Shropshire Council Water Cycle Study

Final Report

July 2020

www.jbaconsulting.com

Shropshire Council

This page is intentionally left blank

JBA Project Manager

Richard Pardoe
Pipe House
Lupton Road
Wallingford
OX10 9BS

Revision History

Revision Ref/Date	Amendments	Issued to
S3-P01 – 26/11/2019	Draft Report	Joy Tetsill (Senior Planning Officer)
S3-P02 – 11/03/2020	Draft – Final Report	Joy Tetsill
S3-P03 – 09/07/2020	Final Report	Joy Tetsill
S3-P04 – 22/07/2020	Final Report (Amended)	Joy Tetsill

Contract

This report describes work commissioned by the Shropshire Council, by an email dated 10th July 2019. Lucy Finch and Richard Pardoe of JBA Consulting carried out this work.

Prepared by ..... Lucy Finch BSc
Analyst

..... Saskia Salwey BSc
Assistant Analyst

Reviewed by ..... Richard Pardoe MSc MEng
Analyst

..... Paul Eccleston BA CertWEM CEnv MCIWEM C.WEM
Technical Director

Purpose

This document has been prepared as a Draft Report for the Shropshire Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Shropshire Council for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Shropshire Council.

Acknowledgements

JBA Consulting would like to thank Shropshire Council, Severn Trent Water, United Utilities and Welsh Water for their assistance in preparing this report.

Copyright

Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 800g if 100% post-consumer recycled paper is used and 1018g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Executive summary

In July 2019, JBA Consulting was commissioned by Shropshire Council to undertake a Water Cycle Study (WCS) to inform the Shropshire Local Plan Review. This study assesses the potential issues relating to future development within Shropshire and the impacts on water supply, wastewater collection and treatment and water quality. The Water Cycle Study is required to assess the constraints and requirements that will arise from potential growth on the water infrastructure.

New homes require the provision of clean water, safe disposal of wastewater and protection from flooding. The allocation of large numbers of new homes in certain locations may result in the capacity of existing available infrastructure being exceeded, a situation that could potentially cause service failures to water and wastewater customers, adverse impacts to the environment, or high costs for the upgrade of water and wastewater assets being passed on to the bill payers.

In addition to increased housing demand, future climate change presents further challenges to the existing water infrastructure network, including increased intensive rainfall events and a higher frequency of drought events. Sustainable planning for water must now take this into account. The water cycle can be seen in the figure below and shows how the natural and man-made processes and systems interact to collect, store or transport water in the environment.

The Water Cycle

Source: Environment Agency – Water Cycle Study Guidance

This study will assist Shropshire Council to select and develop sustainable development allocations where there is minimal impact on the environment, water quality, water resources, infrastructure and flood risk. This has been achieved by identifying areas where there may be conflict between any proposed development, the requirements of the environment and by recommending potential solutions to these conflicts.

The Water Cycle Study has been carried out in co-operation with Severn Trent Water (STW), United Utilities (UU), Welsh Water (WW), the Environment Agency and the neighbouring Local Planning Authorities (LPAs).

Potential development sites were provided by Shropshire Council and wastewater treatment works (WwTW) likely to serve growth in the area were identified using the Environment Agency Consents database. Each development site/growth scenario was then allocated to a WwTW in order to understand the additional wastewater flow resulting from the planned growth. Available information was collated on water policy and legislation, water resources, water quality, and environmental designations within the study area.

Shropshire's proposed growth over the Local Plan period is comprised of the following:

- **Preferred options sites -** An urban-focused distribution of development with the majority of development going to the Strategic Centre (Shrewsbury), the Principal Centres (Bridgnorth, Oswestry, Ludlow, Whitchurch and Market Drayton), and eleven other Key Centres. The remainder is proposed in Community Hubs and Community Clusters in the rural areas.
- **Strategic sites -** In addition to the preferred options sites, three strategic sites have been proposed to meet Shropshire's housing need. These are RAF Cosford, Ironbridge Power Station site and Clive Barracks at Tern Hill near Market Drayton.

The objective of the study is to provide evidence to guide development towards the most sustainable sites. Red / Amber /Green (RAG) assessments have been prepared at the settlement and site scale for the different aspects of the water cycle. It should be remembered that where a development is scored amber or red in a water supply or wastewater infrastructure assessment, it does not mean that development cannot or should not take place in that location, merely that significant infrastructure may be required to accommodate it. The decision on the suitability of sites is made up of a number of assessments outside the scope of this report.

Water Resources

Severn Trent Water is responsible for supplying the majority of Shropshire with water, with Hafren Dyfrdwy operating in a small area in the west of the study area. Shropshire is covered by the Strategic Grid, Shelton, Kinsall, Mardy, Whitchurch and Wem, North Staffs, Bishops Castle, Stafford, Ruyton, Wolverhampton and Llandinam Llanwrin Water Resource Zones (WRZ).

The WRMP shows a supply-demand deficit from 2021-22 at the Strategic Grid WRZ and from 2025-26 at the North Staffs WRZ if no action is taken, however the WRMP goes on to define a number of actions that will address this. The Kinsall and Whitchurch and Wem WRZs show minor supply-demand deficits later on in the plan period.

Severn Trent have stated that the adopted WRMP has planned for the proposed growth, however sites in Albrighton, Shifnal and the strategic site at RAF Cosford were rated as amber as they are located in areas where there are WINEP actions to reduce abstraction. In these locations, water may need to be transferred into the catchment to avoid increasing local abstraction.

Policies to reduce water demand from new developments, or to go further and achieve water neutrality in certain areas (particularly within the Shelton water resource zone), could be defined to reduce the potential environmental impact of additional water abstractions in Shropshire, and also help to achieve reductions in carbon emissions. It is therefore recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Shropshire.

In the areas identified by Severn Trent Water as having particular pressures on Water Resources within the Shelton water resource zone should be considered for the application of water neutrality if required by STW.

Water supply infrastructure

Severn Trent stated that as long as a site is within a water resource zone with sufficient water resources, they do not envisage a problem with supply to that site. An exception to this are the sites around Albrighton, Shifnal and the strategic sites at RAF Cosford and Junction 3 of M54. In these locations water may need to be transferred into the catchment to serve these sites without increasing local abstraction.

Early developer engagement is required to ensure that, as development occurs within the study area, detailed modelling of water supply infrastructure will allow any upgrades to be completed without restricting the timing, location or scale of the planned development.

Wastewater collection infrastructure

STW, UU and WW provide wastewater services to Shropshire. Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented

following an application for a connection, adoption, or requisition from a developer. Early developer engagement with STW, UU and WW is therefore essential to ensure that sewerage capacity can be provided without delaying development.

Only STW and WW provide wastewater services for the preferred options and strategic sites.

STW and WW provided a red/amber/green assessment of the sewer network for each preferred option and strategic site. Significant infrastructure upgrades would be required to serve growth in Shrewsbury, the Strategic Centre, and Bridgnorth and Ludlow from the Principal Centres as well as a number of Key Centre and Rural Areas settlements.

Early engagement with Severn Trent Water and Welsh Water is required, and further modelling of the network may be required at the planning application stage.

Wastewater treatment capacity

STW and WW provided assessments of the WwTW serving growth in each scenario based on hydraulic capacity and headroom in the environmental permit. JBA performed a flow permit assessment in parallel to this.

While the proposed growth in Shropshire can be accommodated at a number of WwTW, some treatment works could require upgrades to ensure growth can occur without causing the flow permits being exceeded.

Early engagement with Severn Trent Water and Welsh Water would be required at the planning application stage to ensure that growth is aligned with provision of capacity at WwTW.

Odour

Only one site was close enough to a WwTW that an odour assessment is recommended as part of the planning application process – SHR166 in Shrewsbury. The cost of this should be met by the developer.

Water quality

The water quality modelling undertaken in this study uses a model calibrated with water quality data and assumptions from 2010-12, and updated with the latest effluent flows at WwTWs within the study area, and incorporating AMP6 and AMP7 improvements provided by the EA. It should therefore be used to identify areas at risk of deterioration, and should not be used to set permit limits or definitively rule out growth in particular catchments.

At eleven WwTWs in Shropshire water quality modelling identified a risk that planned growth could cause a deterioration in water quality, and that it may not be possible to mitigate this with treatment at the technically achievable limit. At a further WwTW, there is a risk that growth may prevent good ecological status being achieved in the future.

At these works, further mitigation may need to be taken to accommodate growth and options include pumping wastewater to a different WwTW or changing the point of discharge to a less sensitive waterbody. Detailed optioneering is beyond the scope of this study and is best undertaken by Severn Trent Water who have a detailed knowledge of their assets, and the range of options and constraints at each.

Flood risk from additional foul flow

A detailed assessment of flood risk can be found in the Shropshire Council Level 1 Strategic Flood Risk Assessment (SFRA). The impact of increased effluent flows at WwTW from any of the proposed development has been assessed and is not predicted to have a significant impact upon flood risk in any of the receiving watercourses.

Environmental constraints

A number of designated Sites of Special Scientific Interest (SSSIs) exist within Shropshire, and there is a possibility of point source pollution (from WwTW) or diffuse pollution (for example from surface runoff from development) to impact these sites. Opportunities exist to mitigate this through implementation of SuDS schemes to manage surface runoff which should consider water quality as well as quantity. Shropshire Council as Lead Local Flood Authority should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics. In the wilder area, opportunities exist to implement natural flood management techniques to achieve multiple benefits of flood risk, water quality and habitat creation.

River Clun Catchment

Growth in the River Clun catchment must comply with the requirements of the Habitat Regulations to prevent any adverse effects on the water quality of the River Clun Special Area of Conservation (SAC). Mitigation options are set out in this report and will be considered as part of the Local Plan Review Habitat Regulations Assessment

Contents

List of Figures

List of Tables

Abbreviations / Glossary

ALS	Abstraction Licensing Strategy
AMP	Asset Management Plan
AMR	Automatic Meter Reading
AONB	Area of Outstanding Natural Beauty
AP	Assessment Point
ASNW	Ancient Semi-Natural Woodland
BIDS	Business, Industrial, distribution and Storage
BOD	Biochemical Oxygen Demand
BREEAM	Building Research Establishment Environmental Assessment Methodology
CAMS	Catchment Abstraction Management Strategies
CAPEX	Capital Expenditure
CED	Common End Date
CFMP	Catchment Flood Management Plan
CfSH	Code for Sustainable Homes
CSO	Combined Sewer Overflow
DCLG	Department of Communities and Local Government (Replaced by MHCLG)
DWF	Dry Weather Flow
DWI	Drinking Water Inspectorate
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
EC	European Community
ECA	European Communities Act
EFI	Ecological Flow Indicator
EP	Environmental Permit
EU	European Union
FEH	Flood Estimation Handbook
FFT	Flow to Full Treatment
FWMA	Flood and Water Management Act
FZ	Flood Zone
GIS	Geographic Information Systems
HOF	Hands-Off Flow
HOL	Hands-off Level
HRA	Habitats Regulations Assessment
JBA	Jeremy Benn Associates
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
l/p/d	Litres per person per day
Ml/d	Mega (Million) litres per day
MHCLG	Ministry of Housing Communities and Local Government
NH4	Ammonia
NMP	Nutrient Management Plan
NPPF	National Planning Policy Framework
OAN	Objectively Assessed Need

OfWAT	Water Service Regulation Authority
OPEX	Operational Expenditure
OS	Ordnance Survey
P	Phosphorous
RAG	Red / Amber / Green assessment
RBD	River Basin District
RBMP	River Basin Management Plan
ReFH	Revitalised Flood Hydrograph
RoFSW	Risk of Flooding from Surface Water (replaced uFMfSW)
RQP	River Quality Planning tool
RZ	Resource Zone
SA	Sustainability Appraisals
SAC	Special Area of Conservation
SBP	Strategic Business Plan
SEA	Strategic Environmental Assessment
SfA	Sewers for Adoption
SFRA	Strategic Flood Risk Assessment
SC	Shropshire Council
SHELAA	Strategic Housing and Economic Land Availability Assessment
SHMA	Strategic Housing Market Assessment
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPZ	Source Protection Zone
SS	Suspended Solids
SSSI	Site of Special Scientific Interest
STW	Severn Trent Water
SU	Sewerage Undertaker
SLP	Shropshire Local Plan
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UU	United Utilities
UWWTD	Urban Waste Water Treatment Directive
WaSC	Water and Sewerage Company
WCS	Water Cycle Study
WFD	Water Framework Directive
WINEP	Water Industry National Environment Programme
WRMP	Water Resource Management Plan
WRZ	Water Resource Zone
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works
WW	Welsh Water

1 Introduction

1.1 Terms of reference

JBA Consulting was commissioned by Shropshire Council to undertake a Water Cycle Study (WCS) for Shropshire. The purpose of the WCS is to form part of a comprehensive and robust evidence base to inform the preparation of the Local Plan Review, which will set out a vision and framework for development in the area up to 2038 and will be used to inform decisions on the location of future development.

Unmitigated future development and climate change can adversely affect the environment and water infrastructure capability. A WCS will provide the required evidence, together with an agreed strategy to ensure that planned growth occurs within environmental constraints, with the appropriate infrastructure in place in a timely manner so that planned allocations are deliverable.

1.2 The Water Cycle

Planning Practice Guidance on Water Supply, Wastewater and Water Quality[1] describes a water cycle study as:

"a voluntary study that helps organisations work together to plan for sustainable growth. It uses water and planning evidence and the expertise of partners to understand environmental and infrastructure capacity. It can identify joined up and cost-effective solutions, that are resilient to climate change for the lifetime of the development.

The study provides evidence for Local Plans and sustainability appraisals and is ideally done at an early stage of plan-making. Local authorities (or groups of local authorities) usually lead water cycle studies, as a chief aim is to provide evidence for sound Local Plans, but other partners often include the Environment Agency and water companies."

The Environment Agency's guidance on WCS[2] recommends a phased approach:

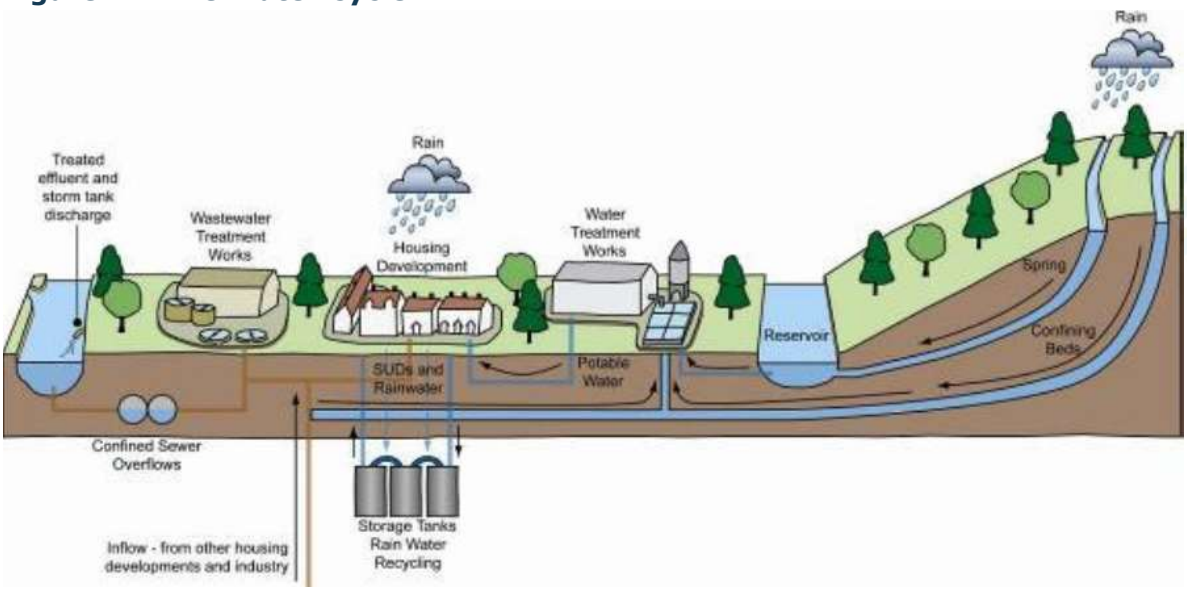
- Phase 1: Scoping study, focussing on formation of a steering group, identifying issues for consideration and the need for an outline study.
- Phase 2: Outline study, to identify environmental constraints, infrastructure constraints, a sustainability assessment and consideration of whether a detailed study is required.
- Phase 3: Detailed study, to identify infrastructure requirements, when they are required, how they will be funded and implemented and an overall assessment of the sustainability of proposed infrastructure.

Figure 1.1 below shows the main elements that compromise the Water Cycle and shows how the natural and man-made processes and systems interact to collect, store or transport water in the environment.

1 Planning Practice Guidance: Water supply, wastewater and water quality, Department for Communities and Local Government (2014). Accessed online at: http://planningguidance.planningportal.gov.uk/blog/guidance/ on: 25/07/2019

2 Water Cycle Study Guidance, Environment Agency (2009). Accessed online at: http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/geho0109bpff-e-e.pdf on: 25/07/2019

Figure 1.1 The Water Cycle



1.3 Impacts of Development on the Water Cycle

New homes require the provision of clean water, safe disposal of wastewater and protection from flooding. It is possible that allocating large numbers of new homes at some locations may result in the capacity of the existing available infrastructure being exceeded. This situation could potentially lead to service failures to water and wastewater customers, have adverse impacts on the environment or cause the high cost of upgrading water and wastewater assets being passed on to bill payers. Climate change presents further challenges such as increased intensity and frequency of rainfall and a higher frequency of drought events that can be expected to put greater pressure on the existing infrastructure.

1.4 Objectives

As a WCS is not a statutory instrument, Local Planning Authorities are advised to prioritise the different stages of the WCS to integrate with their Local Plan programme. This scoping report is written to support the Shropshire Local Plan Review.

The WCS brief from Shropshire Council stated that the overall objective of the WCS is to understand the environmental and physical constraints of development and identify opportunities for more sustainable planning and improvements that may be required to achieve the required level of development. This should be assessed by considering the following issues:

- Water demand and supply;
- Wastewater infrastructure and treatment;
- Water quality and the environment;
- Flood risk and drainage.

1.5 Study Area

Shropshire Council covers an area of approximately 3,197km^2 and has a population of 306,129 reported in the 2011 census. The main urban areas in Shropshire are Shrewsbury, Oswestry, Bridgnorth, Ludlow and Market Drayton, although the county is predominantly rural.

Shropshire is located mostly within the River Severn catchment, and contains the River Teme, River Tern, River Onny, River Roden, River Worfe, River Rea, and the River Severn, which is the major waterway in the county. The northern part of the county is within the River Dee and River Weaver catchments.

Water supply is provided by Severn Trent Water. Wastewater services are provided by Severn Trent Water, United Utilities and Welsh Water.

1.6 Record of Engagement

1.6.1 Introduction

Preparation of a WCS requires significant engagement with stakeholders, within the Local Planning Authority area, with water and wastewater utilities, with the Environment Agency, and where there may be cross-boundary issues, with neighbouring local authorities. This section forms a record of engagement for the WCS.

1.6.2 Engagement

The preparation of this WCS was supported by the following engagement:

Inception meeting

Engaged Parties	Shropshire Council Environment Agency
Details	Scope of works and data collection requirements reviewed.

Neighbouring authorities

Engaged Parties	South Staffordshire Council Powys County Council Wyre Forest District Council Newcastle-under-Lyme Borough Council Telford and Wrekin Council Herefordshire Council Wrexham County Borough Council Stafford Borough Council Malvern Hills District Council Cheshire East Council Cheshire West Chester Council
Details	Request for water cycle studies conducted in their area, and housing growth that would be served by WwTW within or shared with Shropshire Council.

Collaboration with Water Companies

Engaged Parties	Severn Trent Water United Utilities Welsh Water
Details	Water company assessments of water and wastewater infrastructure and capacity constraints.

Discussions on the River Clun catchment

Engaged Parties	Shropshire Council Severn Trent Water

	Environment Agency Natural England
Details	Ongoing discussion on the impact of growth on the Clun SAC.

2 Future Growth in Shropshire

2.1 Growth in Shropshire

Shropshire Council are currently undertaking a Local Plan Review (LPR) and this is expected to be adopted in the financial year 2021-2022. The review will provide an updated Local Plan to cover the period 2016 to 2038.

The preferred development strategy proposes 30,800 dwellings, much of which is made up of current committed sites, sites with planning permission and allocations which have not yet gained planning permission. There is a net additional requirement of around 12,000 new houses (as at March 31st 2018). Around 300ha of employment land is anticipated, 225ha of which has already been completed/committed/allocated, leaving a requirement for approximately 75ha of additional employment land (as at March 31st 2017).

However, the eventual employment land supply may be somewhat higher in order to ensure that the distribution of employment development reflects the proposed distribution of housing development and ensure that balanced growth is achieved.

The modelling for this study is based on these figures although it must be noted that regular monitoring carried out by the Council means that the figures (as well as the windfall allowances – see below) may change after this report is published.

Table 2.1 Calculation of Shropshire Council's Housing Requirement (as at 31st March 2018)

Development strategy requirement 2016-2038	Completions, commitments and undeveloped allocations	Net housing requirement
30,800	Around 19,000	Around 12,000

Table 2.2 Shropshire Council's Employment Requirement (as at 31st March 2017)

Development strategy requirement 2016-2038	Completions, commitments and undeveloped allocations	Net employment requirement
300ha	225ha	75ha

The LPR proposes an urban-focused distribution of development as part of their preferred options consultation with the majority being in the following settlements:

- Strategic Centre
  - Shrewsbury
- Principal Centres
  - Bridgnorth
  - Oswestry
  - Ludlow
  - Whitchurch
  - Market Drayton
- Key centres
  - Albrighton
  - Bishop's Castle
  - Broseley
  - Church Stretton

- Cleobury Mortimer
- Craven Arms
- Ellesmere
- Highley
- Much Wenlock
- Shifnal
- Wem

- Rural areas
  - Community hubs and Community Clusters

A further LPR preferred options consultation proposed the allocation of three strategic sites to meet Shropshire's housing need:

- Clive Barracks at Tern Hill near Market Drayton
- Ironbridge power station site
- RAF Cosford

2.2 Development sites in Shropshire

Figure 2.1 shows the location of the preferred options and strategic sites under consideration in Shropshire.

Along with the preferred options and strategic sites, Shropshire Council also provided a list of completions already achieved within the Local Plan Review period and their commitments. The committed sites consisted of:

- Sites with planning permission that have not been built out,
- Allocated sites from the Site Allocations and Management of Development (SAMDev) Plan adopted in 2015, that have yet to be granted planning permission,
- Prior approvals sites (dwellings granted consent through permitted development rights) that have not been built out.

These commitments and completions (including the SAMDEV sites) were also considered as part of the WCS, to assess overall water and wastewater demand, however assessments from the water companies was not required for these sites. Where the net overall dwellings at a site were zero or negative (due to properties being demolished and new houses built etc.) these were not considered as part of the assessment.

2.3 Windfall

Windfall sites are sites that have not been specifically allocated in the Local Plan. Local Plans usually provide an allowance to cover this circumstance, consistent with the National Planning Policy Framework (NPPF).

The windfall allowances for each settlement were provided by Shropshire Council (as at 31st March 2018) and are outlined in Table 2.3. As above, these may change as a result of subsequent monitoring.

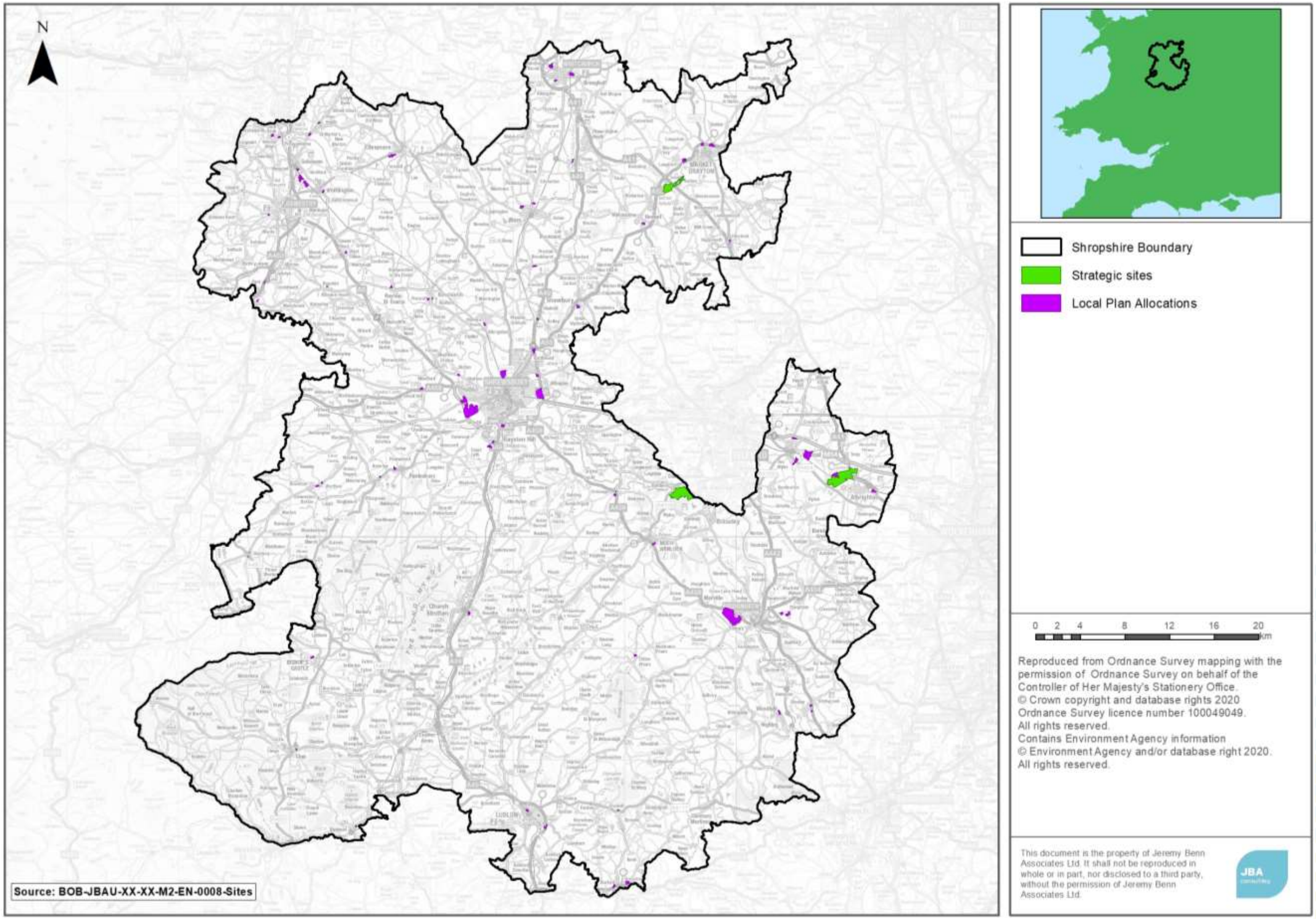
Table 2.3 Windfall allowances by settlement

Settlement	Dwellings over the Local Plan Period	Employment m^2 space over the Local Plan Period
Shrewsbury	1,034	-
Bridgnorth	58	-
Ludlow	58	-
Market Drayton	48	-
Oswestry	65	-

Settlement	Dwellings over the Local Plan Period	Employment m^2 space over the Local Plan Period
Whitchurch	105	-
Albrighton	45	20,000
Bishops Castle	0	-
Broseley	-12	8,000
Church Stretton	19	8,000
Cleobury Mortimer	120	4,000
Craven Arms	95	-
Ellesmere	102	-
Highley	10	4,000
Much Wenlock	15	2,000
Shifnal	124	-
Wem	81	8,000
Bucknell	3	-
Chirbury	2	-
Clun	8	-
Worthen and Brockton	4	-
Alveley	28	-
Ditton Priors	0	-
Burford	96	-
Clee Hill	3	-
Hinstock	20	-
Hodnet	12	-
Woore, Irelands Cross and Pipe Gate	30	-
Minsterley	20	-
Pontesbury	4	-
Cressage	7	-
Gobowen	17	-
Kinnerley	23	-
Knockin	6	-
Llanymynech	1	-
Pant	8	-
Ruyton XI Towns	39	-
St Martins	34	-
Trefonen	50	-
West Felton	-20	-
Weston Rhyn	-5	-
Whittington	19	-
Baschurch	29	-
Bayston Hill	16	-
Bicton	11	-
Bomere Heath	13	-
Cross Houses	7	-

Settlement	Dwellings over the Local Plan Period	Employment m^2 space over the Local Plan Period
Dorrington	71	-
Ford	18	-
Hanwood	19	-
Longden	27	-
Nesscliffe	19	-
Clive	13	-
Hadnall	12	-
Shawbury	32	-
Prees	33	-

Figure 2.1 Map of the water cycle study area



2.4 Growth outside Shropshire

Where growth within a neighbouring Local Planning Authority (LPA) area may be served by infrastructure within or shared with Shropshire, the LPA were contacted as part of a duty to cooperate request to provide information on:

- The latest growth forecast (housing and employment) for the district
- Details of future growth within the catchments of WwTW which serve part of their council area and Shropshire.

Where specific trajectory was not given by the neighbouring councils, committed development was spread evenly over the next five years (2018/19 to 2022/23) and Local Plan development was spread evenly from 2018/19 to the end of the Local Plan period.

2.4.1 Malvern Hills District Council

JBA completed a WCS for Malvern Hills as one of the South Worcestershire Councils in 2019. Since the study the Council has reduced their potential site list to preferred SHLAA sites and provided this information to JBA. This was to inform growth at Tenbury WwTW, which serves growth in Tenbury in Malvern Hills District, and Burford in Shropshire. This information is provided in Table 2.4.

Table 2.4 Summary of growth in Malvern Hills served by infrastructure shared with Shropshire

WwTW	Proposed number of dwellings	Period
Tenbury	61	2018-2041

2.4.2 Powys County Council

Powys County Council provided JBA with their Adopted Local Development Plan[3] and Land Availability Assessment[4] to inform growth in Llanymynech served by Pant-Plas Cerrig WwTW (which also serves growth in Pant in Shropshire) and Knighton served by Knighton WwTW (which also serves a small area in the south of Shropshire).

Table 2.5 Summary of growth in Powys served by infrastructure or shared with Shropshire

WwTW	Proposed number of dwellings	Period
Pant-Plas Cerrig	44 (Local development plan)	2018-2036
	31 (Land availability assessment)	2021/22-2023/24
Knighton	133 (Local development plan)	2018-2036
	94 (Land availability assessment)	2020/21-2022/23

2.4.3 Telford and Wrekin Council

The main WwTW shared between Telford and Wrekin and Shropshire is Coalport, which serves a large amount of growth in both council areas. Monkmoor WwTW also serves a small area in Telford and Wrekin around Rodington, Rodington Heath and Somerwood. Telford and Wrekin provided shapefiles of their Adopted Local Plan[5] sites, and also their 2018 Annual Monitoring Report (AMR) sites. A number of AMR sites were for a net loss in dwellings or employment floorspace and were therefore not considered as part of this

3 Adopted Local Plan 2018, Powys County Council. Accessed online at: https://en.powys.gov.uk/article/4898/Adopted-LDP-2018 on 19/09/2019
4 Joint Housing Land Availability Study, 2019, Powys County Council. Accessed online at: https://en.powys.gov.uk/article/4911/Joint-Housing-Land-Availability-Study on 19/09/2019
5 Adopted Local Plan, Telford and Wrekin Council. Accessed online at: https://www.telford.gov.uk/downloads/file/6655/telford_and_wrekin_local_plan_2011-2031_adopted_january_2018 on 20/09/2019

assessment. Edgmond WwTW also serves both council areas, however there is no proposed development in Shropshire for this WwTW.

Table 2.6 Summary of growth in Telford and Wrekin served by infrastructure shared with Shropshire

WwTW	Proposed number of dwellings	Proposed employment floorspace m^2	Period
Coalport	2,091 (Local Plan)	199,520 (Local Plan)	To 2031
	312 (AMR completions 17/18)	38,063 (AMR completions 17/18)	2017/18
	4,203 (AMR pipeline)	1,145.1 (AMR pipeline)	2018/19-2022/23
Monkmoor	1 (AMR completions 17/18)	-	2017/18
	13 (AMR pipeline)	-	2018/19-2022/23

2.4.4 South Staffordshire District Council

At the time of writing this WCS, JBA were also completing a WCS for the Southern Staffordshire Councils, which includes South Staffs District. There are several WwTW serving both areas – Burnhill Green, Codsall, Bishopswood and Blymhill, however Blymhill is the only WwTW which will serve growth in both council areas.

Table 2.7 Summary of growth in Telford and Wrekin served by infrastructure shared with Shropshire

WwTW	Proposed number of dwellings	Period
Blymhill	3 (committed sites)	2018/19-2022/23

2.4.5 Herefordshire Council

Orleton, Richards Castle and Brimfield in Herefordshire are served by Ludlow WwTW, which also serves growth in Shropshire. Herefordshire Council provided JBA with the neighbourhood plans for these areas, which gives the minimum requirements for housing. It should be noted that as minimum requirements, there may be additional dwellings granted permission in addition to those specified in the neighbourhood plans.

Table 2.8 Summary of growth in Herefordshire served by infrastructure shared with Shropshire

WwTW	Proposed number of dwellings	Period
Ludlow	146	2018/19-2030/31

2.4.6 Wrexham Council

A large part of Wrexham Council area is served by Five Fords WwTW, which serves growth in Shropshire in St Martins, Weston Rhyn and surrounding areas. Wrexham Councils BP8 Housing Supply and Delivery Paper provided trajectory of development over their Local Plan Period up to 2028. The paper provided information of completed, committed and allocated sites as well as a windfall allowance for the whole Council area of 195 houses per year. Around 80% of the development outlined in the paper was part of the Five Fords catchment, and for that reason it was assumed that 80% of the total yearly windfall allowance would be served by Five Fords WwTW.

Wrexham Council's BP7 Employment Land paper and Deposit Plan predicts a job growth of 4,200 over the Local Plan period (2013-2028), or 280 jobs per year. As a worst-case scenario, all this development was assumed to go to Five Fords WwTW as it was unclear where this employment development would be focussed within the Council area.

WwTW	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	2028+
	Proposed number of dwellings											
Five Fords	265	376	347	495	538	574	626	577	605	712	712	1587
	Proposed number of jobs											
	280	280	280	280	280	280	280	280	280	280	280	

2.4.7 Other neighbouring authorities

The remaining authorities neighbouring Shropshire (Wyre Forest District, Newcastle-under-Lyme Borough, Wrexham, Stafford Borough, Cheshire East, Cheshire West and Chester) do not share any wastewater infrastructure with Shropshire and therefore growth in these authorities have not been considered as part of this study.

3 Legislative and Policy Framework

3.1 Introduction

The following sections introduce several national, regional and local policies that must be considered by the LPA, water companies and developers during the planning stage. Key extracts from these policies relating to water consumption targets and mitigating the impacts on the water from the new development are summarised below.

3.2 National Policy

3.2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[6] was published on 27th March 2012, as part of reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. A comprehensive revision was issued in July 2018. This was further revised in February 2019[7], but the changes were not significant from the July 2018 version for policy areas relevant to the WCS. The NPPF provides guidance to planning authorities to take account of flood risk and water and wastewater infrastructure delivery in their Local Plans. Key paragraphs include:

Paragraph 34:

> *"Plans should set out the contributions expected from development. This should include setting out the levels and types of affordable housing provision required, along with other infrastructure (such as that needed for education, health, transport, flood and water management, green and digital infrastructure). Such policies should not undermine the deliverability of the plan."*

Paragraph 149:

> *"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply..."*

Paragraph 170 (e):

> *"…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans".*

6 National Planning Policy Framework, Department for Communities and Local Government (2012)
7 National Planning Policy Framework, Ministry of Housing, Communities and Local Government (2019). Accessed online at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 on: 04/11/2019

In March 2014, the Planning Practice Guidance was issued by the Department for Communities and Local Government, with the intention of providing guidance on the application of the National Planning Policy Framework (NPPF) in England. The MHCLG is in the process of updating the Guidance to consider the necessary 2018 and 2019 updates of the NPPF. Of the sections relevant to this study, only the Water Supply, Wastewater and Water Quality section has been updated.

- Flood Risk and Coastal Change[8]
- Water Supply, Wastewater and Water Quality[9].
- Housing - Optional Technical Standards[10].

3.2.2 Planning Practice Guidance: Flood Risk and Coastal Change

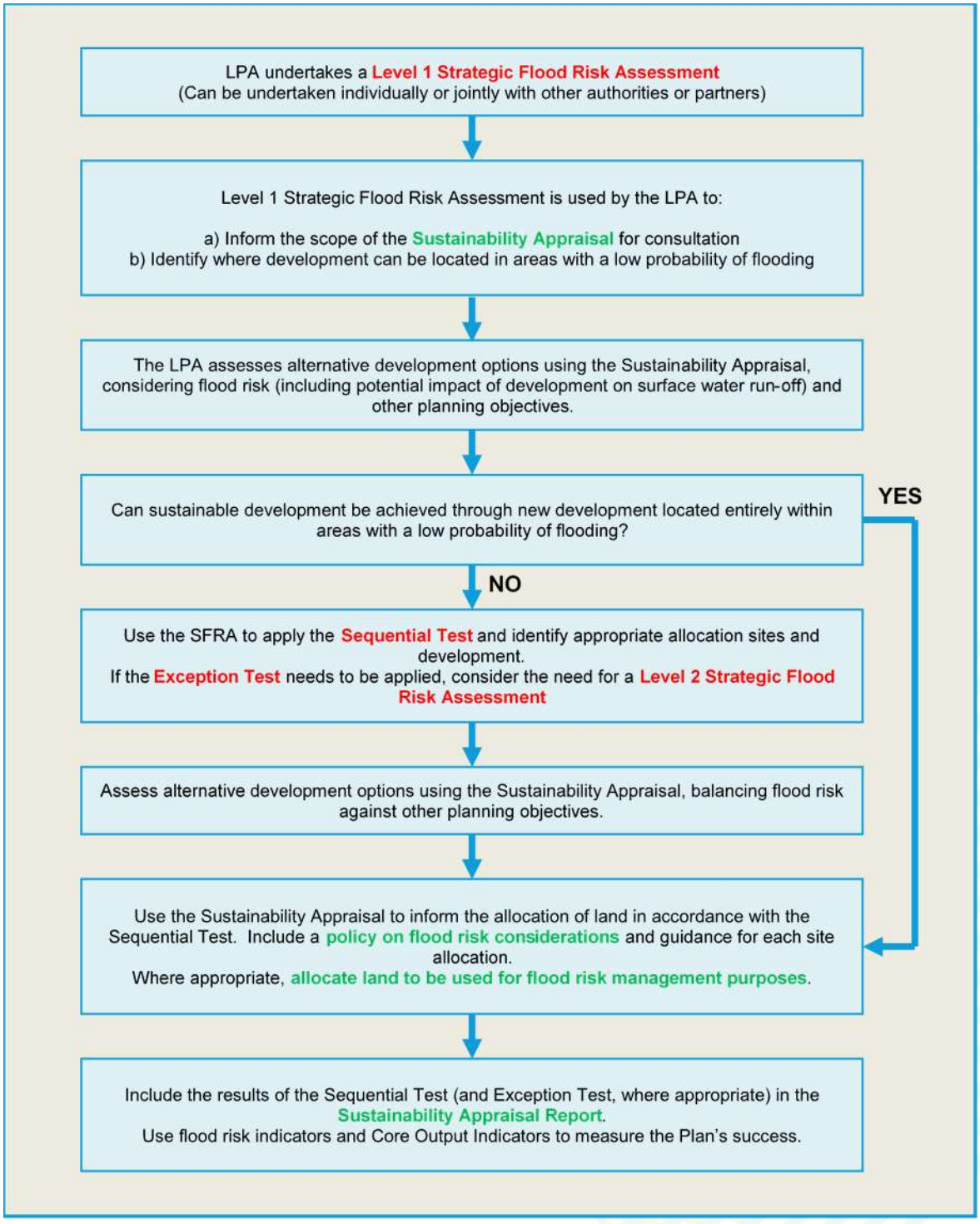
Diagram 1 in the Planning Practice Guidance sets out how flood risk should be considered in the preparation of Local Plans (Figure 3.1). These requirements are addressed principally in the Council's Strategic Flood Risk Assessment.

3.2.3 Planning Practice Guidance: Water Supply, Wastewater and Water Quality

A summary of the specific guidance on how infrastructure, water supply, wastewater and water quality considerations should be accounted for in both plan-making and planning applications is summarised below in Figure 3.2.

8 Planning Practice Guidance: Flood Risk and Coastal Change, Department for Communities and Local Government (2014). Accessed online at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/ on: 05/11/2019.
9 Planning Practice Guidance: Water supply, wastewater and water quality, Department for Communities and Local Government (2014). Accessed online at: https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality on: 05/11/2019
10 Planning Practice Guidance: Housing - Optional Technical Standards, Department for Communities and Local Government (2014). Accessed online at: https://www.gov.uk/guidance/housing-optional-technical-standards on: 05/11/2019

Figure 3.1 Flood Risk and the Preparation of Local Plans[11]



11 Based on Diagram 1 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-021-20140306

Figure 3.2 PPG: Water supply, wastewater and water quality considerations for plan-making and planning applications

	Plan-making		Planning applications
Infrastructure	Identification of suitable sites for new or enhanced infrastructure. Consider whether new development is appropriate near to water and wastewater infrastructure. Phasing new development so that water and wastewater infrastructure will be in place when needed.	→	Wastewater considerations include: First presumption is to provide a system of foul drainage discharging into a public sewer. Phasing of development and infrastructure. Circumstances where package sewage treatment plants or septic tanks are applicable.
Water supply	Not Specified	→	Planning for the necessary water supply would normally be addressed through the Local Plan, exceptions might include: Large developments not identified in Local Plans; Where a Local Plan requires enhanced water efficiency in new developments.
Water quality	How to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage. The type or location of new development where an assessment of the potential impacts on water bodies may be required. Expectations relating to sustainable drainage systems.	→	Water quality is only likely to be a significant planning concern when a proposal would: Involve physical modifications to a water body; Indirectly affect water bodies, for example as a result of new development such as the redevelopment of land that may be affected by contamination etc. or through a lack of adequate infrastructure to deal with wastewater.
Wastewater	The sufficiency and capacity of wastewater infrastructure. The circumstances where wastewater from new development would not be expected to drain to a public sewer.	→	If there are concerns arising from a planning application about the capacity of wastewater infrastructure, applicants will be asked to provide information about how the proposed development will be drained and wastewater dealt with.
Cross-boundary concerns	Water supply and water quality concerns often cross local authority boundaries and can be best considered on a catchment basis. Recommends liaison from the outset.	→	No specific guidance (relevant to some developments).
SEA and Sustainability	Water supply and quality are considerations in strategic environmental assessment and sustainability appraisal ... sustainability appraisal objectives could include preventing deterioration of current water body status, taking climate change into account and seeking opportunities to improve water bodies.	→	No specific guidance (should be considered in applications).

3.2.4 Planning Practice Guidance: Housing – Optional Technical Standards

This guidance, advises planning authorities on how to gather evidence to set optional requirements, including for water efficiency. It states that "all new homes already have to meet the mandatory national standard set out in the Building Regulations (of 125 litres/person/day). Where there is a clear local need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day. Planning authorities are advised to consult with the EA and water companies to determine where there is a clear local need, and also to consider the impact of setting this optional standard on housing viability. A 2014 study[12] into the cost of implementing sustainability measures in housing found that meeting a standard of 110 litres per person per day would cost only £9 for a four-bedroom house. The evidence for adopting the optional requirements is outlined in section 4.6.

3.2.5 Building Regulations

The Building Regulations (2010) Part G[13] was amended in early 2015 to require that all new dwellings must ensure that the potential water consumption must not exceed 125 litres/person/day, or 110 litres/person/day where required under planning conditions.

3.2.6 BREEAM

The Building Research Establishment (BRE) publish an internationally recognised environmental assessment methodology for assessing, rating and certifying the sustainability of a range of buildings.

New homes are most appropriately covered by the Home Quality Mark[14], and commercial, leisure, educational facilities and mixed-use buildings by the Building Research Establishment Environmental Assessment Methodology (BREEAM) UK New Construction Standard[15].

Using independent, licensed assessors, BREEAM/HQM assesses criteria covering a range of issues in categories that evaluate energy and water use, health and wellbeing, pollution, transport, materials, waste, ecology and management processes.

In the Homes Quality Mark, 400 credits are available across 11 categories and lead to a star rating. 18 credits are available for water efficiency and water recycling. A greater number of credits are awarded for homes using water efficient fittings (with the highest score achieving 100l/p/d or less), and further credits are awarded for the percentage of water used in toilet flushing that is either sourced from rainwater or from grey water.

The BREEAM New Construction Standard awards credits across nine categories, four of which are related to water: water consumption, water monitoring, leak detection and water efficient equipment. This leads to a percentage score and a rating from "Pass" to "Outstanding".

The Councils have the opportunity to seek BREEAM or HQM status for all new, residential and non-residential buildings.

