wastewater Network	
AECOM ID	Ref ID	SLAA Ref	Location	Total Dwellings	Site Area (ha)	SWMP Hotspot	Overall Surface Water Flood Risk	% Flood Zone 1	% Flood Zone 2	% Flood Zone3	Potential receiving watercourse for surface water	Aquifer Designation	Source Protection Zone	Groundwater Protection	SuDS Constraints	Known Network Constraints	WwTW Catchment
N_W_1	NR3 URN: SLA 103	Draft_Local_Plan_2016_Housing	Site rear of Manor Farm / Baddons Farm, Main Road, Newton Regis	21	1.3	Predicted Hotspot Only	Medium	100.0	0.0	0.0	Bramcote Brook	Bedrock - data not available	N/A	N/A	No Restrictions	There are no known network constraints downstream of this site.	Polesworth
N_W_4	SLA22	Draft_Local_Plan_2016_Housing	Land south of Shuttington Village Hall	24	1.2	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	River Anker	Superficial - Unproductive ; Bedrock - data not available	N/A	Low	No Restrictions	There are no known network constraints downstream of this site.	Polesworth
N_W_5	PS158	Draft_Local_Plan_2016_Housing	Land West of Robey's Lane, Tamworth	1191	66.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	Coventry Canal	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements.	Tamworth
N_W_6	ATH14	Draft_Local_Plan_2016_Housing	Atherstone Football Ground, Sheepy Road, Atherstone	46	2.2	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	River Anker	Bedrock - data not available	N/A	N/A	No Restrictions	There are no known network constraints downstream of this site.	Atherstone
N_W_9	PS111	Draft_Local_Plan_2016_Housing	Former Polesworth High school	14	0.7	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Anker	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Polesworth
N_W_11	POL12 URN: FD0505 / SLA 57	Draft_Local_Plan_2016_Housing	Land West of Woodpark Farm, Polesworth	32	1.5	Predicted Hotspot Only	High	100.0	0.0	0.0	River Anker	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Polesworth
N_W_12	DOR26	Draft_Local_Plan_2016_Housing	Land east of Dordon and Polesworth	2000	160.8	Predicted Hotspot Only	Low	100.0	0.0	0.0	Coventry Canal / Penmire Brook	Bedrock - data not available	N/A	N/A	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Grendon / Dordon / Polesworth
N_W_15	GRE1 URN: SLA138	Draft_Local_Plan_2016_Housing	Former Sparrowdale School Site, spon Lane, Grendon	39	1.9	Historic and Predicted Spot	High	100.0	0.0	0.0	Penmire Brook	Bedrock - data not available	N/A	N/A	No Restrictions	There are no known network constraints downstream of this site.	Grendon
N_W_18	Part PS213	Draft_Local_Plan_2016_Housing	Land at Whittington Farm, Atherstone	1282	71.2	Historic and Predicted Spot	Low	87.2	12.2	0.7	Coventry Canal	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements. Needs to be assessed in conjunction with ATH20 and ATH14 site	Atherstone
N_W_19	Formerly ATH4, 5 and 8) URN: SLA77 and SLA78	Draft_Local_Plan_2016_Housing	Land east and west of Holly Lane, north Atherstone	531	32.7	Predicted Hotspot Only	Low	45.4	38.4	16.3	Innage Brook	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site.	Atherstone
N_W_20	URN PS12	Draft_Local_Plan_2016_Housing	Atherstone Football Ground, Sheepy Road, Atherstone	46	2.2	Predicted Hotspot Only	High	67.3	5.9	26.8	Innage Brook	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site.	Atherstone
N_W_21	PS203	Draft_Local_Plan_2016_Housing	Land off Lindridge Road Wishaw	141	6.7	Not Met Hotspot Trigger	Medium	93.1	1.7	5.2	Langley Brook	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site.	Minworth
N_W_22	PS232	Draft_Local_Plan_2016_Housing	Land north of Kingsbury Hall	41	2.8	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Tame	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Tamworth
N_W_23	SLA31 & PS63	Draft_Local_Plan_2016_Housing	Land to rear of 109-117 Tamworth Road, Wood End	28	1.3	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Tame	Superficial - Unproductive ; Bedrock - data not available	N/A	Low	No Restrictions	There are no known network constraints downstream of this site.	Hurley
N_W_24	BE7 URN: SLA72	Draft_Local_Plan_2016_Housing	Church Farm, Baddesley Ensor	47	2.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	Penmire Brook	Bedrock - data not available	N/A	N/A	No Restrictions	There are no known network constraints downstream of this site.	Grendon
N_W_25	ATH18	Draft_Local_Plan_2016_Housing	Brittania Mill, Coleshill Road, Atherstone	54	0.4	Predicted Hotspot Only	Medium	100.0	0.0	0.0	Innage Brook	Bedrock - data not available	N/A	N/A	No Restrictions	There are no known network constraints downstream of this site.	Atherstone
N_W_26	HAR3 URN: SLA 52	Draft_Local_Plan_2016_Housing	Land between Church Road and Nuneaton Road Hartshill	400	30.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	Bar Pool Brook	Bedrock - data not available	N/A	N/A	No Restrictions	There are known flooding problems. Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements.	Hartshill