---

12 Housing Standards Review: Cost Impacts, Department for Communities and Local Government (2014). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/353387/021c_Cost_Report_11th_Sept_2014_FINAL.pdf on: 05/11/2019

13 The Building Regulations (2010) Part G - Sanitation, hot water safety and water efficiency, 2015 edition with 2016 amendments. HM Government (2016). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504207/BR_PDF_AD_G_2015_with_2016_amendments.pdf on: 05/11/2019

14 Home Quality Mark, BRE, (2018). Accessed online at: https://www.homequalitymark.com/professionals/standard/ on: 16/04/2020

15 2 BREEAM UK New Construction, BRE, (2018). Accessed online at: https://www.breeam.com/NC2018/ on: 16/04/2020

3.2.7 Sustainable Drainage Systems (SuDS)

From April 2015, Local Planning Authorities (LPA) have been given the responsibility for ensuring that sustainable drainage is implemented on developments of 10 or more homes or other forms of major development through the planning system. Under the new arrangements, the key policy and standards relating to the application of SuDS to new developments are:

- The National Planning Policy Framework, which requires that development in areas already at risk of flooding should give priority to sustainable drainage systems.
- The House of Commons written statement[16] setting out governments intentions that LPAs should "ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate" and "clear arrangements in place for ongoing maintenance over the lifetime of the development." This requirement is also now incorporated in the 2019 update of the NPPF (paragraph 165). In practice, this has been implemented by making Lead Local Flood Authorities (LLFAs) statutory consultees on the drainage arrangements of major developments.
- The Defra non-statutory technical standards for sustainable drainage systems[17]. These set out the government's high-level requirements for managing peak flows and runoff volumes, flood risk from drainage systems and the structural integrity and construction of SuDS. This very short document is not a design manual and makes no reference to the other benefits of SuDS, for example water quality, habitat and amenity.
- Shropshire Council is the LLFA in the area and play a key role in ensuring that the proposed drainage schemes for all new developments comply with technical standards and policies in relation to SuDS. Shropshire Council's "Surface Water Management: Interim Guidance for Developers guide"[18] and contains guidance for the design and application of SuDS in Shropshire.
- An updated version of the CIRIA SuDS Manual[19] was published in 2015. The guidance covers the planning, design, construction and maintenance of SuDS for effective implementation within both new and existing developments. The guidance is relevant for a range of roles with the level of technical detail increasing throughout the manual. The guidance does not include detailed information on planning requirements, SuDS approval and adoption processes and standards, as these vary by region and should be checked early in the planning process.
- CIRIA also publish "Guidance on the Construction of SuDS" (C768)[20], which contains detailed guidance on all aspects of SuDS construction, with specific information on each SuDS component available as a downloadable chapter.
- Severn Trent Connect (part of Severn Trent Water) do not currently have a SuDS adoption manual. In its Addendum to Sewers for Adoption 7th Edition[21], Severn

16 Sustainable drainage systems: Written statement - HCWS161, UK Government (2014). Accessed online at: http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/ on: 05/11/2019

17 Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems, Defra (2015). Accessed online at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards on: 05/11/2019

18 Surface Water Management: interim Guidance for Developers, Shropshire Council (2018). Accessed online at: https://www.shropshire.gov.uk/media/5929/surface-water-management-interim-guidance-for-developers.pdf on: 05/11/2019

19 The SuDS Manual (C753), CIRIA (2015).

20 Guidance on the Construction of SuDS (C768), CIRIA (2017), Accessed online at: https://www.ciria.org/ItemDetail?iProductcode=C768&Category=BOOK on: 04/10/2019

21 Addendum to Sewers for Adoption 7th Edition, Severn Trent Connect. Accessed online at:

Trent Connect (STC) states that it "will consider the adoption of SuDS as long as the systems are designed and constructed in accordance with the CIRIA SuDS Manual (C753)" and also outlines the SuDS techniques that are adoptable by STC.

- United Utilities do not mention SuDS in their equivalent Addendum, but have stated that all SuDS options must be considered before developers apply to connect to their public sewer system and will "continue to work with the Local Authorities to promote the use of SuDS on all new developments"[22].
- Welsh Water also do not include SuDS in their Addendum but, in compliance with new Welsh regulation, are now required to have SuDS for surface water drainage for all new development of more than one building or where the construction area is 100m^2 or greater[23].
- As of April 2020, the new Design and Construction Guidance (DCG)[24] came into force in England. This contains details of the water sector's approach to the adoption of SuDS, which meet the legal definition of a sewer. The guidance replaces the former, voluntary Sewers for Adoption guidance, as compliance by water companies in England is now mandatory.

3.3 Regional Policy

3.3.1 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMP) are high level policy documents covering large river basin catchments. They aim to set policies for sustainable flood risk management for the whole catchment covering the next 50 to 100 years. The River Severn CFMP is the most relevant to Shropshire[25] the north of Shropshire is also part of the River Dee CFMP[26].

3.3.2 Surface Water Management Plans (SWMPs)

SWMPs outline the preferred surface water management strategy in a given location and establish a long-term action plan to manage surface water. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. Shropshire Council has and is currently producing SWMPs in areas identified in their Preliminary Flood Risk Assessment. Six existing SWMPs in Shropshire for Craven Arms, Church Stretton, Much Wenlock, Oswestry, Shifnal and Shrewsbury[27].

3.3.3 Water Resource Management Plans

Water Resource Management Plans (WRMPs) are 25-year strategies that water companies are required to prepare, with updates every five years. In reality, water companies prepare internal updates more regularly. WRMPs are required to assess:

---

https://www.severntrentconnect.com/media/1567/severn-trent-connect-addendum-to-sewers-for-adoption-7th-final.pdf on: 04/10/2019

22 Site Drainage, United Utilities (n.d.) Accessed online at: https://www.unitedutilities.com/builders-developers/pre-development/site-drainage/ 30/07/2019

28 Sustainable Drainage Systems on New Developments, Welsh Water (2019). Accessed online at: https://www.dwrcymru.com/en/Developer-Services/Sewerage-Services/Sustainable-Drainage.aspx on 04/10/2019

[24] Water UK (2020) Sewerage Sector Guidance: Appendix C Design and Construction Guidance version 2. Accessed online at https://www.water.org.uk/sewerage-sector-guidance-approved-documents/ on 19/06/2020.

25 River Severn Catchment Flood Management Plan, Environment Agency (2009). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/289103/River_Severn_Catchment_Management_Plan.pdf on: 30/07/2019

26 River Dee Catchment Flood Management Plan, Environment Agency (2010). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/357552/LIT_10019_River_Dee_CFMP_gewa0110brko-e-e.pdf on: 16/01/2020

27 Shropshire Surface Water Management Plans, Shropshire Council. Accessed online at: https://www.shropshire.gov.uk/drainage-and-flooding/policies-plans-reports-and-schemes/surface-water-management-plans/on: 30/07/2019

- Future demand (due to population and economic growth)
- Future water availability (including the impact of sustainability reductions)
- Demand management and supply-side measures (e.g. water efficiency and leakage reduction, water transfers and new resource development)
- How the company will address changes to abstraction licences
- How the impacts of climate change will be mitigated

Where necessary, they set out the requirements for developing additional water resources to meet growing demand and describe how the balance between water supply and demand will be balanced over the period 2015 to 2040.

- Using cost-effective demand management, transfer, trading and resource development schemes to meet growth in demand from new development and to restore abstraction to sustainable levels.
- In the medium to long term, ensuring that sufficient water continues to be available for growth and that the supply systems are flexible enough to adapt to climate change.

The Severn Trent WRMP covers Shropshire and is reviewed in section 4.

3.4 Local Policy

3.4.1 Localism Act

The Localism Act (2011) changes the powers of local government, it re-distributes the balance of decision making from central government back to councils, communities and individuals. In relation to the planning of sustainable development, provision 110 of the Act places a duty to cooperate on Local Authorities. This duty requires Local Authorities to *"engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter"*[28].

The Localism Act also provides new rights to allow local communities to come together and shape the development and growth of their area by preparing Neighbourhood Development Plans, or Neighbourhood Development Orders, where the ambition of the neighbourhood is aligned with strategic needs and priorities for the area. This means that local people can decide where new homes and businesses should go and also what they should look like. As neighbourhoods draw up their proposals, Local Planning Authorities are required to provide technical advice and support.

3.5 International Environmental Policy

3.5.1 Ramsar

The Convention on Wetlands of International Importance, more commonly known as the Ramsar convention after the city where it was signed in 1971, aims to protect important wetland sites. Under the treaty, member counties commit to:

- Wise use of all their wetlands
- Designating sites for the Ramsar list of "Wetlands of International Importance" (Ramsar Sites) and their conservation
- Cooperating on transboundary wetlands and other shared interests.

"Wise use" of wetlands is defined under the convention as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches,

28 Localism Act 2011: Section 110, UK Government (2011). Accessed online at: http://www.legislation.gov.uk/ukpga/2011/20/section/110 on: 30/07/2019

within the context of sustainable development". A handbook on the wise use of wetlands is available from the Ramsar Convention Secretariat[29].

Ramsar Sites are designated by the National Administrative Authority, responsible for the Ramsar Convention in each country. In the case of the UK this is the Joint Nature Conservation Committee (JNCC).

In general, the designation of UK Ramsar sites is underpinned through prior notification of these areas as Sites of Special Scientific Interest (SSSIs) and as such receive statutory protection under the Wildlife and Countryside Act 1981 (as amended). More recently, Paragraph 176 of the NPPF states that Ramsar sites should be given the same protection in the planning process as sites designated under the EU Habitats Directive.

3.6 European Environmental Policy

3.6.1 Urban Wastewater Treatment Directive (UWWTD)

The UWWTD[30] is an EU Directive that concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of wastewater from certain industrial sectors. The objective of the Directive is to protect the environment from the adverse effects of wastewater discharges. More specifically Annex II A(a) sets out the requirements for discharges from urban wastewater treatment plants to sensitive areas which are subject to eutrophication. The Directive has been transposed into UK legislation through enactment of the Urban Waste Water Treatment (England and Wales) Regulations 1994 and 'The Urban Waste Water Treatment (England and Wales) (Amendments) Regulations 2003'.

3.6.2 Habitats Directive

The EU Habitats Directive aims to protect the wild plants, animals and habitats that make up our diverse natural environment. The directive created a network of protected areas around the European Union of national and international importance called Natura 2000 sites. These include:

- Special Areas of Conservation (SACs) - support rare, endangered or vulnerable natural habitats, plants and animals (other than birds).
- Special Protection Areas (SPAs) - support significant numbers of wild birds and habitats.

Special Protection Areas and Special Areas of Conservation are established under the EC Birds Directive and Habitats Directive respectively. The directive also protects over 1,000 animals and plant species and over 200 so called "habitat types" (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.

3.6.3 The Water Framework Directive

The Water Framework Directive (WFD) was first published in December 2000 and transposed into English and Welsh law in December 2003. It introduced a more rigorous concept of what "good status" should mean than the previous environmental quality measures. The WFD estimated that 95% of water bodies were at risk of failing to meet "good status".

River Basin Management Plans (RBMP) are required under the WFD and document the baseline classification of each waterbody in the plan area, the objectives, and a programme of measures to achieve those objectives. Shropshire falls mostly within the

29 Wise use of wetlands, Ramsar Convention Secretariat (2010). Accessed online at: https://www.ramsar.org/sites/default/files/documents/library/hbk4-01.pdf on: 11/05/2020
30 UWWTD. Accessed online at: https://ec.europa.eu/environment/water/water-urbanwaste/index_en.html On: 30/07/2019.

Severn River Basin District (RBD)[31] and a small area in the north of Shropshire falls within the River Dee[32] and North West RBD[33]. Under the WFD the RBMPs, which were originally published in December 2009 were reviewed and updated in December 2015. A primary WFD objective is to ensure 'no deterioration' in environmental status, therefore all water bodies must meet the class limits for their status class as declared in the Severn River Basin Management Plan. Another equally important objective requires all water bodies to achieve good ecological status. Future development needs to be planned carefully so that it helps towards achieving the WFD and does not result in further pressure on the water environment and compromise WFD objectives. The WFD objectives as outlined in the updated RBMPs are summarised below:

- Prevent deterioration of the status of surface waters and groundwater
- Achieve objectives and standards for protected areas
- Achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status
- Reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- Stop discharges/emissions of priority hazardous substances into surface waters
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

Local Planning Authorities (LPAs) must have regard to the Water Framework Directive as implemented in the Environment Agency's River Basin Management Plans. It is of primary importance when assessing the impact of additional wastewater flows on local river quality.

3.6.4 Protected Area Objectives

The WFD specifies that areas requiring special protection under other EC Directives, and waters used for the abstraction of drinking water, are identified as protected areas. These areas have their own objectives and standards.

Article 4 of the WFD required Member States to achieve compliance with the standards and objectives set for each protected area by 22 December 2015, unless otherwise specified in the Community legislation under which the protected area was established. Some areas may require special protection under more than one EC Directive or may have additional (surface water and/or groundwater) objectives. In these cases, all the objectives and standards must be met.

The types of protected areas are:

- Areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas)
- Areas designated for the protection of economically significant aquatic species (Freshwater Fish and Shellfish)
- Bodies of water designated as recreational waters, including Bathing Waters;

31 Severn River Basin District River Basin Management Plan: 2015, Environment Agency (2015). Accessed at: https://www.gov.uk/government/publications/severn-river-basin-district-river-basin-management-plan on: 30/07/2019

32 River Dee River Basin Management Plan 2015-2021, Natural Resources Wales, (2015). Accessed online at: https://cdn.naturalresources.wales/media/685098/deerbdsummary.pdf?mode=pad&rnd=131705195500000000 on: 16/01/2020

33 North West River Basin Management Plan: 2015, Environment Agency (2015). Accessed online at: https://www.gov.uk/government/publications/north-west-river-basin-district-river-basin-management-plan on: 16/01/2020

- Nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive (UWWTD)
- Areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites

Many WFD protected areas coincide with water bodies; these areas will need to achieve the water body status objectives in addition to the protected area objectives. Where water body boundaries overlap with protected areas the most stringent objective applies; that is the requirements of one EC Directive should not undermine the requirements of another. The objectives for Protected Areas relevant to this study are as follows:

Drinking Water Protected Areas

- Ensure that, under the water treatment regime applied, the drinking water produced meets the requirements of the Drinking Water Directive plus any UK requirements to make sure that drinking water is safe to drink
- Ensure the necessary protection to prevent deterioration in the water quality in the protected area in order to reduce the level of purification treatment required

Economically Significant Species (Freshwater Fish Waters)

- Protect or improve the quality of running or standing freshwater to enable them to support fish belonging to indigenous species offering a natural diversity; or species, the presence of which is judged desirable for water management purposes by the competent authorities of the Member States

Nutrient Sensitive Areas (Nitrate Vulnerable Zones)

- Reduce water pollution caused or induced by nitrates from agricultural sources
- Prevent further such pollution

Nutrient Sensitive Areas (Urban Waste Water Treatment Directive)

- Protect the environment from the adverse effects of urban waste water discharges and waste water discharges from certain industrial sectors

Natura 2000 Protected Areas (water dependent SACs and SPAs)

The objective for Natura 2000 Protected Areas identified in relation to relevant areas designated under the Habitats Directive or Birds Directive is to:

- Protect and, where necessary, improve the status of the water environment to the extent necessary to achieve the conservation objectives that have been established for the protection or improvement of the site's natural habitat types and species of importance

3.6.5 Groundwater Source Protection Zones

The Environment Agency has a Groundwater Protection Policy to help prevent groundwater pollution. In conjunction with this the Environment Agency have defined groundwater Source Protection Zones (SPZs) to help identify high risk areas and implement pollution prevention measures. The SPZs show the risk of contamination from activities that may cause pollution in the area, the closer the activity, the greater the risk. There are three main zones (inner, outer and total catchment) and a fourth zone of special interest which is occasionally applied.

Zone 1 (Inner protection zone)

This zone is designed to protect against the transmission of toxic chemicals and water-borne disease. It indicates the area in which pollution can travel to the borehole within 50 days from any point within the zone and applies at and below the water table. There is also a minimum 50 metre protection radius around the borehole.

Zone 2 (Outer protection zone)

This zone indicates the area in which pollution takes up to 400 days to travel to the borehole, or 25% of the total catchment area, whichever area is the largest. This is the minimum length of time the Environment Agency think pollutants need to become diluted or reduce in strength by the time they reach the borehole.

Zone 3 (Total catchment)

This is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Zone of special interest

This is defined on occasions, usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment.

The Environment Agency's approach to Groundwater protection[34] sets out a series of position statements that detail how the Environment Agency delivers government policy on groundwater and protects the resources from contamination. The position statements that are relevant to this study with regard to discharges to groundwaters, include surface water drainage and the use of SuDS, discharges from contaminated surfaces (e.g. lorry parks) and from treated sewage effluent.

3.6.6 European Derived Legislation and Brexit

Much of the legislation behind the regulation of the water environment derives from the UK enactment of European Union (EU) directives. Following the departure of the United Kingdom from the European Union on 31st January 2020, this legislation remains in force during the transition period, until 31st December 2020. The UK government has signalled that "the UK will in future develop separate and independent policies in areas such as … the environment … maintaining high standards as we do so."[35]

As the details of future changes to environmental regulation are not yet known, this study has used existing, European Union derived environmental legislation, most significantly the Water Framework Directive, to assess the environmental impacts of planned development during the plan period for the Local Plan. Should this situation change, a review of this Water Cycle Study may be required considering any new emerging regulatory regime.

3.7 UK Environmental Policy

3.7.1 Conservation of Habitats and Species Regulations 2017 (as amended)

The Conservation of Habitats and Species Regulations 2010 (commonly referred to as the Habitats Regulations) consolidated the Conservation (Natural Habitats, &c.) Regulations 1994, and transposed the EU Habitats Directive in England and Wales. This was further amended in 2017.

The Habitats Regulations define the requirement for a Habitats Regulations Assessment (HRA) to be carried out. The purpose of this is to determine if a plan or project may affect the protected features of a "habitats site". These include:

- A special area of conservation (SAC)
- A site of Community Importance
- A site hosting a priority natural habitat type or priority species protected in accordance with Article 5(4) of the Habitats Directive

34 The Environment Agency's approach to groundwater protection, Environment Agency (2018). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/598778/LIT_7660.pdf on: 30/07/2019

35 The Future Relationship between the UK and the EU (2020) Accessed online at: https://www.gov.uk/government/speeches/the-future-relationship-between-the-uk-and-the-eu on 25/02/2020

- A Special Protection Area (SPA)
- A potential SPA

All plans and projects (including planning applications) which are not directly connected with, or necessary for the conservation management of a habitat site require consideration of whether the plan or project is likely to have significant effects on that site.

This is referred to as the "Habitats Regulations Assessment screening" and should take into account the potential effects of both the plan/project itself and in combination with other plans or projects.

Part 6 of the conservation of Habitats and Species Regulations 2017 states that where the potential for likely significant effects cannot be excluded, a competent authority must make an appropriate assessment of the implications of the plan or project for that site, in view of the site's conservation objectives.

The competent authority may agree to the plan or project only after having ruled out adverse effects on the integrity of the habitats site.

If adverse effects cannot be rules out, and where there are no alternative solutions, the plan or project can only proceed if there are imperative reasons of over-riding public interest and if the necessary compensatory measures can be secured.

The "People over Wind" ECJ ruling (C-323/17) clarifies that when making screening decisions for the purposes of deciding whether an appropriate assessment is required, competent authorities cannot take into account any mitigation measures. This must be part of the appropriate assessment itself.

3.7.2 Wildlife and Countryside Act 1981

Sites of Special Scientific Interest (SSSI) are designated and legally protected under the Wildlife and Countryside Act 1981, Section 28G places a duty to take reasonable steps, consistent with the proper exercise of the authority's functions, to "further to the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which the site is of special scientific interest."[36]

The Government's 25-year Environment Plan[37] has a target of "restoring 75% of our one million hectares of terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term." In line with this, and the Wildlife and Countryside Act 1981, Local Authorities should look put forward options that contribute to conservation or restoration of favourable condition, and at the very least must not introduce policies that hinder the restoration of favourable condition by increasing existing issues.

A site is said to be in "favourable condition" when the designated feature(s) within a unit are being adequately conserved and the results from monitoring demonstrate that the feature(s) in the unit are meeting all the mandatory site specific monitoring targets set out in the favourable condition targets (FCT).

3.7.3 The Natural Environment Rural Communities Act (NERC)

The Natural Environment and Rural Communities Act 2006 (commonly referred to the as the NERC Act), was intended to implement key aspects of the Government's Rural Strategy published in 2004 and established Natural England as a new independent body responsible for conserving, enhancing and managing England's natural environment.

---

36 Wildlife and Countryside Act 1981, HM Government (1981). Accessed online at: http://www.legislation.gov.uk/ukpga/1981/69/section/28G on: 11/05/2020

37 A Green Future: Our 25 Year Plan to Improve the Environment, HM Government (2018). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf on: 11/05/2020

Section 40 of the NERC Act places a duty to conserve biodiversity on public authorities, including Local Planning Authorities and water companies. "The 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."[38]

Section 41 requires the Secretary of State to publish and maintain a list of species and types of habitat which in the Secretary of State's opinion (in consultation with Natural England) are of "principal importance for the purpose of conserving biodiversity."

3.8 Water Industry Policy

3.8.1 The Water Industry in England

Water and sewerage services in England and Wales are provided by 10 Water and Sewerage Companies (WaSCs) and 12 'water-only' companies. The central legislation relating to the industry is the Water Industry Act 1991. The companies operate as regulated monopolies within their supply regions, although very large water users and developments are able to obtain water and/or wastewater services from alternative suppliers - known as inset agreements.

The Water Act 2014 aims to reform the water industry to make it more innovative and to increase resilience to droughts and floods. Key measures could influence the future provision of water and wastewater services include:

- Non-domestic customers will be able to switch their water supplier and/or sewerage undertaker (from April 2017)
- New businesses will be able to enter the market to supply these services
- Measures to promote a national water supply network
- Enabling developers to make connections to water and sewerage systems

3.8.2 Regulations of the Water Industry

The water industry is primarily regulated by three regulatory bodies;

- The Water Services Regulation Authority (OfWAT) – economic/ customer service regulation
- Environment Agency - environmental regulation
- Drinking Water Inspectorate (DWI) - drinking water quality

Every five years the industry submits a Business Plan to OfWAT for a Price Review (PR). These plans set out the companies' operational expenditure (OPEX) and capital expenditure (CAPEX) required to maintain service standards, enhance service (for example where sewer flooding occurs), to accommodate growth and to meet environmental objectives defined by the Environment Agency. OfWAT assesses and compares the plans with the objective of ensuring what are effectively supply monopolies and operating efficiently. The industry is currently in Asset Management Plan 6 (AMP6) which runs from 2015 to 2020.

When considering investment requirements to accommodate growing demand, water companies are required to ensure a high degree of certainty that additional assets will be required before funding them. Longer term growth is, however, considered by the companies in their internal asset planning processes and in their 25-year Strategic Direction Statements and WRMPs.

38 Natural Environment and Rural Communities Act 2006, HM Government (2006). Accessed online at: http://www.legislation.gov.uk/ukpga/2006/16/section/40 on: 11/05/2020

3.8.3 Drainage and Wastewater Management Plans

The UK Water Industry Research (UKWIR) "21st Century Drainage" programme has brought together water companies, governments, regulators, local authorities, academics and environmental groups to consider how planning can help to address the challenges of managing drainage in the future. These challenges include climate change, population growth, urban creep and meeting the Water Framework Directive.

The group recognised that great progress has been made by the water industry in its drainage and wastewater planning over the last few decades, but that, in the future, there needs to be greater transparency and consistency of long-term planning. The Drainage and Wastewater Management Plan (DWMP) framework[39] sets out how the industry intends to approach these goals, with the objective of the water companies publishing plans by the end of 2022, in order to inform their business plans for the 2024 Price Review.

DWMPs will be prepared for wastewater catchments or groups of catchments and will encompass surface water sewers within those areas which do not drain to a treatment works. The framework defines drainage to include all organisations and all assets which have a role to play in drainage, although, as the plans will be water company led, it does not seek to address broader surface water management within catchments.

LPAs and LLFAs are recognised as key stakeholders and will be invited to join, alongside other stakeholders, the Strategic Planning Groups (SPGs) organised broadly along river basin district catchments.

DWMPs cannot inform this study, as process is only just commencing. In the future, however, DWMPs will provide more transparent and consistent information on sewer flooding risks and the capacity of sewerage networks and treatment works, and this should be taken into account in SFRAs, Water Cycle Studies, as well as in site-specific FRAs and Drainage Strategies.

3.8.4 Developer Contributions and Utility Companies

Developments with planning permission have a right to connect to the public water and sewerage systems, however, there is no guarantee that the capacity exists to serve a development.

Developers may requisition a water supply connection or sewerage system or self-build the assets and offer these for adoption by the water company or sewerage undertaker. Self-build and adoption are usually practiced for assets within the site boundary, whereas requisitions are normally used where an extension of upgrading the infrastructure requires construction on third party land. The cost of requisitions is shared between the water company and developer as defined in the Water Industry Act 1991.

Where a water company is concerned that a new development may impact upon their service to customers or the environment (for example by causing foul sewer flooding or pollution) they may request the LPA to impose a Grampian condition, whereby the planning permission cannot be implemented until a third-party secures the necessary upgrading or contributions.

The above arrangements are third party transactions because the Town and Country Planning Act Section 106 agreements and Community Infrastructure Levy agreements may not be used to obtain funding for water or wastewater infrastructure.

---

39 A framework for the production of Drainage and Wastewater Management Plans, UK Water Industry Research (2018). Accessed online at: http://www.water.org.uk/wp-content/uploads/2018/12/Water-UK-DWMP-Framework-Report-Main-Document.pdf on: 30/07/2019.

3.8.5 Changes to Charging Rules for New Connections

OfWAT, the water industry's economic regulator, has published new rules covering how water and wastewater companies may charge customers for new connections[40]. These rules apply to all companies in England and will commence on 1st April 2018. The three relevant water companies for the study area have now published their charging arrangements which can be found in the footnotes[41,42,43]. The key changes include:

- More charges will be fixed and published on water company websites. This will provide greater transparency to developers and will also allow alternative connection providers to offer competitive quotations more easily
- There will be a fixed infrastructure charge for water and one for wastewater
- The costs of network reinforcement will no longer be charged directly to the developer in their connection charges. Instead, the combined costs of all of the works required on a company's networks, over a five-year rolling period, will be covered by the infrastructure charges payed for all new connections.
- The definition of network reinforcement has changed and will now apply only to works required as a direct consequence of the increased demand due to a development. Where the water company has not been notified of a specific development, for example when developing long-term strategic growth schemes, the expenditure cannot be recovered through infrastructure charges.
- Some suppliers offer charging incentives to encourage environmentally sustainable development:
    - Severn Trent Water[44] will provide 100% discount on the water infrastructure charge whereby builds are demonstrated to be below 110 litres per person per day. They also provide incentives for sewerage infrastructure charge: when there is no surface water connection, 100% discount is applied. Alternatively, when a surface water connection is available via a sustainable drainage system, the charge is reduced by 75%.
    - United Utilities[45] will provide a 90% discount on the water infrastructure charge where properties are built for the consumption of 110 litres or less per person per day. A 98.9% discount is applied to sewage infrastructure charges when properties are built with no surface water connection to the existing public sewer.
    - Welsh Water does not appear to offer reduced rates for wastewater infrastructure.

---

40 Charging rules for new connection services (English undertakers), OfWAT (2017). Accessed online at: https://www.ofwat.gov.uk/publication/charging-rules-new-connection-services-english-undertakers/ on: 30/07/2019
41 New Connections Charging, Severn Trent Water (2018). Accessed online at: https://www.stwater.co.uk/content/dam/stw/stw_buildinganddeveloping/STWChargingArrangementDocument-brandv0.230012018A.pdf on: 30/07/2019
42 New Connections and Developer Services, United Utilities (2019). Accessed Online at: https://www.unitedutilities.com/globalassets/documents/pdf/acc19_united-utilities-water-limited-new-connection-and-developer-services-charges-scheme-2019-2020.pdf on: 30/07/2019
42 Developer Services Schedule of Charges, Welsh Water (2019). Accessed Online at: https://www.dwrcymru.com/en/Developer-Services/Sewerage-Services/-/media/Files/Publications/2016/03/Developer-Services---2017-2018-final-English-version.pdf on: 30/07/2019
44 Infrastructure Charges Discount Scheme, Severn Trent Water (2018). Accessed online at: https://www.stwater.co.uk/building-and-developing/regulations-and-forms/application-forms-and-guidance/infrastructure-charges/ 16/10/2019
45 New Connections and Developer Services, United Utilities (2019). Accessed Online at: https://www.unitedutilities.com/globalassets/documents/pdf/acc19_united-utilities-water-limited-new-connection-and-developer-services-charges-scheme-2019-2020.pdf on: 30/07/2019

3.8.6 Design and Construction Guidance (DCG)

The Design and Construction Guidance, part of a new Codes for Adoption covering the adoption of new water and wastewater infrastructure by water companies, contains details of the water sector's approach to the adoption of SuDS, which meet the legal definition of a sewer. This replaces the formerly voluntary Sewers for Adoption The new guidance came into force in April 2020 and compliance by water companies in England is be mandatory.

The standards, up to and including Sewers for Adoption Version 7, have included a narrow definition of sewers to mean below-ground systems comprising of gravity sewers and manholes, pumping stations and rising mains. This has essentially excluded the adoption of SuDS by water companies, with the exception of below-ground storage comprising of oversized pipes or chambers.

The new guidance provides a mechanism for water companies to secure the adoption of a wide range of SuDS components which are now compliant with the legal definition of a sewer. There are however several non- adoptable components such as green roofs, pervious pavements and filter strips. These components may still form part of a drainage design so long as they remain upstream of the adoptable components.

The Design and Construction Guidance states that the drainage layout of a new development should be considered at the earliest stages of design. It is hoped that the new guidance will lead to better managed and more integrated surface water systems which incorporate amenity, biodiversity and water quality benefits.

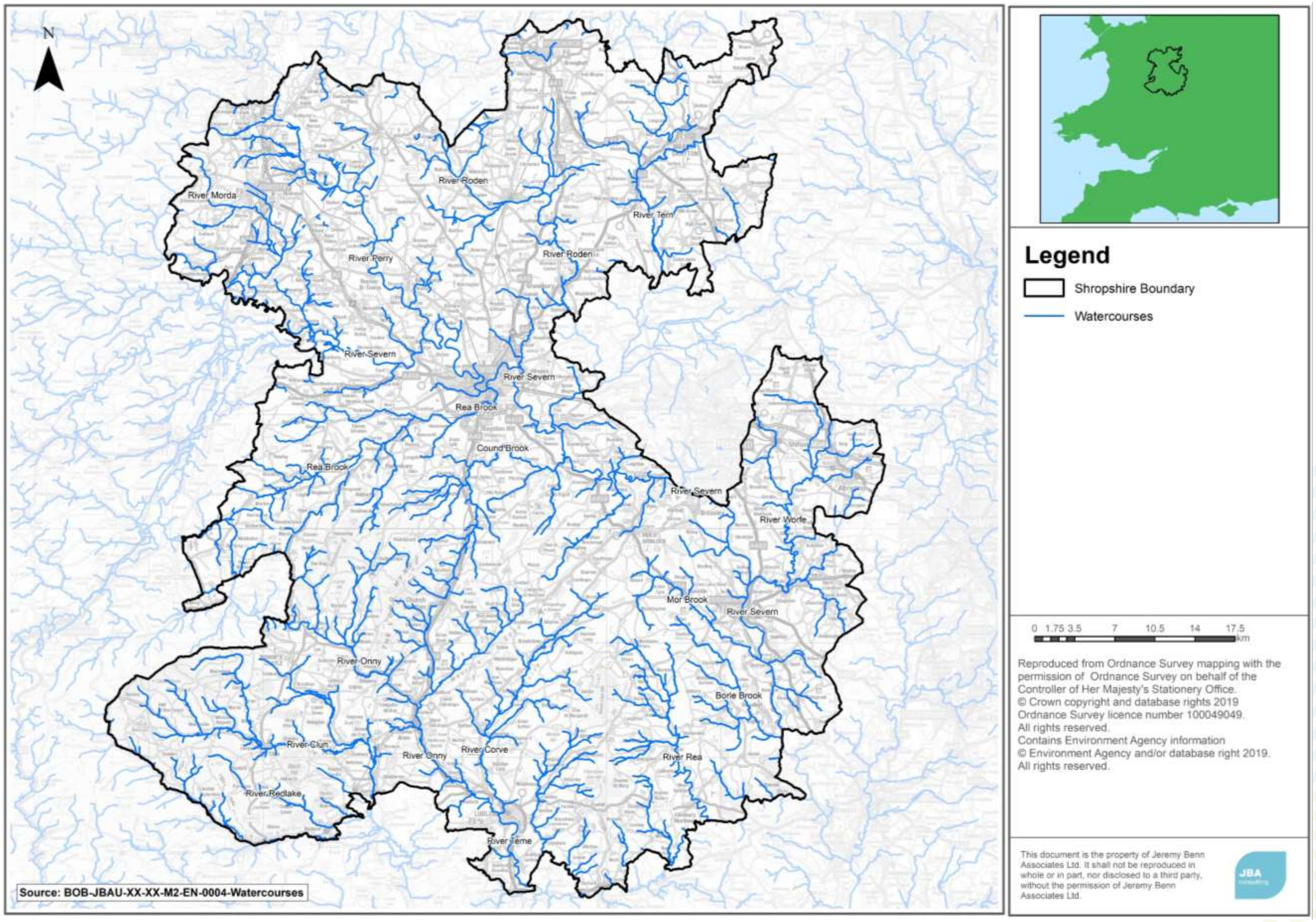
4 Water Resources and Water Supply

4.1 Introduction

4.1.1 Surface Waters

Figure 4.1 shows the main watercourses within the study area, which lies within the River Severn catchment. The River Severn enters Shropshire in the west around Melverley and flows east through the study area, through Shrewsbury where it continues in a general south-eastern direction through Bridgnorth and out of Shropshire into Wyre Forest around Arley. The main tributaries of the River Severn in Shropshire include the River Roden, River Perry, Rea Brook, River Worfe, Cound Brook and Mor Brook. The River Redlake, River Clun, River Onny and River Corve are tributaries of the River Teme in the south of the study area. The River Teme flows into the River Severn outside of Shropshire in Malvern Hills District to the south of the study area. The north of Shropshire also lies within the River Dee catchment.

Figure 4.1 Significant watercourses within Shropshire



4.1.2 Geology

The geology of the catchment can be an important influencing factor in the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy.

Figure 4.2 shows the bedrock geology of the Shropshire study area. The geology of Shropshire is varied, but dominated by sandstone, mudstone, siltstone and conglomerates.

Figure 4.3 shows superficial (at the surface) deposits of clay, silt and sand along the course of the River Severn, River Teme, River Clun, Rea Brook and River Tern within wider areas of sand and gravel and diamicton (clay with flints). Isolated deposits of peat can be found in the north of Shropshire.

Figure 4.2 Bedrock geology of Shropshire

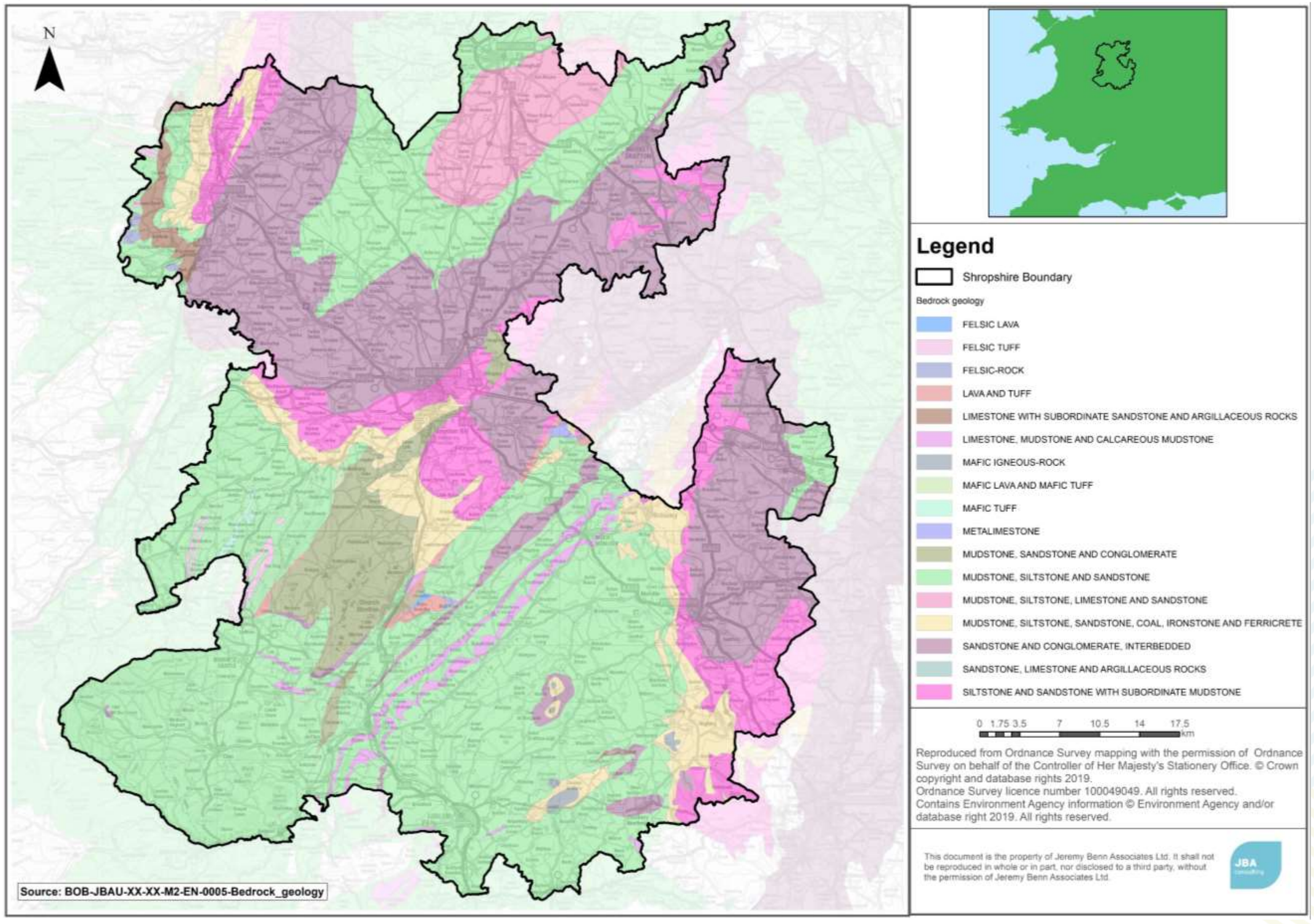
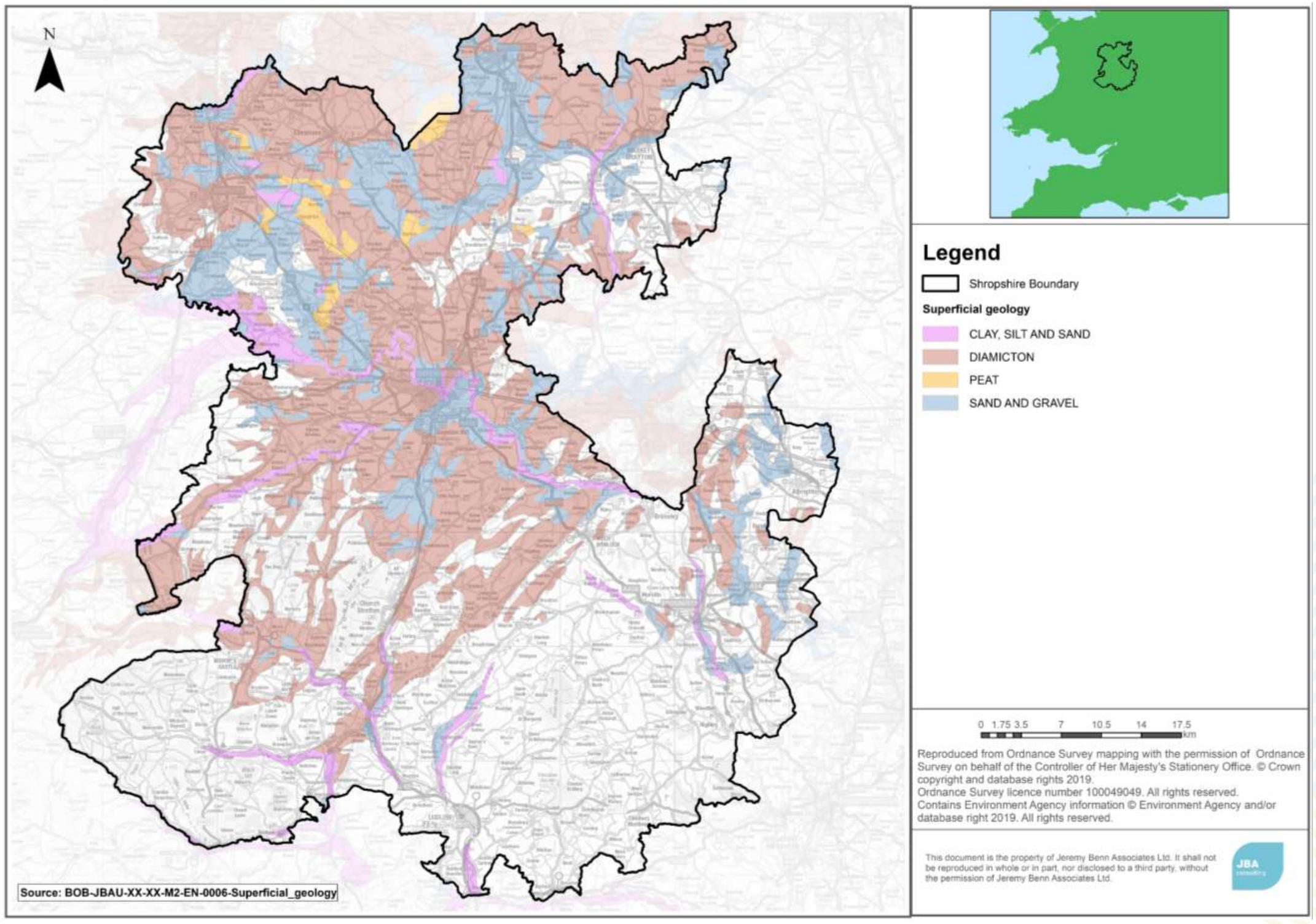


Figure 4.3 Superficial (at surface) geology of Shropshire



4.2 Availability of Water Resources

4.2.1 Abstraction Licencing Strategy

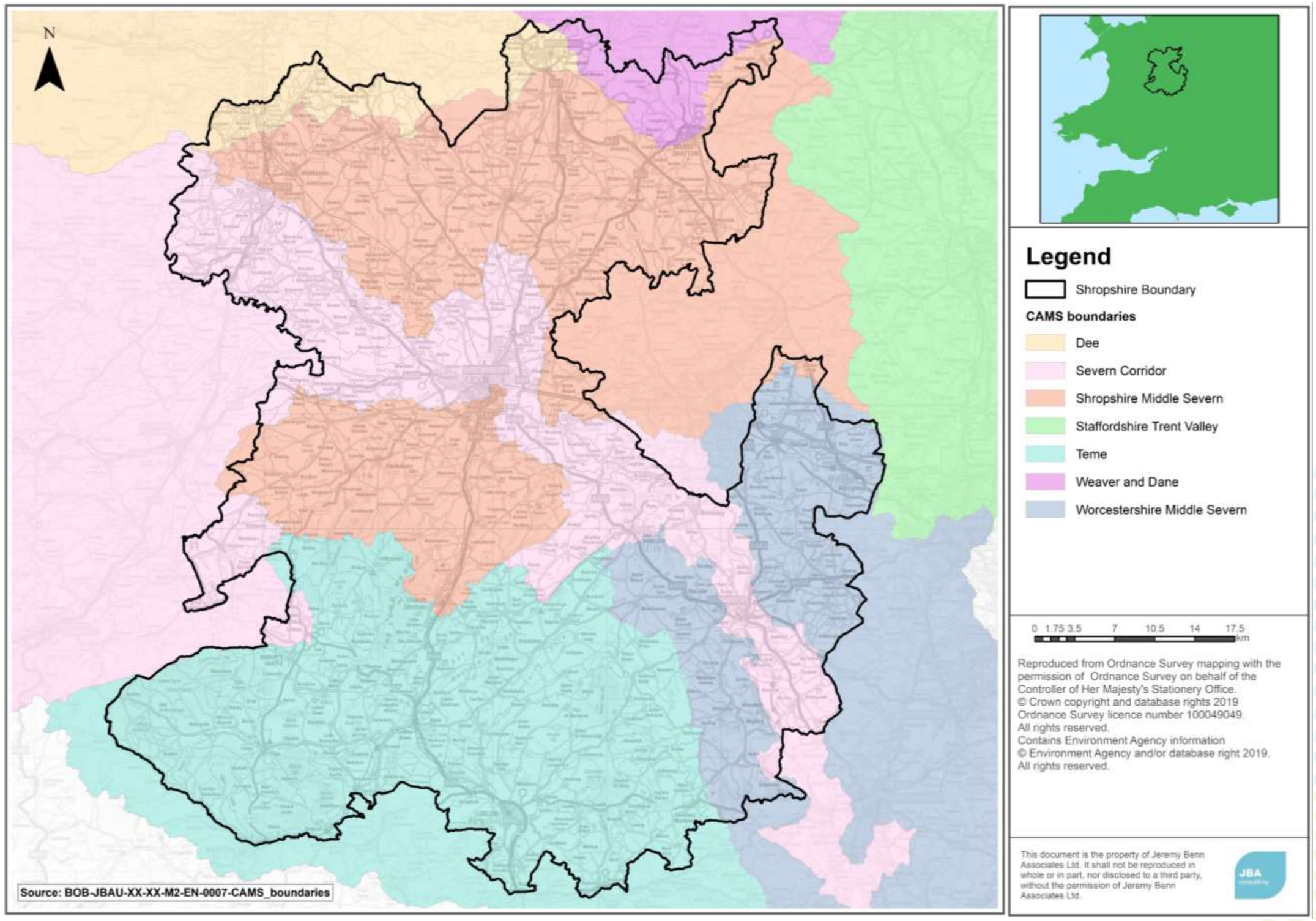
The Environment Agency (EA), working through their Catchment Abstraction Management Strategy (CAMS) process, prepare an Abstraction Licensing Strategy (ALS) for each sub-catchment within a river basin. This licensing strategy sets out how water resources are managed in different areas of England and contributes to implementing the Water Framework Directive (WFD). The ALS report provides information on the resources available and what conditions might apply to new licences. The licences require abstractions to stop or reduce when a flow or water level falls below a specific threshold, as a restriction to protect the environment and manage the balance between supply and demand for water users. The CAMS process is published in a series of ALSs for each river basin.

All new licences, and some existing licenses, are time limited. This allows time for a periodic review of the specific area as circumstances may have changed since the licences were initially granted. These are generally given for a twelve-year duration, but shorter license durations may also be granted. This is usually based on the resource assessment and environmental sustainability. In some cases, future plans or changes may mean that the EA will grant a shorter time limited licence, so it can be re-assessed following the change. If a licence is only required for a short time period, it can be granted either as a temporary licence or with a short time limit. If a licence is considered to pose a risk to the environment it may be granted with a short time limit while monitoring is carried out. The licences are then replaced with a changed licence, revoked or renewed near to the expiry date.