N_W_27	N/A	Draft_Local_Plan_2016_Housing	Land at Common Farm, off Thorncliffe Way, Coleshill Road Ansley common	355	15.6	Not Met Hotspot Trigger	Medium	100.0	0.0	0.0	Bar Pool Brook	Bedrock - data not available	N/A	N/A	No Restrictions	There are known flooding problems. Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements. Assess in conjunction with HAR3 and ANSCOMM1	Hartshill
N_W_28	PS59, 128 & 139	Draft_Local_Plan_2016_Housing	Land south of Coleshill Road, off Bretts Hall Estate, Ansley Common	230	15.0	Predicted Hotspot Only	Low	100.0	0.0	0.0	Bar Pool Brook	Bedrock - data not available	N/A	N/A	No Restrictions	There are known flooding problems. Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements. Assess in conjunction with HAR3 and ANSCOMM1 and DRAFT 6	Hartshill
N_W_30	ANSCOMM1 URN: PS30 / SLA2 / SLA122	Draft_Local_Plan_2016_Housing	Land RO/145 coleshill Road Ansley	38	1.8	Predicted Hotspot Only	High	100.0	0.0	0.0	Bar Pool Brook	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are known flooding problems. Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements. Assess in conjunction with HAR3	Hartshill
N_W_31	ANS4 SLA147 / FD0828	Draft_Local_Plan_2016_Housing	R/O Church, Ansley	31	1.5	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Bourne Brook	Superficial - Unproductive ; Bedrock - data not available	N/A	Low	No Restrictions	There are known flooding problems. Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements. Assess in conjunction with HAR3 and ANSCOMM1 and DRAFT 6 and DRAFT7 and ANS1	Hartshill
N_W_32	ANS1 URN: SLA58	Draft_Local_Plan_2016_Housing	Paddock at Village Farm, Ansley	12	0.6	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Bourne Brook	Superficial - Unproductive ; Bedrock - data not available	N/A	Low	No Restrictions	There are known flooding problems. Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements. Assess in conjunction with HAR3 and ANSCOMM1 and DRAFT 6 and DRAFT7	Hartshill
N_W_34	N/A	Draft_Local_Plan_2016_Housing	Land at Water Orton Primary School, Vicarage Lane, Water Orton	71	3.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Tame	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Coleshill
N_W_35	COL1 URN: SLA143 / NWAR224	Draft_Local_Plan_2016_Housing	Land at Grimstock Hill	12	1.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Cole	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are known network constraints downstream of this site. Due to development size the impact on preformance will be negligable.	Coleshill
N_W_36	COL6 URN: PS123	Draft_Local_Plan_2016_Housing	Land at Blytheways, Coleshill	27	1.3	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Cole	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Coleshill
N_W_37	COL3 / PS19	Draft_Local_Plan_2016_Housing	Ex Leisure Centre Site and Police Station, Park Road, Coleshill	25	0.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Cole	Bedrock - data not available	N/A	N/A	No Restrictions	There are no known network constraints downstream of this site.	Coleshill
N_W_39	PS153	Draft_Local_Plan_2016_Housing	Land at Packington Lane, Coleshill	119	6.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Cole	Superficial - Secondary A ; Bedrock - data not available	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Coleshill
N_B_1	NUN348	SHLAA15	Vale View opp 84	27	0.3	Predicted Hotspot Only	Low	100.0	0.0	0.0	Bar Pool Brook / Coventry Canal	Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_2	NUN245	SHLAA15	21 Church Road	22	0.3	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Bar Pool Brook	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_3	NUN258	SHLAA15	14-16 The Square, Attleborough	11	0.1	Predicted Hotspot Only	Medium	100.0	0.0	0.0	Wem Brook	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_4	NUN350	SHLAA15	Disused garage site, Raveloe Drive, Nuneaton	12	0.1	Predicted Hotspot Only	Low	0.0	0.0	100.0	Wem Brook	Bedrock - Principal	N/A	High	Space for surface attenuation SuDS will be limited within FZ 3.	There are no known network constraints downstream of this site.	Hartshill
N_B_5	NUN318	SHLAA15	Land rear of Marston House Farm, Nuneaton Road Bulkington	45	1.5	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Ashby-de-la-Zouch Canal	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_6	NUN174	SHLAA15	Land Rear of furnace Road / Beechwood Road (Charity docks)	66	2.2	Predicted Hotspot Only	High	35.1	32.9	32.0	Wem brook	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site.	Marston Lane
N_B_7	NUN323	SHLAA15	Acacia Crescent, Bedworth	13	0.1	Predicted Hotspot Only	High	0.0	0.0	100.0	Wem Brook	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS will be limited within FZ 3.	There are no known network constraints downstream of this site.	Marston Lane
N_B_8	NUN352	SHLAA15	Former play area, cheveral Road, Bedworth	13	0.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Superficial - Secondary A ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_9	NUN75	SHLAA15	Disused play area rear of parl road flats	17	0.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Superficial - Secondary A ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Finham