The ALS are important in terms of the Water Resource Management Plan (WRMP) as this helps to determine the current and future pressures on water resources and how the supply and demand will be managed by the relevant water companies[46]. Shropshire is covered by seven ALS areas: Dee, Severn Corridor, Shropshire Middle Severn, Staffordshire Trent Valley, Teme, Weaver and Dane and Worcestershire Middle Severn as shown in Figure 4.4 below.

46 Environment Agency (2018) Managing Water Abstraction. Accessed Online at: https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process on: 03/09/2019

Figure 4.4 CAMS Boundaries covering Shropshire



4.2.2 Resource Availability Assessment

In order to abstract surface water, it is important to understand what water resources are available within a catchment and where abstraction for consumptive purposes will not pose a risk to resources or the environment. The Environment Agency has developed a classification system which shows:

- The relative balance between the environmental requirements for water and how much has been licensed for abstraction;
- whether there is more water available for abstraction in the area;
- areas where abstraction may need to be reduced.

The availability of water for abstraction is determined by the relationship between the fully licensed (all abstraction licences being used to full capacity) and recent actual flows (amount of water abstracted in the last 6 years) in relation to the Environmental Flow Indicator (EFI). Results are displayed using different water resource availability colours, further explained in Table 4.1. In some cases, water may be scarce at low flows, but available for abstraction at higher flows. Licences can be granted that protect low flows, this usually takes the form of a "Hands-off Flow" (HOF) or Hands-off Level (HOL) condition on a licence.

Groundwater availability as a water resource is assessed similarly, unless better information on principle aquifers is available or if there are local issues that need to be taken into account.

Table 4.1 Implications of Surface Water Resource Availability Colours

Water Resource Availability Colour	Implications for Licensing
High hydrological regime	There is more water than required to meet the needs of the environment. Due to the need to maintain the near pristine nature of the water body, further abstraction is severely restricted.
Water available for licensing	There is more water than required to meet the needs of the environment. Licences can be considered depending on local/downstream impacts.
Restricted water available for licensing	Fully Licensed flows fall below the Environmental Flow Indicator (EFI). 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 via licence trading.
Water not available for licensing	Recent Actual flows are below the Environmental Flow Indicator (EFI). This scenario highlights water bodies where flows are below the indicative flow requirement to help support Good Ecological Status. No further licences will be granted. Water may be available via licence trading.
HMWBs (and /or discharge rich water bodies)	These water bodies have a modified flow that is influenced by reservoir compensation releases or they have flows that are augmented. There may be water available for abstraction in discharge rich catchments.

4.2.3 Severn Corridor ALS

The Severn Corridor ALS[47], covers from the upper reaches of the River Severn and its upland tributaries in Wales and parts of Shropshire until its confluence with the River Perry north-west of Shrewsbury. From here the Severn Corridor catchment focusses on the River Severn itself and its smaller tributaries down to the Severn Estuary. The main water demand pressure in the Severn Corridor ALS is from agriculture.

The entirety of the Severn Corridor has reliable water resources, with water being available for abstraction at least 70% of the time.

There are 13 APs within the Severn Corridor ALS, five of which fall within Shropshire, AP5, AP6, AP7, AP8 and AP9. Currently there is restricted water available for licensing at these APs.

The groundwater availability in the Severn Corridor ALS region is guided by the surface water assessment unless specific information on principal aquifers exists or local issues that need protecting overrule it.

Consumptive groundwater licences which do not have a direct impact upon main river flows may be permitted but may be subject to restrictions such as prescribed groundwater levels. Restrictions will be determined on a case-by-case basis, dependent upon the nature and scale of any abstraction.

Resource availability for the APs within Shropshire are presented in Table 4.2 below.

Table 4.2 Severn Corridor ALS resource availability

AP	Name	ALS	Local Resource Availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
5	River Tanat at Llanyblodwel	Severn Corridor	Restricted water available for licensing	87Ml/d at Llanyblodwel gauging station	328	14	Yes
6	River Vyrnwy at Llanymynech	Severn Corridor	Restricted water available for licensing	87Ml/d at Llanyblodwel gauging station	328	14	Yes
7	River Severn at Montford	Severn Corridor	Restricted water available for licensing	1219Ml/d at Bewdley gauging station	328	55	Yes
8	River Severn at Monkmoor	Severn Corridor	Restricted water available for licensing	1219Ml/d at Bewdley gauging station	328	55	No
9	River Severn at Buildwas	Severn Corridor	Restricted water available for licensing	1219Ml/d at Bewdley gauging station	328	55	Yes

(1) Hands off Flow restriction (2) Number of days per annum abstraction may be available

(3) Approximate volume available at restriction (Ml/D)

47 Severn Corridor catchment abstraction licensing strategy, Environment Agency (2013). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291406/LIT_7848_c0b50e.pdf on: 02/09/2019

At AP7, AP8 and AP9 there is water available for licensing subject to a HOF of 1219Ml/d at Bewdley gauging station. This means that for new licenses:

- All new consumptive or partially consumptive licences will be issued with this HOF.
- Water is available during periods of medium to high flows subject to this HOF condition.

At AP5 and AP6 there is water available for licensing subject to a HOF of 87Ml/d at Llanyblodwel gauging station. This means that for new licenses:

- There is no water available for unconstrained abstraction, i.e. abstraction with no HOF condition.
- Water is available during periods of medium to high flow subject to this HOF condition.

4.2.4 Teme ALS

The Teme ALS[48] covers the south of Shropshire, along the River Teme and its tributaries including Clun, Bishops Castle, Craven Arms, Ludlow and Cleobury Mortimer. The main demand for water within the Teme catchment comes from public water supply and agriculture.

The entirety of the Teme ALS has reliable water resources, with water being available for abstraction at least 70% of the time.

There are 15 APs within the Teme ALS, 6 of which fall within Shropshire: AP2, AP6, AP7, AP8, AP9 and AP10. Currently there is restricted water available for licensing at these APs.

The groundwater availability in the Teme ALS region is guided by the surface water assessment unless specific information on principal aquifers exists or local issues that need protecting overrule it.

Consumptive groundwater licences which do not have a direct impact upon main river flows may be permitted but may be subject to restrictions such as prescribed groundwater levels. Restrictions will be determined on a case-by-case basis, dependent upon the nature and scale of any abstraction.

Resource availability for APs within Shropshire is presented in Table 4.3 below.

Table 4.3 Teme ALS resource availability

AP	Name	ALS	Local Resource Availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
2	River Teme at Bromfield	Teme	Restricted water available for licensing	240Ml/d	292	29Ml/d available upstream of Tenbury and 33 Ml/d available downstream of Tenbury	No
6	River Clun at Redlake	Teme	Restricted water available for licensing	240Ml/d at Tenbury gauging station	292	29Ml/d available upstream of Tenbury and 33 Ml/d available	No

48 Teme Abstraction Licencing Strategy, Environment Agency (2013). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291396/LIT_7850_7f5c56.pdf on: 02/09/2019

AP	Name	ALS	Local Resource Availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
						downstream of Tenbury	
7	River Clun at Clunton	Teme	Restricted water available for licensing	240Ml/d at Tenbury gauging station	292	29Ml/d available upstream of Tenbury and 33 Ml/d available downstream of Tenbury	No
8	Quinney Brook	Teme	Restricted water available for licensing	240Ml/d at Tenbury gauging station	292	29Ml/d available upstream of Tenbury and 33 Ml/d available downstream of Tenbury	No
9	River Onny at Onibury	Teme	Restricted water available for licensing	240Ml/d at Tenbury gauging station	292	29Ml/d available upstream of Tenbury and 33 Ml/d available downstream of Tenbury	Yes
10	River Corve at Ludlow	Teme	Restricted water available for licensing	240Ml/d at Tenbury gauging station	292	29Ml/d available upstream of Tenbury and 33 Ml/d available downstream of Tenbury	Yes

(1) Hands off Flow restriction

(2) Number of days per annum abstraction may be available

(3) Approximate volume available at restriction (Ml/D)

At AP2, AP6, AP7 AP9 and AP10, there is water available for licensing subject to HOF of 226Ml/d at Tenbury gauging station. This means that for new licenses:

- There is no water available for unconstrained abstraction i.e. abstraction with no HOF restriction.
- Water is only available during periods of medium to high flows subject to a HOF condition.

4.2.5 Worcestershire Middle Severn ALS

The Worcestershire Middle Severn ALS[49] covers parts of the east of Shropshire, including the River Worfe, Shifnal and Albrighton. In addition, part of the ALS covers the Dowles Brook, Borle Brook and Mor Brook. The main water resource issue in the Worcestershire Middle Severn ALS is the historic over-abstraction of groundwater for public supply and the associated environmental impact as well as the high demand for water to irrigate agricultural land.

The majority of the Worcestershire Middle Severn ALS, including parts covering Shropshire has limited water resources, with water being available for abstraction less than 30% of the time. A small area covering Shropshire around Wyre Forest has water resources available at least 70% of the time, however.

There are 10 APs within the Worcestershire Middle Severn ALS, 2 of which fall within Shropshire: AP1 and AP2. Currently there is restricted water available for licensing at these APs.

The groundwater availability in the Worcestershire Middle Severn ALS region is guided by the surface water assessment unless specific information on principal aquifers exists or local issues that need protecting overrule it.

Consumptive groundwater licences which do not have a direct impact upon main river flows may be permitted but may be subject to restrictions such as prescribed groundwater levels. Restrictions will be determined on a case-by-case basis, dependent upon the nature and scale of any abstraction.

Resource availability for AP1 and AP2 is presented in Table 4.4 below.

Table 4.4 Worcestershire Middle Severn ALS resource availability

AP	Name	ALS	Local Resource Availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
1	River Worfe at Burcote	Worcestershire Middle Severn	Restricted water available for licensing	162Ml/d	36	4.8	Yes
2	Dowles Brook at Oak Cottage	Worcestershire Middle Severn	Restricted water available for licensing	3Ml/d	328	0.4	Yes

(1) Hands off Flow restriction

(2) Number of days per annum abstraction may be available

(3) Approximate volume available at restriction (Ml/D)

At AP1 and AP2, there is restricted water available for licensing subject to the HOF conditions as stated in the above table. This means that for new licenses:

- There is no water available for unconstrained abstraction, i.e. abstraction with no HOF restriction.
- Water is only available during periods of medium to high flows due to the HOF condition

49 Worcestershire Middle Severn Abstraction Licencing Strategy, Environment Agency (2013). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/305450/lit_5356_35376b.pdf on: 02/09/2019

4.2.6 Shropshire Middle Severn ALS

The Shropshire Middle Severn ALS[50] is largely rural, mainly covering Shropshire, but also covers the west of Stafford Borough and a small area in the north-west of South Staffordshire District. It included the River Perry, Rea Brook, Cound Brook, River Roden, River Tern and the tributaries of these watercourses covering Ellesmere, Wem, Shawbury and parts of Shrewsbury within Shropshire.

The majority of the CAMS area has moderately reliable water resources, however a small area around the Boleham Brook in the east of Shropshire has unreliable water resources, with water being available for abstraction for less than 30% of the time.

There are 8 APs within the Shropshire Middle Severn ALS, seven of which fall within Shropshire or are located on the border with Shropshire: AP1, AP2, AP3, AP5, AP6, AP7 and AP8. Currently there is restricted water available for licensing at these APs.

The groundwater availability is guided by the surface water assessment unless specific information on principal aquifers exists or local issues that need protecting overrule it.

Consumptive groundwater licences which do not have a direct impact upon main river flows may be permitted but may be subject to restrictions such as prescribed groundwater levels. Restrictions will be determined on a case-by-case basis, dependent upon the nature and scale of any abstraction.

Resource availability for AP4 is presented in Table 4.5 below.

Table 4.5 Shropshire Middle Severn ALS resource availability

AP	Name	ALS	Local Resource Availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
1	River Perry at Yeaton	Shropshire Middle Severn	Restricted water available for licensing	56Ml/d	256	3.8	Yes
2	Rea Brook at Hookagate	Shropshire Middle Severn	Restricted water available for licensing	27Ml/d	328	2.8	Yes
3	River Tern at Ternhill	Shropshire Middle Severn	Restricted water available for licensing	427Ml/d at Walcot gauging station	146	45	Yes
5	River Meese at Tibberton	Shropshire Middle Severn	Restricted water available for licensing	427Ml/d at Walcot gauging station	146	45	Yes
6	River Roden at Rodington	Shropshire Middle Severn	Restricted water available for licensing	427Ml/d at Walcot gauging station	146	45	Yes

50 Shropshire Middle Severn catchment abstraction licensing strategy, Environment Agency (2013). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291395/LIT_5393_7eeda4.pdf on: 13/08/2019

AP	Name	ALS	Local Resource Availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
7	River Tern at Walcot	Shropshire Middle Severn	Restricted water available for licensing	427Ml/d	146	45	Yes
8	Cound Brook at Cound Bridge	Shropshire Middle Severn	Restricted water available for licensing	46Ml/d at Boreton Bridge gauging station	256	1.4	No

(1) Hands off Flow restriction

(2) Number of days per annum abstraction may be available

(3) Approximate volume available at restriction (Ml/D)

At AP1, AP2, AP3, AP5, AP6, AP7 and AP8 there is restricted water available for licensing subject to the HOF conditions as stated in the above table. This means that for new licenses:

- There is no water available for unconstrained abstraction, i.e. abstraction with no HOF restriction.
- Water is only available during periods of medium to high flows due to the HOF condition

4.2.7 Weaver and Dane ALS

The Weaver and Dane ALS[51] covers parts of northern Shropshire including Adderley and parts of Market Drayton.

The area of the ALS covering Shropshire has very reliable water resources, with water available for abstraction at least 95% of the time.

There are 13 AP points within the Weaver and Dane ALS, none of which are located within Shropshire. There nearest AP to Shropshire is AP1.

Resource availability for AP1 is presented in Table 4.6 below.

Table 4.6 Weaver and Dane ALS resource availability

AP	Name	ALS	Local Resource Availability	HOF Q (1)	Days p.a. (2)	HOF (Ml/d) (3)	Gauging station at AP?
1	Audlem gauging station (River Weaver)	Weaver and Dane	Water available for licensing	9.1Ml/d	36	1.8	Yes

At AP1 there is water available for licensing. This means that for new licenses:

- There is water available for unconstrained abstraction.

51 Weaver and Dane catchment abstraction licensing strategy, Environment Agency (2013). Accessed online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/319959/lit_7884_52dcff.pdf on: 03/09/2019

4.2.8 Dee ALS

The Dee ALS[52] covers parts of Northern Shropshire, including Whitchurch, Weston Rhyn and Chirk Bank. There is no water available for licensing in the Dee ALS within Shropshire.

4.2.9 Staffordshire Trent Valley ALS

The Staffordshire Trent Valley ALS[53] covers a very small area in the east of Shropshire. The part of Shropshire covered by this ALS has moderately reliable water resources, with water being available for abstraction at least 50% of the time. There are no APs within the Staffordshire Trent Valley ALS within Shropshire.

4.3 Recommendations for better management practices

The ALS reports identify outline options for better management practices in order to reduce demand and avoid the requirement to increase abstractions . Methods include:

- Testing the level of water efficiency before granting an abstraction licence,
- Promoting efficient use of water,
- Taking actions to limit the demand,
- Reducing leakage; and
- Embedding policies for low-water consumption design in new buildings into spatial plans.

52 Dee catchment abstraction licensing strategy, Natural Resources Wales (2015). Accessed online at https://cdn.naturalresources.wales/media/674759/dee_cams_2015_english.pdf?mode=pad&rnd=131596369480000000 on: 03/09/2019

53 Staffordshire Trent Valley catchment abstraction licensing strategy, Environment Agency (2013). Accessed online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291409/LIT_3096_6bef40.pdf on: 03/09/2019

4.4 Water Resource Assessment: Water Resource Management Plans

4.4.1 Introduction

When new development within a Local Planning Authority is being planned, it is important to ensure that there are sufficient water resources in the area to cover the increase in demand without risk of shortages in the future or during periods of high demand, and without causing a negative impact on the waterbodies from which water is abstracted.

The aim of this assessment was to compare the future additional demand as a result of development proposed within the emerging Local Plan, with the demand allowed for by Severn Trent Water in their Water Resource Management Plans.

The water resources assessment has been carried out utilising two approaches; initially by reviewing the Water Resource Management Plans (WRMPs) of Severn Trent Water and secondly by providing the water company with a growth estimate allowing them to assess the impact of planned growth on their water resource zone.

4.4.2 Methodology

Severn Trent's Water Resource Management Plan (WRMP)[54], covering the period 2020 to 2045 was reviewed and attention was mainly focussed upon:

- The available water resources and future pressures which may impact upon the supply element of the supply/demand balance
- The allowance within those plans for housing and population growth and its impact upon the demand side of the supply/demand balance

The spatial boundaries for Severn Trent's water resource zones were used to overlay the local authority boundaries. The Ministry for Housing, Communities and Local Government (MHCLG) 2014-based estimates of household growth up to 2041[55] were collated for the local authorities which lie within each WRZ. The percentage of the current population of each local authority within the WRZ was estimated from the OS Code Point dataset and the WRZ boundary. The assessment has used MHCLG figures, because they are available for all LPAs within the water resource zone, and over a consistent timescale and methodology. The resulting total number of households in the base year within the WRZ is comparable with the figures quoted in the WRMPs.

The results were assessed using a red/amber/green traffic light definition to score the water resource zone:

Adopted WRMP has planned for the increase in demand, or sufficient time to address supply demand issues in the next WRMP.	Adopted WRMP has planned for the increase in demand, or sufficient time to address supply demand issues in the next WRMP. The site is located in an area that is significantly affected by WFD WINEP and would not be a favoured site.	Adopted WRMP does not take into consideration the planned increase in demand. Additional water resources may be required.

54 Water Resources Management Plan 2019, Severn Trent Water (2019). Accessed online at: https://www.severntrent.com/about-us/future-plans/water-resource-management/wrmp-19-documents/on: 04/09/2019

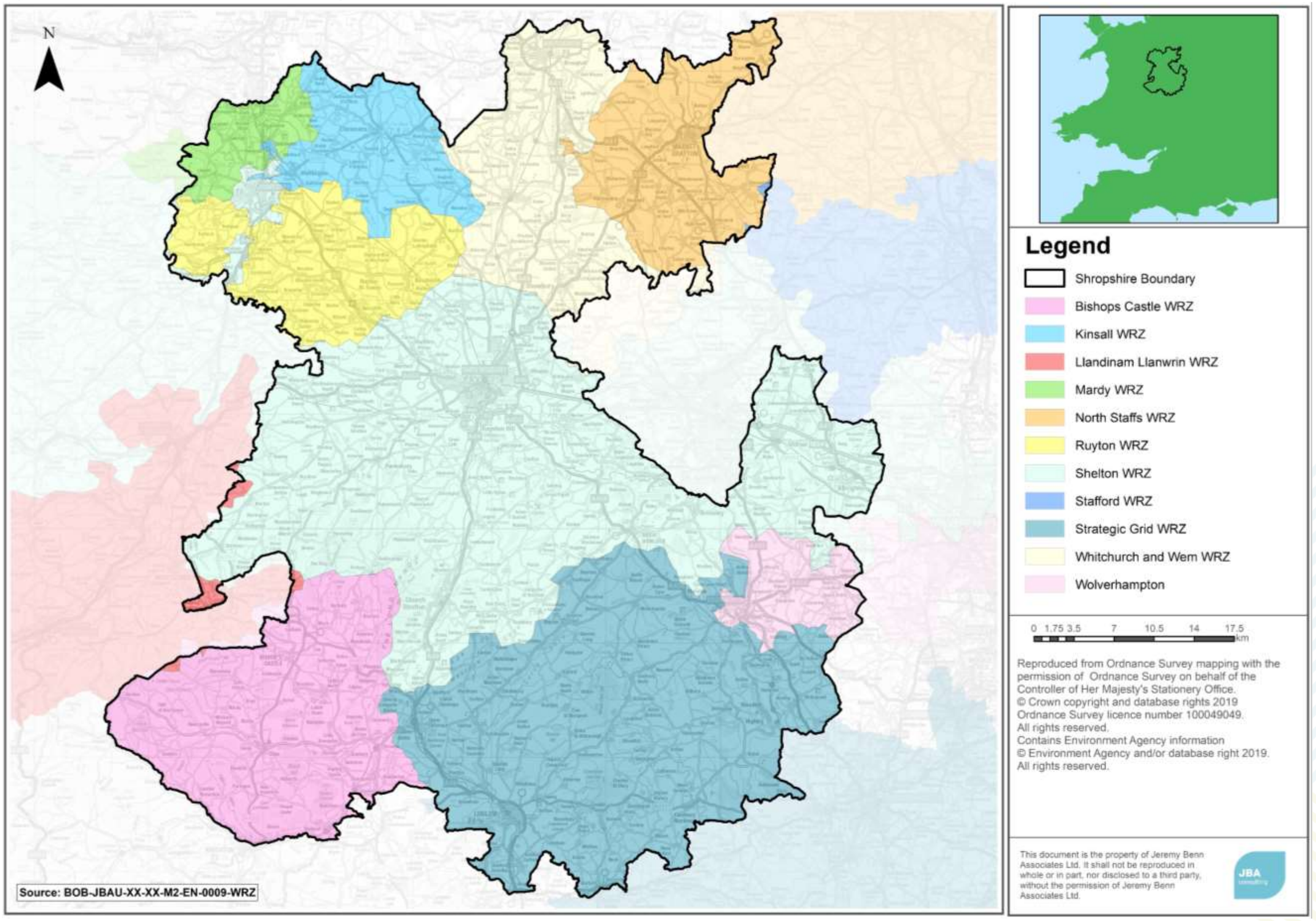
55 2014-Based Household Projections for England, Office for National Statistics (2018). Accessed online at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland on: 31/10/2018

4.4.3 Severn Trent Water

Severn Trent Water is responsible for supplying the majority of Shropshire with water, with Hafren Dyfrdwy operating in a small area in the west of the study area. For the purposes of water resources planning, the STW supply area is divided into 15 Water Resources Zones (WRZs) which vary greatly in scale and have unique water resource concerns. Shropshire is covered by Bishops Castle, Kinsall, Mardy, North Staffs, Ruyton, Shelton, Stafford, Strategic Grid, Whitchurch and Wem, Wolverhampton and Llandinam Llanwrin (now part of Hafren Dfrdwy) WRZs.

None of the preferred options sites or strategic sites are located in Stafford or Llandinam Llanwrin WRZs. As there are no OS Code Points in Shropshire in the Stafford WRZ and as there is no preferred options sites or strategic sites in the Llandinam Llanwrin WRZ, these have not been considered in this part of the assessment. Figure 4.5 shows the location of the WRZs within Shropshire.

Figure 4.5 Water Resource Zones within Shropshire



Severn Trent's WRMP forecasts a significant deficit between supply and demand for water, with a focus to prevent the risk of future environmental deterioration, meaning that alternative ways of meeting customer demand need to be found as current water sources become unreliable. The water company aims to do this by:

- Using demand management measures to reduce the amount of water that is needed to put into the supply by:
    - Educating customers to use less water
    - Reducing network leakage
    - Reducing consumption by increasing the coverage of water meters
- Making the best of sustainable sources of supply by:
    - Reducing abstraction from sources that have a negative environmental impact
    - Ensuring future water abstractions do not pose a risk of environmental deterioration (a requirement of the Water Framework Directive)
    - Improving resilience and flexibility of the supply system
    - Increasing or optimising outputs for existing sustainable sources
    - Improving habitats and ecological resilience to low flows using catchment restoration techniques
    - Protecting drinking water supply sources from risk of pollution using catchment management measures
    - Optimising national use of resources

Across all of their WRZs, Severn Trent aim to improve long term supply capability by replacing output from unsustainable sources of abstraction. This includes reducing the pressures upon groundwater abstraction ensuring that there is no future increase associated with this source. Consequently, Severn Trent are focusing their supply upon surface water abstraction and existing reservoir storage. Also, it is proposed that the strategic water distribution links will be enhanced to allow increased flexibility around the system to move water to locations that require it most.

Across the water supply area, 34% of supply is provided by groundwater, with the majority (approximately 88%) being derived from Sherwood Sandstone or sandstone aquifers in the Midlands region. The sandstone aquifers have substantial storage and are typically not sensitive to short term changes in precipitation.

Vulnerability assessments upon the WRZ's across the supply area identified those most sensitive to the impacts of climate change. The results showed that the largest WRZs (the Strategic Grid and Nottingham) are both vulnerable to potential changes in temperature and rainfall and all other WRZ are given a "low" vulnerability to climate change.

STW's Strategic Grid, Nottinghamshire and North Staffordshire WRZs show the greatest supply/demand deficit within STW's supply area, two of these cover part of Shropshire. Strategic Grid shows a deficit of 16.24 Ml/d by 2021-22, with a maximum potential deficit over the WMRP period of 244.50 Ml/d in 2039-40. North Staffs first shows a deficit in 2025-26 of 34.29 Ml/d, which increases to 41.80 Ml/d by 2044-45. Key points outlined in the WRMP to target this deficit in these areas are outlined in Table 4.7 and Table 4.8.

The Kinsall and Whitchurch and Wem WRZs also show a deficit between supply and demand, present from 2030-31 and 2035-36 respectively, however the deficits at these WRZs are much less significant than the Strategic Grid and North Staffs WRZs.

Leakage makes up around 23% of the total water that STW put into supply and measures to reduce leakage have helped to meet the demand of a growing population without having to increase abstraction. Between 2010 and 2020 STW reduced leakage by around 15% and the WRMP proposes to reduce leakage by a further 15% between 2020 and

2025, with an overall ambition to reduce leakage by 50% over the next 25 years. Proposed leakage targets for each of the WRZ in Shropshire are set out in Table 4.9.

Table 4.7 Summary of recommended supply schemes for Strategic Grid

Delivery Period	Scheme Description	Assumed Benefit
AMP7 2020-2025	River Trent to Site Q water treatment works transfer with Site Q treatment enhancements	26 Ml/d
AMP7 to AMP8 2020-2030	Site E water treatment works expansion and transfer main supported by raw augmentation of the River Trent	35 Ml/d
	Site B water treatment works enhancements	3.6 Ml/d
	Site J water treatment works expansion	15 Ml/d
	Thornton Reservoir to support Site B water treatment works	8 Ml/d
	Site C Reservoir capacity increase (Size A) with transfer from Site C water treatment works to Coventry	9 Ml/d
	Site R water treatment works to Grindleford pipeline capacity increase	7.5 Ml/d
AMP8 2025-2030	Site C water treatment works enhancements	8 Ml/d
	Site F water treatment works expansion	10 Ml/d
	Maximise deployment from Diddlebury water treatment works and Munslow borehole	0.9 Ml/d
AMP7 to AMP9 2020-2035	River Soar to support Site B water treatment works	17 Ml/d
	East Midlands raw water storage (Site CQ) including new water treatment works	45 Ml/d
AMP8 to AMP9 2025-2035	Stanford Reservoir capacity increase (Size A)	2.5 Ml/d
	Site A Reservoir capacity increase (Size A)	2.5 Ml/d
	Ladyflatte boreholes recommissioning	2.7 Ml/d
	Lower Shustoke capacity increase (Size A)	2.5 Ml/d
	Site I water treatment works enhancements	2 Ml/d

Table 4.8 Summary of recommended supply schemes for North Staffordshire

Delivery Period	Scheme Description	Assumed Benefit
AMP7 to AMP8 2020-2030	Peckforton Group boreholes treatment enhancements	6.5 Ml/d
AMP 9 2030-2035	Improve Site L water treatment works outputs during low raw water periods	7 Ml/d

Table 4.9 Leakage targets for WRZs in Shropshire

WRZ	Leakage targets (Ml/d)					
	2019-20	2024-25	2029-30	2034-35	2039-40	2044-45
Bishops Castle	0.6	0.6	0.5	0.4	0.4	0.3
Kinsall	1.1	1.1	1.0	0.8	0.7	0.7
Mardy	0.9	0.9	0.8	0.7	0.6	0.6
Ruyton	1.6	1.6	1.4	1.2	1.1	1.0

WRZ	Leakage targets (Ml/d)					
	2019-20	2024-25	2029-30	2034-35	2039-40	2044-45
Whitchurch and Wem	3.0	3.0	2.5	2.1	1.9	1.7
Wolverhampton	14.4	14.4	12.2	10.4	9.4	8.4
Shelton	24.0	24.0	20.4	17.3	15.6	14.0
North Staffs	29.4	29.4	25.0	21.3	19.1	17.2
Strategic Grid	272.1	214.1	181.9	154.7	39.2	125.3

4.4.4 Population and household growth

Table 4.10 shows a comparison of household growth forecasts for the nine WRZs serving growth in Shropshire, the Ministry of Housing Communities and Local Government (MHCLG) 2014-based household projections, and Shropshire Council's OAN.

The MHCLG 2014-based projections forecast a 13.34% increase in the number of households in Shropshire between 2016 and 2036. The MHCLG projections for each WRZ covering Shropshire are lower than what has been accounted for in the WRMP.

If growth in Shropshire occurred according to the preferred development strategy of 28,750 dwellings from 2016-2036, it would result in an increase in the number of households of approximately 21%, which is greater than what has been accounted for in the WRMPs, most significantly in the North Staffs, Wolverhampton and Mardy WRZs.

Table 4.10 Comparison of household growth forecasts (Severn Trent Water)

Forecast	2016	2036	% increase
MHCLG 2014-based forecast – Shropshire	**135,511**	**153,588**	**13.34%**
MHCLG 2014-based forecast – All LPAs in Shelton WRZ	189,076	212,762	12.53%
MHCLG 2014-based forecast – All LPAs in North Staffs WRZ	232,806	254,617	9.37%
MHCLG 2014-based forecast – All LPAs in Wolverhampton WRZ	105,809	119,458	12.90%
MHCLG 2014-based forecast – All LPAs in Strategic Grid WRZ	2,165,187	2,538,480	17.24%
MHCLG 2014-based forecast – All LPAs in Ruyton WRZ	6,327	7,170	13.32%
MHCLG 2014-based forecast – All LPAs in Kinsall WRZ	5,934	6,724	13.32%
MHCLG 2014-based forecast – All LPAs in Mardy WRZ	4,054	4,583	13.03%
MHCLG 2014-based forecast – All LPAs in Bishops Castle WRZ	4,542	5,138	13.13%
MHCLG 2014-based forecast – All LPAs in Whitchurch and Wem WRZ	14,060	15,914	13.19%
WRMP Forecast – Shelton	212,400	246,590	16.10%
WRMP Forecast – North Staffs	250,950	282,530	12.58%
WRMP Forecast - Wolverhampton	110,000	124,260	12.96%
WRMP Forecast – Strategic Grid	2,307,760	2,684,880	16.34%
WRMP Forecast – Ruyton	5,440	6,520	19.85%
WRMP Forecast – Kinsall	6,000	7,070	17.83%
WRMP Forecast – Mardy	3,800	4,330	13.95%
WRMP Forecast – Bishops Castle	3,360	4,060	20.83%

Forecast	2016	2036	% increase
WRMP Forecast – Whitchurch and Wem	14,210	16,930	19.14%
OAN – Shropshire	**135,511**	**164,261**	**21.22%**

4.4.5 Summary

The majority settlements and sites within Shropshire are supplied by Severn Trent Water and are located within the Strategic Grid, Mardy, Ruyton, Kinsall, Bishops Castle, Whitchurch and Wem, Shelton, North Staffs and Wolverhampton WRZs. Severn Trent Water's WRMP highlights the significant deficit between supply and demand forecast and emphasises the need to reduce this potential deficit and prevent the risk of future environmental deterioration.

The growth forecast planned for in the WRMP is greater than that expected if the level of growth forecast by the MHCLG is realised, however the WRMP accounts for less growth than is planned by Shropshire Council from their preferred development strategy.

Although Severn Trent Water has not relied on new homes being more water-efficient than existing metered homes, the opportunity, through the planning system, to ensure that new homes do meet the higher standard of domestic water usage, at no additional cost to the developer, would be in line with general principals of sustainable development, and reducing energy consumed in the treatment and supply of water.

4.5 Severn Trent Water's Assessment

4.5.1 Strategic sites

Severn Trent provided comments regarding water resources for each of the strategic sites:

Clive Barracks – "We do not anticipate that this site will negatively affect future groundwater supplies in the area. However, we would recommend that best industry and EA guidelines are adopted when developing on the Principal Aquifer (sandstone and conglomerate) which underlies the site."

Ironbridge power station – "Our initial assessments suggest that this site is located within an area in which surface water/groundwater bodies are at risk of deterioration under the Water Framework Directive if demand is to be met by increased abstraction from the environment. This may limit our ability to supply water." "To mitigate the risk to water supplies the Council should adopt stronger positions on promoting the optional 110 l/p/d Per Capita Consumption (PCC) standards outlined in the Building Regulations in their planning guidance."

RAF Cosford – "Our initial assessments suggest that this site is located within an area in which surface water/groundwater bodies are at risk of deterioration under the Water Framework Directive if demand is to be met by increased abstraction from the environment. This may limit our ability to supply water."

4.5.2 Water resources RAG assessment

Severn Trent's assessments show that the adopted WRMP has planned for the increase in demand based on the growth figures provided, however if significantly higher growth rates are expected, this result would need to be reassessed.

Several of the preferred options sites and strategic sites have been given an amber rating, as they are located in areas where there is a Water Industry National Environment Programme (WINEP) action identified. WINEP represents a set of actions requested by the Environment Agency from water companies for completion during the period 2020-2025, in order to contribute towards meeting their environmental obligations. These actions may be in the form of investigations, or measures to reduce abstraction of water in a given location to maintain river flows as part of work to improve WFD status. The sites identified by STW as amber below are located in a sub-area where there is a greater

risk of increased abstraction of their sources causing environmental degradation and so they have stated that they would not be preferred sites. The RAG results are shown in Table 4.11 and Figure 4.6.

Table 4.11 Water resources RAG assessment results

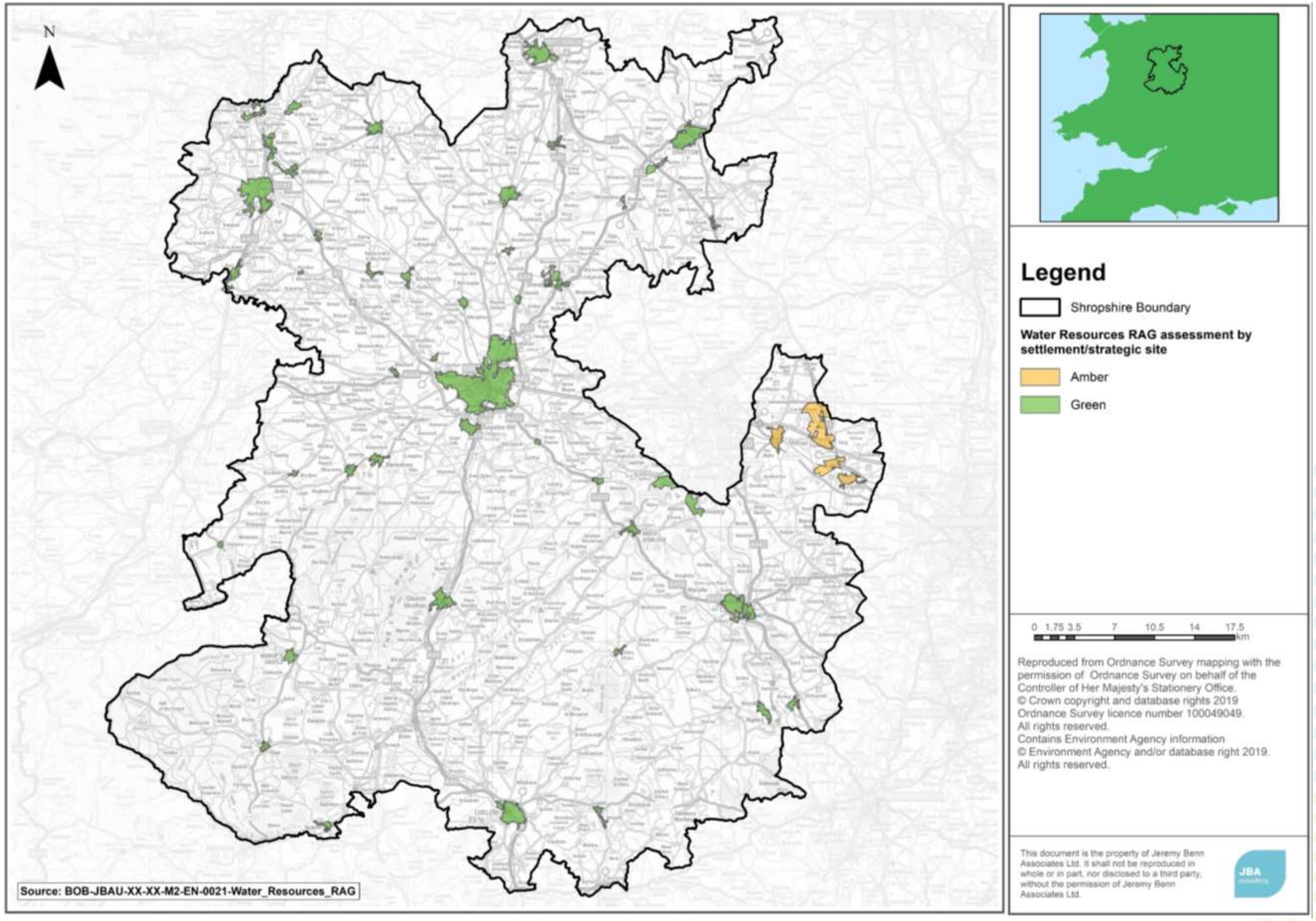
Strategic site	Overall RAG assessment	STW comment
Clive Barracks	Green	Adopted WRMP has planned for the increased demand based on the housing growth figures provided. If significantly higher growth rates are expected, we would need to reassess
Ironbridge		
RAF Cosford	Amber	Adopted WRMP has planned for the increased demand based on the housing growth figures provided. If significantly higher growth rates are expected, we would need to reassess. This site is located in an area that is significantly affected by WFD WINEP and would not be a favoured site.
Settlement	**Overall RAG assessment**	**STW comment**
Albrighton	Amber	Adopted WRMP has planned for the increased demand based on the housing growth figures provided. If significantly higher growth rates are expected, we would need to reassess. This site is located in an area that is significantly affected by WFD WINEP and would not be a favoured site.
Shifnal		
All other preferred options settlements	Green	Adopted WRMP has planned for the increased demand based on the housing growth figures provided. If significantly higher growth rates are expected, we would need to reassess

STW additional comments on the sites scored as amber:

"These sites are marked as Amber as they are not our favored sites due to the pressures of WFD on our sources and the need for solutions to mitigate the risk. However, at this time, as long as demand from additional housing is in line with that in the local plans, we don't expect any supply issues as this is accounted for in our recently published Water Resources Management Plan. We would not expect significant additional infrastructure at the time but may manage demand through transfers between neighboring control groups, with the need for possible infra links to be delivered in 2025-30 if required."

STW further commented that in order to serve the amber sites, water may need to be transferred into the catchment in order to avoid an increase in local abstraction. This has a cost, both financially and in terms of carbon through additional energy usage. At these sites, the concept of water neutrality could be explored in order to accommodate these sites if it is required by STW in order to avoid additional infrastructure.

Figure 4.6 Water resources RAG assessment results



4.6 Water efficiency and water neutrality

It is widely recognised that the climate is changing and in response Shropshire Council declared a climate emergency in May 2019,[56]. Climate change is predicted to increase pressure on water resources, increasing the potential for a supply-demand deficit in the future, and making environmental damage from over abstraction of water resources more likely. Furthermore, the delivery of water and wastewater services and the heating of water in the home require high energy inputs, and therefore contribute directly to emissions of greenhouse gases. Water efficiency therefore reduces energy use and carbon emissions.

It is important therefore that new development does not result in an unsustainable increase in water abstraction. This can be done in a number of ways from reducing the water demand from new houses through to achieving "water neutrality" in a region by offsetting a new developments water demand by improving efficiency in existing buildings.

It is for Local Authorities to establish a clear need to adopt the tighter water efficiency target through the building regulations. This should be based on:

- Existing sources of evidence such as:
    - The Environment Agency classification of water stress
    - Water resource management plans produced by water companies
    - River Basin Management Plans which describe the river basin district and the pressure that the water environment faces. These include information on where water resources are contributing to a water body being classified as 'at risk' or 'probably at risk' of failing to achieve good ecological status, due to low flows or reduced water availability.
- Consultations with the local water and sewerage company, the Environment Agency and catchment partnerships
- Consideration of the impact on viability and housing supply of such a requirement

4.6.1 Water Stress

Water stress is a measure of the level of demand for water (from domestic, business and agricultural users) compared to the available freshwater resources, whether surface or groundwater. Water stress causes deterioration of the water environment in both the quality and quantity of water, and consequently restricts the ability of a waterbody to achieve a "Good" status under the WFD.

The Environment Agency has undertaken an assessment of water stress across the UK. This defines a water stressed area as where:

- "The current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or
- The future household demand for water is likely to be a high proportion of the effective rainfall available to meet that demand.

In the Environment Agency and Natural Resources Wales assessment[57] the Severn Trent and United Utilities supply regions are classed as areas of "moderate" water stress.

Although Shropshire is not in an area of high water stress compared to the south and east of England, there are sub-areas within the county where abstraction of water is

56 Meeting of Council, 16th May 2019, Shropshire Council, 2019. Accessed online at: https://shropshire.gov.uk/committee-services/mgAi.aspx?ID=13065 on: 26/11/2019

57 Water Stressed Areas - Final Classification, Environment Agency and Natural Resources Wales (2013). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf on: 03/09/2019

causing an environmental impact, and actions exist under WINEP to reduce this abstraction in order to contribute to meeting WFD targets.

4.6.2 River Basin Management Plans

One of the challenges identified in the River Basin Management Plan (RBMP) for the River Severn Basin is "changes to natural flow and levels of water". The management recommendations from the RBMP are listed below:

- **All sectors** take up or encourage water efficiency measures, including water industry work on metering, leakage, audits, providing water efficient products, promoting water efficiency and education.
- **Local Government** sets out local plan policies requiring new homes to meet the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010.
- **Industry manufacturing and other business** implement tighter levels of water efficiency, as proposed by changes to the Building Regulations.
- **Agriculture and rural land management** manage demand for water and use water more efficiently to have a sustainable water supply for the future.
- **Local government** commissions water cycle studies to inform spatial planning decisions around local water resources.

The RBMP goes on to state that "dealing with unsustainable abstraction and implementing water efficiency measures is essential to prepare and be able to adapt to climate change and increased water demand in the future."

4.6.3 National Water Resources Framework

A new National Framework for Water Resources was published by the Government in March 2020[58]. This outlines the water resources challenges facing England and sets out the strategic direction for the work being carried out by regional water resource groups.

A range of options were explored, and the most ambitious scenarios rely on policy change to introduce mandatory labelling of water using fittings and associated standards. The Government is currently reviewing policy on water efficiency following a recent consultation. The framework proposes that regional groups plan to help customers reduce their water use to around 110 l/p/d. This is achievable without policy interventions.

This aligns with the tighter standard of 110 l/p/d per day as described in building regulations. A water efficiency target higher than 110 l/p/d would make the overall target for the UK harder to achieve.

4.6.4 Impact on viability

As outlined in section 3.8, the cost of installing water-efficient fittings to target a per capita consumption of 110l/d has been estimated as a one-off cost of £9 for a four-bedroom house. Research undertaken for the devolved Scottish and Welsh governments indicated potential annual savings on water and energy bills for householders of £24-£64 per year as a result of such water efficiency measures . Water efficiency is therefore not only viable but of positive economic benefit to both private homeowners and tenants.

4.6.5 Summary of evidence for tighter efficiency standard

The strategic direction in the UK set out in the new National Water Resources Framework is to attain an average household water efficiency of 110 l/p/d by 2050. This also aligns with the recommendation in the River Basin Management Plan aimed at reducing the

58 National Water Resources Framework, Environment Agency (2020). Accessed online at: https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources on: 16/06/2020

impact of abstraction. There would also be a positive economic impact for residents in terms of reduced energy and water bills.

Severn Trent Water confirmed that they support this approach.

It is therefore recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Shropshire.

4.6.6 Water neutrality concept

Water neutrality is a relatively new concept for managing water resources, but one that is receiving increased interest as deficits in future water supply/demand are identified. The definition adopted by the Government and the Environment Agency[59] is:

> ***"For every development, total water use in the wider area after the development must be equal to or less than total water use in the wider area before development".***

It is useful to also refer to the refined definition developed by Ashton:

"For every new significant development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community, where practical to do so, and these water savings must be sustained over time" (V Ashton, 2014)[60]

This definition states the need to sustain water saving measures over time, and the wording "predicted increase in total water demand" reflects the need for water neutrality to be designed in at the planning stage.

Both definitions refer to water use in the region or "wider area", and the extent of this area should be appropriate to local authority boundaries, water resource zones, or water abstraction boundaries depending on what is appropriate for that particular location. For instance, if a development site is in an area of water stress relating to a particular abstraction source, offsetting water use in a neighbouring town that is served by a different water source will not help to achieve water neutrality.

In essence water neutrality is about accommodating growth in a region without increasing overall water demand.

Water neutrality can be achieved in a number of ways:

- Reducing leakage from the water supply networks
- Making new developments more water-efficient
- "Offsetting" new demand by retrofitting existing homes with water-efficient devices
- Encouraging existing commercial premises to use less water
- Implementing metering and tariffs to encourage the wise use of water
- Education and awareness-raising amongst individuals

Suggestions for water-efficiency measures are listed in Figure 4.7 below.

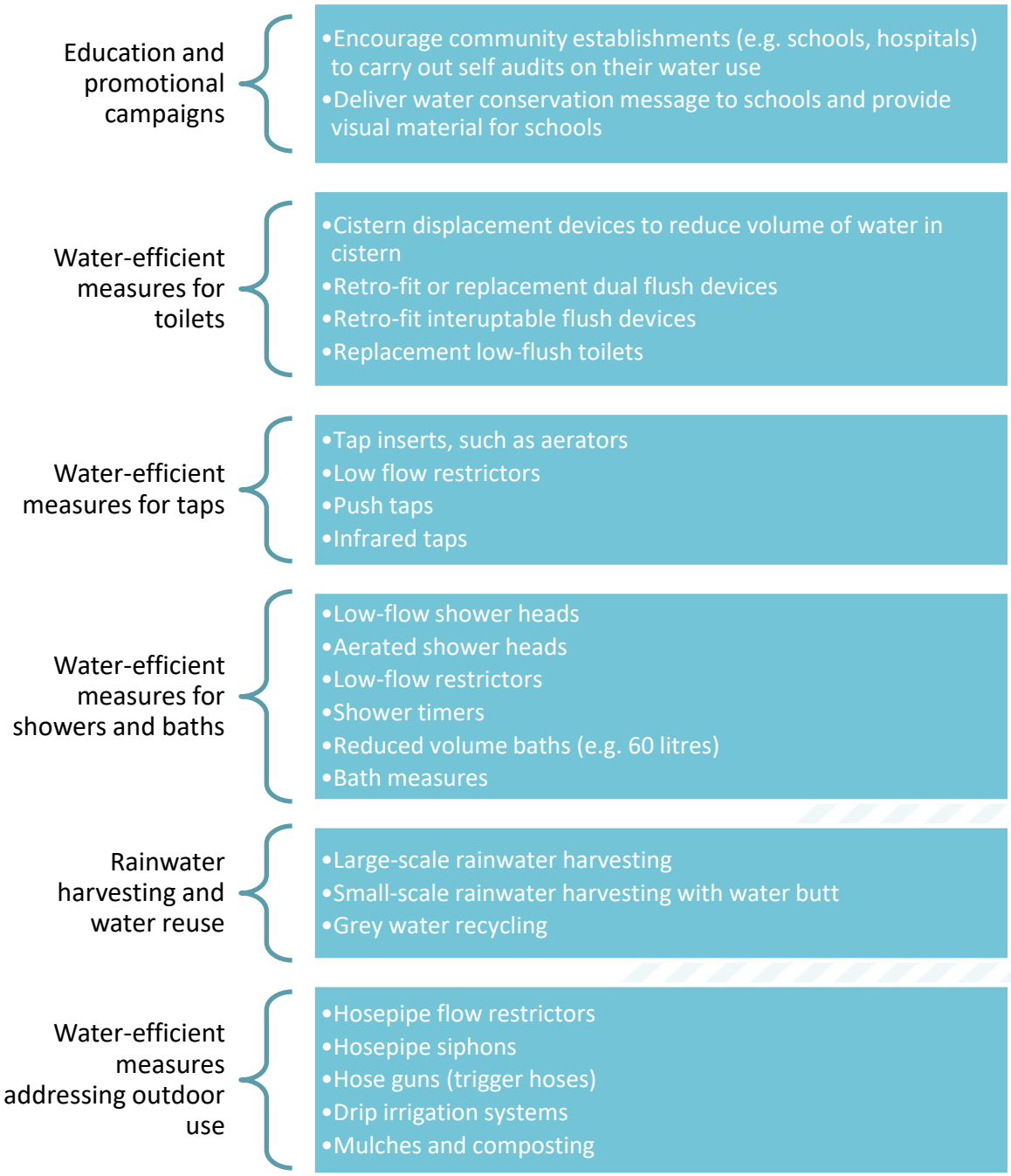
---

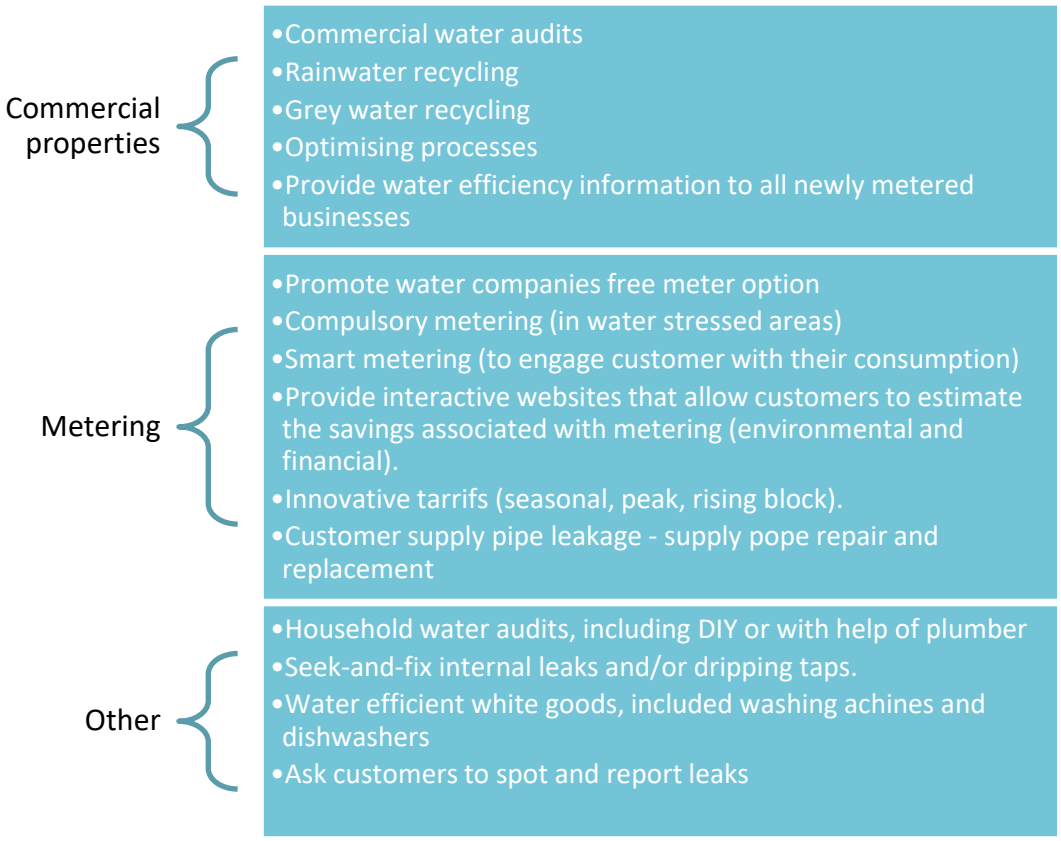
59 Water Neutrality: An improved and expanded water resources management definition (SC080033/SR1), Environment Agency, 2009. Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291675/scho1009bqzr-e-e.pdf on: 26/11/2019

60 Water Resources in the Built Environment, edited by Booth and Charlesworth (2014). Published by Wiley.

4.6.7 Consumer water efficiency measures

Figure 4.7 Consumer water-efficiency measures





Source: Adapted from Booth and Charleswell 2014

Many interventions are designed to reduce water use if operated in a particular way, and so rely on the user being aware and engaged with their water use. The educational aspect is therefore important to ensure that homeowners are aware of their role in improving water efficiency.

4.6.8 Rainwater and Greywater Recycling

Rainwater harvesting

Rainwater recycling or rainwater harvesting (RwH) is the capture of water falling on buildings, roads or pathways that would normally be drained via a surface water sewer, infiltrate into the ground or evaporate. In the UK this water cannot currently be used as a drinking water supply as there are strict guidelines on potable water, but it can be used in other systems within domestic or commercial premises.

Systems for collection of rainwater can be simple water butts attached to a drainpipe on a house, or it could be a complex underground storage system, with pumps to supply water for use in toilet flushing and washing machines. By utilising rainwater in this way there is a reduced dependence on mains water supply for a large proportion of the water use in a domestic property.

Benefits of RwH

- **RwH reduces the dependence on mains water supply – reducing bills for homeowners and businesses**
- **Less water needs to be abstracted from river, lakes and groundwater**
- **Stormwater is stored in a RwH system reducing the peak runoff leaving a site providing a flood risk benefit (for smaller storms)**
- **By reducing surface water flow, RwH can reduce the first flush effect whereby polluted materials adhering to pavement surfaces during dry periods are removed by the first flush of water from a storm and can cause pollution in receiving watercourses.**

Challenges of RwH

- **Dependency on rainfall can limit availability of harvested rainwater during drought and hot weather events.**
- **Increased capital (construction) costs to build rainwater harvesting infrastructure into new housing (£2,674 for a 3/4bed detached home)**
- **Payback periods are long as the cost of water is low so there is little incentive for homeowners to invest. For further information see:** https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/353387/021c_Cost_Report_11th_Sept_2014_FINAL.pdf

Greywater harvesting

Greywater refers to water that has been "used" in the home in appliances such as washing machines, showers and hand basins. Greywater recycling or greywater harvesting (GwH) is the treatment and re-use of this water in other systems such as for toilet flushing. By their nature, GwH systems require more treatment and are more complex than RwH systems, and there are limited examples of their use in the UK.

Greywater re-use refers to systems where wastewater is taken from source and used without further treatment. An example of this would be water from a bath or shower being used on plants in the garden. This sort of system is easy to install and maintain, however as mentioned above the lack of treatment to remove organic matter means the water cannot be stored for extended periods.

Greywater recycling refers to systems where wastewater undergoes some treatment before it is used again. These systems are complex and require a much higher level of maintenance than RwH or greywater re-use systems.

Domestic water demand can be significantly reduced by using GwH, and unlike with a RwH system where the availability of water is dependent on the weather, the source of water is usually constant (for instance if it is from bathing and showering). However, the payback period for a GwH system is usually long, as the initial outlay is large, and the cost of water relatively low. Viability of greywater systems for domestic applications is therefore currently limited. Communal systems may offer more opportunities where the cost can be shared between multiple households.

4.6.9 Energy and Water use

According to EU statistics (Eurostat 2017), 17% of the UK's domestic energy usage is for water heating. If less water was being used within the home, for instance through more water efficient showers, less water would need to be heated, and overall domestic energy usage would be reduced.

The Government is currently consulting on a Future Homes Standard that will involve changes to Part L (conservation of fuel and power) of the Building Regulations for new dwellings. Whilst there is no direct mention of water efficiency in this consultation, there is an important link between water use and energy use, and therefore between water use and carbon footprint.

4.6.10 Funding for water neutrality

Water neutrality is unlikely to be achieved by just one type of measure, and likewise it is unlikely to be achieved by just one funding source. Funding mechanisms that may be available could be divided into the following categories:

- Infrastructure-related funding (generally from developer payments)
- Fiscal incentives at a national or local level to influence buying decisions of households and businesses
- Water company activities, either directly funded by the five-year price review or as a consequence of competition and individual company strategies
- Joint funding through energy efficiency schemes (and possibly to integrate with the heat and energy saving strategy).

Currently in the UK, the main funding resource for the delivery of water efficiency measures is the water companies, with some discretionary spending by property owners or landlords. For water neutrality to be achieved, policy shifts may be required in order to increase investment in water efficiency. Possible measures could include:

- Further incentivisation of water companies to reduce leakage and work with customers to reduce demand
- Require water efficient design in new development
- Developer funding to contribute towards encouraging water efficiency measures
- Require water efficient design in refurbishments, when a planning application is made
- Tighter standards on water using fittings and appliances.

4.7 Conclusions

The WRMP shows a supply-demand deficit from 2021-22 (Strategic Grid) and 2025-26 (North Staffs) if no action is taken. It goes on to define a number of actions that will address this.

Severn Trent have stated that the adopted WRMP has planned for the increase in demand based on the figures of all the strategic and preferred options sites, however, should significantly higher growth that planned occur, this may need to be reassessed. The preferred option sites in Albrighton and Shifnal and strategic site at Clive Barracks are not favoured sites for STW, as they are located in areas where there are WINEP actions to reduce abstraction.

Policies to reduce water demand from new developments, or to go further and achieve water neutrality in certain areas (particularly within the Shelton water resource zone), could be defined to reduce the potential environmental impact of additional water abstractions in Shropshire, and also help to achieve reductions in carbon emissions in Shropshire. It is therefore recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Shropshire.

In the areas identified by Severn Trent Water as having particular pressures on Water Resources within the Shelton water resource zone should be considered for the application of water neutrality if appropriate.

4.8 Recommendations

The recommendations for water resources are provided in Table 4.12 below.

Table 4.12 Recommendations for water resources for Shropshire

Action	Responsibility	Timescale
Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities.	STW	Ongoing
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	SC	Ongoing
Use planning policy to require the 110l/person/day water consumption target permitted by National Planning Policy Guidance across Shropshire.	SC	In Local Plan Review
The concept of water neutrality has the potential to provide a significant benefit in terms of resilience to climate change and enabling all waterbodies to be brought up to Good status. This approach could have particular application in the strategic site of RAF Cosford, and the settlements of Albrighton and Shifnal and should be explored further if required by STW to accommodate growth in these locations.	STW, SC, EA,	In Local Plan Review and Climate Change Action Plan
Water companies should advise SC of any strategic water resource infrastructure developments within the Authority, where these may require safeguarding of land to prevent other type of development occurring.	STW, SC	In Local Plan Review

5 Water Supply Infrastructure

5.1 Introduction

An increase in water demand due to growth can exceed the hydraulic capacity of the existing supply infrastructure. This is likely to manifest itself as low pressure at times of high demand. An assessment is required to identify whether the existing infrastructure is adequate or whether upgrades will be required. The time required to plan, obtain funding and construct major pipeline works can be considerable and therefore water companies and planners need to work closely together to ensure that the infrastructure is able to meet growing demand.

Water supply companies make a distinction between supply infrastructure, the major pipelines, reservoirs and pumps that transfer water around a WRZ, and distribution systems, smaller scale assets which convey water around settlements to customers. This outline study is focused on the supply infrastructure. It is expected that developers should fund water company impact assessments and modelling of the distribution systems to determine requirements for local capacity upgrades to the distribution systems.

In addition to the work undertaken by water companies, there are opportunities for the local authority and other stakeholders to relieve pressure on the existing water supply system by increasing water efficiency in existing properties. This can contribute to reducing water consumption targets and help to deliver wider aims of achieving water neutrality.

A cost-effective solution can be for local authorities to co-ordinate with water supply companies and "piggyback" on planned leakage or metering schemes, to survey and retrofit water efficient fittings into homes[61]. This is particularly feasible within property owned or managed by the local authorities, such as social housing.

5.2 Methodology

Severn Trent Water were provided with a complete list of sites and the potential/equivalent housing numbers for each scenario. Using this information, STW were asked to comment on the impact of the proposed growth on water supply infrastructure in Shropshire.

5.3 Results and conclusion

Severn Trent stated that as long as a site is within a water resource zone with sufficient water resources, they do not envisage a problem with supply to that site. Where a site is a long distance from the network, a requisition may be required which is assessed at the time of contact with the developer. Water supply could therefore potentially be an issue for sites in Albrighton, Shifnal and the strategic site at RAF Cosford where Severn Trent have stated that there may be water resource issues as they are located in areas where there are WINEP actions to reduce abstraction.

Much Wenlock has experienced water supply issues recently with residents reporting low pressure, or intermittent supply. Severn Trent Water are aware of this issue. Network reinforcement is likely to be required if further development is planned in this supply area.

61 Water Efficiency Retrofitting: A Best Practice Guide, Waterwise (2009). Accessed online at: http://www.waterwise.org.uk/wp-content/uploads/2018/01/Waterwise-2009_Water-efficiency-Retrofitting_Best-practice.pdf on: 30/09/2019

5.4 Recommendations

Table 5.1 Recommendations for water supply infrastructure

Action	Responsibility	Timescale
Undertake network modelling where appropriate as part of the planning application process to ensure adequate provision of water supply is feasible	STW SC	As part of the planning process
SC and Developers should engage early with STW to ensure infrastructure is in place prior to occupation.	SC STW Developers	Ongoing

6 Wastewater Collection

6.1 Sewerage undertakers

Severn Trent Water is the Sewerage Undertaker (SU) for the majority of the study area, with Welsh Water operating in the north-west of Shropshire. The role of the sewerage undertaker includes the collection and treatment of wastewater from domestic and commercial premises, and in some areas, it also includes the drainage of surface water from building curtilages to combined or surface water sewers. It excludes, unless adopted by the SU, systems that do not connect directly to the wastewater network, e.g. Sustainable Drainage Systems (SuDS) or highway drainage.

Increased wastewater flows into collection systems due to growth in populations or per-capita consumption can lead to an overloading of the infrastructure, increasing the risk of sewer flooding and, where present, increasing the frequency of discharges from Combined Sewer Overflows (CSOs).

Likewise, headroom at Wastewater Treatment Works (WwTW) can be eroded by growth in population or per-capita consumption, requiring investment in additional treatment capacity. As the volumes of treated effluent rises, even if the effluent quality is maintained, the pollutant load discharged to the receiving watercourse will increase. In such circumstances the Environment Agency as the environmental regulator, may tighten consented effluent consents to achieve a "load standstill", i.e. ensuring that as effluent volume increases, the pollutant discharged does not increase. Again, this would require investment by the water company to improve the quality of the treated effluent.

In combined sewerage systems, or foul systems with surface water misconnections, there is potential to create headroom in the system, thus enabling additional growth, by the removal of surface water connections. This can most readily be achieved during the redevelopment of brownfield sites which have combined sewerage systems, where there is potential to discharge surface waters via sustainable drainage systems (SuDS) to groundwater, watercourses or surface water sewers. In some areas of Shropshire, there are known issues of surface water causing localised flooding. Strategic schemes to provide improved local surface water drainage may be required in such areas, rather than solely relying upon on-site soakaways on brownfield or infill plots.

STW are supportive of the use of SuDS and SuDS principles to manage surface water run-off. They recommend that the Drainage Hierarchy is used to direct surface water to natural outfall routes such as infiltration to the ground or into watercourses, before utilising sewers, as supported by paragraph 80 of the NPPG. Surface water should also not be permitted to connect to a foul sewer.

Welsh Water states that all new development of more than one building and/or where the construction area is >100m^2, will require SuDS, and that within the WW operational areas within England, WW will adopt surface water sewers designed in accordance with Sewers for Adoption 7th Edition. SuDS schemes on developments larger than 100m^2 must be approved by the SuDS Approving Body before construction begins.

6.2 Sewerage System Capacity Assessment

New residential developments and new employment land add pressure to the existing sewerage systems. An assessment is required to identify the available capacity within the existing systems, and the potential to upgrade overloaded systems to accommodate future growth. The scale and cost of upgrading works may vary significantly depending upon the location of the development in relation to the network itself and the receiving WwTW.

It may be the case that an existing sewerage system is already working at its full capacity and further investigations have to be carried out to define which solution is necessary to implement an increase in its capacity. New infrastructure may be required if, for example, a site is not served by an existing system. Such new infrastructure will

normally be secured through private third-party agreements between the developer and utility provider.

Sewerage Undertakers must consider the growth in demand for wastewater services when preparing their five-yearly Strategic Business Plans (SBPs) which set out investment for the next Asset Management Plan (AMP) period. Typically, investment is committed to provide new or upgraded sewerage capacity to support allocated growth with a high certainty of being delivered. Additional sewerage capacity to service windfall sites, smaller infill development or to connect a site to the sewerage network across third party land is normally funded via developer contributions, as third-party arrangements between the developer and utility provider.

6.3 Methodology

Severn Trent Water and Welsh Water were provided with the list of preferred sites and strategic sites, along with the proposed capacity and trajectory of each of these sites. Using this information, they were asked to assess each site using the range of datasets they hold.

The following red/amber/green traffic light definition was used to score each site:

Capacity available to serve the proposed growth	Infrastructure and/or treatment work upgrades are required to serve proposed growth, but no significant constraints to the provision of this infrastructure have been identified	Infrastructure and/or treatment upgrades will be required to serve proposed growth. Major constraints have been identified.

Comments were also received on each site or scenario.

A red RAG score given by the water companies reflects the presence of sewer flooding, CSO spills or pollution events in the vicinity of the site, on the assumption that an increase in wastewater flows from development would make those occurrences more likely in the future. It also takes into account the size of the site, with larger sites more likely to exacerbate existing issues in the network.

A red assessment does not reflect a "showstopper" and the water companies have a statutory duty to serve new development under the Water Industry Act 1991 – but they show where the most amount of new infrastructure or network reinforcement will be required.

An amber assessment indicates where further modelling may be required to understand local capacity in the network, and a green assessment indicates that no constraints have been identified.

It should be noted that this assessment does not replace appropriate assessments or modelling as part of developer engagement with the sewerage undertaker, evidence of which should be demonstrated to the LPA as an application progresses through the planning process.

6.4 Data collection

The following datasets were used to assess the sewerage system capacity:

- Locations of preferred and strategic sites in GIS format (provided by SC)
- Site tracker spreadsheet (see Appendix A)
- Wastewater catchments (provided by STW and WW)

6.5 Results

6.6 Drainage and Wastewater Management Plans

Whilst publication of Drainage and Wastewater Management Plans (DWMPs) is not scheduled until 2022/23, STW have published a draft of their initial findings as they start the process[62]. This has been reviewed to report information of relevance to the sewer networks in Shropshire.

The Monkmoor WwTW catchment is the largest treatment works serving growth in the study area, serving a population of 89,719. There are known interactions between Monkmoor WwTW and the River Severn through Shrewsbury, and during times of high river levels, the River Severn can inundate assets, limiting capacity during storm conditions. The DWMP outlines strategic solutions including rationalisation of the 'Shrewsbury Loop' CSO river interactions and accommodation of the sustainable urban extension development to combat this issue and accommodate the proposed growth in the area.

Welsh Water are currently developing their DWMP and will be consulting on proposals once draft plans have been developed. The latest information about the DWMP can be found on their website[63].

6.6.1 Foul sewer network assessment

Table 6.1 summarises the RAG assessments of the foul sewer network by STW and WW for the strategic sites and the preferred options sites (given on a settlement by settlement basis). Note that where there are multiple sites in a settlement, the "worst-case" RAG rating was given to the whole settlement, for example, if Settlement A has 3 sites, 2 with a green RAG rating and 1 with amber, Settlement A would be given an overall RAG rating of Amber. A complete list of assessments and comments on a site-by-site basis can be found in site tracker spreadsheets in Appendix A.

The 60 houses allocation within the community hub of Dudleston Heath does not have any defined sites associated with at this stage, so STW were unable to carry out a full assessment. However, as there is limited capacity in the wastewater network in Dudleston Heath, they have advised an amber rating is appropriate.

Where settlements have been given a RAG of "Not assessed", Severn Trent stated that these are "Small scale development unlikely to have a significant impact on the sewerage network, provided surface water is drained to a sustainable outfall (i.e. watercourse)".

No sites were identified that could not be connected to the public sewer system.

All of the strategic sites were scored red by STW who gave the following comments for each of the sites:

Clive Barracks – "The connection of this development site to the nearby sewerage system is anticipated to have a significant impact and will require upgrades to accommodate additional flows. If a site is given planning approval, we request that the Council and developer work closely with us to incorporate a sustainable solution to manage this risk."

Ironbridge power station – "The development of this site will have a significant impact on the sewerage system in the area if connected without upgrades or the provision of an on-site treatment facility. If this site is given planning permission, we request that the Council and developer work closely with us to incorporate a sustainable solution to manage this risk."

62 A9: Drainage and Wastewater Management Plan 2018, Severn Trent Water (2018). Accessed online at: https://www.stwater.co.uk/content/dam/stw/about_us/pr19-documents/sve_appendix_a9_drainage_and_wastewater_management_plan.pdf on: 02/10/2019

63 Drainage and Wastewater Management Plan, Welsh Water. Accessed online at: https://www.dwrcymru.com/en/My-Wastewater/Drainage-and-Wastewater-Management-Plan.aspx on: 02/10/2019

"Coalport WwTW will treat flows from this development if connected to the existing system. We would rather flows from this development are treated onsite using a passive wetland system given the constraints in the network leading to the WwTWs, the sensitive nature of the surrounding environment and difficult ground conditions. This option is currently being discussed with the developer."

RAF Cosford – "If the expansion of this site requires connection to the sewerage system, significant upgrades will be required to accommodate additional flows at the wastewater treatment works. If this site is likely to need sewerage connection, we request that the Council and developer work closely with us to incorporate a sustainable solution to manage this risk."

The Ministry of Defence have indicated that they are planning to treat their own wastewater on site, however they would not rule out connection to the public sewerage system in the future, but at present have no plans to do so.

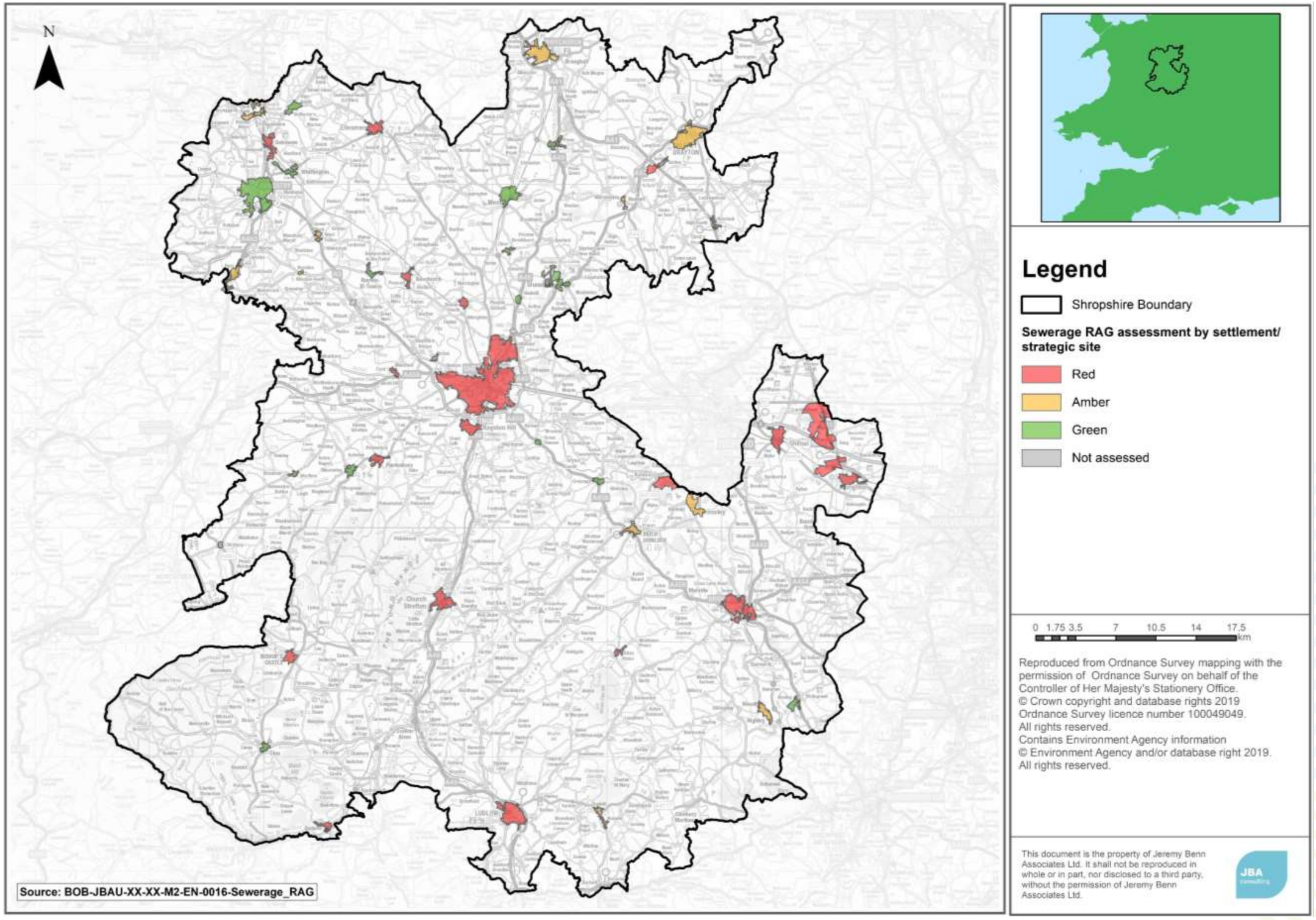
Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented following an application for a connection, adoption, or requisition from a developer. Early developer engagement with water companies is therefore essential to ensure that sewerage capacity can be provided without delaying development.

Table 6.1 Foul sewerage network assessment results

Strategic site	Sewerage undertaker	Overall RAG assessment	Total potential number of houses	Total potential number of employees
RAF Cosford	Severn Trent	Red	682	Unknown
Clive Barracks		Red	750	329
Ironbridge		Red	1,000	343
Settlement	**Sewerage undertaker**	**Overall RAG assessment**	**Total potential number of houses**	**Total potential number of employees**
Albrighton	Severn Trent	Red	180	0
Alveley	Severn Trent	Green	70	0
Baschurch	Severn Trent	Red	55	0
Bayston Hill	Severn Trent	Red	147	0
Bicton	Severn Trent	Not assessed	15	0
Bishop's Castle	Severn Trent	Red	45	0
Bomere Heath	Severn Trent	Red	55	0
Bridgnorth	Severn Trent	Red	1,050	1,566
Bucknell	Severn Trent	Red	20	0
Chirbury	Severn Trent	Not assessed	7	0
Church Stretton	Severn Trent	Red	70	0
Clee Hill	Severn Trent	Amber	20	0
Clive	Severn Trent	Green	20	0
Clun	Severn Trent	Green	20	0
Cressage	Severn Trent	Green	64	0
Cross Houses	Severn Trent	Green	40	0
Ditton Priors	Severn Trent	Red	40	0
Dudleston Heath	Severn Trent	Amber	60	0

Ellesmere	Severn Trent	Amber	170	0
Ford	Severn Trent	Red	75	0
Gobowen	Severn Trent	Red	25	0
Hadnall	Severn Trent	Green	40	0
Highley	Severn Trent	Amber	120	0
Hinstock	Severn Trent	Green	35	0
Hodnet	Severn Trent	Amber	40	0
Knockin	Severn Trent	Amber	25	0
Llanymynech	Severn Trent	Green	50	0
Ludlow	Severn Trent	Red	254	286
Market Drayton	Severn Trent	Amber	435	0
Minsterley	Severn Trent	Green	20	0
Much Wenlock	Severn Trent	Amber	120	0
Oswestry	Severn Trent	Green	30	0
Pant	Severn Trent	Amber	45	0
Park Hall	Severn Trent	Green	260	0
Pontesbury	Severn Trent	Red	40	0
Prees	Severn Trent	Green	35	0
Ruyton XI Towns	Severn Trent	Green	65	0
Shawbury	Severn Trent	Green	80	0
Shifnal	Severn Trent	Red	220	2,180
Shrewsbury	Severn Trent	Red	2,510	7,304
St Martins	Welsh Water	Green	95	0
Wem	Severn Trent	Green	210	0
West Felton	Severn Trent	Amber	60	0
Weston Rhyn	Welsh Water	Amber	100	0
Whitchurch	Welsh Water	Amber	450	0
Whittington	Severn Trent	Green	70	0
Worthen	Severn Trent	Green	45	0

Figure 6.1 Sewerage RAG assessment results



6.7 Conclusions

Development in areas where there is limited wastewater network capacity will increase pressure on the network, increasing the risk of a detrimental impact on existing customers, and increasing the likelihood of CSO operation. Early engagement with developers, Severn Trent Water and Welsh Water is required, and further modelling of the network may be required at the planning application stage. Furthermore, in STW and WW networks, there are areas where the current network is a combined sewer system, and further separation of foul and surface water may be required, as well as suitably design SuDS.

The results in section 6.6.1 show that in order to serve the proposed growth in a number of settlements in Shropshire, wastewater infrastructure and/or treatment upgrades would be required. Early engagement between developers, Shropshire Council and STW and WW is recommended to allow time for the strategic infrastructure required to serve these developments to be planned.

No sites were identified that would not be connecting to the public sewer, although local treatment is being considered for the Ironbridge power station site.

6.8 Recommendations

Table 6.2 Recommendations from wastewater network assessment

Action	Responsibility	Timescale
Early engagement between the SC and STW and WW is required to ensure that where strategic infrastructure is required, it can be planned in by STW/WW.	SC STW WW	Ongoing
Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	SC STW WW	Ongoing
Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline Drainage Strategy for sites. The Outline Drainage strategy should set out the following: What – What is required to serve the site Where – Where are the assets / upgrades to be located When – When are the assets to be delivered (phasing) Which – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	STW, WW and Developers	Ongoing
Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to surface water sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA.	Developers LLFA	Ongoing

7 Wastewater Treatment

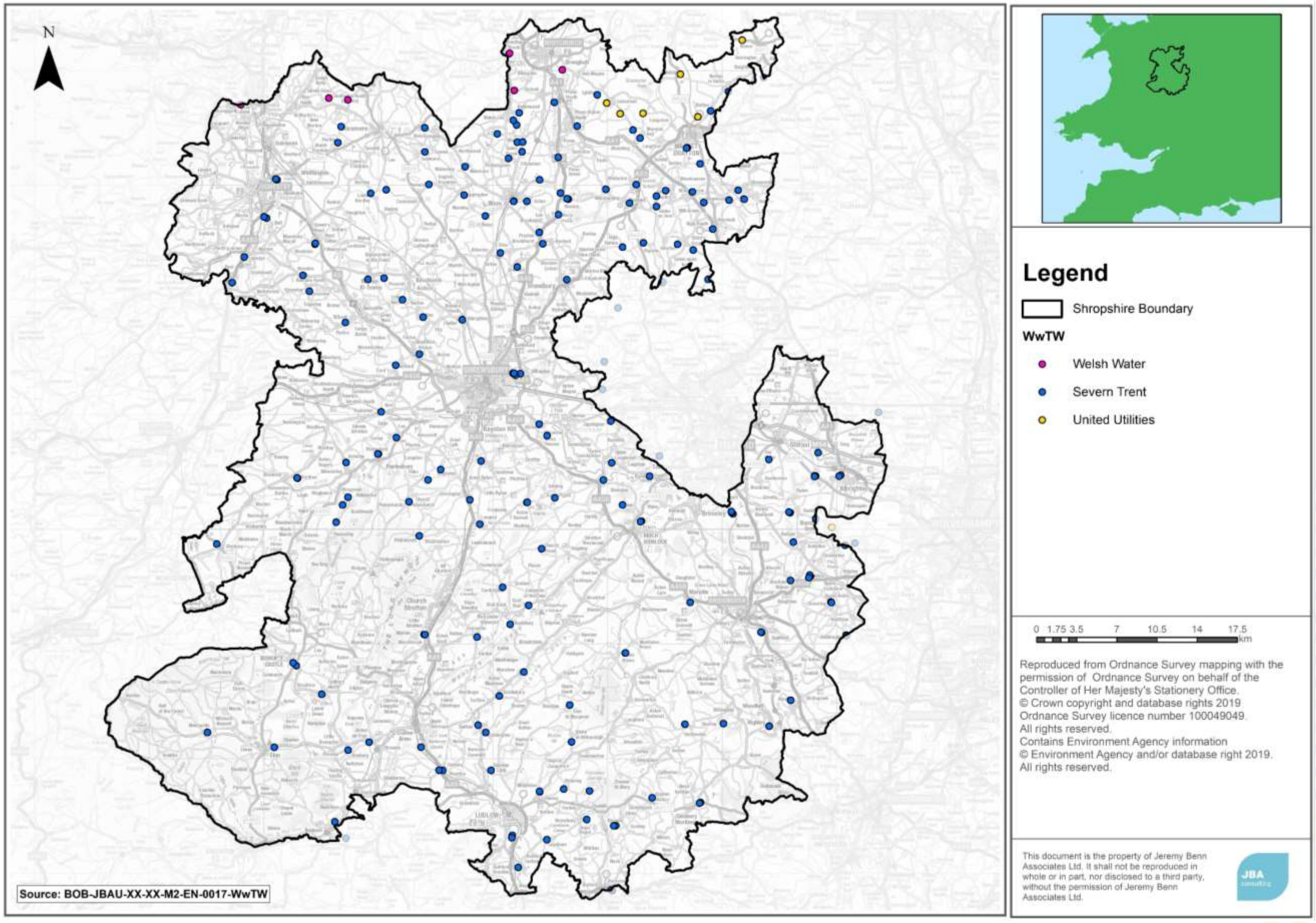
7.1 Wastewater Treatment Works in Shropshire

Severn Trent Water, United Utilities and Welsh Water all operate WwTW within Shropshire; however, it is only Welsh Water and Severn Trent Water that operate WwTW serving the preferred options and strategic sites. There are a number of WwTW outside of the Shropshire boundary which serve growth within the study area including Coalport, Five Fords and Tenbury WwTWs.

The location of the WwTWs in and around Shropshire are shown in Figure 7.1 below.

Each preferred option site, strategic site, completion, commitment and windfall allowance was assigned to a WwTW using the sewerage drainage area boundary to assess the impact that the proposed growth would have on flows at each WwTW. Due to the majority of Shropshire being rural, a number of the committed and completed sites did not fall within the catchment boundary of any WwTW. These sites were small-scale, for one or two dwellings and were widespread throughout the study area and so would be very unlikely to significantly impact any discharge flows from WwTW. Very small developments in rural areas may be suitable for on-site treatment and discharge, however the Environment Agency will not usually permit this where there is a public sewerage system within a distance calculated as 30m per dwelling.

Figure 7.1 Location of WwTWs in and around Shropshire



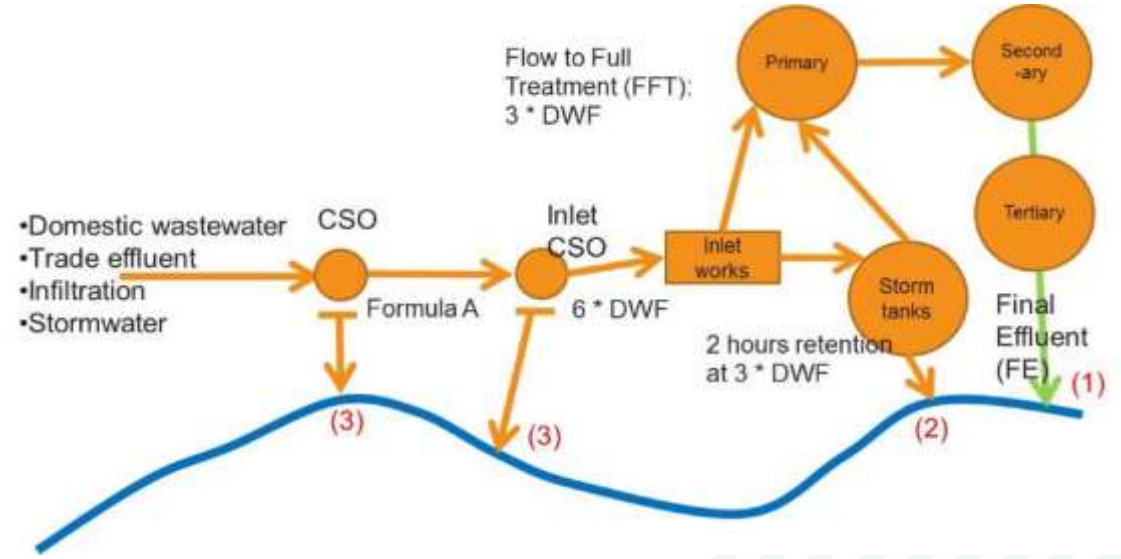
7.2 Wastewater Treatment Works Flow Permit Assessment

7.2.1 Introduction

The Environment Agency is responsible for regulating sewage discharge releases via a system of Environmental Permits (EPs). Monitoring for compliance with these permits is the responsibility of both the EA and the plant operators. Figure 7.2 summarises the different types of wastewater releases that might take place, although precise details vary from works to works depending on the design.

During dry weather, the final effluent from the Wastewater Treatment Works (WwTW) should be the only discharge (1). With rainfall, the storm tanks fill and eventually start discharging to the watercourse (2) and Combined Sewer Overflows (CSOs) upstream of the storm tanks start to operate (3). The discharge of storm sewage from treatment works is allowed only under conditions of heavy rain or snow melt, and therefore the flow capacity of treatment systems is required to be sufficient to treat all flows arising in dry weather and the increased flow from smaller rainfall events. After rainfall, storm tanks should be emptied back to full treatment, freeing their capacity for the next rainfall event.

Figure 7.2 Overview of typical combined sewerage system and WwTW discharges



Environmental permits are used alongside water quality limits as a means of controlling the pollutant load discharged from a water recycling centre to a receiving watercourse. Sewage flow rates must be monitored for all WwTWs where the permitted discharge rate is greater than 50 m^3/day in dry weather.

Permitted discharges are based on a statistic known as the Dry Weather Flow (DWF). As well as being used in the setting and enforcement of effluent discharge permits, the DWF is used for WwTW design, as a means of estimating the 'base flow' in sewerage modelling and for determining the flow at which discharges to storm tanks will be permitted by the permit (Flow to Full Treatment, FFT).

WwTW Environmental Permits also consent for maximum concentrations of pollutants, in most cases Suspended Solids (SS), Biochemical Oxygen Demand (BOD) and Ammonia (NH4). Some works (usually the larger works) also have permits for Phosphorous (P). These are determined by the Environment Agency with the objective of ensuring that the receiving watercourse is not prevented from meeting its environmental objectives, with specific regard to the Chemical Status element of the Water Framework Directive (WFD) classification.

Increased domestic population and/or employment activity can lead to increased wastewater flows arriving at a WwTW. Where there is insufficient headroom at the works to treat these flows, this could lead to failures in flow consents.

7.3 Methodology

Severn Trent and Welsh Water were provided with the proposed sites and the potential housing numbers and employment space for each site (see Appendix A). STW and WW were then invited to provide an assessment of the receiving WwTW and provide any additional comments about the impacts of development.

The assessment consists of two factors, the hydraulic capacity of the WwTW (consented flow vs current flow) and the capacity of the WwTW to treat a given load. The assessment may also reflect upgrades already planned at WwTW.

The following red/amber/green traffic light definition was used by Welsh Water to score each WwTW:

Capacity available to serve the proposed growth	Infrastructure and/or treatment upgrades will be required to serve proposed growth, but no significant constraints to the provision of this infrastructure have been identified	Infrastructure and/or treatment upgrades will be required to serve proposed growth. Major constraints have been identified.

The following definition was used by Severn Trent Water to score each WwTW:

Hydraulic capacity likely available at 2045	Uncertain sites with no measured flow data or sites with flow data available with <15% overcapacity at 2045	Hydraulic capacity unavailable at 2020 and/or >15% overcapacity at 2045 (with flow data available)	High risk as DWF cannot be increased without mitigation (ref: River Clun SAC Nutrient Management Plan)

A parallel assessment of WwTW capacity was carried out by JBA using measured flow data supplied by the water companies. The process was as follows:

- WW provided their Dry Weather Flow (DWF) statistics, and from this the 20th percentile (80% exceedance flow) for 2015-2018 was calculated. The flow data was cleaned to remove zero values and low outlier values which would bring the measured DWF down.
- STW provided their calculated 20th percentile (80% exceedance flow) statistic for each WwTW.
- Preferred options sites, strategic sites, windfall and existing commitments were assigned to a WwTW using the sewerage drainage area boundaries.
- For each site, the future DWF was calculated using the occupancy rates and per-capita consumption values obtained from the Water Resource Management Plans (Table 7.1), and the assumption that 95% of water used is returned to sewer. Permitted headroom was used as a substitute for actual designed hydraulic capacity for each WwTW being assessed.

Table 7.1 Per capita consumption values used in water demand calculations

Water Company	Water Resource Zone	Occupancy rate (persons per dwelling)	Per capita consumption (m3/person/day)
Severn Trent	Stafford	2.3	0.115
	Strategic Grid	2.2	0.121
	Wolverhampton	2.1	0.120
	North Staffs	2.2	0.112
	Shelton	2.2	0.116
	Bishops Castle	2.2	0.128
	Kinsall	2.3	0.129
	Mardy	2.3	0.123
	Ruyton	2.7	0.129
	Whitchurch and Wem	2.2	0.124

7.4 Results

Severn Trent provided assessments for all WwTW serving any growth, however this study is only concerned with growth at WwTW which could serve the preferred options, strategic sites or windfall sites and therefore only these WwTW have been presented in Table 7.2. The full assessments for WwTW serving only completions and commitments can be found in Appendix A Site tracker. Individual graphs for each WwTW showing the additional DWF from JBAs assessment of WwTW capacity is contained in Appendix B, and a map of the WwTW RAG results is shown in Figure 7.3.