N_B_10	NUN65	SHLAA15	New Inn Public House, Bulkington	30	0.3	Predicted Hotspot Only	Low	100.0	0.0	0.0	Wem Brook	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Bulkington
N_B_11	NUN239	SHLAA15	Armson Road, Exhall	19	0.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_12	NUN181	SHLAA15	Land off Stockley Road	80	3.2	Predicted Hotspot Only	High	100.0	0.0	0.0	Coventry Canal	Bedrock - Principal	N/A	High / Medium	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_13	NUN236	SHLAA15	Land corner of Exhall Road and Bennetts Road	19	0.1	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Breach Brook	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_14	NUN286	SHLAA15	Land Rear of Burbages Lane	127	3.5	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_15	NUN317	SHLAA15	Land Rear of Burbages Lane	combined with NUN286	1.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_16	HSG1	HSG_Sites	North of Nuneaton	3186	215.2	Historic and Predicted Spot	Low	98.7	0.2	1.2	River Anker	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	All development proposals to the north of Nuneaton currently drain to a sewage pumping station off Weddington Road. Whilst there is some spare capacity to accommodate initial levels of development in the catchment it is expected that significant capacity upgrades will be required to accommodate this development and others in the same catchment. Feasibility work to assess the scope of capacity upgrades is due to commence shortly.	Hartshill
N_B_17	HSG11	HSG_Sites	HSG11, Tuttle Hill	365	4.7	Predicted Hotspot Only	Medium	100.0	0.0	0.0	Coventry Canal	Bedrock - Principal	N/A	High	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Hartshill
N_B_18	HSG11	HSG_Sites	HSG11	combined with HSG11, Tuttle Hill	8.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	Coventry Canal	Bedrock - Principal	N/A	High	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Hartshill
N_B_19	HSG10	HSG_Sites	HSG10, Attleborough Fields	360	15.3	Predicted Hotspot Only	Medium	91.9	1.5	6.6	River Anker	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site. However modelling will be required to confirm any capacity improvements.	Hartshill
N_B_20	HSG9	HSG_Sites	HSG9, Golf Drive	680	33.8	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Anker	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Hartshill
N_B_21	HSG2	HSG_Sites	HSG2, Arbury	1340	85.0	Historic and Predicted Spot	Low	99.1	0.1	0.8	Coventry Canal	Bedrock - Principal	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory Syphon performance. Modelling will be required to assess the scope of any capacity improvements.	Hartshill
N_B_22	HSG2 South Eastern Extension	HSG_Sites	HSG2 South Eastern Extension	Combined with HSG2, Arbury	0.8	Historic and Predicted Spot	Medium	100.0	0.0	0.0	Coventry Canal	Bedrock - Secondary A	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory Syphon performance. Modelling will be required to assess the scope of any capacity improvements.	Hartshill
N_B_23	HSG3 (v2)	HSG_Sites	HSG3, Gipsy Lane	550	28.9	Predicted Hotspot Only	Medium	75.3	5.7	19.0	Wem Brook	Bedrock - Principal	N/A	High	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site. However modelling will be required to confirm the capacity of the pumping stations.	Hartshill
N_B_24	HSG4 (v2)	HSG_Sites	HSG4, Woodlands	1039	75.6	Predicted Hotspot Only	Medium	91.9	2.1	6.0	River Sowe	Bedrock - Principal	N/A	High	Space for surface attenuation SuDS may be limited within FZ 3.	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk.Modelling will be required to assess the scope of any capacity improvements.	Finham
N_B_25	HSG5	HSG_Sites	HSG5, Hospital Lane	400	22.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	Breach Brook	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site. However modelling will be required to confirm the capacity improvements.	Finham

Site Details						Surface Water Flood Risk		Fluvial Flood Risk				Groundwater Protection				Wastewater Network	
AECOM ID	Ref ID	SLAA Ref	Location	Total Dwellings	Site Area (ha)	SWMP Hotspot	Overall Surface Water Flood Risk	% Flood Zone 1	% Flood Zone 2	% Flood Zone3	Potential receiving watercourse for surface water	Aquifer Designation	Source Protection Zone	Groundwater Protection	SuDS Constraints	Known Network Constraints	WwTW Catchment
N_B_26	HSG6	HSG_Sites	HSG6, School Lane	388	16.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site. However modelling will be required to confirm the capacity improvements.	Finham
N_B_27	HSG8 Northern Parcel	HSG_Sites	HSG8, West of Bulkington	600	7.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	Wem Brook	Bedrock - Principal	N/A	High	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk.Modelling will be required to assess the scope of any capacity improvements.	Bulkington
N_B_28	HSG8 middle Parcel	HSG_Sites	hsg Middle Parcel	Combined with HSG8, West of Bulkington	4.8	Predicted Hotspot Only	High	100.0	0.0	0.0	Wem Brook	Bedrock - Principal	N/A	High	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk.Modelling will be required to assess the scope of any capacity improvements.	Bulkington