Table 7.2 Summary of WwTW flow assessment

WwTW	Areas served by WwTW	Proposed growth over Local Plan period*	RAG	Sewerage company comments	Does DWF flow exceed permitted flow before 2045? (JBA assessment)
Albrighton	Albrighton, Tong, Tong Norton	4,181 houses 220,000m^2 employment space	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes between 2025 and 2030
Alveley	Alveley	126 houses	Green		No
Baschurch	Baschurch, Little Ness, Yeaton, Walford, Walford Heath, Prescott, Myddle, Harmer Hill, Stanwardine in the Fields, Westoncommon, Westonwharf, Weston Lullingfields, Petton, Burlton, Cockshutt	437 houses	Amber		Yes – reaches maximum permitted DWF around 2035
Bishops Castle	Bishops Castle	136 houses 10,400m^2 employment space	Black	AMP7 quality upgrade scheme planned - may address some capacity pressures. Site subject to nutrient management plan - any growth above DWF would require mitigation of increased phosphorus loads.	Yes – reaches maximum permitted DWF around 2035
Bomere Heath	Bomere Heath	116 houses	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No
Bridgnorth – Slads	Bridgnorth, Stanmore, Eardington	1,695 houses 142,400m^2 employment space	Amber	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes between 2025 and 2030
Brompton-Cross Houses	Brompton, Cross Houses	91 houses	Green		No
Bucknell	Bucknell, Bedstone	100 houses 5,600m^2 employment space	Green	Site subject to nutrient management plan - any growth above DWF would require mitigation of increased phosphorus loads.	No

WwTW	Areas served by WwTW	Proposed growth over Local Plan period*	RAG	Sewerage company comments	Does DWF flow exceed permitted flow before 2045? (JBA assessment)
Chirbury	Chirbury	46 houses	Amber	No flow monitoring – observed 80%ile is theoretical	Yes – already exceeding maximum permitted, however observed flow is theoretical
Church Stretton	Church Stretton, Little Stretton, All Stretton, Hope Bowlder	217 houses 13,200m^2 employment space	Green		No
Cleobury Mortimer	Cleobury Mortimer	204 houses 6,000m^2 employment space	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – already exceeding maximum permitted
Clive	Clive, Grinshill, Yorton	43 houses	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No
Clun	Clun	92 houses	Green	Site subject to nutrient management plan - any growth above DWF would require mitigation of increased phosphorus loads.	No
Coalport	Broseley	7,782 houses 273,514m^2 employment space	Amber	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – between 2020 and 2025
Coreley – Clee Hill	Cleehill, Knowle, Brookrow, Hints	82 houses	Red		Yes
Craven Arms	Craven Arms, Stokesay, The Grove, Winstanstow	472 houses 56,000m^2 employment space	Green		No
Cressage	Cressage	79 houses	Green		No
Ditton Priors	Ditton Priors	67 houses	Red		Yes – already exceeding maximum permitted
Dorrington	Dorrington	145 houses	Green		No
Drenewydd – Oswestry	Babbinswood, Whittington, Park Hall, Twmpath, Gobowen, Rhewl	845 houses 8,000m^2 employment space	Green	AMP6 quality upgrade scheme planned - may address some capacity pressures.	No

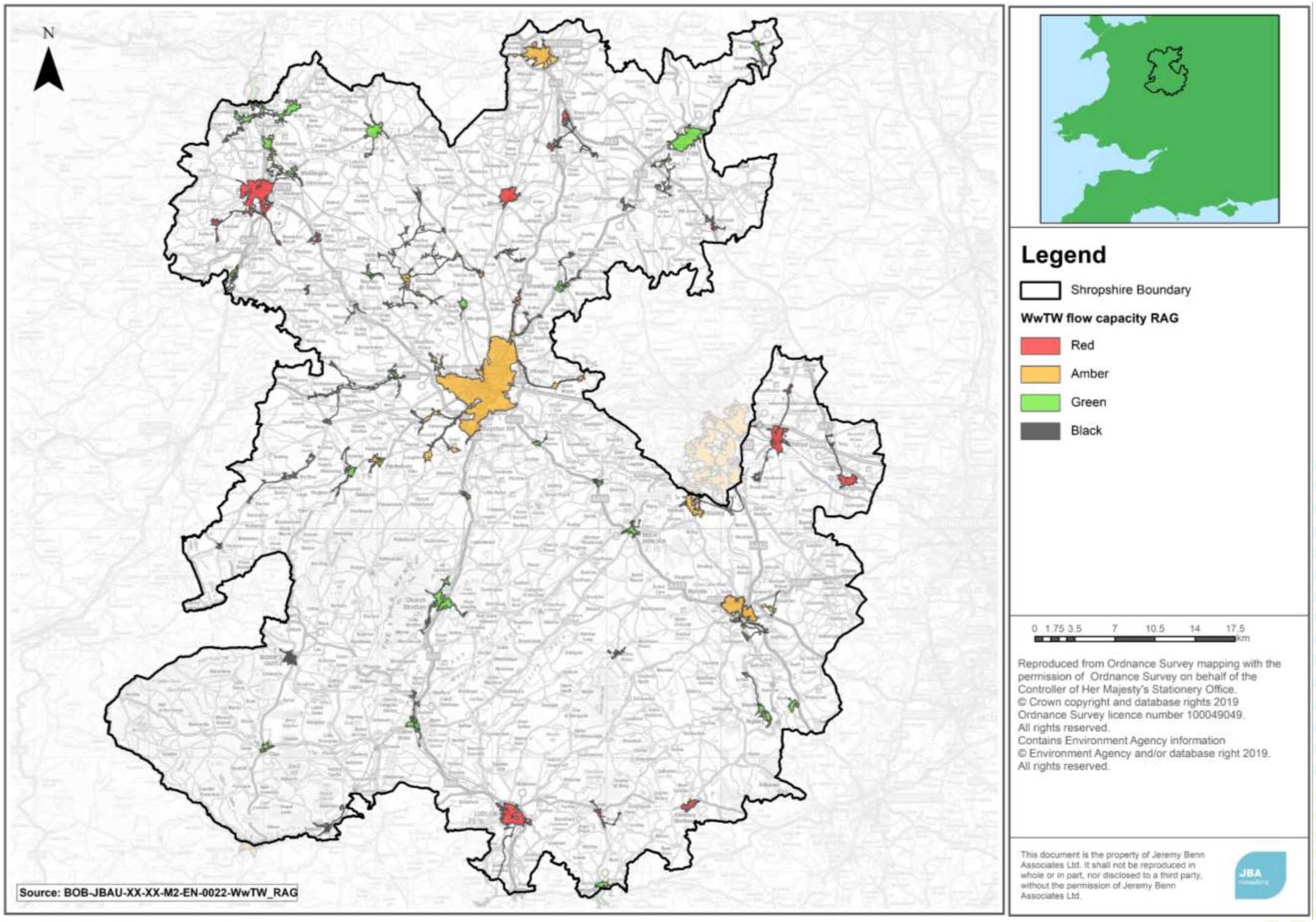
WwTW	Areas served by WwTW	Proposed growth over Local Plan period*	RAG	Sewerage company comments	Does DWF flow exceed permitted flow before 2045? (JBA assessment)
Dudleston Heath	Dudleston Heath	100	Amber	AMP6 quality upgrade scheme planned - may address some capacity pressures.	Yes – reaches maximum permitted DWF around 2035
Ellesmere	Ellesmere, Tetchill	811 houses 36,800m^2 employment space	Green	AMP6 quality upgrade scheme planned - may address some capacity pressures.	No
Five Fords	Weston Rhyn, Rhoswiel, Chirk Bank, St Martins, Ifton Heath, Preesgweene, Wern, Selattyn	586 houses	Green	There is capacity available at Five Fords WwTW	No
Ford	Ford, Shoot Hill, Cardeston, Albebury, Rowton, Westbury, Halfway House, Wattlesborough Heath	186 houses	Green		No
Higher Heath-Prees	Prees, Fauls, Darliston, Prees Higher Heath	339 houses	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – already exceeding permitted flow
Highley	Highley, Wood Hill, Chelmarsh	201 houses 4,000m^2 employment space	Green		No
Hinstock	Hinstock	157 houses	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – already exceeding permitted flow
Hodnet	Hodnet	110 houses	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No
Kinnerley	Kinnerley	63 houses	Green		No
Knockin	Knockin	55 houses	Amber	No flow monitoring – observed 80%ile is theoretical	No
Ludlow	Ludlow, Sheet	1,136 houses	Red		Yes – already exceeding permitted flow

WwTW	Areas served by WwTW	Proposed growth over Local Plan period*	RAG	Sewerage company comments	Does DWF flow exceed permitted flow before 2045? (JBA assessment)
		44,000m^2 employment space			
Market Drayton	Market Drayton	1,006 houses 48,000m^2 employment space	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No
Mile Oak	Oswestry, Morda, Weston, Trefonen, Treflach, Maesbury Marsh	1,822 houses 148,000m^2 employment space	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – already exceeding permitted flow
Minsterley	Minsterley, Ploxgreen, Ladyoak, Wagbeach, Horsebridge, Asterley	141 houses 560m^2 employment space	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No
Monkmoor	Shrewsbury, Bayston Hill, Longden, Lyth Bank, Hanwood, Calcott, Bicton, Hadnall, Astley, Bings Heath, Uffington, Upton Magna, Withington	8,145 houses 604,520m^2 employment space	Amber	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Reaching capacity after 2035
Much Wenlock	Much Wenlock	190 houses 4,400m^2 employment space	Green		No
Nesscliffe – Wilcot	Nesscliffe, Wilcott	155 houses	Green		No
Pant-Plas Cerrig	Pant, Llanymynech	269 houses	Green		Yes – after 2035
Pontesbury	Pontesbury, Polesgate	178 houses	Amber	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes around 2034
Ruyton XI Towns	Ruyton-XI-Towns	116 houses	Green		No

WwTW	Areas served by WwTW	Proposed growth over Local Plan period*	RAG	Sewerage company comments	Does DWF flow exceed permitted flow before 2045? (JBA assessment)
Shawbury	Shawbury, Moreton Corbet, Stanton upon Hine Heath, The Groves, Edgebolton	196 houses	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No
Shifnal	Shifnal, Sheriffhales, Kemberton	1,914 houses 160,600m^2 employment space	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – already exceeding permitted flow
Stoke Heath	Ternhill	820 houses 23,000m^2 employment space	Amber	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Reaching capacity at 2045
Tenbury	Burford	167 houses	Green		No
Wem – Aston Road	Wem	534 houses 24,000m^2 employment space	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – before 2020
West Felton	West Felton	112 houses	Red	AMP7 quality upgrade scheme planned - may address some capacity pressures.	Yes – before 2020
Whitchurch	Whitchurch	1,532 houses 78,000m^2 employment space	Amber	A scheme to deliver improvements at Whitchurch WwTW is to be undertaken in the investment period AMP7 (2020-2025)	Yes – around 2020
Woore	Woore, Dorrington, Pipe Gate, Ireland's Cross	91 houses	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No
Worthen	Worthen, Brockton, Aston Pigott, Aston Rogers, Binweston, Marton	63 houses	Green	AMP7 quality upgrade scheme planned - may address some capacity pressures.	No

*includes preferred options, strategic sites, commitments, recent completions, windfall and neighbouring authority growth

Figure 7.3 WwTW flow capacity RAG results



7.5 Conclusions

A number of WwTWs are likely to exceed the maximum permitted DWF over the Local Plan period with the proposed growth in Shropshire., however at many of these WwTW, upgrades are currently planned which may alleviate some capacity issues. Early engagement between the Council and Severn Trent and Welsh Water is required to ensure that opportunities to accommodate this growth within existing upgrade schemes can be realised.

Severn Trent provided the following comments for treatment works that are likely to exceed the maximum DWF flow with the proposed growth but where no upgrade schemes are planned:

"It is our obligation to comply with permits to discharge. If the permit is breached as a consequence of growth within the sewerage catchment then we are obliged to remedy the situation using our own resources. The calculation of the exact spare capacity available at a sewage treatment works is not an exact science as there are numerous variables which need to be considered, therefore we monitor this position on an annual basis. Where development results in dry weather flows exceeding the current discharge permit, or we feel it is appropriate to increase capacity in advance of growth arriving, we will need to negotiate new consent parameters with the Environment Agency and provide additional treatment capacity as required. The outcome of this review can be anywhere from there already being capacity available at the works to the new permit parameters not being technically achievable. The result would be dependent on a combination of the state of the waterbody and the performance of and assets available at the treatment works as well as how much growth is modelled."

7.6 Recommendations

Table 7.3 Recommendations for wastewater treatment

Action	Responsibility	Timescale
Early engagement with STW and WW is required to ensure that provision of WwTW capacity is aligned with delivery of development.	SC STW, WW	Ongoing
Provide Annual Monitoring Reports to STW and WW detailing projected housing growth.	SC	Ongoing
STW and WW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	STW, WW SC	Ongoing

8 Odour Assessment

8.1 Introduction

Where new developments encroach upon an existing Wastewater Treatment Works (WwTW), odour from that site may become a cause for nuisance and complaints from residents. Managing odour at WwTWs can add considerable capital and operational costs, particularly when retro fitted to existing WwTWs. National Planning Policy Guidance recommends that plan-makers consider whether new development is appropriate near to sites used (or proposed) for water and wastewater infrastructure, due to the risk of odour nuisance.

8.2 Methodology

Sewerage undertakers recommend that an odour assessment may be required if the site of a proposed development is close to a WwTW and is encroaching closer to the WwTW than existing urban areas. The closest WwTW to each site is determined, along with the distance and direction of the WwTW to that site. The actual odour experienced is dependent on the size of the works, the type of treatment processes present, and the age and condition of the site. There is also significant variation due to current weather conditions.

To take into account the size of the works, the dry weather flow (DWF) was used to calculate an approximate population served by each WwTW and this was used to assign a "trigger" distance. Where the distance between the site and the WwTW is less than the trigger distance, an odour assessment is recommended. The trigger distances used are outlined in Table 8.1.

Table 8.1 Trigger distance assignment

Population served by WwTW	Trigger distance (m)
0-1,000	0
1,001-2,500	50
2,501-5,000	100
5,001-10,000	150
10,001-50,000	300
50,001-100,000	400
>100,000	800

Another important aspect is the location of the site in respect to the WwTW. Historic wind direction records for sites around Shropshire indicate that the prevailing wind is from west south-west (Shawbury) to west (Cosford Royal Air Force base) recorded at METAR weather stations[64].

A red/amber/green assessment was applied by JBA:

Site is unlikely to be impacted by odour from WwTW	Site location is such that an odour impact assessment is recommended	Site is in an area with confirmed WwTW odour issues

8.3 Data Collection

The datasets used to assess the impact of odour from a WwTW were:

- Site location in GIS format (provided by SC)
- WwTW locations (from "Consented discharges to controlled waters with conditions" database)
- Site tracker spreadsheet (see Appendix A)

64 RenSMART website http://www.rensmart.com/Weather/WindArchive#monthlyLayer accessed on: 04/09/2019

8.4 Results

There is one potential preferred option site (SHR166) that may require an odour assessment, and this is shown in Table 8.2. None of the strategic sites would require an odour assessment.

Table 8.2 Site with potential risk of nuisance odour

WwTW	Site Ref.	Settlement	Distance from WwTW (m)	Direction to WwTW	Encroaches closer than existing urban area (Y/N)
Monkmoor	SHR166	Shrewsbury	191	NNW	N

8.5 Conclusions

SHR166 is the only site identified as being at risk of nuisance odour and given a RAG rating of amber due to its proximity to Monkmoor WwTW. An odour assessment is recommended as part of the planning process, paid for by developers. The remaining sites have been given a rating of green.

8.6 Recommendations

Table 8.3 Recommendations from the odour assessment

Action	Responsibility	Timescale
Consider odour risk for those sites identified to be potentially at risk from nuisance odour	SC	Ongoing
Carry out an odour assessment for SHR166 at the planning application stage.	Site Developers	Ongoing

9 Water Quality

9.1 Introduction

An increase in the discharge of effluent from Wastewater Treatment Works (WwTW) as a result of development and growth in the area in which they serve can lead to a negative impact on the quality of the receiving watercourse. Under the Water Framework Directive (WFD), a watercourse is not allowed to deteriorate from its current WFD classification (either as an overall watercourse or for individual elements assessed).

It is Environment Agency (EA) policy to model the impact of increasing effluent volumes on the receiving watercourses. Where the scale of development is such that a deterioration is predicted, a variation to the Environmental Permit (EP) may be required for the WwTW to improve the quality of the final effluent, so that the increased pollution load will not result in a deterioration in the water quality of the watercourse. This is known as "no deterioration" or "load standstill". The need to meet river quality targets is also taken into consideration when setting or varying a permit.

The Environment Agency operational instructions on water quality planning and no-deterioration are currently being reviewed. Previous operational instructions[65] (now withdrawn) set out a hierarchy for how the no-deterioration requirements of the WFD should be implemented on inland waters. The potential impact of development should be assessed in relation to the following objectives:

- **Could the development cause a greater than 10% deterioration in water quality?** This objective is to ensure that all the environmental capacity is not taken up by one stage of development and there is sufficient capacity for future growth.
- **Could the development cause a deterioration in WFD class of any element assessed?** This is a requirement of the Water Framework Directive to prevent a deterioration in class of individual contaminants. The "Weser Ruling"[66] by the European Court of Justice in 2015 specified that individual projects should not be permitted where they may cause a deterioration of the status of a water body. If a water body is already at the lowest status ("bad"), any impairment of a quality element was considered to be a deterioration. Emerging practice is that a 3% limit of deterioration is applied.
- **Could the development alone prevent the receiving watercourse from reaching Good Ecological Status (GES) or Potential?** Is GES possible with current technology or is GES technically possible after development with any potential WwTW upgrades.

The overall WFD classification of a water body is based on a wide range of ecological and chemical classifications. This assessment focuses on three physico-chemical quality elements; Biochemical Oxygen Demand (BOD), Ammonia, and Phosphate.

BOD – Biochemical Oxygen Demand

BOD is a measure of how much organic material – sewage, sewage effluent or industrial effluent – is present in a river. It is defined as the amount of oxygen taken up by micro-organisms (principally bacteria) in decomposing the organic material in a water sample stored in darkness for 5 days at 20°C. Water with a high BOD has a low level of dissolved oxygen. A low oxygen content can have an adverse impact on aquatic life.

Ammonia

Nitrogen is an essential nutrient required by all plants and animals for the formation of amino acids. In its molecular form nitrogen cannot be used by most aquatic plants, and

65 Water Quality Planning: no deterioration and the Water Framework Directive, Environment Agency (2012). Accessed online at: http://www.fwr.org/WQreg/Appendices/No_deterioration_and_the_WFD_50_12.pdf on: 28/09/2019
66 PRESS RELEASE No 74/15, European Court of Justice (2015). Accessed online at: https://curia.europa.eu/jcms/upload/docs/application/pdf/2015-07/cp150074en.pdf on: 28/09/2019

so it is converted into other forms. One such form is ammonia (NH_3). This may then be oxidized by bacteria into nitrate (NO_3) or nitrite (NO_2). Ammonia may be present in water in either the unionized form NH_3 or the ionized form NH_4. Taken together these forms care called Total Ammonia Nitrogen.

Although ammonia is a nutrient, in high concentrations it can be toxic to aquatic life, in particular fish, affecting hatching and growth rates.

The main sources in rivers include agricultural sources, (fertilizer and livestock waste), residential sources (ammonia containing cleaning products and septic tank leakages), industrial processes and wastewater treatment works.

Phosphate

Phosphorus is a plant nutrient and elevated concentrations in rivers can lead to accelerated plant growth of algae and other plants. Its impact on the composition and abundance of plant species can have adverse implications for other aspects of water quality, such as oxygen levels. These changes can cause undesirable disturbances to other aquatic life such as invertebrates and fish.

Phosphorus (P) occurs in rivers mainly as Phosphate (PO_4), which are divided into Orthophosphates (reactive phosphates), and organic Phosphates.

Orthophosphates are the main constituent in fertilizers used in agriculture and domestic gardens and provide a good estimation of the amount of phosphorus available for algae and plant growth and is the form of phosphorus that is most readily utilized by plants.

Organic phosphates are formed primarily by biological processes and enter sewage via human waste and food residues. Organic phosphates can be formed from orthophosphates in biological treatment processes or by receiving water biota.

Although it is phosphorus in the form of phosphates that is measured as a pollutant, the term phosphorus is often used in water quality work to represent the total phosphorus containing pollutants.

9.2 Methodology

9.2.1 General Approach

SIMCAT is used by the Environment Agency to model potential deterioration of waterbodies and to support decision making to guide development to locations where environmental deterioration will be reduced. SIMCAT is a 1D stochastic, steady state, deterministic model which represents inputs from point-score effluent discharges and the behaviour of solutes in the river.[67]

SIMCAT can simulate inputs of discharge and water quality data and statistically distribute them from multiple effluent sources along the river reach. It uses the Monte Carlo method for distribution that randomly models up to 2,500 boundary conditions. The simulation calculates the resultant water quality as the calculations cascade further downstream.

Once the distribution results have been produced, an assessment can be undertaken on the predicted mean and ninety percentile concentrations or loads.

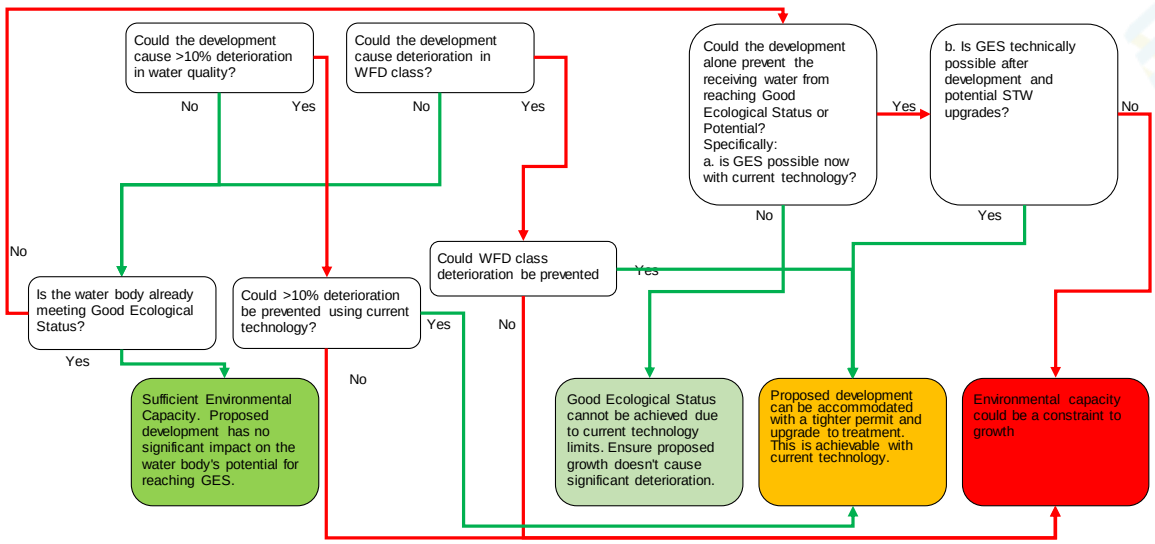
In the north of Shropshire, WwTWs operated by Welsh Water discharge into the River Dee catchment. Due to the limited number of WwTWs, and the relative size of the Dee catchment it was decided to carry out a single site assessment using the Environment Agency's River Quality Planning (RQP) tool, which also uses a Monte Carlo method approach.

67 Cox. B. A. (2003) A Review of Currently Available in-Stream Water-quality models their applicability for simulating dissolved oxygen in lowland rivers. The Science of the Total Environment. 314 -316, 355 -377. Elsevier

In each case the determinands that were modelled were Biochemical Oxygen Demand (BOD), Ammonia (NH_4) and Phosphorus (P).

The methodology followed in summarised in Figure 9.1 below.

Figure 9.1 water quality impact assessment following EA guidance



Where modelling indicated growth may lead to a deterioration in the watercourse, or where the watercourse is not currently meeting at least a 'Good' class for each determinand, the models were used to test whether this could be addressed by applying stricter discharge concentrations. In such cases, a Technically Achievable Limit (TAL) was considered.

The EA advised that the following permit values are achievable using treatment at TAL, and that these values should be used for modelling all WwTW potential capacity irrespective of the existing treatment technology and size of the works:

- Ammonia (90%ile): 1 mg/l
- BOD (90%ile): 5 mg/l
- Phosphorus (mean): 0.25 mg/l

This assessment did not take into consideration whether it is feasible to upgrade each existing WwTW to TAL due to constraints of costs, timing, space, carbon costs etc.

9.3 Data Sets

The datasets used to assess the water quality impact were as follows:

- Water quality, river and effluent flow data from within the Environment Agency SIMCAT model
- Current effluent flow data from Severn Trent Water
- Future wastewater demand calculated from site information provided by Shropshire Council and a mean occupancy rate and per capita consumption provided by Severn Trent Water
- Current reach specific WFD class limits for each contaminant
- TAL limits for each contaminant

9.4 SIMCAT Modelling approach

The Existing SIMCAT models developed by the Environment Agency were supplied for the River Severn catchment; one modelling Ammonia and BOD, the other modelling Phosphorous. The models were understood to have been largely based on observed flow and quality data for the period 2010 to 2012. A widespread update of the models, and

the resultant recalibration were not within scope of this project. It was therefore decided to update just the effluent flow and quality statistics at WwTWs receiving growth in the study area.

Many of the WwTWs in the study area already had upgrades planned in AMP6 and AMP7, which would be expected to improve water quality at those locations. These were therefore factored into the model.

The two models were run as received from the Environment Agency to set a baseline and ensure the models were working appropriately. A complete update of the two SIMCAT models and subsequent recalibration were not within scope of the project, and so a limited update was carried out. Consequently, the modelling work presented should be used to identify areas at risk of water quality deterioration, but not for permit setting. Flow data from the last three years for each WwTW in the study area was supplied by STW and WW and used to update the model. The updated models were then run as a 2018 baseline.

Additional effluent flow from growth during the Local Plan period was added to current flow at WwTWs receiving growth and the model re-run as a future scenario.

In order to assess whether a deterioration in WFD class would be predicted, targets for BOD, Ammonia and Phosphate were provided by the EA.

Where treatment at TAL and reductions in diffuse sources in the present day could improve water quality to meet Good class, it is important to understand whether this could be compromised as a result of future growth within the catchment.

Guidance from the EA suggests breaking this down in to two questions:

a) Is GES possible now with current technology?

b) Is GES technically possible after development and any potential WwTW upgrades?

If the answer to questions a) and b) are both 'Yes' or 'No' then the development can be assessed as having no significant impact on the water bodies potential for reaching GES. However, if the answer to a) is 'Yes' and the answer for b) is 'No' then development is having a significant impact.

Run type 9 within SIMCAT was then used which assumes that upstream flow each treatment works is at good ecological status. The permit value required to achieve GES is then calculated by the model.

In some cases, the effluent quality was expressed in the model as a load (mg) rather than a concentration (mg/l). This prevented run type 9 producing a result in these locations.

9.4.1 RQP modelling approach

The RQP tool was used to assess Five Fords and Whitchurch WwTWs that lie within the River Dee catchment. Flow data for these WwTW was provided by WW, and water quality data was provided by Natural Resources Wales. River flow was estimated using Low Flows 2[68].

In the case of Five Fords WwTW there was no upstream water quality sampling point so upstream water quality was assumed to be at the midpoint of good ecological status.

Reach specific targets for phosphate were not available and so targets from an appropriate nearby catchment were used (Roden – source to conf unnamed trib).

68 Low Flows 2 Software developed by WHS - https://www.hydrosolutions.co.uk/software/lowflows2/

9.5 Results

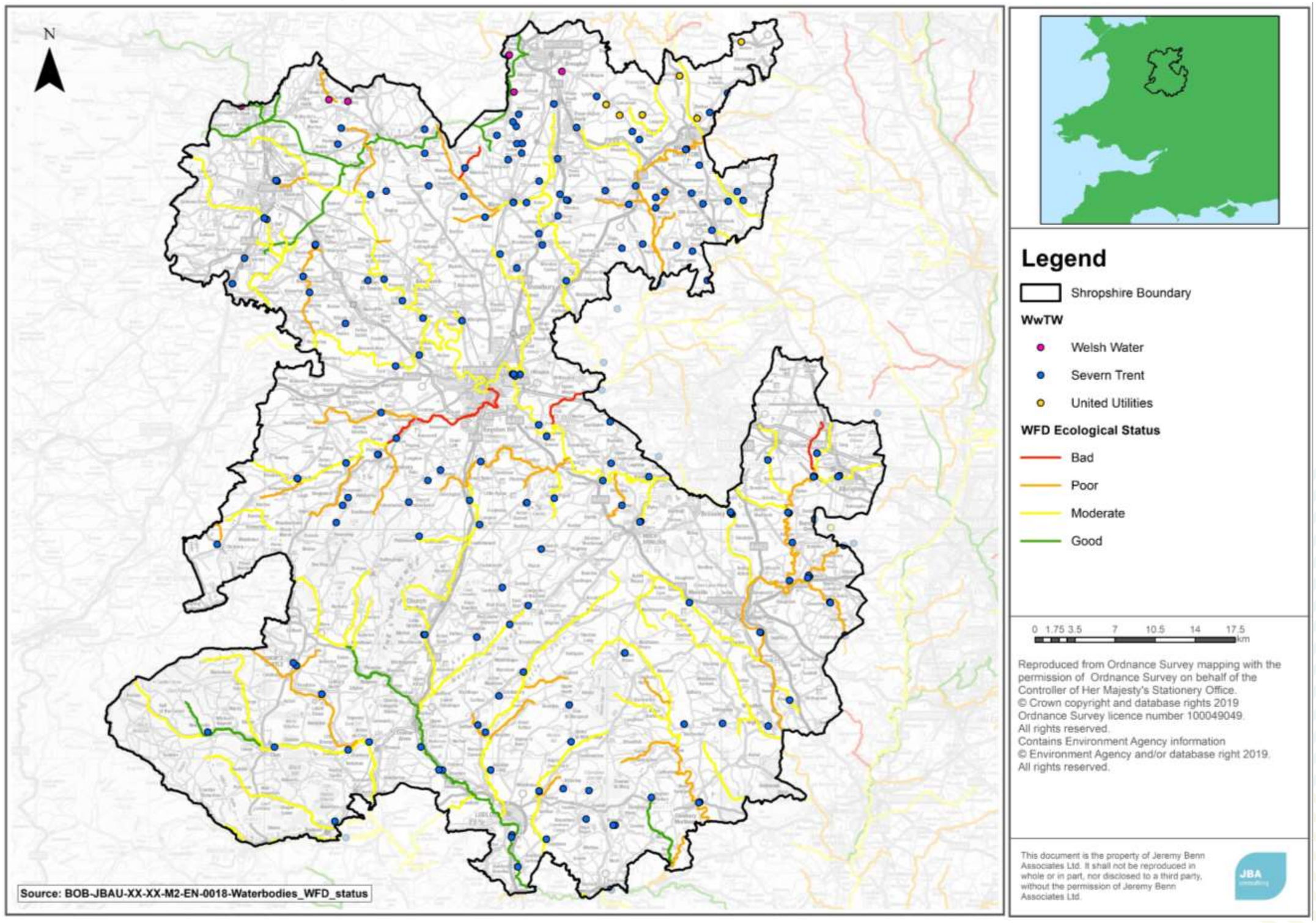
9.5.1 Water Framework Directive Overview

Figure 9.2 shows the Cycle 2 Water Framework Directive overall waterbody classifications for watercourses in the study area, and the location of all WwTW in Shropshire. The majority of the waterbodies have a moderate or poor ecological status, and in all of the waterbodies that contain a WwTW serving growth, sewage discharge was cited as one of the "reasons for not achieving good status". The exceptions to this are the River Onny (River East Onny to River Teme), Folly Brook, River Clun (Folly Brook to River Unk), River Teme and the Mill Brook, which are currently achieving a good ecological status. There are also a number of waterbodies which have a bad ecological status, the Rea Brook (Pontesford Brook to River Severn), Burlington Brook, River Tern (River Roden to River Severn) and a tributary of the River Roden. Also contributing to the good status not being achieved are diffuse sources of phosphate from agriculture (livestock and poor nutrient management), and in some cases from urban and transport sources. The RBMP for the River Severn[69] estimates that pollution from wastewater affects 29% of water bodies within this river basin district.

Where waterbodies have designated sites such as Special Areas of Conservation or SSSIs, they may have additional water quality targets aimed at achieved favourable condition for that site. These may be more stringent than the WFD target.

69 Severn river basin district River basin management plan (LIT 10315), Environment Agency (2015). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718336/Severn_RBD_Part_1_river_basin_management_plan.pdf on: 28/10/2019

Figure 9.2 WFD status of waterbodies in Shropshire



9.6 Summary of Modelling Results

Table 9.2 below summarises the results of the water quality assessments that have been performed in the study area. Only those WwTWs where an issue was identified (either a deterioration of greater than 10%, a deterioration in class, or a prevention of good ecological status being achieved in the future are shown. Table 9.3 lists the remaining WwTWs where modelling did not identify an issue. All other WwTWs modelled in the study area had the required environmental capacity to support growth. The exception to these is the WwTWs in the Clun catchment. The modelling shows a less than 10% deterioration, however the presence of the SAC at the downstream end of the catchment dictates that any deterioration in water quality is unacceptable. This is covered in more detail in section 12.

Some WwTWs discharged to a watercourse which is not assessed under the water framework directive and so are marked as "Unknown WFD Standards". Only the 10% deterioration test has been applied at these works.

Within the BOD/Ammonia SIMCAT model, some of the WwTWs had their effluent quality expressed as a load (mg) rather than a concentration (mg/l). This prevented the running of the final test of whether the development could prevent the waterbody from reaching good ecological status.

At many WwTW in the study area, development is predicted to cause a deterioration in water quality of 10% or greater in one or more determinands, or in WFD class. In the majority of cases deterioration could be prevented by treatment at the technically achievable limit.

At fourteen WwTWs deterioration could not be prevented:

Table 9.1 WwTW where TAL cannot mitigate deterioration

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m2)
Bobbington	1	0
Chirbury	46	0
Clive	43	0
Ditton Priors	67	0
Highley	201	4000
Hinstock	157	0
Hodnet	110	0
Market Drayton	1,006	48,000
Much Wenlock	190	4400
Nesscliffe Wilcot	155	0
Oswestry Drenewydd	845	8000
Oswestry Mile Oak	1,822	148,000
Shifnal	1,914	160,600
Woore	91	0

At Albrighton, deterioration can be prevented by treatment at TA and whilst a large deterioration is not predicted due to growth, should improvements in water quality be made elsewhere in the catchment, there is a risk that the additional growth served by this WwTW could become the factor that prevents good ecological status being achieved in the watercourse downstream in the future.

Table 9.2 Water quality modelling results (WwTWs with identified issues only)

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
ACKLETON/STABLEFORD (WRW)	3	0	Predicted deterioration is >10% for Ammonia and Phosphate	No	Yes	No
ALBRIGHTON (WRW)	4,181	220,000	Predicted deterioration is >10% for Ammonia, BOD and Phosphate	Development may cause BOD class to deteriorate from Moderate to Poor.	Yes	Yes (Ammonia)
ALVELEY (WRW)	126	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
BASCHURCH	437	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
BISHOPS CASTLE (WRW)	136	10,400	Predicted deterioration is >10% for Ammonia	Unknown WFD Standards	Yes	Unknown WFD Standards
BOBBINGTON (WRW)	1	0	Predicted deterioration is	No	Yes	No

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
			>10% for Phosphate			
BOMERE HEATH (WRW)	116	0	Predicted deterioration is <10% for Phosphate, BOD and Ammonia	No	Yes	No
BRIDGNORTH-SLADS (WRW)	1,695	192,800	Predicted deterioration is >10% for Phosphate	No	Yes	No
BURNHILL GREEN (WRW)	4	0	Predicted deterioration is <10% for Ammonia and Phosphate	Deterioration in class from Poor to Bad predicted for Phosphate	Yes	No – Phosphate only – Unable to assess BOD and Ammonia
CHILDS ERCALL	13	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
CHILDS ERCALL-LEAFIELDS (WRW)	2	0	Predicted deterioration is >10% for Phosphate	No	Yes	No – Phosphate only – Unable to assess BOD and Ammonia
CHIRBURY (WRW)	46	0	Predicted deterioration is	Unknown WFD Standards	Yes	Unknown WFD Standards

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
			>10% for Phosphate			
CLAVERLEY (WRW)	12	0	Predicted deterioration is >10% for Ammonia	No	Yes	No
CLEOBURY MORTIMER (WRW)	204	6,000	Predicted deterioration is >10% for Ammonia	No	Yes	No
CLIVE (WRW)	43	0	Predicted deterioration is <10% for Ammonia and Phosphate	No	No (Ammonia deterioration remains >10%)	No
COALPORT (WRW)	7,782	273,514	Predicted deterioration is <10% for Phosphate	No	Yes	No
CORLEY	82	0	Predicted deterioration is >10% for Phosphate	No	Yes	No

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
DITTON PRIORS (WRW)	67	0	Predicted deterioration is >10% for Ammonia and Phosphate	Unknown WFD Standards	No (Ammonia deterioration remains >10%)	Unknown WFD Standards
DORRINGTON (WRW)	145	0	Predicted deterioration is >10% for Ammonia and Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
DUDLESTON HEATH (STW)	100	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
ELLESMERE - WHARF MEADOW (WRW)	811	36,800	Predicted deterioration is >10% for Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
GRAFTON (WRW)	1	0	Predicted deterioration is >10% for Phosphate	No	Yes	No – Phosphate only – Unable to assess BOD and Ammonia
HAMPTON LOADE	1	0	Predicted deterioration is >10% for Ammonia	Unknown WFD Standards	Yes	Unknown WFD Standards

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
HIGHLEY (WRW)	201	4,000	Predicted deterioration is >10% for Ammonia	Unknown WFD Standards	Yes	Unknown WFD Standards
HINSTOCK STW (STW)	157	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
HODNET (WRW)	110	0	Predicted deterioration is >10% for Ammonia	Ammonia and BOD may deteriorate in class from Good to Moderate	Yes	No
HOLLINWOOD	7	0	Predicted deterioration is >10% for Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
HORDLEY	2	0	Predicted deterioration is >10% for Phosphate	No	Yes	No – Phosphate only – Unable to assess BOD and Ammonia

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
KINNERLEY (WRW)	63	0	Predicted deterioration is >10% for Phosphate	Phosphate may deteriorate in class from Moderate to Poor	Yes	No
KNIGHTON (WRW)	253	0	Predicted deterioration is >10% for Ammonia and Phosphate	No	Yes	No
KNOCKIN (WRW)	55	0	Predicted deterioration is >10% for Phosphate	Phosphate may deteriorate in class from Moderate to Poor	Yes	No
LYDBURY NORTH (WRW)	19	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
MARKET DRAYTON (WRW)	1,006	48,000	Predicted deterioration is >10% for Ammonia and Phosphate	No	No (Ammonia deterioration remains >10%)	No
MORETON SAYE	22	0	Predicted deterioration is	Unknown WFD Standards	Yes	Unknown WFD Standards

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
			>10% for Phosphate			
MUCH WENLOCK	190	4,400	Predicted deterioration is >10% for Phosphate	Phosphate may deteriorate in class from Poor to Bad	Yes	No
NESSCLIFFE - WILCOT (WRW)	155	0	Predicted deterioration is >10% for Ammonia and Phosphate	No	No (Ammonia deterioration remains >10%)	No
NORTON-IN-HALES (WRW)	63	0	Predicted deterioration is >10% for Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
OSWESTRY MILE OAK	1,822	148,000	Predicted deterioration is >10% for Ammonia	No	No (Ammonia deterioration remains >10%)	No
PEPLOW	6	0	Predicted deterioration is >10% for Phosphate	No	Yes	No – Phosphate only – Unable to assess BOD and Ammonia
PERTHY - WINDY RIDGE (WRW)	33	0	Predicted deterioration is	No	Yes	No – Phosphate only – Unable to assess BOD and Ammonia

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
			>10% for Phosphate			
HIGHER HEATH-PREES (WRW)	339	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
PREES - GOLFHOUSE LANE (WRW)	103	0	Predicted deterioration is >10% for Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
RUSHBURY	5	0	Predicted deterioration is >10% for Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
RUYTON TOWNS	116	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
SHIFNAL	1,914	160,600	Predicted deterioration is >10% for Phosphate	No	Yes	No
SHREWSBURY MONKMOOR	8,145	604,520	Predicted deterioration is >10% for Phosphate	No	Yes	No

WwTW	Housing growth over plan period (dwellings)	Employment growth over plan period (m^2)	Could the development cause a greater than 10% deterioration in WQ for one or more determinands?	Could the development cause a deterioration in WFD class of any element?	Can a deterioration of >10% or in class be prevented by treatment at TAL?	Could the development prevent the water body from reaching Good class?
WEST FELTON (WRW)	112	0	Predicted deterioration is >10% for Phosphate	No	Yes	No
WHIXALL	1	0	Predicted deterioration is >10% for Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
WOLLERTON	3	0	Predicted deterioration is >10% for Phosphate	No	Yes	No – Phosphate only – Unable to assess BOD and Ammonia
WOORE (WRW)	91	0	Predicted deterioration is >10% for Phosphate	Unknown WFD Standards	Yes	Unknown WFD Standards
WORFIELD	1	0	Predicted deterioration is >10% for Phosphate	No	Yes	No – Phosphate only – Unable to assess BOD and Ammonia

Although no issues were identified at the treatment works identified in Table 9.3 below, upgrade work may be required if it contributes to an overall downstream improvement in water quality in combination with WwTW identified in Table 9.2 above.

Table 9.3 WwTW with environmental capacity

Wastewater Treatment Works		
Acton Burnell	Five Fords (Assessed with RQP)	Pant Plas Cerig
Ashton Carbonell	Ford	Pontesbury
Aston near Wem	Frankton	Prees-Hill
Aston-on-Clun	High Hatton	Seifton
Beckbury	Hilton Stratford Lane	Shawbury
Bedlem	Homer	Snailbeach
Bitterley-Orchard Lee	Hopton Wafers	Snailbeach P/Pect Cottage
Blymhill	Ightfield	Stiperstone
Bucknell*	Kidderminster Oldington	Stoke Heath
Buildwas-Park View	Knowbury	Stoke St Milborough
Cardington	Lea Cross	Stoke on Tern
Castle Pulve	Llynclys Bryn Melyn	Stottesdon
Caynham Pulverbatch	Longon Common	Tenbury Wells
Cheswardine	Longville in the Dale	Ticklerton
Clun*	Loppington	Walcot
Condover	Lower Common	Welshampton
Coton-Park Villas	Ludlow	Wem – Soulton Villas
Craven Arms	Lyneal	Wem
Cressage	Minsterley	Whitchurch (Assessed with RQP)
Cross Houses	Montford Bridge	Woodseaves
Culmington-Corve View	Morville	Worthen
Diddlebury-the Moors	Munslow	Yockleton
Edstaston-Pepper Street	Newcastle	
Ercall Heath	Onibury	

*Water quality modelling did not identify an issue using the methodology described here, but the fact that the River Clun SAC is already in an unfavourable condition means that any deterioration at these WwTWs would be unacceptable – see section 12.

9.6.1 Priority substances

As well as the physico-chemical water quality elements (BOD, Ammonia, Phosphate etc.) addressed above, a watercourse can fail to achieve Good Ecological Status due to exceeding permissible concentrations of hazardous substances. Currently 33 substances are defined as hazardous or priority hazardous substances, with others under review.

Such substances may pose risks both to humans (when contained in drinking water) and to aquatic life and animals feeding in aquatic life. These substances are managed by a range of different approaches, including EU and international bans on manufacturing and use, targeted bans, selection of safer alternatives and end-of-pipe treatment solutions. There is considerable concern within the UK water industry that regulation of these substances by setting permit values which require their removal at wastewater treatment works will place a huge cost burden upon the industry and its customers, and that this approach would be out of keeping with the "polluter pays" principle.

We also consider how the planning system might be used to manage priority substances:

- Industrial sources – whilst this report covers potential employment sites, it doesn't consider the type of industry and therefore likely sources of priority substances are unknown. It is recommended that developers should discuss potential uses which may be sources of priority substances from planned industrial facilities at an early stage with the EA and, where they are seeking a trade effluent consent, with the sewerage undertaker.
- Agricultural sources - There is limited scope for the planning system to change or regulate agricultural practices. UK water companies are involved in a range of "Catchment-based Approach" schemes aimed at reducing diffuse sources of pollutants, including agricultural pesticides.
- Surface water runoff sources - some priority substances e.g. heavy metals, are present in urban surface water runoff. It is recommended that future developments would manage these sources by using SuDS that provide water quality treatment, designed following the CIRIA SuDS Manual. This is covered in more detail in section 11.7.
- Domestic wastewater sources - some priority substances are found in domestic wastewater as a result of domestic cleaning chemicals, detergents, pharmaceuticals, pesticides or materials used within the home. Whilst an increase in the population due to housing growth could increase the total volumes of such substances being discharged to the environment, it would be more appropriate to manage these substances through regulation at source, rather than through restricting housing growth through the planning system.

No further analysis of priority substances will be undertaken as part of this study.

9.7 Conclusions

The water quality modelling undertaken in this study uses a model calibrated with water quality data and assumptions from 2010-12, and updated with the latest effluent flows at WwTWs within the study area, and incorporating AMP6 and AMP7 improvements provided by the EA. It should therefore be used to identify areas at risk of deterioration, and should not be used to set permit limits or definitively rule out growth in particular catchments.

At eleven WwTWs in Shropshire water quality modelling identified a risk that planned growth could cause a deterioration in water quality, and that it may not be possible to mitigate this with treatment at the technically achievable limit. At Albrighton WwTW, there is a risk that growth may prevent good ecological status being achieved in the future.

At these works, further mitigation may need to be taken to accommodate growth and options include pumping wastewater to a different WwTW or changing the point of discharge to a less sensitive waterbody. Detailed optioneering is beyond the scope of this study and is best undertaken by Severn Trent Water who have a detailed knowledge of their assets, and the range of options and constraints at each.

9.8 Recommendations

Table 9.4 Table of recommendations for water quality

Action	Responsibility	Timescale
Provide annual monitoring reports to STW and WW detailing projected housing growth in the Local Authority	SC	Ongoing
Take into account the full volume of growth (from SC and neighbouring authorities) within the catchment when considering WINEP schemes or upgrades at WwTW	STW, WW	Ongoing
Identify options to accommodate growth at the eleven WwTWs at risk of deterioration that cannot be prevented.	STW	Aligned with projected growth plan

10 Flood Risk Management

10.1 Assessment of additional flood risk from increased WwTW discharges

In catchments with a large planned growth in population and which discharge effluent to a small watercourse, the increase in the discharged effluent might have a negative effect on the risk of flooding. An assessment has been carried out to quantify such an effect.

10.2 Methodology

The following process has been used to assess the potential increased risk of flooding due to the extra flow reaching a specific WwTW:

- Calculate the increase in DWF attributable to planned growth;
- Identify the point of discharge of these WwTWs;
- At each outfall point, identify the FEH v1.0 catchment descriptors associated with the WwTW;
- Use FEH Statistical method to calculate peak 1 in 30 (Q30) and 1 in 100 (Q100) year fluvial flows;
- Calculate the additional foul flow as a percentage of the Q30 and Q100 flow.

A red/amber/green rating was applied to score the associated risk as follows:

Additional flow ≤5% of Q30. Low risk that increased discharges will increase fluvial flood risk	Additional flow ≥5% of Q30. Moderate risk that increased discharges will increase fluvial flood risk	Additional flow ≥5% of Q100. High risk that increased discharges will increase fluvial flood risk

The following datasets were used to assess the risk of flooding:

- Current and predicted future DWF for each WwTW
- Location of WwTW outfalls
- Catchment descriptors from FEH CD-Rom v1.0

The hydrological assessment of river flows was applied using a simplified approach, appropriate to this type of screening assessment. The Q30 and Q100 flows quoted should not be used for other purposes, e.g. flood modelling or flood risk assessments.

10.3 Results

Table 10.1 reports the additional flow from each WwTW as a percentage of the Q30 and Q100 peak flow. This shows that additional flows from the WwTW post development would have a negligible effect on the predicted peak flow events with return periods of 30 and 100 years.

Table 10.1 Summary of DWF as a % of Q30 and Q100 peak flows

WwTW	FEH Stat Q30 (m^3/s)	FEH Stat Q100 (m^3/s)	Additional Flow (m3/s)	Flow increase as % of Q30	Flow increase as % of Q100
Albrighton	2.44	3.36	0.04	0.53%	0.39%
Alveley	0.72	0.99	0.01	0.05%	0.04%
Baschurch	31.86	43.67	0.51	0.01%	0.00%
Bishops Castle	2.66	3.65	0.04	0.03%	0.02%
Bomere Heath	1.53	2.10	0.02	0.02%	0.02%
Bridgnorth Slads	739.18	888.93	10.29	0.00%	0.00%

WwTW	FEH Stat Q30 (m^3/s)	FEH Stat Q100 (m^3/s)	Additional Flow (m3/s)	Flow increase as % of Q30	Flow increase as % of Q100
Brompton Cross Houses	828.24	1001.18	11.59	0.00%	0.00%
Bucknell	17.25	22.36	0.26	0.00%	0.00%
Chirbury	2.57	3.53	0.04	0.00%	0.00%
Church Stretton	4.14	5.72	0.07	0.02%	0.01%
Cleobury Mortimer	57.50	74.47	0.86	0.00%	0.00%
Clive	0.50	0.67	0.01	0.03%	0.02%
Clun	50.00	66.40	0.77	0.00%	0.00%
Coalport	640.89	763.84	8.84	0.00%	0.00%
Coreley – Clee Hill	3.37	4.54	0.05	0.01%	0.01%
Craven Arms	84.84	117.90	1.36	0.00%	0.00%
Cressage	694.58	827.87	9.58	0.00%	0.00%
Ditton Priors	1.62	2.19	0.03	0.01%	0.01%
Dorrington	1.15	1.58	0.02	0.04%	0.03%
Drenewydd - Oswestry	1.71	2.32	0.03	0.16%	0.12%
Ellesmere Wharf Meadow	2.07	2.86	0.03	0.16%	0.11%
Five Fords (Wrexham)	40.92	56.31	0.65	0.01%	0.01%
Ford	785.25	947.99	10.97	0.00%	0.00%
Higher Heath Prees	2.68	3.66	0.04	0.04%	0.03%
Highley	12.41	16.77	0.19	0.01%	0.00%
Hinstock	1.75	2.40	0.03	0.02%	0.02%
Hodnet	1.04	1.43	0.02	0.03%	0.02%
Kinnerley	1.37	1.89	0.02	0.02%	0.01%
Knockin	0.12	0.16	0.00	0.18%	0.13%
Ludlow	227.50	293.98	3.40	0.00%	0.00%
Market Drayton	16.33	22.01	0.25	0.03%	0.02%
Mile Oak	23.90	31.19	0.36	0.03%	0.02%
Minsterley	21.39	29.15	0.34	0.00%	0.00%
Monkmoor	777.05	939.28	10.87	0.00%	0.00%
Much Wenlock	2.18	3.01	0.03	0.03%	0.02%
Nesscliffe – Wilcot	0.65	0.90	0.01	0.09%	0.07%
Pant-Plas Cerrig	553.87	704.31	8.15	0.00%	0.00%
Pontesbury	0.46	0.61	0.01	0.11%	0.08%
Ruyton XI Towns	31.24	42.09	0.49	0.00%	0.00%
Shawbury	38.07	52.14	0.60	0.00%	0.00%
Shifnal	5.32	7.17	0.08	0.15%	0.11%
Stoke Heath	1.32	1.81	0.02	0.23%	0.17%
Tenbury	284.11	353.60	4.09	0.00%	0.00%

WwTW	FEH Stat Q30 (m^3/s)	FEH Stat Q100 (m^3/s)	Additional Flow (m3/s)	Flow increase as % of Q30	Flow increase as % of Q100
Wem – Aston Road	14.55	18.66	0.22	0.00%	0.00%
West Felton	0.60	0.83	0.01	0.07%	0.05%
Whitchurch (Rising Sun)	2.93	4.03	0.05	0.21%	0.15%
Woore	3.95	5.30	0.06	0.01%	0.00%
Worthen	7.05	9.78	0.11	0.00%	0.00%

10.4 Conclusions

A detailed assessment of flood risk can be found within the Shropshire Level 1 Strategic Flood Risk Assessment[70].

The impact of increased effluent flows is not predicted to have a significant impact upon flood risk in any of the receiving watercourses.

Increases in discharges of treated wastewater effluent as a result of growth are not expected to significantly increase flood risk.

10.5 Recommendations

Table 10.2 Recommendations from the flood risk assessment

Action	Responsibility	Timescale
Proposals to increase discharges to a watercourse may also require a flood risk activities environmental permit from the EA (in the case of discharges to Main River), or a land drainage consent from the Lead Local Flood Authority (in the case of discharges to an Ordinary Watercourse).	STW, WW	During design of WwTW upgrades

70 Shropshire Level 1 Strategic Flood Risk Assessment (2018) Accessed online at: https://shropshire.gov.uk/drainage-and-flooding/policies-plans-reports-and-schemes/flood-risk-and-planning-policy/ on: 15/11/2019

11 Environmental Opportunities and Constraints

11.1 Introduction

Development has the potential to cause an adverse impact on the environment through a number of routes such as worsening of air quality, pollution to the aquatic environment, or disturbance to wildlife. Of relevance in the context of a Water Cycle Study is the impact of development on the aquatic environment.

Water pollution is usually categorised as either diffuse or point source. Point source sources come from a single well-defined point, an example being the discharge from a WwTW.

Diffuse pollution is defined as "unplanned and unlicensed pollution from farming, old mine workings, homes and roads. It includes urban and rural activity and arises from industry, commerce, agriculture and civil functions and the way we live our lives."

Examples of diffuse sources of water pollution include:

- Contaminated runoff from roads – this can include metals and chemicals
- Drainage from housing estates
- Misconnected sewers (foul drains to surface water drains)
- Accidental chemical/oil spills from commercial sites
- Surplus nutrients, pesticides and eroded soils from farmland
- Septic tanks and non-mains sewer systems

After or during heavy rainfall, the first flush of water carrying accumulated dust and dirt is often highly polluting. Development has the potential to increase the diffuse pollution by providing additional sources from roads and housing estates.

Potential impacts on receiving surface waters include the blanketing of riverbeds with sediment, a reduction in light penetration from suspended solids, and a reduction in natural oxygen levels, all of which can lead to a loss in biodiversity.

11.2 Sites with Environmental Designation

11.2.1 Sites protected by European designations

The Habitats Regulations Assessment process is designed to ensure that consideration is given within planning policy to sites protected by European Directives, namely Special Areas of Conservation (SAC) or Special Protection Areas (SPA). There are no SPAs in Shropshire, however The Stiperstones and The Hollies; Fenn's, Whixhall, Bettisfield, Wem and Cadney Mosses; Downton Gorge; West Midlands Mosses; Brown Moss; River Dee and Lake Bala and the River Clun SACs are all partially or fully located within Shropshire. The River Clun SAC is of particular concern in Shropshire and is discussed in more detail in section 12.

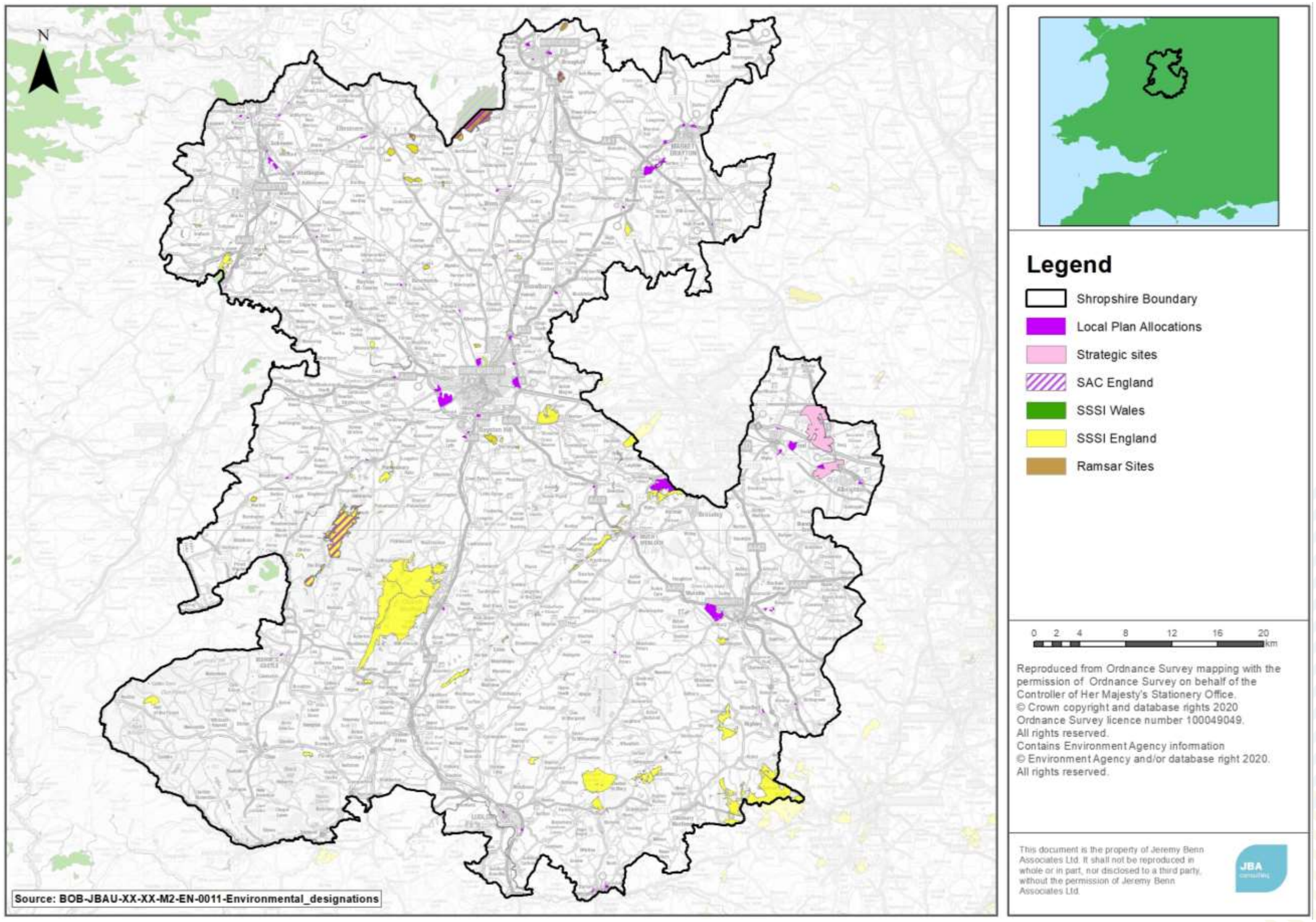
11.2.2 Sites of Special Scientific Interest and Ramsar sites

SSSIs are not subject to the HRA process, but are protected under the Wildlife and Countryside Act, and the impact of development on these sites must also be considered. There are many SSSIs within the study area boundary, as well outside which could be affected by the effects of development upstream.

Ramsar sites are wetland sites designated to be of international importance under the Ramsar Convention. A number of Ramsar Sites exist within the Shropshire boundary and are all part of the Midlands Meres and Mosses Phase 1 and Phase 2 designations.

Sites with environmental designations in and around Shropshire are shown in Figure 11.1 below. The hydrological pathways between WwTW and environmental sites development sites and environmental sites and the impact on the environmental sites is discussed in section 11.3 and 11.4.

Figure 11.1 Environmental Designations in Shropshire



11.3 Point source pollution

The main potential source of point source water pollution in Shropshire are the WwTWs. The effect of additional wastewater flows on water quality is assessed in section 9, and a summary of their potential impact following a source-pathway-receptor approach is presented in Table 11.1. The SSSIs, SACs and Ramsar sites within a 20km drainage range of each WwTW serving growth have been assessed, as well as WwTW serving growth which drain into the River Clun catchment. In many cases, deterioration in water quality from additional wastewater flow could be prevented by treatment at technically achievable limit (TAL), but this needs to be verified through a water quality assessment.

Table 11.1 WwTW serving growth in Shropshire relative to sites with environmental designations

Source	Pathway	Receptor	Distance downstream (km)	Potential Impact
Alveley WwTW	Lakehouse Dingle Brook, River Severn	Wyre Forest SSSI (SO745766)	10km	Water quality deterioration possible.
Ashford Carbonell WwTW	River Teme	River Teme SSSI (SO507745)	0km	Water quality deterioration possible.
Aston on Clun WwTW	Aston Brook, River Clun	River Teme SSSI (SO507745) River Clun SAC (SO395745)	7km	Water quality deterioration possible.
Bishops Castle WwTW	Snakescroft Brook, River Kemp	River Teme SSSI (SO507745) River Clun SAC (SO395745)	22km	Water quality deterioration possible.
Bitterley Orchard Lea WwTW	Bitterley Brook, Dogditch Brook, Ledwyche Brook	River Teme SSSI (SO507745)	20km	Water quality deterioration possible.
Blymhill WwTW	Dawford Brook, Wyndford Brook, Moreton Brook, Back Brook, Coley Brook	Aqualate Mere SSSI (SJ773204)	9km	Water quality deterioration possible.
Bridgnorth (The Slads) WwTW	River Severn	Wyre Forest SSSI (SO745766)	13.5km	Water quality deterioration possible.
Brompton Cross Houses WwTW	Tributary of the River Severn, River Severn	Buildwas River Section SSSI (SJ640045)	17.5km	Water quality deterioration possible.
		Tick Wood and Benthall Edge SSSI (SJ663033) Lincoln Hill (SJ669038)	20km	
Bucknell WwTW	River Redlake	River Teme SSSI (SO507745) River Clun SAC (SO395745)	4.5km	Water quality deterioration possible.
Buildwas Park View WwTW	Tributary of the River Severn, River Severn	Buildwas River Section SSSI (SJ640045)	300m	Water quality deterioration possible.

Source	Pathway	Receptor	Distance downstream (km)	Potential Impact
		Tick Wood and Benthall Edge SSSI (SJ663033) Lincoln Hill (SJ669038)	3km	
Cardington WwTW	Heath Brook, Eaton Brook	Eaton Track (SO501900)	8km	Water quality deterioration possible.
		Wolverton Wood and Alcaston Coppice (SO470872)	13km	
Caynham WwTW	Ledwyche Brook	River Teme SSSI (SO507745)	11km	Water quality deterioration possible.
Childs Ercall WwTW	Tributary of the River Tern, River Tern	Allscott Settling Ponds SSSI (SJ601129)	18.5km	Water quality deterioration possible.
Childs Ercall (Leafields) WwTW	Allford Brook, River Tern	Allscott Settling Ponds SSSI (SJ601129)	18.5km	Water quality deterioration possible.
Chorley WwTW	Tributary of the Borle Brook	Bush Wood and High Wood SSSI (SO706824)	0km	Water quality deterioration possible.
	Tributary of the Borle Brook, Borle Brook, River Severn	Wyre Forest SSSI (SO745766)	11km	Water quality deterioration possible.
Church Stretton WwTW	World's End Brook, Marsh Brook	Marsh Wood Quarry SSSI (SO444890)	2km	Water quality deterioration possible.
Cleobury Mortimer WwTW	River Rea	River Teme SSSI (SO507745)	17.5km	Water quality deterioration possible.
Clun WwTW	River Clun	Clun Catchment River Teme SSSI (SO507745) River Clun SAC (SO395745)	20km	Water quality deterioration possible.
Clee Hill – Coreley WwTW	Corn Brook	River Teme SSSI (SO507745)	9km	Water quality deterioration possible.
Craven Arms WwTW	River Onny	River Teme SSSI (SO507745)	9km	Water quality deterioration possible.

Source	Pathway	Receptor	Distance downstream (km)	Potential Impact
Cressage WwTW	River Severn	Buildwas River Section SSSI (SJ640045)	7km	Water quality deterioration possible.
		Tick Wood and Benthall Edge SSSI (SJ663033) Lincoln Hill (SJ669038)	9.5km	
Culmington WwTW	River Corve	River Teme SSSI (SO507745)	12km	Water quality deterioration possible.
Diddlebury – The Moors WwTW	Tributary of the River Corve, River Corve	River Teme SSSI (SO507745)	16km	Water quality deterioration possible.
Eaton Constantine WwTW	Garmston Brook, River Severn	Buildwas River Section SSSI (SJ640045)	6km	Water quality deterioration possible.
		Tick Wood and Benthall Edge SSSI (SJ663033) Lincoln Hill (SJ669038)	8.5km	
Ercall Heath WwTW	Soulton Brook, River Meese, River Tern	Allscott Settling Ponds SSSI (SJ601129)	20km	Water quality deterioration possible.
Five Fords WwTW	River Clywedog	River Dee SSSI (31WDW)	9km	Water quality deterioration possible.
Ford WwTW	River Severn	River Severn at Montford (SJ414144)	0km	Water quality deterioration possible.
Hampton Loade WwTW	Quatt Farm Brook, River Severn	Wyre Forest SSSI (SO745766)	8.5km	Water quality deterioration possible.
Highley WwTW	Tributary of the Borle Brook, Borle Brook, River Severn	Wyre Forest SSSI (SO745766)	5km	Water quality deterioration possible.
Homer WwTW	Sheinton Brook	Whitwell Coppice SSSI (SJ618021)	300m	Water quality deterioration possible.
		Sheinton Brook SSSI (SJ607038)	2.5km	
	Sheinton Brook, River Severn	Buildwas River Section SSSI (SJ640045)	7km	

Source	Pathway	Receptor	Distance downstream (km)	Potential Impact
		Tick Wood and Benthall Edge SSSI (SJ663033) Lincoln Hill (SJ669038)	9.5km	
Hopton Wafers WwTW	Hopton Brook, Mill Brook, River Rea	River Teme SSSI (SO507745)	15.5km	Water quality deterioration possible.
Kinnerley WwTW	Weir Brook, River Severn	River Severn at Montford (SJ414144)	13km	Water quality deterioration possible.
Knighton WwTW	River Teme	River Teme SSSI (SO507745)	0km	Water quality deterioration possible.
Knockin WwTW	Weir Brook, River Severn	River Severn at Montford (SJ414144)	15km	Water quality deterioration possible.
Knowbury WwTW	Colley Brook, Stoke Brook, Ledwyche Brook	River Teme SSSI (SO507745)	12km	Water quality deterioration possible.
Longville WwTW	Lakehouse Brook, Eaton Brook	Eaton Track (SO501900)	6km	Water quality deterioration possible.
		Wolverton Wood and Alcaston Coppice (SO470872)	11km	
Loppington WwTW	River Roden	Ruewood Pastures SSSI (SJ495279)	3km	Water quality deterioration possible.
Ludlow WwTW	River Teme	River Teme SSSI (SO507745)	0km	Water quality deterioration possible.
Lydbury North WwTW	River Kemp, River Clun	Clun Catchment River Teme SSSI (SO507745) River Clun SAC (SO395745)	16.5km	Water quality deterioration possible.
Lyneal WwTW	Tributary of the River Roden, River Roden	Ruewood Pastures SSSI (SJ495279)	8.5km	Water quality deterioration possible.
Mile Oak WwTW	River Morda	Crofts Mills Pasture SSSI (SJ304246)	3km	Water quality deterioration possible.
Monkmoor WwTW	River Severn	Attingham Park SSSI (SJ551095)	6.5km	Water quality deterioration possible.

Source	Pathway	Receptor	Distance downstream (km)	Potential Impact
Morville WwTW	Mor Brook	Thatchers Wood and Westood Covert SSSI (SO702904)	5km	Water quality deterioration possible.
Much Wenlock WwTW	Farley Brook	Tick Wood and Benthall Edge SSSI (SJ663033)	2.5km	Water quality deterioration possible.
	Farley Brook, River Severn	Buildwas River Section SSSI (SJ640045)	4.5km	
		Lincoln Hill (SJ669038)	7km	
Nescliffe WwTW	Nescliffe Brook, River Severn	River Severn at Montford (SJ414144)	7km	Water quality deterioration possible.
Newcastle on Clun	River Clun	River Clun catchment		Water quality deterioration possible.
Onibury Church Close WwTW	River Onny	River Teme SSSI (SO507745)	6km	Water quality deterioration possible.
Pentre Coed WwTW	Tributary of the Bryndaniel Brook, Bryndaniel Brook, Llanyfelin Brook, Shell Brook	River Dee SSSI (31WDW), River Dee and Bala Lake SAC	5.5km	Water quality deterioration possible.
Peplow WwTW	Greenhurst Brook, River Tern	Allscott Settling Ponds SSSI (SJ601129)	19km	Water quality deterioration possible.
Pontfaen WwTW	River Ceiriog	River Dee SSSI (31WDW), River Dee and Bala Lake SAC	0km	Water quality deterioration possible.
Rushbury WwTW	Lakehouse Brook, Eaton Brook	Eaton Track (SO501900)	3km	Water quality deterioration possible.
		Wolverton Wood and Alcaston Coppice (SO470872)	9km	
Seifton WwTW	Seifton Brook, River Corve	River Teme SSSI (SO507745)	14km	Water quality deterioration possible.
Shawbury WwTW	River Roden	Allscott Settling Ponds SSSI (SJ601129)	14km	Water quality deterioration possible.

Source	Pathway	Receptor	Distance downstream (km)	Potential Impact
Stiperstones WwTW	Tributary of the Minsterley Brook	The Stiperstones and the Hollies SSSI (SO368995) and SAC	0km	Water quality deterioration possible.
Tenbury WwTW	River Teme	River Teme SSSI (SO507745)	0km	Water quality deterioration possible.
Ticklerton WwTW	Ticklerton Hall Brook, Eaton Brook	Wolverton Wood and Alcaston Coppice (SO470872)	4.5km	Water quality deterioration possible.
Walcot WwTW	Tributary of the River Tern, River Tern	Allscott Settling Ponds SSSI (SJ601129)	0km	Water quality deterioration possible.
		Attingham Park SSSI (SJ551095)	5km	
West Felton WwTW	Weir Brook	River Severn at Montford (SJ414144)	18.5km	Water quality deterioration possible.
Whitchurch (Rising Sun) WwTW	Wych Brook	River Dee SSSI (31WDW)	21km	Water quality deterioration possible.

11.4 Diffuse sources of water pollution

The most likely sources of diffuse pollution from new developments include drainage from housing estates, runoff from roads and discharges from commercial and industrial premises. Preferred options and strategic sites within Shropshire that could be considered as sources of additional runoff, and receptors in the form of sites with environmental designations are summarised in Table 11.2 below. The pollution risk posed by a site will depend on the sensitivity of the receiving environment, the pathway between the source of the runoff and the receiving waters, and the level of dilution available. A probable impact score of low, medium or high was applied to each SSSI to provide an indication of the likely impact prior to any mitigation being applied. It should be noted that this is a desk-based assessment to highlight risk and should not replace the appropriate level assessment on a site by site basis. Other development sites not identified in the table, may still contribute to a cumulative impact within the catchment and so management of water quality of surface runoff from these sites should still be considered. There are no surface water flow routes between the preferred options and strategic sites and any Ramsar sites.

Table 11.2 Potential sources of diffuse pollution and receptors

Source	Pathway	Receptor	Distance (km)	Potential Impact
Ironbridge strategic site	Surface water pathway to SSSI identified using RoFSW map	Tick Wood and Benthall Edge SSSI	SSSI adjacent to site	This SSSI is an area of mixed deciduous woodland overlooking the Severn Gorge. As the wood is on high ground in relation to potential development sites nearby it is unlikely to receive any surface runoff, however as part of the site boundary falls within the SSSI some impact is possible. **Impact possible – the inclusion of SuDS and appropriate management of runoff should limit pollution risk**
LUD05, LUD056, LUD057	Surface water pathway to SSSI identified using RoFSW map	River Teme SSSI	0.5 – 1km	The SSSI supports a number of species under various conservation acts, including twaite shad, lampreys, salmon, crayfish and freshwater pearl mussels. Any runoff from the sites could eventually flow into the River Teme via the River Corve (LUD056) or other flow paths. **Impact possible – the inclusion of SuDS and appropriate management of runoff should limit pollution risk**
BRO012/ BRO024	Surface water pathway to SSSI identified using RoFSW map	Tick Wood and Benthall Edge SSSI	1.2km	This SSSI is an area of mixed deciduous woodland overlooking the Severn Gorge. Runoff from the site could flow down Speed's Lane and Bridge Road and into the SSSI. **Impact possible – the inclusion of SuDS and appropriate management of runoff should limit pollution risk**

11.5 Groundwater Protection

Groundwater is an important source of water in England and Wales.

The Environment Agency is responsible for the protection of "controlled waters" from pollution under the Water Resources Act 1991. These controlled waters include all watercourses and groundwater contained in underground strata.

The zones are based on an estimate of the time it would take for a pollutant which enters the saturated zone of an aquifer to reach the source of abstraction or discharge point (Zone 1 = 50 days, Zone 2 = 400 days, Zone 3 is the total catchment area). The Environment Agency will use SPZs (alongside other datasets such as the Drinking Water Protected Areas (DrWPAs) and aquifer designations as a screening tool to show:

- areas where is would object in principle to certain potentially polluting activities, or other activities that could damage groundwater,
- areas where additional controls or restrictions on activities may be needed to protect water intended for human consumption,
- how it prioritises responses to incidents.

The EA have published a position paper[71] outlining its approach to groundwater protection which includes direct discharges to groundwater, discharges of effluents to ground and surface water runoff. This is of relevance to this water cycle study where a development may manage surface water through SuDS.

Sewage and trade effluent

Discharge of treated sewage of $2m^3$ per day or less to ground are called small sewage discharges (SSDs). The majority of SSDs do not require an environmental permit if they comply with certain qualifying conditions. A permit will be required for all SSDs in source protection zone 1 (SPZ1).

For treated sewage effluent discharges, the EA encourages the use of shallow infiltration systems, which maximise the attenuation within the drainage blanket and the underlying unsaturated zone. Whilst some sewage effluent discharges may not pose a risk to groundwater quality individually, the cumulative risk of pollution from aggregations of discharges can be significant. Improvement or pre-operational conditions may be imposed before granting an environmental permit. The EA will only agree to developments where the addition of new sewage effluent discharges to ground in an area of existing discharges is unlikely to lead to an unacceptable cumulative impact.

Generally, the Environment Agency will only agree to developments involving release of sewage effluent, trade effluent or other contaminated discharges to ground if it is satisfied that it is not reasonable to make a connection to the public foul sewer. The EA would normally expect to only permit new private discharges where the distance to connect to the nearest public sewer exceeds the number of dwellings * 30m. So, for example, a development of 100 dwellings would need to be more than 3km from a public sewer. The developer would have to provide evidence of why the proposed development cannot connect to the foul sewer in the planning application. This position will not normally apply to surface water run-off via sustainable drainage systems and discharges from sewage treatment works operated by sewerage undertakers with appropriate treatment and discharge controls.

Deep infiltration systems (such as boreholes and shafts) are not generally accepted by the EA for discharge of sewage effluent as they bypass soil layers and reduce the opportunity for attenuation of pollutants.

Discharges of surface water run-off to ground at sites affected by land contamination, or from sites for the storage of potential pollutants are likely to require an environmental

71 The Environment Agency's approach to groundwater protection, Environment Agency (2018). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Environment-Agency-approach-to-groundwater-protection.pdf on: 04/10/2019

permit. This could include sites such as garage forecourts and coach and lorry parks. These sites would be subject to a risk assessment with acceptable effluent treatment provided.

Discharge of clean water

"Clean water" discharges such as runoff from roofs or from roads, may not require a permit. However, they are still a potential source of groundwater pollution if they are not appropriately designed and maintained.

Where infiltration SuDS schemes are proposed to manage surface runoff they should:

- be suitably designed;
- meet Government non-statutory technical standards[72] for sustainable drainage systems – these should be used in conjunction with the NPPF and PPG; and
- use a SuDS management treatment train

A hydrogeological risk assessment is required where infiltration SuDS is proposed for anything other than clean roof drainage in a SPZ1.

Source Protection Zones in Shropshire

The Source Protection Zones (SPZs) that are present in Shropshire shown in Figure 11.2. A detailed list of which preferred options and strategic sites are within each SPZ along with management advice are presented in Table 11.3. A large area mainly on the right bank of the River Severn upstream of Shrewsbury is covered by an SPZ, with other large areas of SPZs in the north of Shropshire and also in the east around Shifnal and Albrighton. There are very few, isolated areas of SPZs in the south of the study area.

72 Sustainable Drainage Systems: non-statutory technical standards, Department for Environment, Food & Rural Affairs (2015). Accessed online at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards on: 04/10/2019

Figure 11.2 Source protection zones in the study area

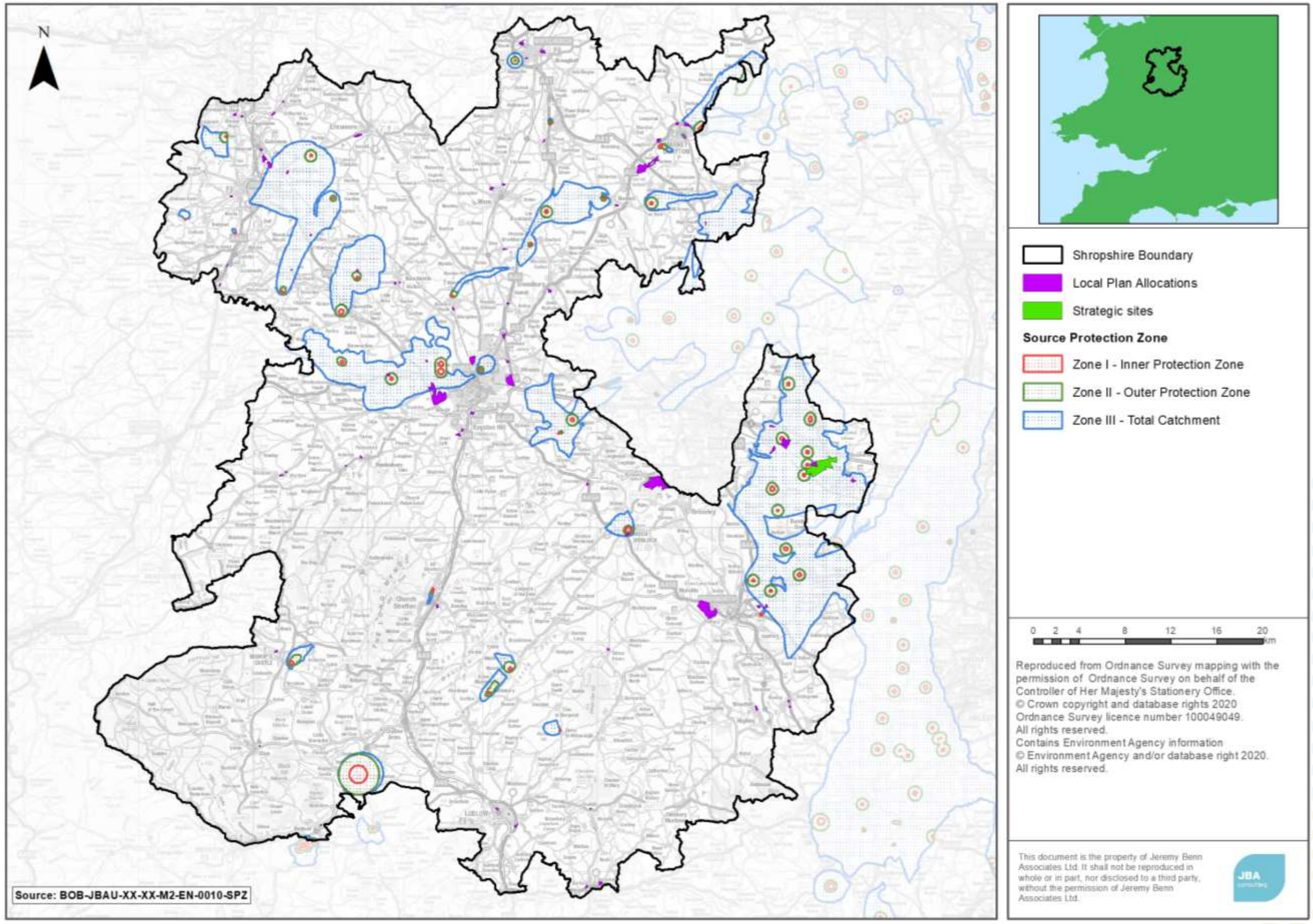


Table 11.3 Preferred and strategic sites within Source Protection Zones

Source Protection Zone	Sites	Management advice / EA position statement
Zone 1 – Inner Protection Zone	Preferred options sites: SHF018b/SHF018d	G2 – Inside SPZ1 all sewage effluent discharges to ground must have an environmental permit. G4 – Inside SPZ1 the EA will object to any new trade effluent, storm overflow from sewage system or other significantly contaminated discharges to ground where the risk of groundwater pollution is high and cannot be adequately mitigated. G12 – Discharge of clean roof water to ground is acceptable both within and outside SPZ1, provided all roof water down-pipes are sealed against pollutants entering the system from surface runoff, effluent disposal or other forms of discharge. The method of discharge must not create new pathways for pollutants to groundwater or mobilise contaminant already in the ground. No permit is required if these criteria are met. G13 – Where infiltration SuDS are proposed for anything other than clean roof drainage in a SPZ1, a hydrogeological risk assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply. SuDS schemes must be suitably designed.
Zone 2 – Outer Protection Zone	Preferred options sites: FRD011, MUW012, SHF018b/SHF018d Strategic sites: RAF Cosford	A hydrogeological risk assessment is not a requirement for SuDS schemes, however they should still be "suitably designed", for instance following best practice guidance in the CIRIA SuDS Design Manual.
Zone 3 – Total Catchment	Preferred options sites: ALB017, ALB021, BIT022, FRD011, HKW009, KCK009, MDR012, MDR034, MUW012, RUY019, SHF013, SHF015, SHF029, SHF022/3, SHR057/SHR117, SHR216, WEF025, WHN024, SHF018b/SHF018d, P58a, STC002, SHR060/SHR158/SHR161 Strategic sites: RAF Cosford	A hydrogeological risk assessment is not a requirement for SuDS schemes, however they should still be "suitably designed", for instance following best practice guidance in the CIRIA SuDS Design Manual.

11.6 Natural flood management

Natural Flood Management (NFM) is used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood risk. A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down flood waters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). NFM involves taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating functions of catchments, rivers, floodplains and coasts. Techniques and measures, which could be applied in Shropshire include:

- Peatland and moorland restoration in upland catchments
- Offline storage areas
- Re-meandering streams
- Targeted woodland planting
- Reconnection and restoration of functional floodplains
- Restoration of rivers and removal of redundant structures
- Installation or retainment of large woody material in river channels
- Improvements in management of soil and land use
- Creation of rural and urban SuDS

In 2017, the Environment Agency published on online evidence base[73] to support the implementation of NFM and with JBA produced maps showing locations with the potential for NFM measures[74]. These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them. There are limitations with the maps; however, it is a useful tool to help start dialogue with key partners.

There are areas within Shropshire whereby removing existing defences and reconnecting the floodplain could create areas for potential without causing risk to properties. These areas are spread throughout Shropshire, with the largest areas present along the River Severn upstream of Shrewsbury. Reconnecting the river with its floodplain and naturalising the river itself should lead to reduced peak flood levels which will protect properties and infrastructure in settlements downstream.

NFM measures are designed to reduce the flow of floodwater to minimise the risk of flooding to areas downstream. Tree planting can play a vital role in reducing flood risk within an area. Increased rainfall interception and infiltration may reduce surface water runoff and therefore increase the potential of NFM in the area. There are many areas within Shropshire where tree planting could be implemented, most notably along the River Severn, with the potential for vast expanses from where the River Vyrnwy enters Shropshire to its confluence with the Severn.

Shropshire Council has received national FCERM Grant in Aid funding for the 'Slow the Flow' Project. Working in partnership with Shropshire Wildlife Trust, the Environment Agency, English Severn and Wye RFCC, landowners and community flood action groups, the aim of the project is to use natural methods to 'slow the flow' in a number of catchments and reduce flood risk to communities downstream.

The six-year project seeks to take an alternative approach to the management of flood risk, rather than the construction of traditional flood defences, considering catchments

73 Working with natural processes to reduce flood risk, Environment Agency (2018). Accessed online at: https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk on: 03/10/2019
74 Mapping the potential for working with natural process, Environment Agency and JBA. Accessed online at: http://wwnp.jbahosting.com/ on: 03/10/2019

as a whole, and looking to reduce or slow flows nearer to their source. This will be done in a number of ways.

- Increasing infiltration into the soil: Allowing more water to soak away means less water travels quickly downstream where it may cause flooding problems.
- Slowing water down as it flows through the catchment: By constructing features such as "leaky dams" or putting other obstructions across the flood plain and in channels, heavier flows can be held back, and flood levels downstream reduced.
- Storing water upstream: By using existing storage areas and creating new ponds and basins, flood water can be stored upstream and released slowly, rather than rushing downstream.

So far, measures have been installed at Battlefield in Shrewsbury and upstream of Culmington in South Shropshire. The Council are currently considering the wider implementation of NFM across the Corvedale Catchment though the Project. This will help reduce flood risk to Ludlow and local rural communities.

11.6.1 Multiple benefits of NFM

In addition to flood risk benefits, there are also significant benefits in other areas such as habitat provision, air quality, climate regulation and of particular note for the River Clun catchment – Water Quality.

Many NFM measures have the ability to reduce nutrient and sediment sources by reducing surface runoff flows from higher ground, reducing soil erosion, trapping sediment at the edge of agricultural land, or encouraging deposition of sediments behind natural dams upstream in watercourses.

Suitable techniques may include:

- Leaky dams
- Woodland planting
- Buffer strips
- Runoff retention ponds
- Land management techniques (soil aeration, cover crops etc)

Case Study – Black Brook Slow the Flow

Four engineered log dams were installed on Black Brook at an estimated cost of £2,000, funded by Natural England and the Environment Agency to restore Stanley Bank SSSI. The scheme aimed to improve habitat and reduce the risk of flooding. However, the scheme also resulted in reduced levels of phosphate and nitrate in Black Brook, with phosphate concentrations falling by 3.6mg/l. By 2035, it is predicted that 792m^3 of sediment will be stored in three ponds retained by the jams.

Reproduced from Case study 17. Black Brook Slow the Flow, St Helens, Norbury, Rogers and Brown, EA WwNP Evidence Base 2017. Photograph taken on 8 May 2015; courtesy of Matthew Catherall

11.7 Surface Water Drainage and SuDS

Since April 2015[75], management of the rate and volume of surface water has been a requirement for all major development sites, through the use of Sustainable Drainage Systems (SuDS).

Shropshire Council as Lead Local Flood Authority (LLFA), is statutory consultees to the planning system for surface water management within major development, which covers the following development scenarios:

- 10 or more dwellings
- a site larger than 0.5 hectares, where the number of dwellings is unknown
- a building greater than 1,000 square metres
- a site larger than 1 hectare

SuDS are drainage features which attempt to replicate natural drainage patterns, through capturing rainwater at source, and releasing it slowly into the ground or a water

75 Department for Communities and Local Government (2014) House of Commons: Written Statement (HCWS161) Written Statement made by: The Secretary of State for Communities and Local Government (Mr Eric Pickles) on 18 Dec 2014. Available at: https://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf on: 12/09/2019

body. They can help to manage flooding through controlling the quantity of surface water generated by a development and improve water quality by treating urban runoff. SuDS can also deliver multiple benefits, through creating habitats for wildlife and green spaces for the community. SuDS also have the advantage of providing effective Blue and Green infrastructure and ecological and public amenity benefits when designed and maintained properly.

National standards on the management of surface water are outlined within the Defra Non-statutory Standards for Sustainable Drainage Systems[76], with local guidance specified by Shropshire Council[77]. The CIRIA C753 SuDS Manual[78] and Guidance for the Construction of SuDS[79] provide the industry best practice guidance for design and management of SuDS.

11.7.1 Use of SuDS in Water Quality Management

SuDS allow the management of diffuse pollution generated by urban areas through the sequential treatment of surface water reducing the pollutants entering lakes and rivers, resulting in lower levels of water supply and wastewater treatment being required. This treatment of diffuse pollution at source can contribute to meeting WFD water quality targets, as well as national objectives for sustainable development.

This is usually facilitated via a SuDS Management Train of a number of components in series that provide a range of treatment processes delivering gradual improvement in water quality and providing an environmental buffer for accidental spills or unexpected high pollutant loadings from the site. Considerations for SuDS design for water quality are summarised in Figure 11.3 below.

76 Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems, DEFRA (2015) Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf on: 12/09/2019

77 SuDS requirements for new developments, Shropshire Council (2018). Accessed online at: https://shropshire.gov.uk/drainage-and-flooding/development-responsibility-and-maintenance/new-development-and-watercourse-consenting/suds-requirements-for-new-developments/ on: 12/09/2019

78 CIRIA Report C753 The SuDS Manual, CIRIA (2015). Accessed online at: https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx on: 12/09/2019

79 Guidance on the Construction of SuDS (C768), CIRIA (2017), Accessed online at: https://www.ciria.org/ItemDetail?iProductcode=C768&Category=BOOK on: 12/09/2019

Figure 11.3 Considerations for SuDS design for water quality

Manage surface water close to source	•Where practicable, treatment systems should be designed to to be close to source of runoff •It is easier to design effective treatment when the flow rate and pollutant loadings are relatively low •Treatment provided can be proportionate to pollutant loadings •Accidental spills or other pollution events can be isolated more easily without affecting the downstream drainage system •Encourages ownership of pollution •Poor treatment performance or component damage/failure can be dealt with more effectively without impacting on the whole site
Treat surface water runoff on the surface	•Where practicable, treatment systems should be designed to be on the surface •Where sediments are exposed to UV light, photolysis and volatilisation processes can act to break down contaminants •If sediment is trapped in accessible parts of the SuDS, it can be removed more easily as part of maintenance •It enables use of evapotranspiration and some infiltration to the ground to reduce runoff volumes and associated total contamination loads (provided risk to groundwater is managed appropriately) •It allows treatment to be delivered by vegetation •Sources of pollution can be easily identified •Accidental spills or misconnections are visible immediately and can be dealt with rapidly •Poor treatment performance can be easily identified during routine inspections, and remedial works can be planned efficiently
Treat surface water runoff to remove a range of contaminants	•SuDS design should consider the likely presence and significant of any contaminant that may pose a risk to the receiving environment •The SuDS component or combination of components selected should include treatment processes that, in combination, are likely to reduce this risk to acceptably low levels
Minimise risk of sediment remobilisation	•The SuDS design should consider and mitigate the risks of sediments (and other contaminants) being remobilised and washed into receiving surface waters during events greater than those which the component has been specifically designed for
Minimise impacts from accidental spills	•By using a number of components in series, SuDS can help insure that accidental spills are trapped in/on upstream component surfaces, facilitating contamination management and removal. •The selected SuDS components should deliver a robust treatment design that manages risks appropriately - taking into account the uncertainty and variability of pollution loadings and treatment processes

Managing pollution close to its source can help keep pollutant levels and accumulation rates low, allowing natural processes to be more effective. Treatment can often be delivered within the same components that are delivering water quantity design criteria, requiring no additional cost or land-take.

SuDS designs should control the 'first flush' of pollutants (usually mobilised by the first 5mm of rainfall) at source, to ensure contaminants are not released from the site. Best practise is that no runoff should be discharged from the site to receiving watercourses or sewers for the majority of small (e.g. less than 5mm) rainfall events.

Infiltration techniques will need to consider Groundwater Source Protection Zones (GSPZs) and are likely to require consultation with the Environment Agency.

Early consideration of SuDS within master planning will typically allow a more effective scheme to be designed.

11.7.2 Additional benefits

Flood Risk

The Strategic Flood Risk Assessment contains recommendations for SuDS to manage surface water on development sites, with the primary aim of reducing flood risk.

SuDS are most effective at reducing flood risk for relatively high intensity, short and medium duration events, and are particularly important in mitigating potential increases in surface water flooding, sewer flooding and flooding from small and medium sized watercourses resulting from development.

Water Resources

A central principle of SuDS is the use of surface water as a resource. Traditionally, surface water drainage involved the rapid disposal of rainwater, by conveying it directly into a sewer or wastewater treatment works.

SuDS techniques such as rainwater harvesting, allow rainwater to be collected and re-used as non-potable water supply within homes and gardens, reducing the demand on water resources and supply infrastructure.

Climate Resilience

Climate projections for the UK suggest that winters may become milder and wetter and summers may become warmer, but with more frequent higher intensity rainfall events, particularly in the south east. This would be expected to increase the volume of runoff, and therefore the risk of flooding from surface water, and diffuse pollution, and reduce water availability.

SuDS offer a more adaptable way of draining surfaces, controlling the rate and volume of runoff leaving urban areas during high intensity rainfall, and reducing flood risk to downstream communities through storage and controlled release of rainwater from development sites.

Through allowing rainwater to soak into the ground, SuDS are effective at retaining soil moisture and groundwater levels, which allows the recharge of the watercourses and underlying aquifers. This is particularly important where water resource availability is limited, and likely to become increasingly scare under future drier climates.

Biodiversity

The water within a SuDS component is an essential resource for the growth and development of plants and animals, and biodiversity benefits can be delivered even by very small, isolated schemes. The greatest value can be achieved where SuDS are planned as part of a wider green landscape, providing important habitat, and wildlife connectivity. With careful design, SuDS can provide shelter, food, foraging and breeding opportunities for a variety of species including plants, amphibians, invertebrates, birds, bats and other animals.

Amenity

Designs using surface water management systems to help structure the urban landscape can enrich its aesthetic and recreational value, promoting health and well-being and supporting green infrastructure. Water managed on the surface rather than underground can help reduce summer temperatures, provide habitat for flora and fauna and act a resource for local environmental education programmes and working groups and directly influence the sense of community in an area.

11.7.3 Suitable SuDS techniques

The hydraulic and geological characteristics of the proposed development at each settlement/strategic site were assessed to determine the constraining factors for surface water management. This assessment is designed to inform the early-stage site planning process and is not intended to replace site-specific detailed drainage assessments.

The following data was used as part of the SuDS suitability assessment:

- Historic landfill sites
- Groundwater Source Protection Zones
- LIDAR data to determine where the mean slopes at a site were >5%
- AStGWF map to determine the risk of groundwater flooding

This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site. SuDS techniques were categorised into five main groups, as shown in Table 11.4. This assessment should not be used as a definitive guide as to which SuDS would be suitable but used as an indicative guide of general suitability. Further site-specific investigation should be conducted to determine what SuDS techniques could be used on a particular development, informed by detailed ground investigations.