N_B_29	HSG8 Southern Parcel	HSG_Sites	HSG Southern Parcel	Combined with HSG8, West of Bulkington	13.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	Wem Brook	Bedrock - Principal	N/A	High	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk.Modelling will be required to assess the scope of any capacity improvements.	Bulkington
N_B_30	HSG7	HSG_Sites	HSG7, East of Bulkington	325	10.3	Predicted Hotspot Only	High	100.0	0.0	0.0	Wem Brook	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements to both the network and pumping station.	Bulkington
N_B_31	299	FSHLAA	NUN305, Bucks Hill, Nuneaton	71	1.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	Bar Pool Brook	Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_32	295	FSHLAA	NUN302, Tudor Road	28	0.3	Predicted Hotspot Only	High	100.0	0.0	0.0	Bar Pool Brook	Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_33	Apgrecno: 96 ; NUN191	FSHLAA	NUN191, St Marys Road	143	2.3	Predicted Hotspot Only	High	65.6	27.2	7.2	River Anker	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site.	Hartshill
N_B_34	A: 201 ; NUN241	FSHLAA	NUN241, Land at Vicarage Street / Orchard Street	15	0.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Anker	Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_35	A: 179 ; NUN047	FSHLAA	NUN047, King Edward Road	44	0.5	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Anker	Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_36	A:187 ; NUN051	FSHLAA	NUN051, R/O 68 Kind Edward Road	27	0.3	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Anker	Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_37	A: 98 ; NUN006	FSHLAA	NUN006, Rear of Spinney Lane/ adjacent railway	53	1.1	Predicted Hotspot Only	Medium	100.0	0.0	0.0	Bar Pool Brook	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_38	A: 172 ; NUN043	FSHLAA	NUN043, Stockingford Sports and Social Club and Bungalow, Arbury Road	67	0.7	Predicted Hotspot Only	Medium	100.0	0.0	0.0	Coventry Canal	Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_39	A: 162 ; NUN227	FSHLAA	NUN227, Coton Carriage Works, Heath End Road	41	0.4	Historic and Predicted Spot	Medium	100.0	0.0	0.0	Coventry Canal	Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_40	A: 131 ; NUN015	FSHLAA	NUN015, Donnithorne Avenue (adjacent canal)	28	0.5	Predicted Hotspot Only	High	100.0	0.0	0.0	Coventry Canal	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Hartshill
N_B_41	A: 202 ; NUN060	FSHLAA	NUN060, Pine Tree Road	22	0.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	Wem Brook	Bedrock - Secondary A / Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Marston Lane
N_B_42	A: 245 ; NUN263	FSHLAA	NUN263, Land rear of Aldi, Park Road	13	0.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Superficial - Secondary A ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_43	A: 216 ; NUN068	FSHLAA	NUN216	N/A	0.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Superficial - Secondary undifferentiated ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_44	A: 229 ; NUN074	FSHLAA	NUN074, John Street	15	0.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Superficial - Secondary undifferentiated ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_45	A: 203 ; NUN061	FSHLAA	NUN061, Rear of 25-39 Whitburn Road	14	0.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Sowe	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_46	A: 208 ; NUN242	FSHLAA	NUN242, Hawkesbury Pump House, Heritage Drivfe, Hawkesbury	13	0.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	Oxford Canal	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of this site.	Finham
N_B_47	NUN356 - Elizabeth Centre	ELIZ	Elizabeth Centre	18	0.7	Predicted Hotspot Only	Low	100.0	0.0	0.0	Wem Brook	Superficial - Secondary A / Secondary undifferentiated ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Marston Lane
RUG_1	DS3.1	Proposed Allocations	Coton House Expansion	100	12.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Swift	Superficial - Secondary undifferentiated ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Site will require pumping to existing sewer network	Churchover
RUG_2	DS3.2	Proposed Allocations	Coton Park East Expansion	800	58.0	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Sewer flooding, overflows spill increase (>10%), and pumping station runs for over an hour during DWF.	Rugby Newbold
RUG_3	DS3.5	Proposed Allocations	South West Rugby	2830	316.0	Predicted Hotspot Only	Low	99.3	0.4	0.3	River Avon	Superficial - Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Dunchurch
RUG_4	DS3.14	Village Allocations	Wolvey	100	3.8	Not Met Hotspot Trigger	Low	99.5	0.4	0.1	River Anker	Superficial-Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site.	Bramcote
RUG_5	DS3.13	Village Allocations	Wolvey	joint with DS3.14	0.4	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	River Anker	Superficial - Secondary undifferentiated ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Bramcote
RUG_6	DS3.7	Village Allocations	Brinklow	100	7.2	Predicted Hotspot Only	Medium	75.3	2.9	21.7	Smite Brook	Superficial-Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site.	Brinklow
RUG_7	DS3.6	Village Allocations	Binley Woods	62	4.7	Predicted Hotspot Only	Medium	100.0	0.0	0.0	River Avon	Superficial-Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Finham
RUG_8	DS3.8	Village Allocations	Long Lawford	100	6.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Long Lawford
RUG_9	DS3.12	Village Allocations	Wolston	15	0.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Wolston
RUG_10	DS3.9	Village Allocations	Ryton on Dunsmore	75	3.0	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Wolston
RUG_11	DS3.11	Village Allocations	Stretton on Dunsmore	75	2.1	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	River Leam	Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Wolston
RUG_12	DS3.10	Village Allocations	Stretton on Dunsmore	Joint with DS3.11	0.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Superficial - Secondary undifferentiated ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Wolston
RUG_13	N/A	Committed Sites	Newton Lane, Newton (R14/1658)	40	2.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A / Secondary undifferentiated ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Rugby Newbold
RUG_14	N/A	Committed Sites	Land south of Brownsover Road	100	8.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	Oxford Canal	Superficial - Secondary A / unproductive ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Rugby Newbold
RUG_15	N/A	Committed Sites	Land at Leicester Road (R15/2074)	25	5.0	Predicted Hotspot Only	Low	93.7	6.3	0.0	River Avon	Superficial- Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Rugby Newbold
RUG_16	N/A	Committed Sites	Back Lane South Long Lawford (R12/1188)	112	4.1	Predicted Hotspot Only	High	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Long Lawford
RUG_17	N/A	Committed Sites	Former Warwickshire College Site (R14/2229)	112	3.8	Predicted Hotspot Only	Low	100.0	0.0	0.0	Clifton Brook	Superficial - Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Rugby Newbold
RUG_18	N/A	Committed Sites	Former Ballast Pits (R14/1641)	76	5.8	Predicted Hotspot Only	Low	100.0	0.0	0.0	Oxford Canal	Superficial - Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Rugby Newbold
RUG_19	N/A	Committed Sites	Land at Homefields, Dunchurch (R15/0507)	50	2.8	Predicted Hotspot Only	Low	100.0	0.0	0.0	Rains Brook	Superficial - Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Dunchurch
RUG_20	N/A	Committed Sites	Dipbar fields, Dunchurch (R13/0690)	86	3.1	Not Met Hotspot Trigger	High	100.0	0.0	0.0	Rains Brook	Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Dunchurch
RUG_21	2	Committed Sites	Coton House (R12/1353)	65	9.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Swift	Superficial - Secondary undifferentiated ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Site will require pumping to existing sewer network	Churchover
RUG_22	4	Committed Sites	Coton Park East Phase B1 & B2 (R15/0814 and R15/0803)	145	13.2	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary undifferentiated ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Sewer flooding, overflows spill increase (>10%), and pumping station runs for over an hour during DWF.	Rugby Newbold
RUG_23	3	Committed Sites	Ridgeway Farm, Ashlawn Road (R15/2239)	96	4.5	Predicted Hotspot Only	Low	100.0	0.0	0.0	Rains Brook	Superficial - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site.	Rugby Newbold
RUG_24	1	Committed Sites	Cawston Lane (R11/1521)	250	11.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Rugby Newbold
RUG_25	5	Committed Sites	Williams Field - Cawston Extension (R15/0540)	113	24.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Rugby Newbold
RUG_26	DS3.15	New Settlement	Lodge Farm A45	825	104.0	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Rains Brook	Superficial - Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements.	Dunchurch
RUG_27	DS3.3	Committed Sites	Gateway Phase R4 (R15/2329)	132	129.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	Clifton Brook / River Swift	Superficial - Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Rugby Newbold
RUG_28	DS3.4	Committed Sites	Rugby Radio Station (R11/0699)	2490	337.0	Predicted Hotspot Only	Low	98.3	0.9	0.8	Clifton Brook / River Swift	Superficial - Secondary A ; Bedrock - Secondary undifferentiated	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Rugby Newbold
WAR_1	H42	Housing_DS11_	Westwood Heath	425	25.4	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Finham Brook	Bedrock - Principal	N/A	High	No Restrictions	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk. Modelling will be required to assess the scope of any capacity improvements.	Finham