Table 11.4 Summary of SuDS categories

SuDS Type	Technique
Source Controls	Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens
Infiltration	Infiltration Trench, Infiltration Basin, Soakaway
Detention	Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin
Filtration	Surface Sand filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench
Conveyance	Dry Swale, Under-drained Swale, Wet Swale

The suitability of each SuDS type for the preferred sites and strategic sites has be described in Table 11.5. The assessment of suitability is broadscale and indicative only; more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. Shropshire Council as LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

Table 11.5 SuDS suitability for preferred options and strategic sites

Site	SuDS feature				
	Source controls	Infiltration	Detention	Filtration	Conveyance
ALB017, ALB021, BIT022, HWK009, SHF018b/018d, SHD022/023, WEF025, WHN024, RAF Cosford	All forms of source control are likely to be suitable.	Infiltration is likely to be suitable. Mapping suggests a low risk of ground water flooding however, site investigations should be carried out to assess potential for drainage by infiltration. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints given that the site is located within a Source Protection Zone.	Detention may be feasible provided site slopes are <5% at the location of the detention feature. If the site has contamination or groundwater issues; a liner will be required.	Filtration is probably suitable provided site slopes are <5% and the depth to the water table is >1m. If the site has contamination or groundwater issues; a liner will be required.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. If the site has contamination issues; a liner will be required.
ALV006/007, ALV009, BOM019, BOM020, DNP009, HDL006, HHH001/014, LUD057, SHA019	All forms of source control are likely to be suitable.	Infiltration is likely to be suitable. Mapping suggests a low risk of ground water flooding however, site investigations should be carried out to assess potential for drainage by infiltration.	Detention may be feasible provided site slopes are < 5% at the location of the detention feature. If the site has contamination or groundwater issues; a liner will be required.	Filtration is probably suitable provided site slopes are <5% and the depth to the water table is >1m. If the site has contamination or groundwater issues; a liner will be required.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. If the site has contamination issues; a liner will be required.
BNP035, BNP024, GWR009, MDR006, SMH038, WEM025, WBR007/008, BLK008a, BAY039, BAY050, CLU005, CHR001, MDR039/043, PPW025, BUR004, SHF013, SHF015/029, WBR010, WRP006	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater.	Infiltration may be suitable. Mapping suggests a medium risk of groundwater flooding and underlying soils may be permeable. Further site investigation should be carried out to assess potential for drainage by infiltration. If infiltration is suitable it should be avoided in areas where the depth to the water table is <1m.	Mapping suggests that the site slopes are suitable for all forms of detention. A liner maybe required due to the site potential groundwater flooding.	All filtration techniques are likely to be suitable. A liner maybe required to prevent the egress of groundwater.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater.
BIS028, CHK002, CES005, ELL005 ELL008, HNN016, SMH031, WHT014, SHR197VAR	Most source control techniques are likely to be suitable. Mapping suggests that slopes may be unsuitable for selective source control techniques.	Infiltration is likely to be suitable. Mapping suggests a low risk of ground water flooding however, site investigations should be carried out to assess potential for drainage by infiltration.	Detention is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible a liner maybe required to prevent the egress of groundwater.	Filtration is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible it should be located where the depth to the water table is >1m.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows.
CST020, CHR002, LUD052, LUD056, SHR145, WHT037/044, OSW017, CST021, MIN018, PYC021, PON008/017/030, WHT042, Ironbridge*	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater. Mapping also suggests that slopes may be unsuitable for selective source control techniques.	Mapping suggests that there is a medium risk of groundwater flooding at this location, therefore it is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration	Detention is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible a liner maybe required to prevent the egress of groundwater.	Filtration is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible it should be located where the depth to the water table is >1m, additionally a liner maybe required to prevent the egress of groundwater.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater.
FRD011, KCK009	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk both to and from groundwater.	Mapping suggests that there is a high risk of groundwater flooding at this location, therefore it is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration. If possible, proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints given that the site is located within a Source Protection Zone.	Detention may be feasible provided site slopes are <5% at the location of the detention feature. If the site has contamination or groundwater issues; a liner will be required.	Filtration is probably suitable provided site slopes are <5% and the depth to the water table is >1m. If the site has contamination or groundwater issues; a liner will be required.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. If the site has contamination or groundwater issues; a liner will be required.

Site	SuDS feature				
	Source controls	Infiltration	Detention	Filtration	Conveyance
SHR116, CES006, PKH002/007/031, WEM033, WRP017, BRD030, BUR001, BUR002, SHF054a	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater.	Mapping suggests that there is a high risk of groundwater flooding at this location, therefore it is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration.	Detention may be feasible provided site slopes are <5% at the location of the detention feature. A liner maybe required to prevent the egress of groundwater.	Filtration is probably suitable provided site slopes are <5% and the depth to the water table is >1m. A liner maybe required to prevent the egress of groundwater.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater.
SHR060/158/161	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater. Mapping also suggests that slopes may be unsuitable for selective source control techniques.	Mapping suggests that there is a high risk of groundwater flooding at this location, therefore it is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints given that the site is partially located within a Source Protection Zone.	Detention is unlikely to be feasible as mapping suggests mean site slopes are > 5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible a liner maybe required to prevent the egress of groundwater.	Filtration is unlikely to be feasible as mapping suggests mean site slopes are > 5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible it should be located where the depth to the water table is >1m, additionally a liner maybe required to prevent the egress of groundwater.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater.
SHF173	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater. Mapping also suggests that slopes may be unsuitable for selective source control techniques.	Mapping suggests that there is a high risk of groundwater flooding at this location, therefore it is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration.	Detention is unlikely to be feasible as mapping suggests mean site slopes are > 5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible a liner maybe required to prevent the egress of groundwater.	Filtration is unlikely to be feasible as mapping suggests mean site slopes are > 5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible it should be located where the depth to the water table is >1m, additionally a liner maybe required to prevent the egress of groundwater.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater.
MDR012, MDR034, SHR057/117, RUY019,	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk both to and from groundwater.	Infiltration may be suitable. Mapping suggests a medium risk of groundwater flooding and underlying soils may be permeable. Further site investigation should be carried out to assess potential for drainage by infiltration. If infiltration is suitable it should be avoided in areas where the depth to the water table is <1m. Additionally, proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints given that the site is located with a Source Protection Zone.	Detention may be feasible provided site slopes are <5% at the location of the detention feature. If the site has contamination or groundwater issues; a liner will be required.	Filtration is probably suitable provided site slopes are <5% and the depth to the water table is >1m. If the site has contamination or groundwater issues; a liner will be required.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. If the site has contamination or groundwater issues; a liner will be required.
P58a, STC002 MUW012	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater. Mapping also suggests that slopes may be unsuitable for selective source control techniques.	Infiltration is likely to be suitable. Mapping suggests a low risk of ground water flooding however, site investigations should be carried out to assess potential for drainage by infiltration. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints given that the site is located with a Source Protection Zone.	Detention is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible a liner maybe required to prevent the egress of groundwater.	Filtration is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible it should be located where the depth to the water table is >1m, additionally a liner maybe required to prevent the egress of groundwater.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater.
Clive Barracks	Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater. Mapping also suggests that slopes may be unsuitable for selective source control techniques.	Mapping suggests that there is a high risk of groundwater flooding at this location, therefore it is likely infiltration techniques will not be suitable. This should be confirmed via site investigations to assess the potential for infiltration.	Detention is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible a liner maybe required to prevent the egress of groundwater.	Filtration is unlikely to be feasible as mapping suggests mean site slopes are >5%. Feasibility of such options should be assessed as part of a site-specific assessment. If this feature is feasible it should be located where the depth to the water table is >1m, additionally a liner maybe required to prevent the egress of groundwater.	All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater.

*The Ironbridge strategic site has areas within its boundary designated by the Environment Agency as being a landfill site. A thorough ground investigation will be required as part of a detailed FRA to determine the extent of the contamination and the impact this may have on SuDS. As such proposed SuDS should be discussed with the relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.

11.8 Conclusions

- A number of SSSIs exist within Shropshire that should be carefully considered in future plan making.
- WwTW serving growth within Shropshire are point sources of pollution in the study area.
- There is potential for additional discharge from WwTW to impact sites with environmental designations (see Section 9).
- Development sites within Shropshire could be sources of diffuse pollution from surface runoff.
- Several of the proposed development sites could have a direct surface water pathway to a SSSI.
- SuDS are required on all sites and their design must consider water quality as well as quantity.
- Runoff from these sites should be managed through implementation of a SuDS scheme with a focus on treating water quality of surface runoff from roads and development sites
- Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity.
- Shropshire Council as LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors
- In the wider area, opportunities exist to implement natural flood management techniques to achieve multiple benefits of flood risk, water quality and habitat creation.

11.9 Recommendations

Table 11.6 Recommendations from environmental constraints and opportunities section

Action	Responsibility	Timescale
The Local Plan should include policies that require all development to adopt SuDS to manage water quality of surface runoff.	SC	Ongoing
The local plan should include policies that require all development to avoid significant adverse effects on areas with environmental designations.	SC	Ongoing
In partnership, identify opportunities for incorporating SuDS into open spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	SC STW, WW EA	Ongoing
Developers should include the design of SuDS at an early stage in their planning application to maximise the benefits of the scheme	Developers	Ongoing
Work with developers to discourage connection of new developments into existing surface water and combined sewer networks. Prevent connections into the foul network, as this is a significant cause of sewer flooding.	SC Developers	Ongoing

Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within Shropshire.	SC, EA, NE	Ongoing

12 River Clun Catchment

12.1 Introduction

The River Clun catchment is a sensitive area for proposed development within the south west of Shropshire. Natural England have published Impact Risk Zones (IRZ)[80], which help to identify the potential risks posed by development proposals to different sites with environmental designations. The dataset provides an indication of what type of development will have the impact, e.g. all planning applications, residential sites of greater than 100 proposed dwellings, industrial/agricultural development, airports, pylons, quarries etc. The IRZ dataset states that "All Planning Applications" in the River Clun Catchment may impact sites with environmental designations, and consultation with Natural England is required.

Part of the catchment is a SAC[81], designated for the presence of freshwater pearl mussels. Surveys conducted since 1995 have shown that the population is non-functioning and may only survive for another 20 years if nothing is done to improve conditions. Assessments of the SAC show high levels of silt and nutrients (particularly phosphate and nitrogen) which affects the health of the pearl mussel population.

In 2014 a nutrient management plan was produced by NE and the EA to provide a long-term, whole catchment strategic view of the types and combinations of measures that are needed to achieve a favourable condition of the river Clun SAC by 2027.

12.2 Sources of pollution

Source apportionment has been carried out and reported in the Nutrient Management Plan (NMR).

12.2.1 Phosphate

It is estimated that third of phosphate load is from point sources, two thirds from diffuse, with the largest single source of phosphate being livestock, accounting for over half of the phosphate load. The largest point source input is estimated to be from WwTW which contribute 35% of the phosphate load.

12.2.2 Nitrate

The EA have undertaken modelling work in the catchment which estimates that between 92% and 99% of the catchment nitrogen loads are from diffuse sources (although the split between arable and livestock farming is unknown), and only approximately 1% is from WwTW discharge.

12.2.3 Sediment

Another significant problem for the freshwater pearl muscle population is siltation / sediment, with an estimated 85% of the annual load being from erosion of catchment soils, and 15% from bank erosion. Sediment derived from point sources is estimated to be very small.

12.3 Growth in the Clun catchment

The current allocated and committed growth in Shropshire has been made possible by upgrading phosphate stripping processes in the WwTW in the Clun catchment in order to reduce point-source inputs of nutrients, however any additional growth in the

80 Natural England's SSSI Impact Risk Zones Accessed online at: https://naturalengland-defra.opendata.arcgis.com/datasets/dd6ff0bd464e42fea19f289423a1d22a_0 on: 04/10/2019
81 Natural England's European Site Conservation Objectives for River Clun SAC Accessed online at: http://publications.naturalengland.org.uk/publication/6453431740923904 on: 30/10/2019

catchment would need further measures to ensure no deterioration to water quality in the catchment.

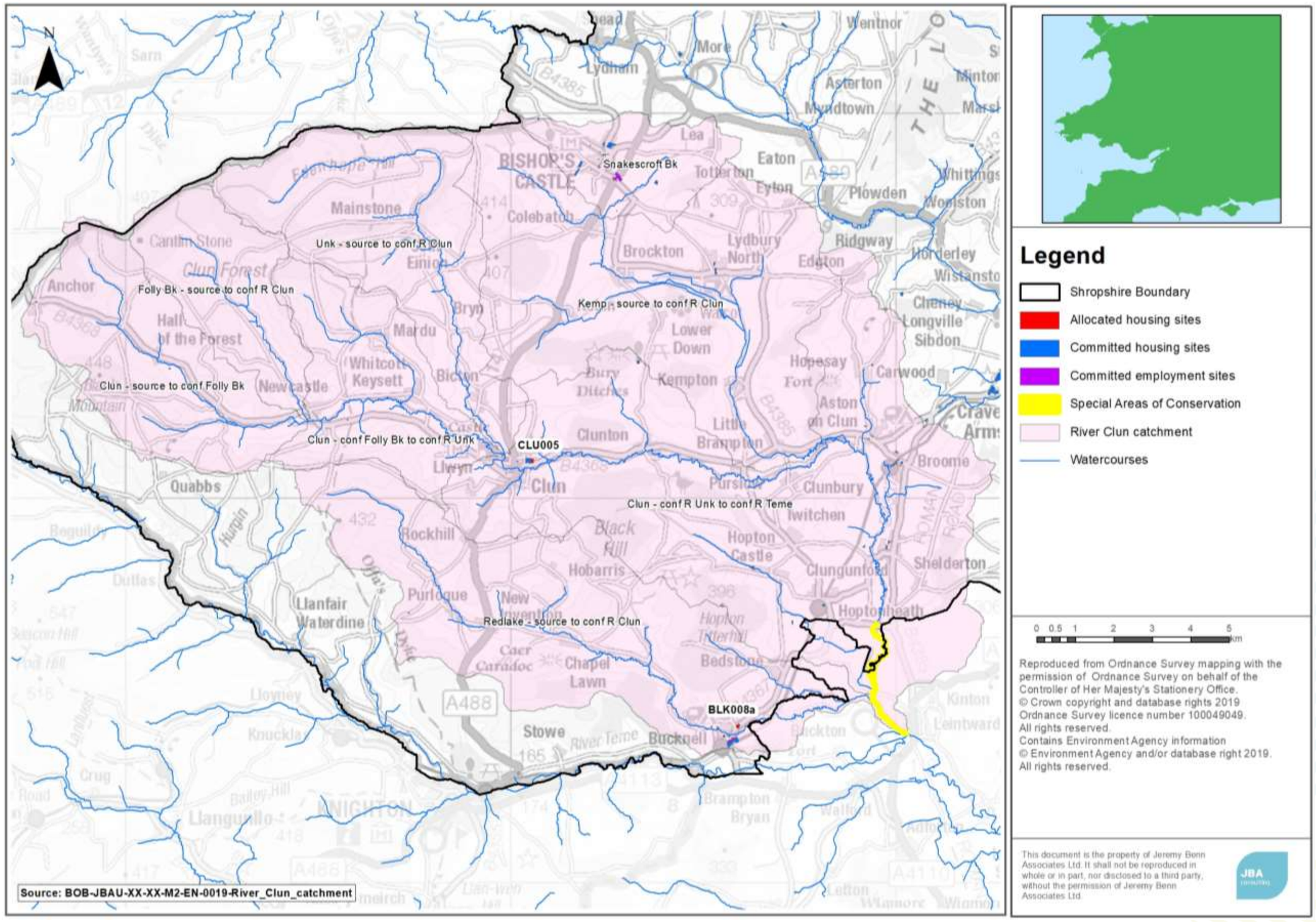
There are two preferred options sites estimated to provide 40 houses within the Clun catchment, as well as further projected growth through windfall of approximately 18 houses. These are outlined in Table 12.1. A total of 58 houses are proposed in the catchment, in addition to approximately 300 already committed/allocated houses. There is also likely to be an element of windfall development outside the Key Centre of Bishop's Castle and the Community Hubs of Clun and Bucknell as part of the 27.5% of the total housing requirement directed to the rural area. There are three employment sites in the catchment with planning permission or that have already been allocated.

Figure 12.1 shows an overview of the River Clun catchment within Shropshire.

Table 12.1 Preferred options growth in the Clun catchment

Settlement	Site reference	Proposed number of houses
Bishops Castle	Windfall	7
Clun	CLU005	20
	Windfall	8
Bucknell	BKL008a	20
	Windfall	3
		TOTAL = 58

Figure 12.1 River Clun catchment



12.4 Mitigation options

12.4.1 Summary

Table 12.2 summarises potential mitigation measures to enable development to proceed within the constraints of the River Clun SAC. These options are then discussed in more detail in section 12.5.

For any mitigation to be successful, it needs to be able to demonstrate that it will be effective, i.e. no detrimental impact on the SAC. In practical terms this means achieving load standstill for Phosphate and Nitrate in the Clun catchment. Any scheme therefore requires strong and convincing evidence to show that it will be both effective and deliverable.

It also requires a realistic funding method, both for initial construction or implementation, or ongoing operation and maintenance.

Table 12.2 Options for improving water quality in the Clun

Mitigation Option	Description	Pros	Cons	Relative cost	Funding route	Evidence	Carbon Cost
Direct growth to catchments with more environmental capacity	No further growth in Clun catchment	No mitigation needed	- Can housing requirement still be met? - Lack of housing in Clun catchment	None	N/A	N/A	None
Growth with no mitigation	Allow growth with current AMP 7 schemes as they are	No mitigation carried out	- Local Plan will not pass Habitats Regulations Assessment - SAC further declines	- Low short term - High long term	N/A	N/A	None
Upgrades at WwTWs	Further upgrade WwTWs in Clun and tighten permits THIS IS ALREADY PARTIALLY COMPLETED	- AMP6 schemes already implemented and AMP planned between 2020-25 - Measurable performance - STW analysis shows 75% reduction in P still achieved in Clun with additional growth	- Does not demonstrate "nitrate neutral" - Costs are placed on water bill payers, not on developers or agricultural polluters	High CAPEX	STW Business Plan	WQ Modelling	High - CAPEX and OPEX
Pump wastewater out of catchment	Pump wastewater (treated or untreated) out of Clun catchment to discharge in different waterbody or treat at a different WwTW	-Clun SAC is not affected by growth -Could achieve betterment in the Clun catchment	- May not be technically feasible at a reasonable cost - Further study needed to assess impact of additional flow in neighbouring catchment	High - CAPEX and OPEX	STW Business Plan	WQ Modelling	High - CAPEX and OPEX

Mitigation Option	Description	Pros	Cons	Relative cost	Funding route	Evidence	Carbon Cost
Integrated Constructed Wetlands (ICW)	ICW connected to WwTW in Clun catchment	- Proven technique to improve WQ - Enhanced biodiversity - Opportunities to combine with agricultural runoff? - Able to consent discharge to give defined outcome	- Requires maintenance - Requires adoption - Who is responsible for consent and therefore performance? - Area of land required	Medium	???	Already an established technology in the UK with applications by water companies and river trusts.	Small positive impact
Natural Flood Management (NFM)	NFM schemes such as Large woody debris dams	- LWD dams shown to be effective in other catchments at reducing phosphate and sediment - Other potential benefits including reduced flood risk and biodiversity	- Exact impact difficult to measure - Requires maintenance to remain effective, - who owns "asset"	Low	- CiL payments? If added to Reg. 123 list - Section 106? What about funding to maintain?	Working with Natural Processes Evidence Base	Small positive impact
Farm management	Schemes aimed at reducing nutrient pollution and sediment loss. - Buffer strips - Cross slope tree planting - Runoff retention basins - Contour ploughing - Cover crops - Smart application of nutrients	- Big potential to reduce sedimentation and nutrient pollution	- Exact impact difficult to measure and will be cumulative over whole catchment - Once implemented it relies on the landowner to maintain, what incentive is there to maintain it?	Low	- Catchment Sensitive Farming (CSF) - Payment for Ecosystem Services (PES) approach. Funding auction - e.g. Wessex Water https://www.entrade.co.uk/Case_study/	https://www.gov.uk/guidance/catchment-sensitive-farming-reduce-agricultural-water-pollution	Small positive impact

12.5 Options

12.5.1 WwTW Upgrades

In response to the nutrient management plan, STW committed to removing 75% of the phosphate load from the Clun catchment. This was planned to be achieved through upgrades at Clun, Newcastle-on-Clun, Lydbury North, Aston-On-Clun and Bucknell WwTW in AMP6.

Additional growth as part of the preferred options and strategic sites identified in the Local Plan Review, would reduce the percentage phosphate load removed to under 75%. However, in AMP7 Bishops Castle is also due to be upgraded and its permit tightened to 0.4mg/l (from 0.43mg/l) to ensure future compliance. This is predicted to offset the proposed additional growth, and even allow some betterment in comparison to AMP6.

Severn Trent Water have therefore commented that they would not need to "undertake further work to accommodate the extra 121 houses over and above the work already scheduled at Bishops Castle. This work alone is sufficient to ensure no net detriment to the SAC."

12.5.2 Pump wastewater out of Clun catchment

An option exists to pump additional wastewater out of the Clun catchment and into WwTW that discharge into neighbouring catchments that have environmental headroom, and do not impact on a protected area. This could either be a volume equivalent to the additional flow from growth, or a higher volume and achieve betterment.

However, the capital cost of putting in place such a scheme, and the operational cost of pumping flows over considerable distance are significant, and this may not be a realistic option for the small volume of flows being considered.

12.5.3 Integrated Constructed Wetlands

An integrated constructed wetland (ICW) is an artificial wetland created for the purpose of treating polluted water, whether this is municipal wastewater, grey water from residential properties, or agricultural runoff.

They are usually unlined, free surface flow wetlands, designed to contain and treat influents within emergent vegetated areas.

Defra carried out a systematic review[82] of the effectiveness of various wetland types, including ICWs for mitigating agricultural pollution such as phosphate and nitrate. The overall conclusion was that all wetland types are very effective at reducing major nutrients and suspended sediments, with the exception of nitrate in ICWs. Nitrate is only reduced when passing through overland buffer strips and through constructed wetlands with vegetation, where the systematic review showed a mean reduction of 29% across the evidence included in the study.

The mean reduction in Total Phosphorus across the evidence base was 78%.

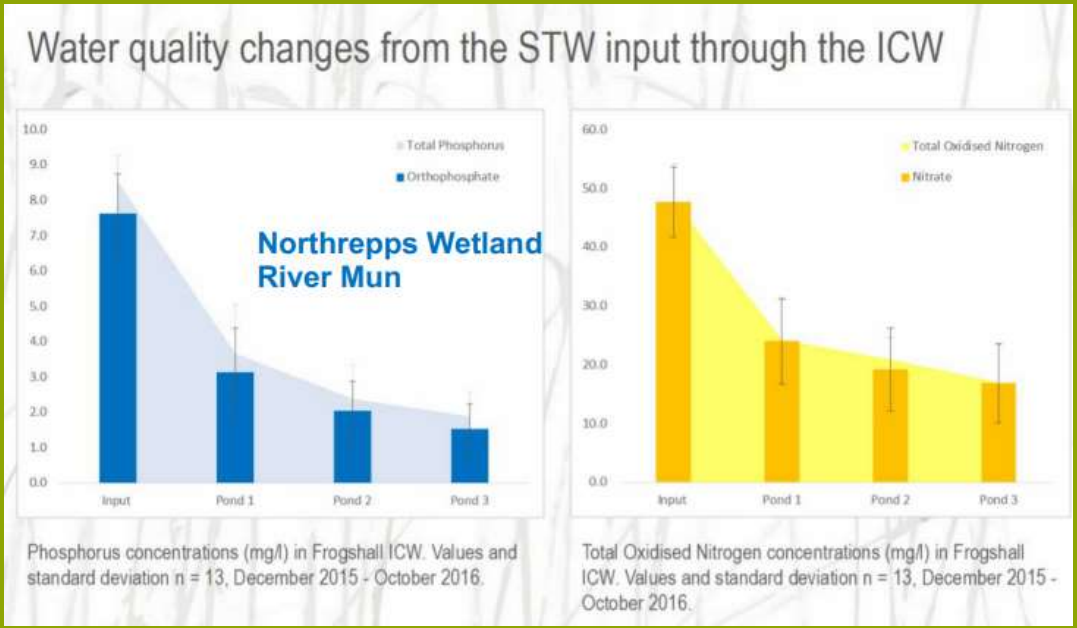
82 Do on-farm natural, restored, managed and constructed wetlands mitigate agricultural pollution in Great Britain and Northern Ireland? A Systematic Review (Final Report WT0989) Defra, (2015).

Case Study – Frogshall ICW

The Upper River Mun in Norfolk was experiencing chronic pollution, and a loss in biodiversity in the river. Investigation found that nutrients from a Sewage Treatment Works upstream were contributing to this issue.

A pilot ICW was created consisting of three shallow ponds, filled with 18,000 emergent aquatic plants, and the outfall from the treatment works was diverted to pass through the wetland.

Early monitoring has shown that 90% of the phosphate is being removed by the wetland, and a large increase in biodiversity downstream observed.



Reproduced from "Stripping the Phosphate" a presentation by the Norfolk Rivers Trust (2018).

https://www.theriverstrust.org/media/2018/08/2.-Stripping-the-phosphate-David-Diggens-Norfolk-Rivers-Trust.pdf

12.5.4 Natural Flood Management

Section 11.6 contains a summary of NFM techniques that could be suitable in the Clun catchment.

NFM techniques have been shown to demonstrate a measurable impact on water quality, either by preventing pollutants from reaching watercourses, or encouraging deposition once in a watercourse. However, predicting the impact of NFM measures before installation is very difficult, as is apportioning a defined impact to a particular intervention. This makes it hard to use NFM measures as a mitigation option for a housing scheme unless the NFM feature is installed well in advance of the development and can be shown to be producing the desired result.

NFM schemes are fairly cost effective as the Black Brook case study (Section 11.6) shows, and funding may be available to help with installation such as Grant in Aid funding. In order to ensure that the NFM feature continues to provide the mitigation required, ongoing maintenance is required which will require continued funding.

12.5.5 Farm Management

The nutrient management plan highlights the contribution from agriculture to phosphate, nitrate and sediment pollution in the Clun catchment. There is therefore a big potential to improve water quality by interventions aimed at agricultural sources, especially considering the measures already taken by STW to reduce their contribution to phosphate load in the Clun by 75%.

Potential schemes could include:

- Buffer strips
- Cross slope tree planting
- Runoff retention basins
- Contour ploughing
- Cover crops

There is considerable overlap with NFM measures, and the challenges are also very similar. Exact impacts are difficult to measure, although modelling tools such as Farmscoper[83] exist to help with this. Once a scheme is implemented it relies on the landowner to continue to maintain it in order to maintain the mitigation benefit.

Funding for agricultural interventions could come from Catchment Sensitive Farming or a Payment for Ecosystem Services approach.

Wessex Water and United Utilities have both recently used a reverse auction approach[84], which enables farmers to bid for funding to plant cover crops in winter to manage runoff from agricultural land.

83 Farmscoper webpage, ADAS (2020). https://www.adas.uk/Service/farmscoper Accessed on 22/01/2020
84 EnTrade webpage, Entrade (2020). https://www.entrade.co.uk/ Accessed on 22/01/2020

Case Study – Wessex Water - EnTrade

Wessex Water catchment team used EnTrade to invite farmers to bid to grow cover crops over winter to reduce the nitrogen leaching into the watercourse.

This avoided the need to upgrade Dorchester WwTW to provide the same nitrogen removal capacity.

A trial auction was held in 2015, and two further auctions have since taken place attracting 557 bids from 63 farmers to save 153 tonnes of nitrogen.

"Using EnTrade to create a market in measures to deliver reductions in nitrogen has delivered a 30% saving for Wessex Water compared to traditional catchment approaches."

Ruth Barden, Director of Environmental Strategy, Wessex Water

12.6 Conclusions

The River Clun catchment provides a unique challenge within Shropshire, with the current unfavourable condition of the Special Area of Conservation being the major factor influencing growth within the catchment. Severn Trent Water have undertaken a considerable programme of upgrades at WwTW within the catchment to reduce their contribution to phosphate load. This report sets out various options for further nutrient reductions including constructed wetlands, natural flood management techniques, and changes to agricultural practices. These need to be considered as part of the Local Plan Review Habitat Regulations Assessment.

12.7 Recommendations

Table 12.3 Recommendations from environmental constraints and opportunities section

Action	Responsibility	Timescale
The HRA for the Local Plan Review should consider mitigation options to prevent any impact from growth on the River Clun SAC	SC	During Local Plan Review process
An updated nutrient management plan for the Clun catchment is required to enable mitigation options to be identified and implemented.	EA, NE	Ongoing

Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within the River Clun catchment	SC, EA, NE	Ongoing

13 Climate change impact assessment

13.1 Approach

A qualitative assessment was undertaken to assess the potential impacts of climate change on the assessments made in this water cycle study. This was done using a matrix which considered both the potential impact of climate change on the assessment in question, and also the degree to which climate change has been considered in the information used to make the assessment.

The impacts have been assessed on a Shropshire area wide basis; the available climate models are generally insufficiently refined to draw different conclusions for different parts of Shropshire or doing so would require a degree of detail beyond the scope of this study.

Table 13.1 Climate change pressures scoring matrix

		Impact of pressure		
		Low	**Medium**	**High**
Have climate change pressures been considered in the assessment?	Yes - quantitative consideration			
	Some consideration but qualitative only			
	Not considered			

13.2 Severn Trent Water infrastructure

Severn Trent Water have published a risk assessment[85] for both water resources, wastewater treatment and wastewater sewerage networks that identifies the level of threat from climate change in key service areas. In the case of WwTW, the highest perceived risks are in asset performance and pollution incidents, both of which can be attributed to an increased risk of flooding. In the case of the wastewater network, sewer flooding, resulting from increased rainfall intensity overwhelming the sewer network is added to the risks of impacts on asset performance and pollution incidents.

Consideration of the impact of climate change on water resources is included in Severn Trent Water's WRMP, with the main risk being the increased likelihood of severe drought events. Allowance is made within the baseline supply forecast by adjusting the "Water Available for Use". Each WRZ is classified as "low", "medium" or "high" vulnerability, to identify which WRZs are the most vulnerable to potential changes in rainfall and temperatures. All WRZs in Shropshire were classified as "low vulnerability" with the exception of the Strategic Grid WRZ which is classified as "high vulnerability". All groundwater sources in Shropshire are considered to be "low vulnerability". Despite these results all WRZs were modelled for climate change as "high vulnerability" for

85 Severn Trent Water's Climate Change Adaptation Report 2015-2020, Severn Trent Water (2015). Accessed online at: https://www.stwater.co.uk/content/dam/stw/about_us/documents/Full-Climate-change-adaptation-report-2015-2020.pdf on: 27/09/19

consistency to assess the potential impacts on deployable output. The results of the modelling showed that the Strategic Grid WRZ was the WRZ in Shropshire most affect by the potential impacts that climate change has on surface water sources. The Strategic Grid WRZ is directly affected by reduced river flows and reservoir infill.

Table 13.2 Scoring of climate change consequences for the water cycle study

Assessment	Impact of Pressure (source of information)	Have climate change pressures been considered in the Water Cycle Study?	RAG
Water resources	High	Yes – quantitative assessment within the WRMP. Climate change impacts on consumption have been calculated in accordance with UKWIR report "Impact of Climate Change on Water Demand" (2013).	
Water supply infrastructure	Medium - some increased demand in hot weather	Yes - quantitative assessment within the WRMP.	
Wastewater Collection	High - Intense summer rainfall and higher winter rainfall increases flood risk	Yes – qualitative assessment in climate change adaptation reports by Severn Trent Water. This has not been considered in site by site assessments.	
Wastewater treatment	Medium - Increased winter flows and more extreme weather events reduces flow headroom	Yes – qualitative assessment in the Severn Trent Water climate change adaptation reports. This has not been considered in site by site assessments.	
WwTW odour	Medium – higher temperatures will exacerbate existing odour control issues.	Severn Trent Water have not considered odour in their climate adaptation plan.	
Water quality	Nutrients: High Sanitary determinands: Medium to High	Qualitative assessments have been included in the climate change adaptation policy papers from Severn Trent Water.	
Flooding from increased WwTW discharge	Low	No - not considered	

(1) River Basin Management Plan

(2) STW WRMPs

13.3 Conclusions and Recommendations

The impact of Climate Change on water resources and water infrastructure are receiving increasing levels of attention by water companies and sewerage undertakers at a strategic level. This has not been included in assessments at a site level as detailed modelling has not been carried out by Severn Trent Water. Consideration of changes in water and wastewater demand should be considered when carrying out detailed site assessments in the future.

There is a risk that lower river flows in the future could exacerbate water quality issues as there would be less opportunity for dilution of pollutants.

Table 13.3 Conclusions and recommendations from climate change assessment

Action	Responsibility	Timescale
When undertaking detailed assessments of environmental or asset capacity, consider how the latest climate change guidance can be included.	EA, STW, WW SC	As required
Take "no regrets"* decisions in the design of developments which will contribute to mitigation and adaptation to climate change impacts. For example, consider surface water exceedance pathways when designing the layout of developments.	SC and Developers	As required

* "No-Regrets" Approach: "No-regrets" actions are actions by households, communities, and local/national/international institutions that can be justified from economic, and social, and environmental perspectives whether natural hazard events or climate change (or other hazards) take place or not. "No-regrets" actions increase resilience, which is the ability of a "system" to deal with different types of hazards in a timely, efficient, and equitable manner. Increasing resilience is the basis for sustainable growth in a world of multiple hazards (Heltberg, Siegel, Jorgensen, 2009; UNDP, 2010).

14 Summary and overall conclusions

14.1 Summary

Shropshire Council's preferred development strategy proposes 30,800 dwellings and 300ha of employment land over the Local Plan Period 2016-2038. Much of this has been met through current committed sites, sites with planning permission and allocations which have not yet gained planning permission. However, there is a net remaining requirement of around 12,000 houses and 75ha of employment land, to be delivered through preferred options sites and a number of larger strategic sites. The aim of this water cycle study is to provide the evidence to inform the selection of sites, taking into account the constraints in the water environment and in water and wastewater infrastructure.

Severn Trent Water supply water for the whole of Shropshire and provide wastewater services for the majority of the study area, with Welsh Water and United Utilities providing wastewater services in small parts of Shropshire.

A number of WwTW have limited headroom in their environmental permits: additional growth may require changes to their flow permits and accompanying changes to their environmental permits and/or upgrades to treatment performance.

Table 14.1 shows the combined RAG results from Severn Trent and Welsh Water, across the water resources, foul sewerage, and WwTW flow assessments. A score of red or amber does not necessarily mean that development in these areas cannot occur, just that infrastructure upgrades may be required to accommodate growth. The recommendations outlined in the below table should be considered and early engagement between the Council and the water companies is key to ensure the required growth can be realised.

The conclusions from each topic area are summarised in Table 14.2, alongside the recommendations in Table 14.3.

Table 14.1 Summary of RAG assessments by settlement

Strategic site / Settlement	Water Resources RAG	Overall sewerage RAG	WwTW flow capacity RAG	Total potential number of houses	Total potential number of employees
RAF Cosford	Green	Red	Not assessed	682	Unknown
Clive Barracks	Amber	Red	Amber	750	329
Ironbridge	Green	Red	Amber	1,000	343
Settlement	**Water Resources RAG**	**Overall sewerage**	**WwTW flow capacity RAG**	**Total potential number of houses**	**Total potential number of employees**
Albrighton	Amber	Red	Red	180	0
Alveley	Green	Green	Green	70	0
Baschurch	Green	Red	Amber	55	0
Bayston Hill	Green	Red	Amber	147	0
Bicton	Green	Not assessed	Amber	15	0
Bishop's Castle	Green	Red	Black	45	0
Bomere Heath	Green	Red	Green	55	0
Bridgnorth	Green	Red	Amber	1,050	1,566
Broseley	Green	Amber	Amber	55	0
Bucknell	Green	Red	Green	20	0

Strategic site / Settlement	Water Resources RAG	Overall sewerage RAG	WwTW flow capacity RAG	Total potential number of houses	Total potential number of employees
Chirbury	Green	Not assessed	Amber	14	0
Church Stretton	Green	Red	Green	70	0
Clee Hill	Green	Amber	Red	20	0
Clive	Green	Green	Green	20	0
Clun	Green	Green	Green	20	0
Cressage	Green	Green	Green	64	0
Cross Houses	Green	Green	Green	40	0
Ditton Priors	Green	Red	Red	40	0
Dudleston Heath	Green	Amber	Green	60	0
Ellesmere	Green	Amber	Green	170	0
Ford	Green	Red	Green	75	0
Gobowen	Green	Red	Green	25	0
Hadnall	Green	Green	Amber	40	0
Highley	Green	Amber	Green	120	0
Hinstock	Green	Green	Red	35	0
Hodnet	Green	Amber	Green	40	0
Knockin	Green	Amber	Amber	25	0
Llanymynech	Green	Green	Green	50	0
Ludlow	Green	Red	Red	254	286
Market Drayton	Green	Amber	Green	435	0
Minsterley	Green	Green	Green	20	0
Much Wenlock	Green	Amber	Green	120	0
Oswestry	Green	Green	Green	30	0
Pant	Green	Amber	Green	45	0
Park Hall	Green	Green	Green	260	0
Pontesbury	Green	Red	Amber	40	0
Prees	Green	Green	Red	35	0
Ruyton XI Towns	Green	Green	Green	65	0
Shawbury	Green	Green	Green	80	0
Shifnal	Amber	Red	Red	220	2,180
Shrewsbury	Green	Red	Amber	2,510	7,304
St Martins	Green	Green	Green	95	0
Wem	Green	Green	Red	210	0
West Felton	Green	Amber	Red	60	0
Weston Rhyn	Green	Amber	Green	100	0
Whitchurch	Green	Amber	Amber	450	0
Whittington	Green	Green	Green	70	0
Worthen	Green	Green	Green	45	0

The water cycle study has also assessed the impact of additional wastewater discharge on water quality in Shropshire. Downstream of many WwTWs that are expected to serve

growth a deterioration in water quality is predicted, but in most cases, this could be prevented by improvements in treatment processes at those works. In five cases (Clive, Ditton Priors, Market Drayton, Nesscliffe Wilcot, and Oswestry Mile Oak), prevention of this deterioration may not be possible. and alternative solutions may be required in order to accommodate growth.

At Albrighton WwTW, whilst a large deterioration is not predicted due to growth, should improvements in water quality be made elsewhere in the catchment, there is a risk that the additional growth served by this WwTW could become the factor that prevents good ecological status being achieved in the watercourse downstream in the future.

Table 14.2 Summary of conclusions from the study

Assessment	Conclusion
Water resources	• The WRMP shows a supply-demand deficit for Strategic Grid WRZ from 2021/22 and for the North Staffs WRZ from 2025/26 if no action is taken. It goes on to define a number of actions that will address this. • The WRMP also identifies a supply-demand deficit for Kinsall WRZ (from 2030/31) and Whitchurch and Wem WRZ (2035/36) however these deficits are much less significant than for Strategic Grid and Whitchurch and Wem. • Severn Trent have stated that the adopted WRMP has planned for the proposed growth, however sites in Albrighton, Shifnal and the strategic site at RAF Cosford were rated amber as they are located in areas where there are WINEP actions to reduce abstraction. Water may need to be transferred into the catchment to supply this growth without increasing local abstraction. • Policies to reduce water demand from new developments, or to go further and achieve water neutrality in certain areas (particularly within the Shelton water resource zone), could be defined to reduce the potential environmental impact of additional water abstractions in Shropshire, and also help to achieve reductions in carbon emissions in Shropshire. It is therefore recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Shropshire. • In the areas identified by Severn Trent Water as having particular pressures on Water Resources such as Shelton water resource zone should be considered for the application of water neutrality if required by STW.
Water supply infrastructure	• Severn Trent stated that as long as a site is within a water resource zone with sufficient water resources, they do not envisage a problem with supply to that site. An exception to this are the sites around Albrighton, Shifnal and the strategic site at RAF Cosford. In these locations water may need to be transferred into the catchment to serve these sites without increasing local abstraction. • Early developer engagement is required to ensure that, as development occurs within the study area, detailed modelling of water supply infrastructure will allow any upgrades to be completed without restricting the timing, location or scale of the planned development.
Wastewater collection	• Development in areas where there is limited wastewater network capacity will increase pressure on the network, increasing the risk of a detrimental impact on existing customers, and increasing the likelihood of CSO operation. • Significant wastewater infrastructure upgrades would be required for all of the Strategic Sites and for a number of settlements in Shropshire, including Shrewsbury, Bridgnorth, Shifnal, Ludlow and Albrighton.

Assessment	Conclusion
	• Early engagement with Severn Trent Water and Welsh Water is required, and further modelling of the network may be required at the planning application stage.
Wastewater Treatment Works Flow Permit assessment	• STW and WW provided assessments of the WwTW serving growth in each scenario based on hydraulic capacity and headroom in the environmental permit. JBA performed a flow permit assessment in parallel to this. • While the proposed growth in Shropshire can be accommodated at a number of WwTW, some treatment works could require upgrades to ensure growth can occur without causing the maximum DWF to be exceeded. • Early engagement with Severn Trent Water and Welsh Water would be required at the planning application stage to ensure that growth is aligned with provision of capacity at WwTW.
Odour Assessment	• One site, SHR166 is identified as being at risk of nuisance odour from a WwTW. An odour assessment is recommended as part of the planning application process, paid for by developers.
Water quality impact assessment	• At eleven WwTWs in Shropshire , water quality modelling identified a risk that planned growth could cause a deterioration in water quality, and that it may not be possible to mitigate this with treatment at the technically achievable limit. • At a further WwTW (Albrighton), there is a risk that growth may prevent good ecological status being achieved in the future. • At these works, further mitigation may need to be taken to accommodate growth and options include pumping wastewater to a different WwTW or changing the point of discharge to a less sensitive waterbody. Detailed optioneering is beyond the scope of this study and is best undertaken by Severn Trent Water who have a detailed knowledge of their assets, and the range of options and constraints at each.
Flood risk from additional WwTW flow	• The impact of increased effluent flows at WwTW from any of the proposed development is not predicted to have a significant impact upon flood risk in any of the receiving watercourses.
Environmental Constraints and Opportunities	• There are numerous SSSIs within Shropshire which should be carefully considered in future plan-making. • WwTWs serving growth within Shropshire are significant point sources of pollution in the study area. • There is potential for additional discharge from WwTW to impact sites with environmental designations (see Section 11.2). • Development sites within Shropshire could be sources of diffuse pollution from surface runoff. • Several of the proposed development sites could have a direct surface water pathway to a SSSI. • Runoff from these sites should be managed through implementation of a SuDS scheme with a focus on treating water quality of surface runoff from roads and development sites. • Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity. • SuDS for a single site could be demonstrated to have limited impact, but it is the cumulative impact of all development across the catchment (combined with the potential effects of climate change) that should be taken into account. For this reason, SuDS should be considered on sites that do not have a direct pathway to a SSSI.
River Clun	• Further mitigation needs to be considered in the context of the Local Plan Review Habitat Regulations Assessment. Options could include

Assessment	Conclusion
	constructed wetlands, natural flood management techniques, and changes to agricultural practices.
Climate Change	• The impact of Climate Change on water resources and water infrastructure are receiving increasing levels of attention by water companies and sewerage undertakers at a strategic level. This has not been included in assessments at a site level as detailed modelling has not been carried out by Severn Trent Water. Consideration of changes in water and wastewater demand should be considered when carrying out detailed site assessments in the future. • There is a risk that lower river flows in the future could exacerbate water quality issues as there would be less opportunity for dilution of pollutants.

14.2 Recommendations

Table 14.3 below summarises the recommendations from each section of the report.