WAR_2	H24	Housing_DS11_	Burrow Hill Nursery (DS7)	90	3.7	Predicted Hotspot Only	Low	100.0	0.0	0.0	Finham Brook	Bedrock - Principal	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites. However modelling will be required to confirm the capacity improvements.	Finham
WAR_3	H08	Housing_DS11_	Land at Oak Lea, Howes Lane	20	1.8	Not Met Hotspot Trigger	High	58.0	14.6	27.4	River Sowe	Bedrock - Principal	SPZ3	High	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of these sites.	Finham
WAR_4	H19	Housing_DS11_	Land north of Rosswood Farm	80	4.0	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	River Sowe	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of these sites.	Finham
WAR_5	H43	Housing_DS11_	Kings Hill	1800	269.2	Predicted Hotspot Only	Low	96.8	0.6	2.6	Finham Brook	Bedrock - Principal	SPZ3	High	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known hydraulic sewer flooding issues associated with the 1350mm dia sewer crossing this development site. However there is known to be interactions with the inlet works at Finham STW but these issues are under review as part of sewage treatment upgrade assessments.	Finham
WAR_6	H07	Housing_DS11_	Crackley Triangle	93	3.2	Historic and Predicted Spot	Low	100.0	0.0	0.0	Finham Brook	Bedrock - Principal	SPZ3	High	No Restrictions	There are known hydraulic sewer flooding issues downstream of this large development. Modelling will be required to assess and determine any capacity improvements .	Finham
WAR_7	H18	Housing_DS11_	Former Aylesbury House Hotel and surounds	20	4.9	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Stratford upon Avon Canal	Superficial - Secondary undifferentated ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There is known pollution incidents dawstream (7 no. between 2012 and 2016) at Packwood due to the combined sewer (operational issues, structural condition and storm events). There are also two flooding incidents downstream (one external and one unknown). The combined sewer discharges through Packwood Pollution area to Dorridge – Norton Green Lane TPS. Curdworth PS then pumps flow to Norton Green STW.	Norton Green
WAR_10	H32	Housing_DS11_	Land to the rear of Broome Hall Lane (DS7)	12	0.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	Grand Union Canal	Bedrock -Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites.	Longbridge

Site Details						Surface Water Flood Risk		Fluvial Flood Risk				Groundwater Protection				Wastewater Network	
AECOM ID	Ref ID	SLAA Ref	Location	Total Dwellings	Site Area (ha)	SWMP Hotspot	Overall Surface Water Flood Risk	% Flood Zone 1	% Flood Zone 2	% Flood Zone3	Potential receiving watercourse for surface water	Aquifer Designation	Source Protection Zone	Groundwater Protection	SuDS Constraints	Known Network Constraints	WwTW Catchment
WAR_11	H29	Housing_DS11_	Meadow House Site (DS7)	30	2.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	Grand Union Canal	Superficial - Secondary A ; Bedrock - Secondary A / Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites.	Longbridge
WAR_12	H30	Housing_DS11_	Kingswood Farm, Old Warwick Road	joint with H29	2.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	Grand Union Canal	Bedrock- Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites.	Longbridge
WAR_13	H40	Housing_DS11_	Crewe Lane, Southcrest Farm and Woodside Training	640	91.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of these sites. However modelling will be required to confirm the capacity improvements.	Finham
WAR_14	H09	Housing_DS11_	Kenilworth School	250	9.4	Predicted Hotspot Only	High	100.0	0.0	0.0	Finham Brook	Bedrock - Principal	N/A	High	No Restrictions	There are known hydraulic sewer flooding issues downstream of this large development. Modelling will be required to assess and determine any capacity improvements .	Finham
WAR_15	H06	Housing_DS11_	Thickthorn	760	91.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Bedrock - Principal	N/A	High	No Restrictions	There are known hydraulic sewer flooding issues downstream of this large development. Modelling will be required to assess and determine any capacity improvements .	Finham
WAR_16	H12	Housing_DS11_	Castle Sixth Form	130	4.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Bedrock - Principal	N/A	High	No Restrictions	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements .	Finham
WAR_17	H41	Housing_DS11_	East of Warwick Road, Kenilworth	100	5.8	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Bedrock - Principal	N/A	High	No Restrictions	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements .	Finham
WAR_18	DSNEW3	Housing_DS11_	Leek Wooton - Former Policy HQ	115	25.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Bedrock - Principal	N/A	High	No Restrictions	This development is expected to drain to small pumping station serving the former police headquarters complex. Further modelling work will be required to assess whether the capacity of the existing pumping station will be able to accommodate comparable flows from 115 dwellings but should capacity improvements be required they are not expected to be a significant contraint to redevelopment.	Leek Wooton
WAR_19	H37	Housing_DS11_	Warwickshire Golf and Country Club Car Park (DS7)	N/A	N/A	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Bedrock - Principal	N/A	High	No Restrictions		
WAR_20	H26	Housing_DS11_	Land Opposite Willow Sheet Meadow (DS7)	65	5.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements to both the network and pumping station.	Longbridge
WAR_21	H25	Housing_DS11_	Allotment Land, Rugby Road (DS7)	35	5.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Superficial - Secondary undifferentiated ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements to both the network and pumping station.	Longbridge
WAR_22	H50	Housing_DS11_	Cubbington - Land East of Cubbington	95	11.8	Predicted Hotspot Only	Low	99.8	0.1	0.1	River Leam	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements to both the network and pumping station.	Longbridge
WAR_23	H44	Housing_DS11_	North of Milverton	250	24.2	Predicted Hotspot Only	Low	99.0	1.0	0.0	River Avon	Bedrock - Principal / Secondary B / Secondary undifferentiated	SPZ3	High	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_24	H04	Housing_DS11_	Red House Farm	250	13.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Superficial - Secondary A / Secondary undifferentiated / unproductive ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_25	H53	Housing_DS11_	Hatton Park - Brownley Green Lane	55	2.5	Predicted Hotspot Only	Low	100.0	0.0	0.0	Canal / Gog Brook	Superficial - Secondary undifferentiated ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_26	H28	Housing_DS11_	Land North of Birmingham Road (DS7)	80	5.1	Predicted Hotspot Only	Low	100.0	0.0	0.0	Canal / Gog Brook	Superficial - Secondary A ; Bedrock - Secondary B / Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_27	H39	Housing_DS11_	Opus 40, Birmingham Road, Warwick	90	3.9	Predicted Hotspot Only	Low	100.0	0.0	0.0	Grand Union Canal	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_28	H27	Housing_DS11_	Land South of Arras Boulevard (DS7)	100	6.2	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Gog Brook	Bedrock - Secondary B / Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites. However modelling will be required to confirm the capacity improvements.	Longbridge
WAR_29	H51	Housing_DS11_	Hampton Magna - Land South of Lloyd Close	115	5.4	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Gog Brook	Bedrock - Secondary B / Secondary undifferentiated	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites. However modelling will be required to confirm the capacity improvements.	Longbridge
WAR_30	H17	Housing_DS11_	Garage Site, Theatre Street	39	0.1	Predicted Hotspot Only	Medium	100.0	0.0	0.0	River Avon	Bedrock - Principal	N/A	High	No Restrictions	There are no known network constraints downstream of these sites.	Longbridge
WAR_31	H11	Housing_DS11_	Former Ridgeway School	140	3.7	Predicted Hotspot Only	High	100.0	0.0	0.0	Canal	Bedrock - Principal	SPZ3	High	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_32	H15	Housing_DS11_	Leamington Fire Station	N/A	0.5	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_33	H14	Housing_DS11_	Riverside House	100	1.8	Predicted Hotspot Only	High	2.5	11.8	85.7	River Leam	Bedrock - Principal	N/A	High	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site	Longbridge
WAR_34	H10	Housing_DS11_	Station Area	220	4.5	Predicted Hotspot Only	Low	100.0	0.0	0.0	Canal	Superficial- Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_35	H16	Housing_DS11_	Court Street Area	75	1.3	Predicted Hotspot Only	High	100.0	0.0	0.0	Canal	Superficial- Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_36	H13	Housing_DS11_	Soans Site, Sydenham Drive	55 / 88 (2 records)	2.6	Predicted Hotspot Only	Medium	100.0	0.0	0.0	Canal	Superficial- Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of this site	Longbridge
WAR_37	H01	Housing_DS11_	Myton Garden Suburb	1190	63.5	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	Due to development size relative to the existing system, improvement will be needed to ensure additional flows do not increase flood risk or unsatisfactory syphon and CSO performance. Modelling will be required to assess the scope of any capacity improvements.	Longbridge
WAR_38	H46A	Housing_DS11_	Gallows Hill	630	35.5	Predicted Hotspot Only	Low	94.6	2.2	3.2	New Waters	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	There are no known network constraints downstream of this site	Longbridge
WAR_39	H46B	Housing_DS11_	The Asps	900	56.6	Predicted Hotspot Only	Low	92.5	1.3	6.2	New Waters	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	Due to development size relative to the existing system, improvement will be needed to ensure additional flows do not increase flood risk or unsatisfactory syphon and CSO performance. Modelling will be required to assess the scope of any capacity improvements.	Longbridge
WAR_40	H02	Housing_DS11_	South of Harbury Lane	1720	122.9	Predicted Hotspot Only	Low	94.4	1.4	4.2	New Waters	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	Due to development size relative to the existing system, improvement will be needed to ensure additional flows do not increase flood risk or unsatisfactory syphon and CSO performance. Modelling will be required to assess the scope of any capacity. There are 2 rising mains crossing the site.improvements.	Longbridge
WAR_41	H38	Housing_DS11_	Land Fronting Southam Road (DS7)	25	2.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	Grand Union Canal	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_42	H52	Housing_DS11_	Land south of Spring Lane	60	3.9	Predicted Hotspot Only	High	100.0	0.0	0.0	River Leam	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of this development.	Longbridge
WAR_43	H03	Housing_DS11_	Whitnash East	300	33.6	Predicted Hotspot Only	Medium	59.3	9.0	31.7	River Leam	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	Space for surface attenuation SuDS may be limited within FZ 3.	Due to development size relative to the existing system, improvement may be needed to ensure additional flows do not increase flood risk or unsatisfactory PS performance. Modelling will be required to assess the scope of any capacity improvements.	Longbridge
WAR_44	H45	Housing_DS11_	Hazelmere and Little Acre	70	3.3	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Superficial - Secondary A ; Bedrock - Secondary A	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites. However modelling will be required to confirm the capacity of the pumping stations.	Longbridge
WAR_45	H49	Housing_DS11_	Bishops Tachbrook - Seven Acre Close	30	2.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	Tach Brook	Superficial - Secondary undifferentiated	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments and limited storeage at the SPS. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_46	H23	Housing_DS11_	Land South of School (DS7)	150	6.3	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Tach Brook	Superficial - Secondary A / Secondary undifferentiated	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments and limited storeage at the SPS. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_47	H21	Housing_DS11_	Sherbourne Nursery (DS7)	60	2.6	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_48	H48	Housing_DS11_	South of Westham Lane	45	2.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_49	H22	Housing_DS11_	Land off Bremridge Close (DS7)	12	2.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are known hydraulic sewer flooding issues downstream of these developments. Modelling will be required to assess and determine any capacity improvements.	Longbridge
WAR_50	H20	Housing_DS11_	South of Barford House (DS7)	N/A	0.3	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites. However modelling will be required to confirm the capacity of the pumping stations.	Longbridge
WAR_51	H47	Housing_DS11_	Barford - Land south of Wasperton Lane	30	1.3	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	River Avon	Superficial - Secondary A ; Bedrock - Secondary B	N/A	Medium	No Restrictions	There are no known network constraints downstream of these sites. However modelling will be required to confirm the capacity of the pumping stations.	Longbridge
WAR_52	L62	SHLAA_Sites	Land off Cloister Way	47	1.4	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Bedrock - Principal	N/A	High	N/A	There are known hydraulic sewer flooding issues downstream of this development. Modelling will be required to assess and determine any capacity improvements .	Longbridge
WAR_53	L58	SHLAA_Sites	Lillington Free Church	15	N/A	Historic and Predicted Spot	Low	100.0	0.0	0.0	River Leam	Bedrock - Principal	N/A	High	N/A	There are no known network constraints downstream of these sites.	Longbridge
WAR_54	R215	SHLAA_Sites	Haseley Manor	15	N/A	Not Met Hotspot Trigger	Low	100.0	0.0	0.0	Grand Union Canal	Superficial - Secondary undifferentiated ; Bedrock - Secondary B	N/A	Medium	N/A	There are no known network constraints downstream of these sites.	Longbridge
WAR_55	W40	SHLAA_Sites	Lock Lane	20	N/A	Predicted Hotspot Only	Low	100.0	0.0	0.0	St. John's Brook	Superficial - Secondary A ; Bedrock - Principal	N/A	High	N/A	There are no known network constraints downstream of these sites.	Longbridge
WAR_56	W43	SHLAA_Sites	Idex Site, Charles Street	42	N/A	Predicted Hotspot Only	Low	100.0	0.0	0.0	Canal	Superficial - Secondary A ; Bedrock - Principal	N/A	High	N/A	There are no known network constraints downstream of these sites.	Longbridge
WAR_57	L32	SHLAA_Sites	Jewsons	29	N/A	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Avon	Bedrock - Secondary B	N/A	Medium	N/A	There are no known network constraints downstream of these sites.	Longbridge
WAR_58	L06	SHLAA_Sites	Edmonscote Manor	35	N/A	Predicted Hotspot Only	Low	100.0	0.0	0.0	River Leam	Superficial - Secondary A ; Bedrock - Principal	N/A	High	N/A	There are no known network constraints downstream of these sites.	Longbridge

About AECOM

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