Table 14.3 Summary of recommendations

Aspect	Action	Responsibility	Timescale
Water resources	Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities.	STW	Ongoing
	Provide yearly profiles of projected housing growth to water companies to inform the WRMP.	SC	Annually
	Use planning policy to require the 110l/person/day water consumption target permitted by National Planning Policy Guidance across Shropshire.	SC	In Local Plan Review
	The concept of water neutrality has the potential to provide a significant benefit in terms of resilience to climate change and enabling all waterbodies to be brought up to Good status. This approach could have particular application in the strategic site of RAF Cosford, and the settlements of Albrighton and Shifnal and should be explored further if required by STW to accommodate growth in these locations.	SC, EA, STW	In Local Plan Review and Climate Change Action Plan
	Water companies should advise SC of any strategic water resource infrastructure developments within the Authority, where these may require safeguarding of land to prevent other type of development occurring.	STW, SC	In Local Plan Review
Water supply	Undertake network modelling where appropriate as part of the planning application process to ensure adequate provision of water supply is feasible.	STW SC	As part of the planning process
	SC and Developers should engage early with STW to ensure infrastructure is in place prior to occupation.	SC STW Developers	Ongoing
Wastewater collection	Early engagement between the SC and STW and WW is required to ensure that where strategic infrastructure is required, it can be planned in by STW/WW.	SC STW/WW	Ongoing
	Take into account wastewater infrastructure constraints in phasing	SC STW/WW	Ongoing

Aspect	Action	Responsibility	Timescale
	development in partnership with the sewerage undertaker		
	Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline Drainage Strategy for sites. The Outline Drainage strategy should set out the following: **What** – What is required to serve the site **Where** – Where are the assets / upgrades to be located **When** – When are the assets to be delivered (phasing) **Which** – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	STW/WW and Developers	Ongoing
	Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to surface water sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA.	Developers LLFA	Ongoing
Wastewater treatment	Early engagement with STW and WW is required to ensure that provision of WwTW capacity id aligned with delivery of development.	SC STW/WW	Ongoing
	Provide Annual Monitoring Reports to STW/WW detailing projected housing growth.	SC	Ongoing
	STW/WW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	STW/WW SC	Ongoing
Odour	Consider odour risk for those sites identified to be at risk from nuisance odour	SC	Ongoing
	Carry out an odour assessment for SHR166 at the planning application stage.	Site Developers	Ongoing
Water Quality	Take into account the full volume of growth (from SC and neighbouring authorities) within the catchment	STW, WW	Ongoing

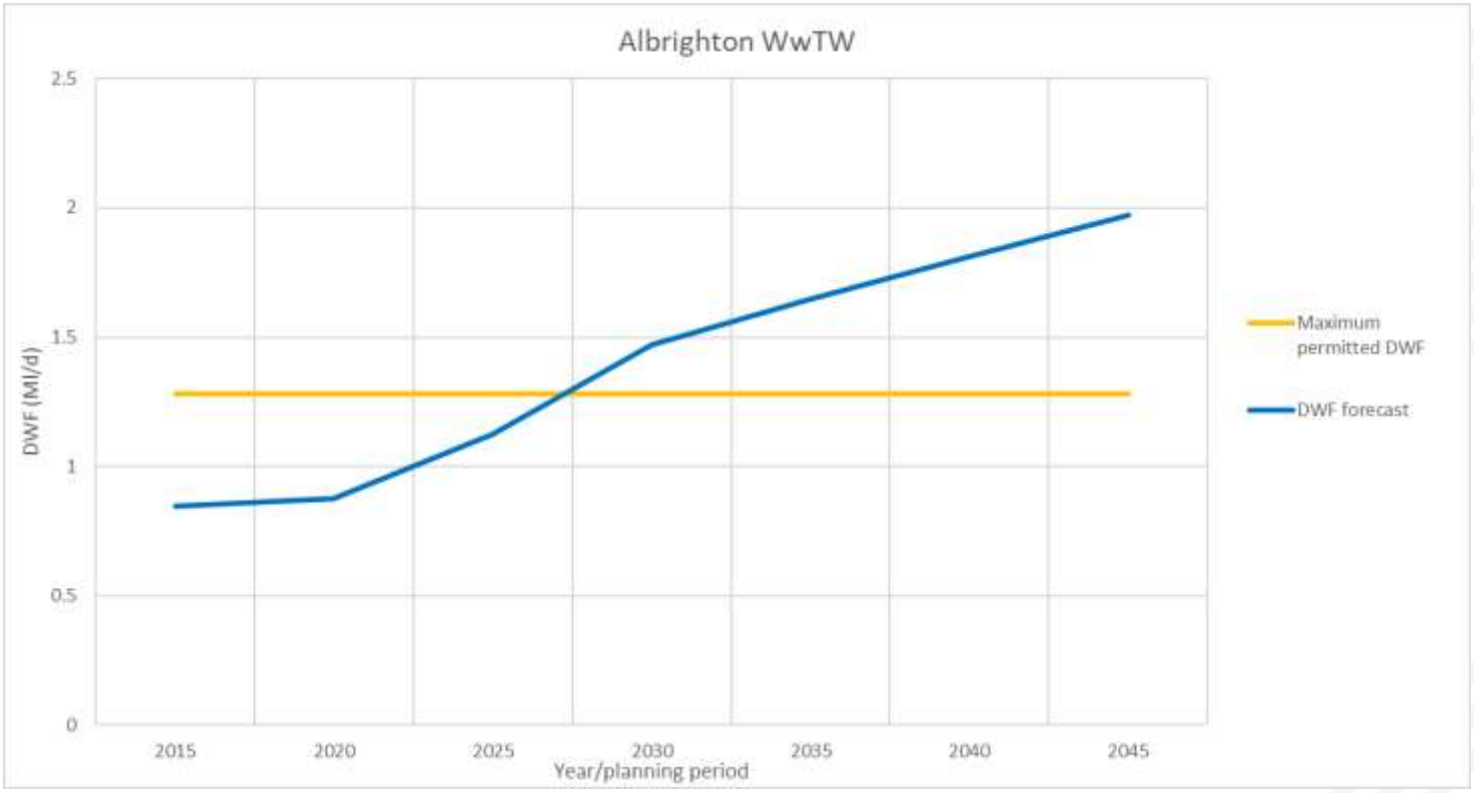
Aspect	Action	Responsibility	Timescale
	when considering WINEP schemes or upgrades at WwTW		
	Identify options to accommodate growth at the eleven WwTWs at risk of a deterioration.	STW	Aligned with projected growth plan
Flood Risk Management	Proposals to increase discharges to a watercourse may also require a flood risk activities environmental permit from the EA (in the case of discharges to Main River), or a land drainage consent from the Lead Local Flood Authority (in the case of discharges to an Ordinary Watercourse).	STW/WW	During design of WwTW upgrades
Environment	The Local Plan should include policies that require all development to adopt SuDS to manage water quality of surface runoff.	SC	Ongoing
	The local plan should include policies that require all development to avoid significant adverse effects on areas with environmental designations.	SC	Ongoing
	In partnership, identify opportunities for incorporating SuDS into open spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	SC STW EA	Ongoing
	Developers should include the design of SuDS at an early stage in their planning application to maximise the benefits of the scheme	Developers	Ongoing
	Work with developers to discourage connection of new developments into existing surface water and combined sewer networks. Prevent connections into the foul network, as this is a significant cause of sewer flooding.	SC Developers	Ongoing
	Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within Shropshire.	SC, EA, NE	Ongoing
River Clun Catchment	The HRA for the Local Plan Review should consider mitigation options to prevent any impact from growth on the River Clun SAC.	SC	Ongoing
	An updated nutrient management plan for the Clun catchment is required to enable mitigation	EA, NE	Ongoing

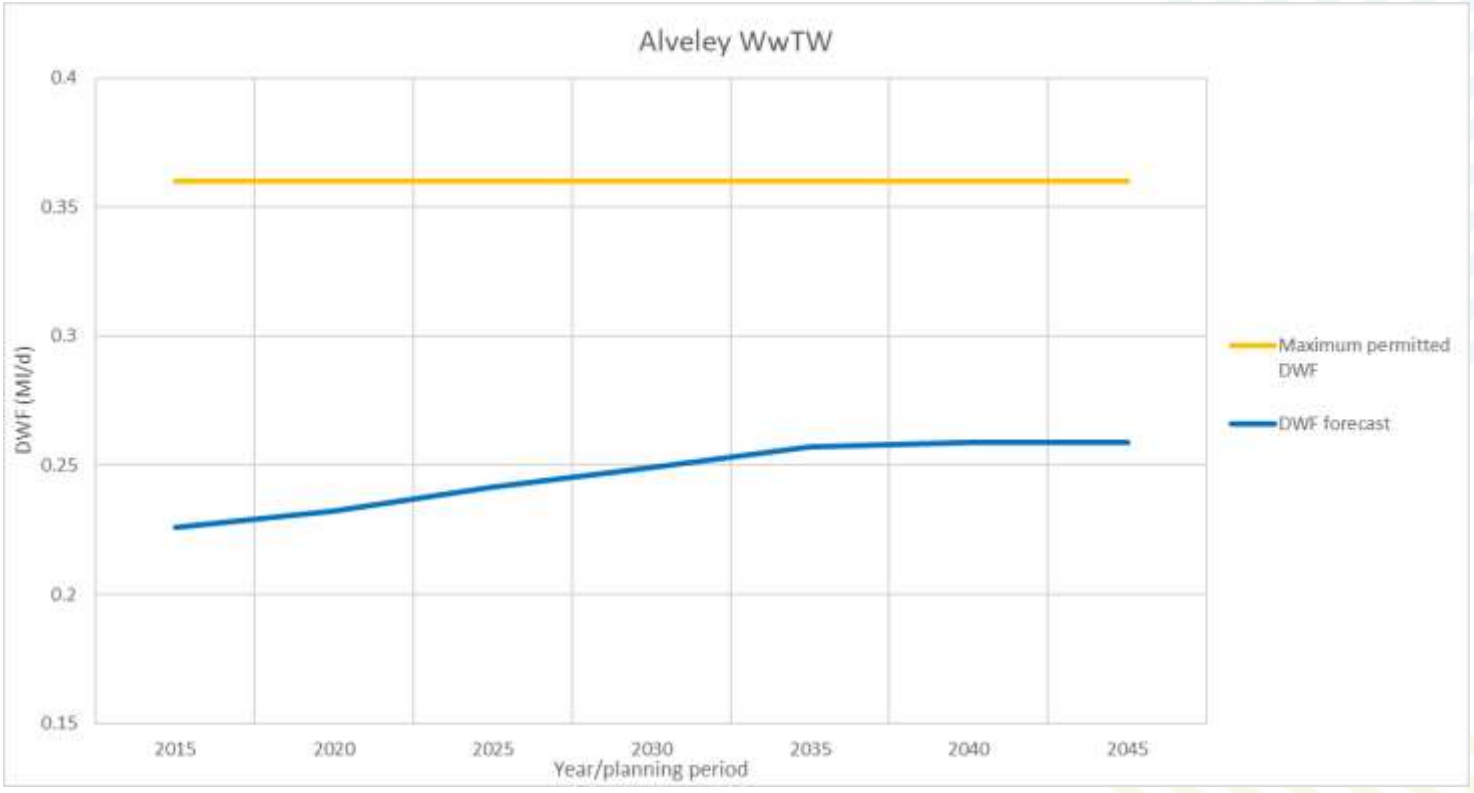
Aspect	Action	Responsibility	Timescale
	options to be identified and implemented.		
	Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within the River Clun catchment	SC, EA, NE	
Climate change	When undertaking detailed assessments of environmental or asset capacity, consider how the latest climate change guidance can be included.	EA, STW, WW SC	As required
	Take "no regrets" decisions in the design of developments which will contribute to mitigation and adaptation to climate change impacts. For example, consider surface water exceedance pathways when designing the layout of developments.	SC and Developers	As required

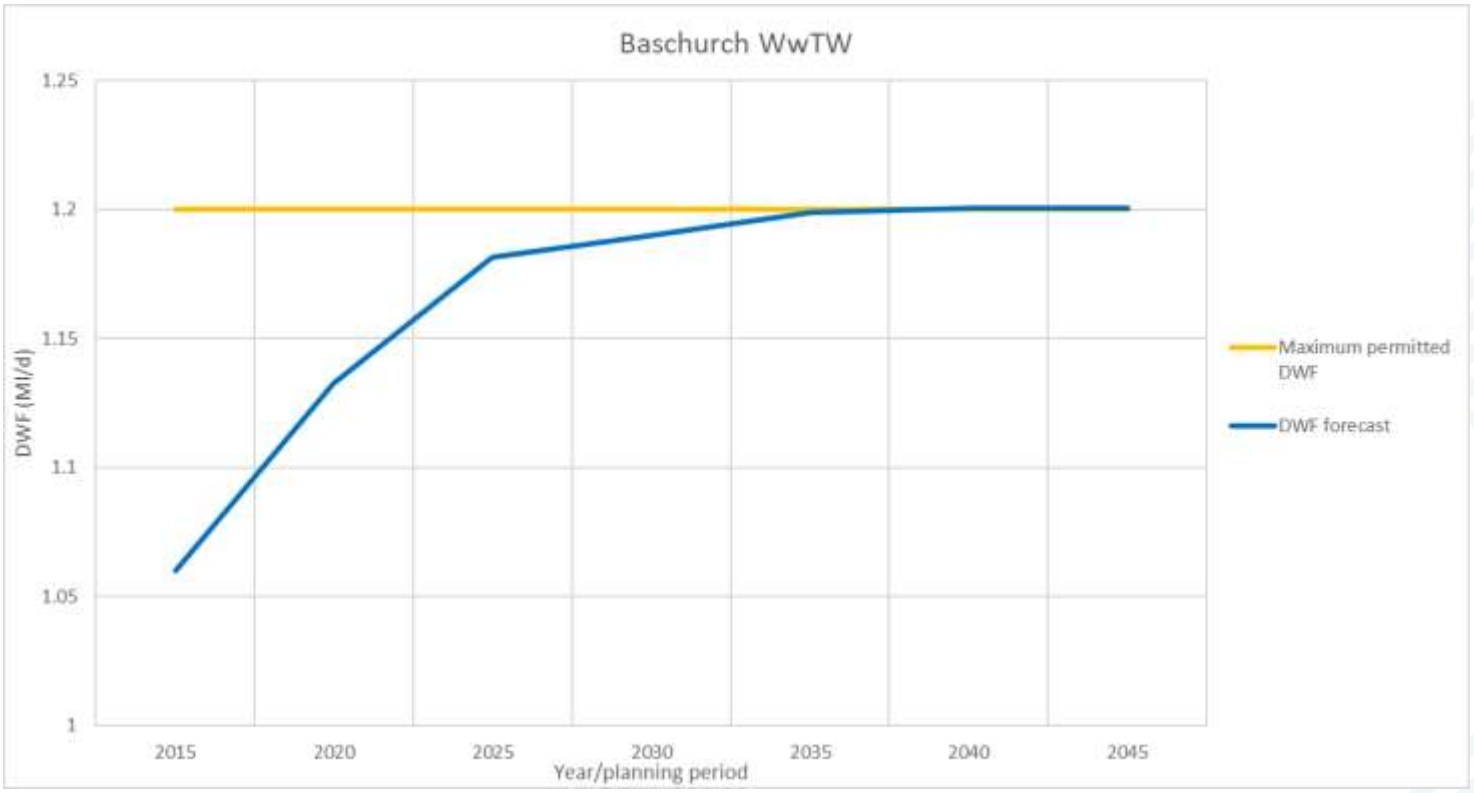
Appendices

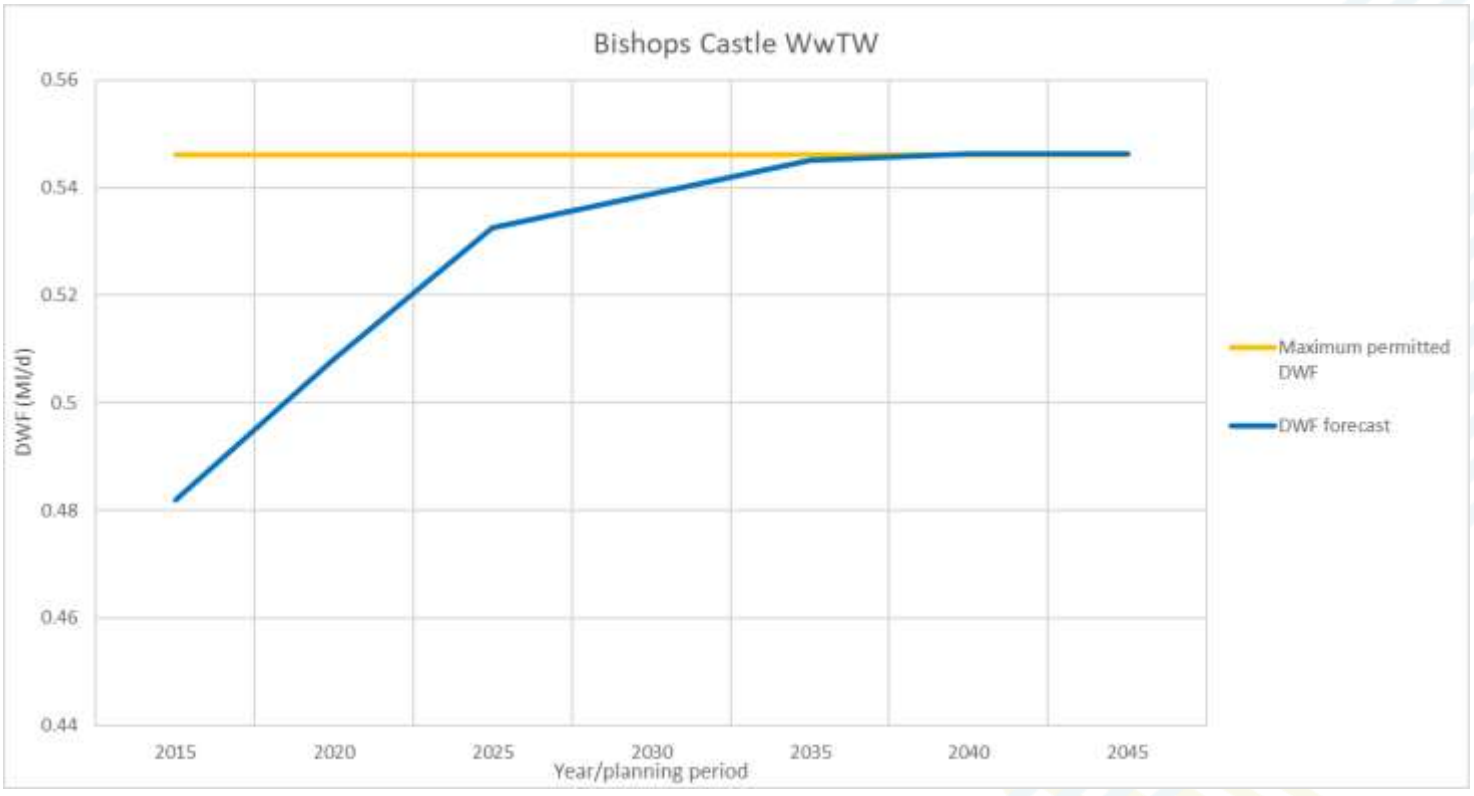
A Site tracker spreadsheet

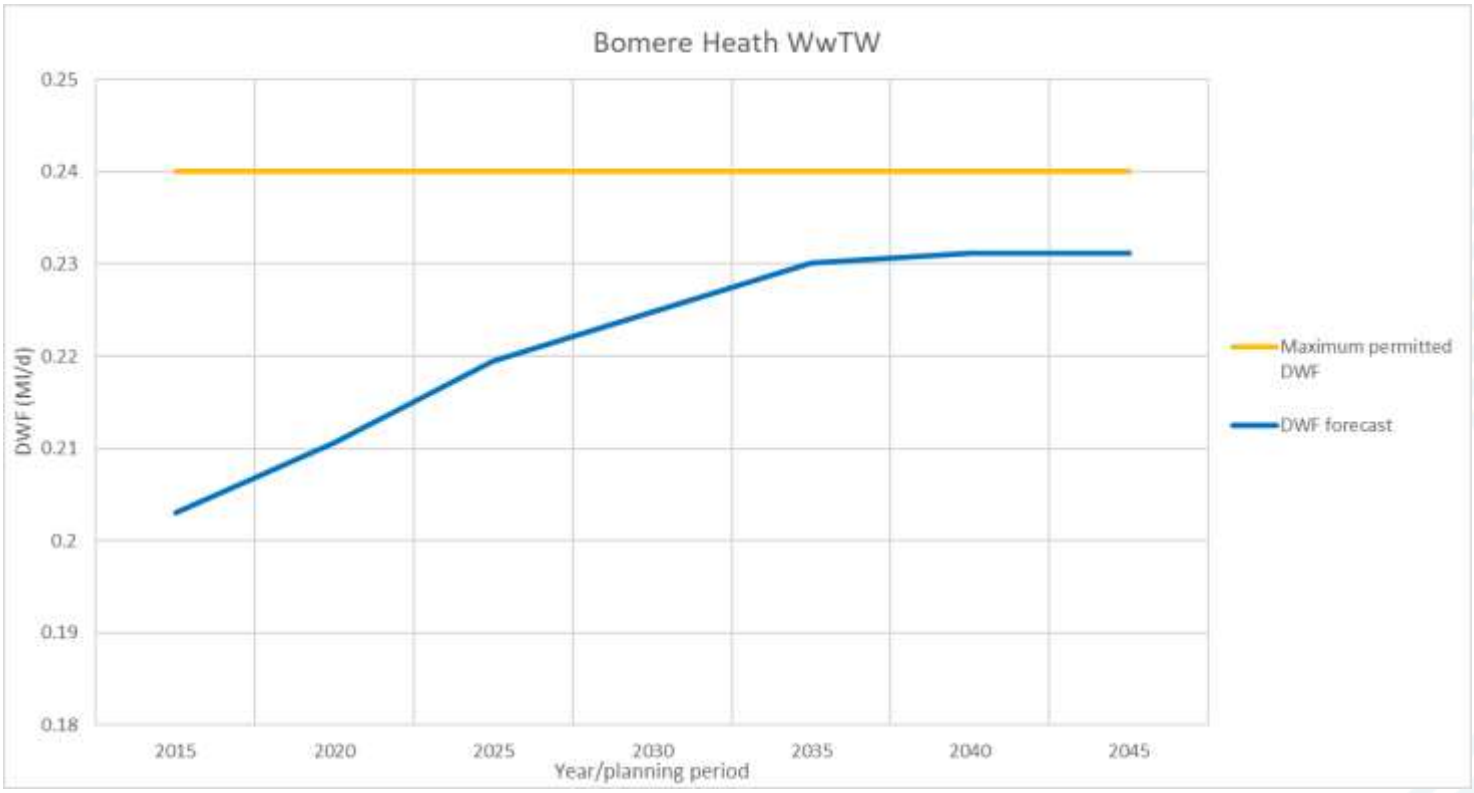
B WwTW flow capacity assessments

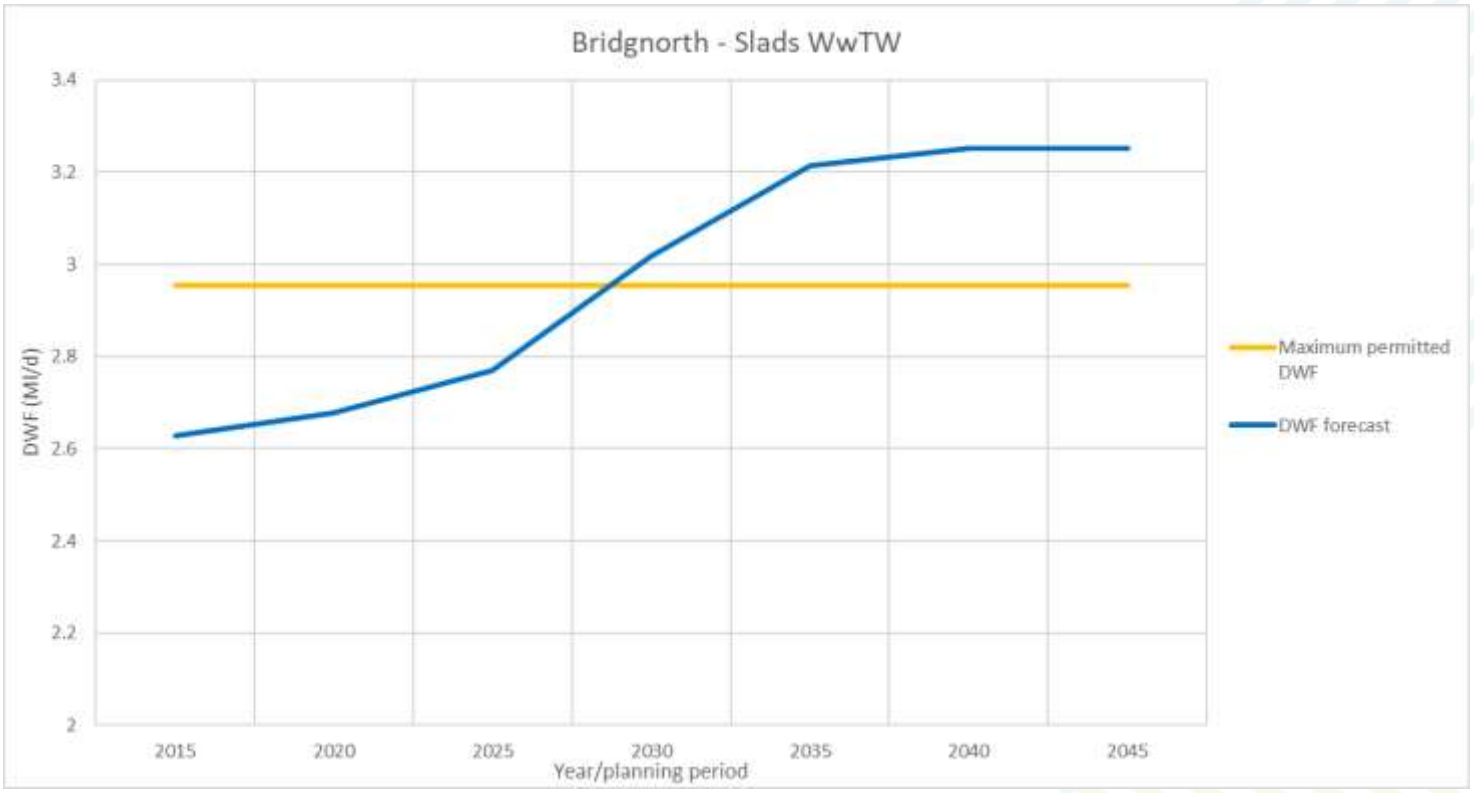


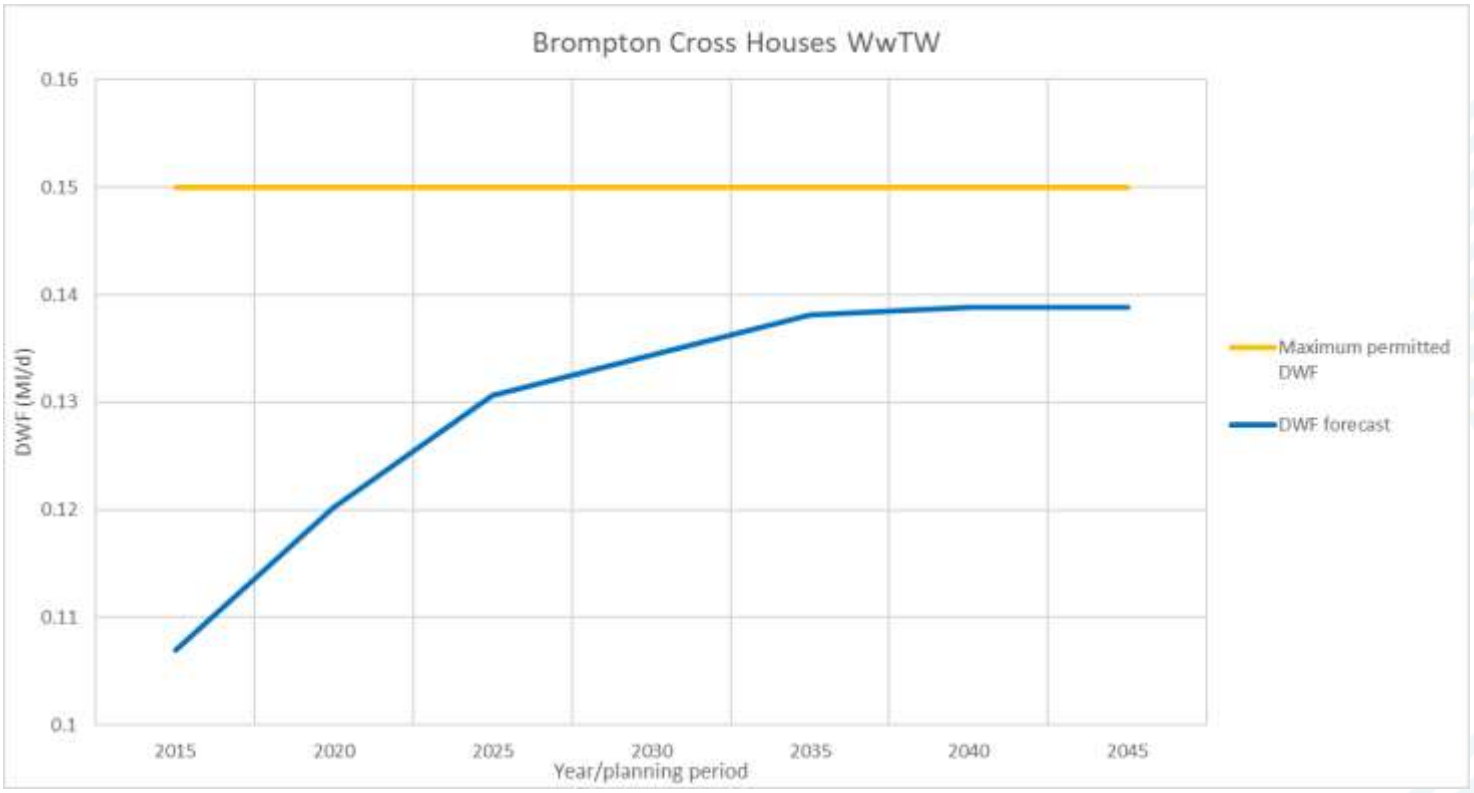


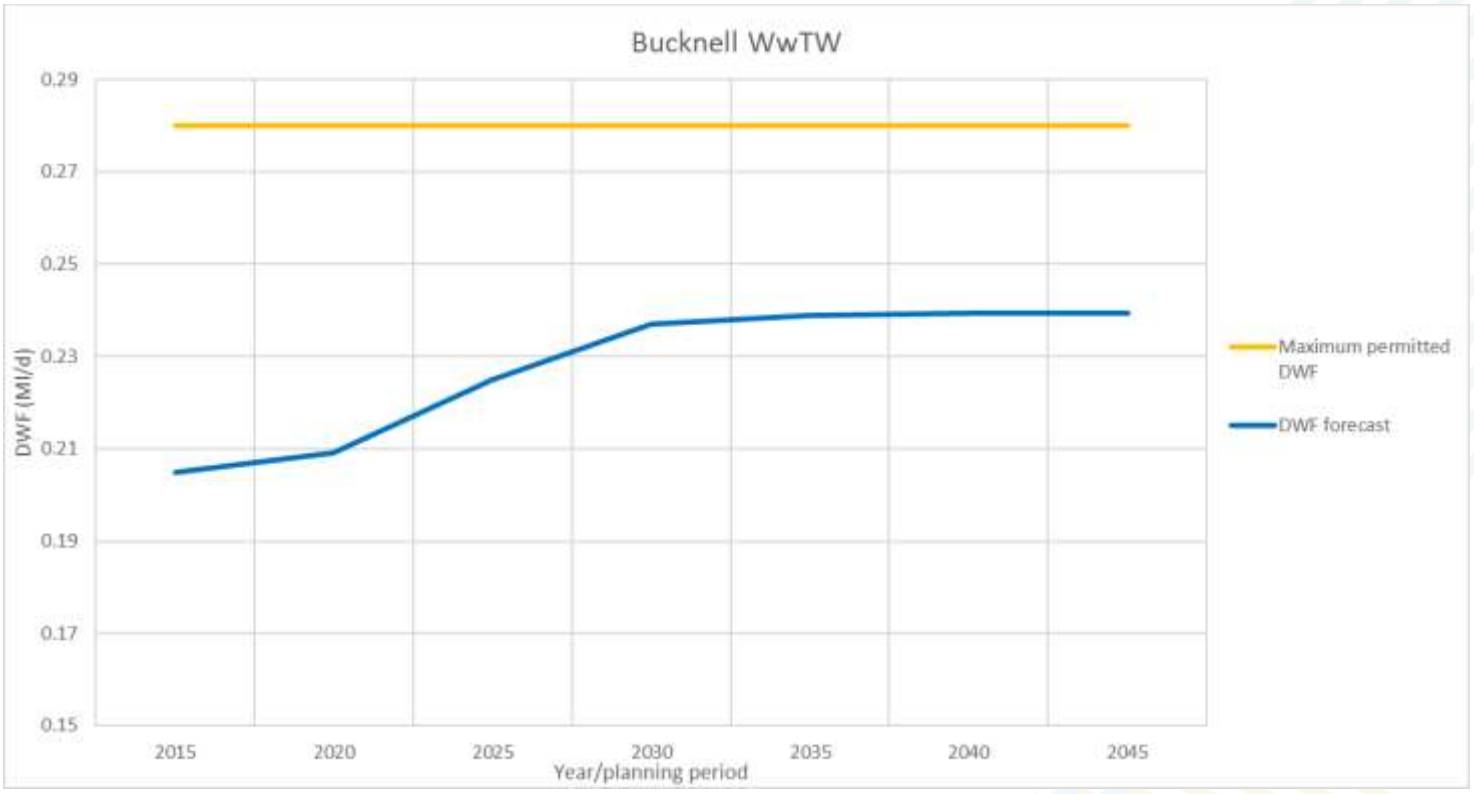

Baschurch WwTW
1.25
1.2
1.15
1.1
1.05
1
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

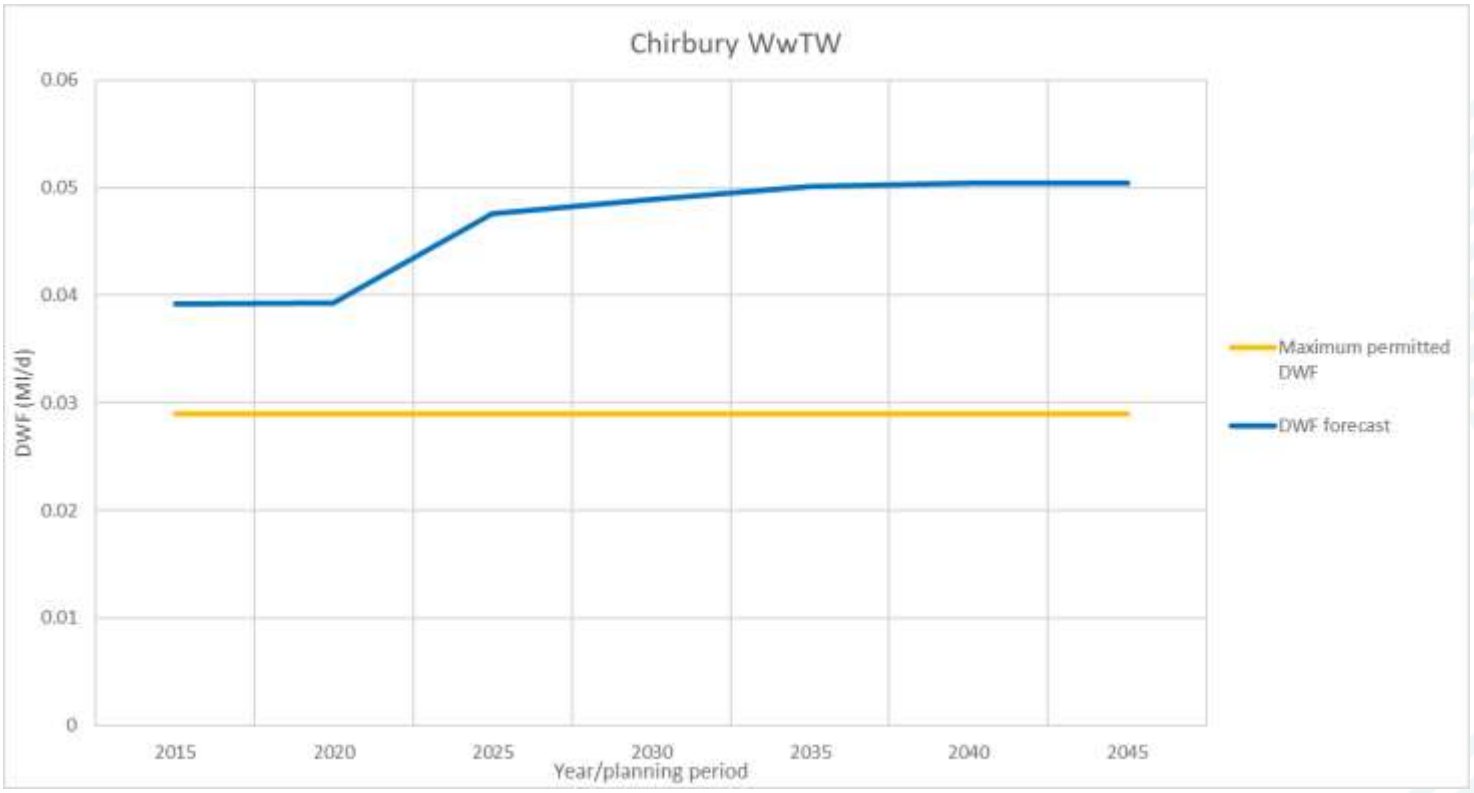

Bishops Castle WwTW
0.56
0.54
0.52
0.5
0.48
0.46
0.44
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

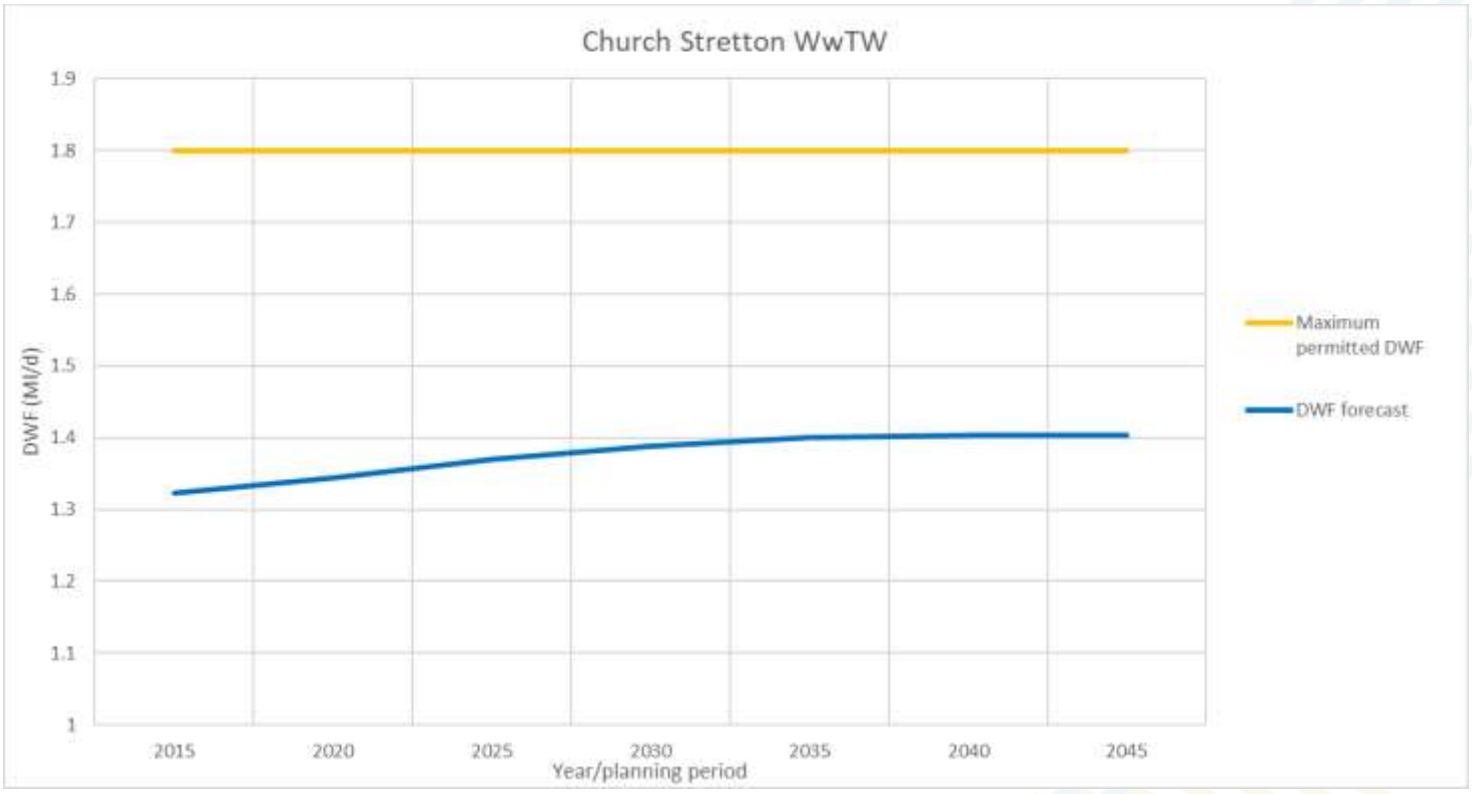

Bomere Heath WwTW
0.25
0.24
0.23
0.22
0.21
0.2
0.19
0.18
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

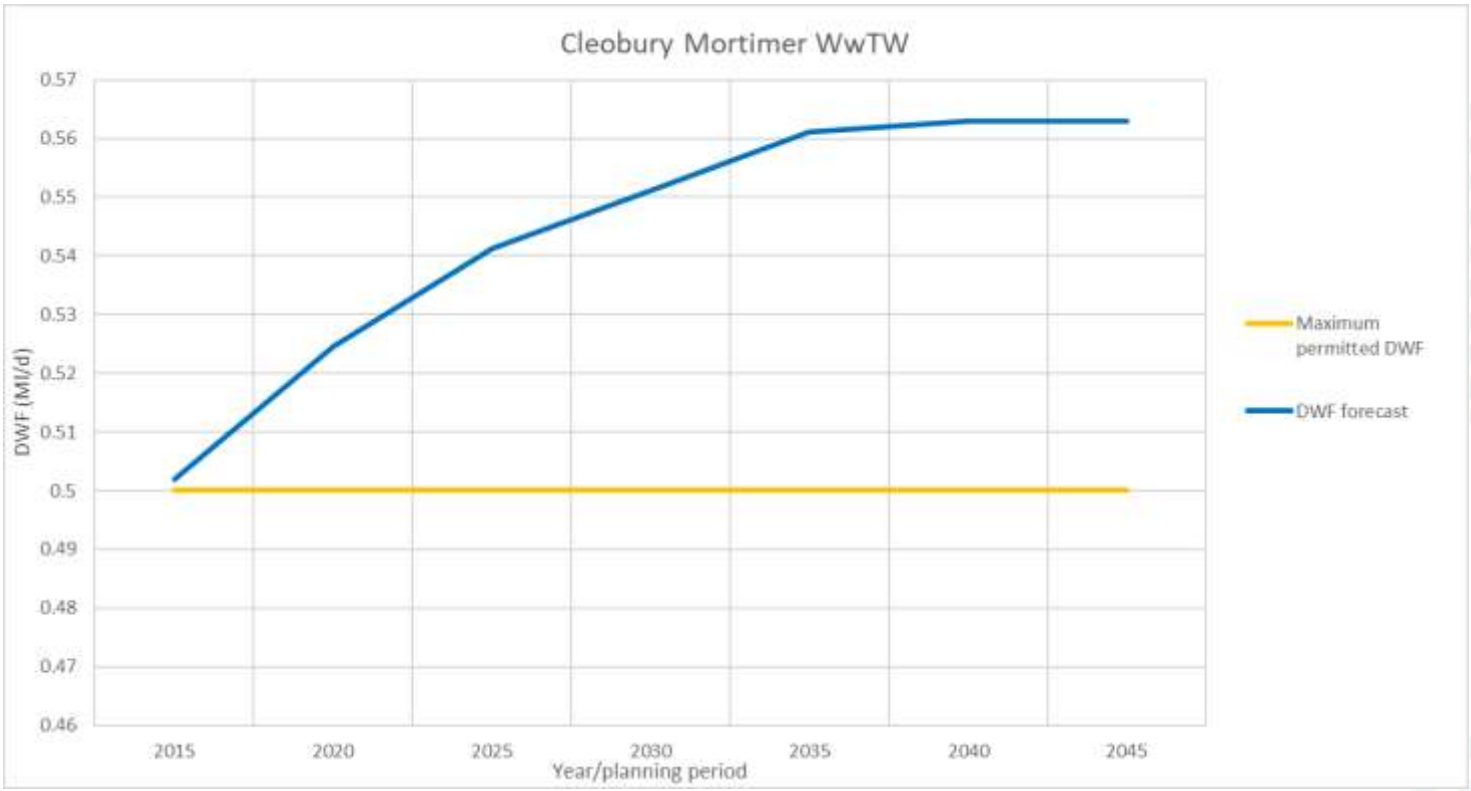

Bridgnorth - Slads WwTW
3.4
3.2
3
2.8
2.6
2.4
2.2
2
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

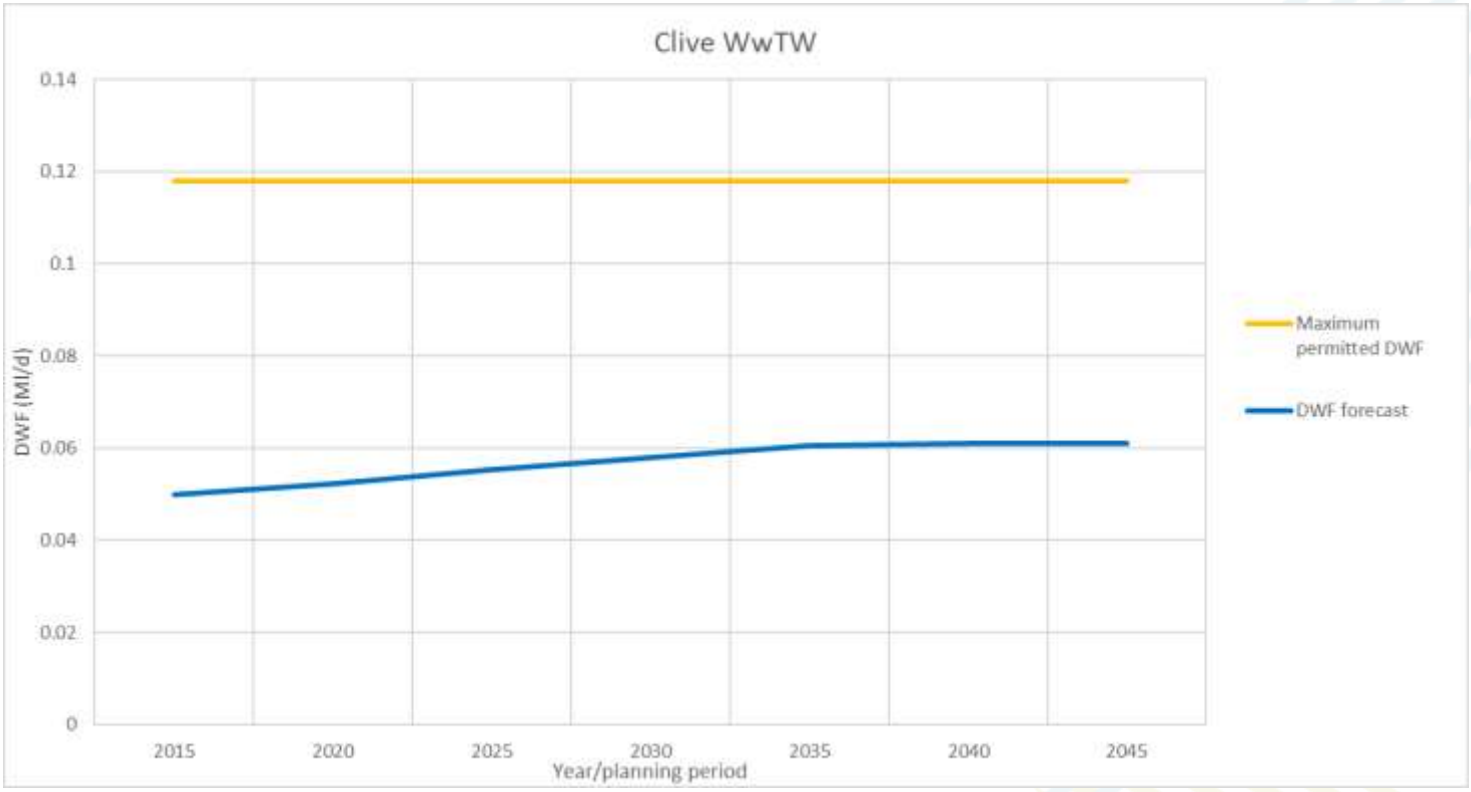

Brompton Cross Houses WwTW
0.16
0.15
0.14
0.13
0.12
0.11
0.1
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

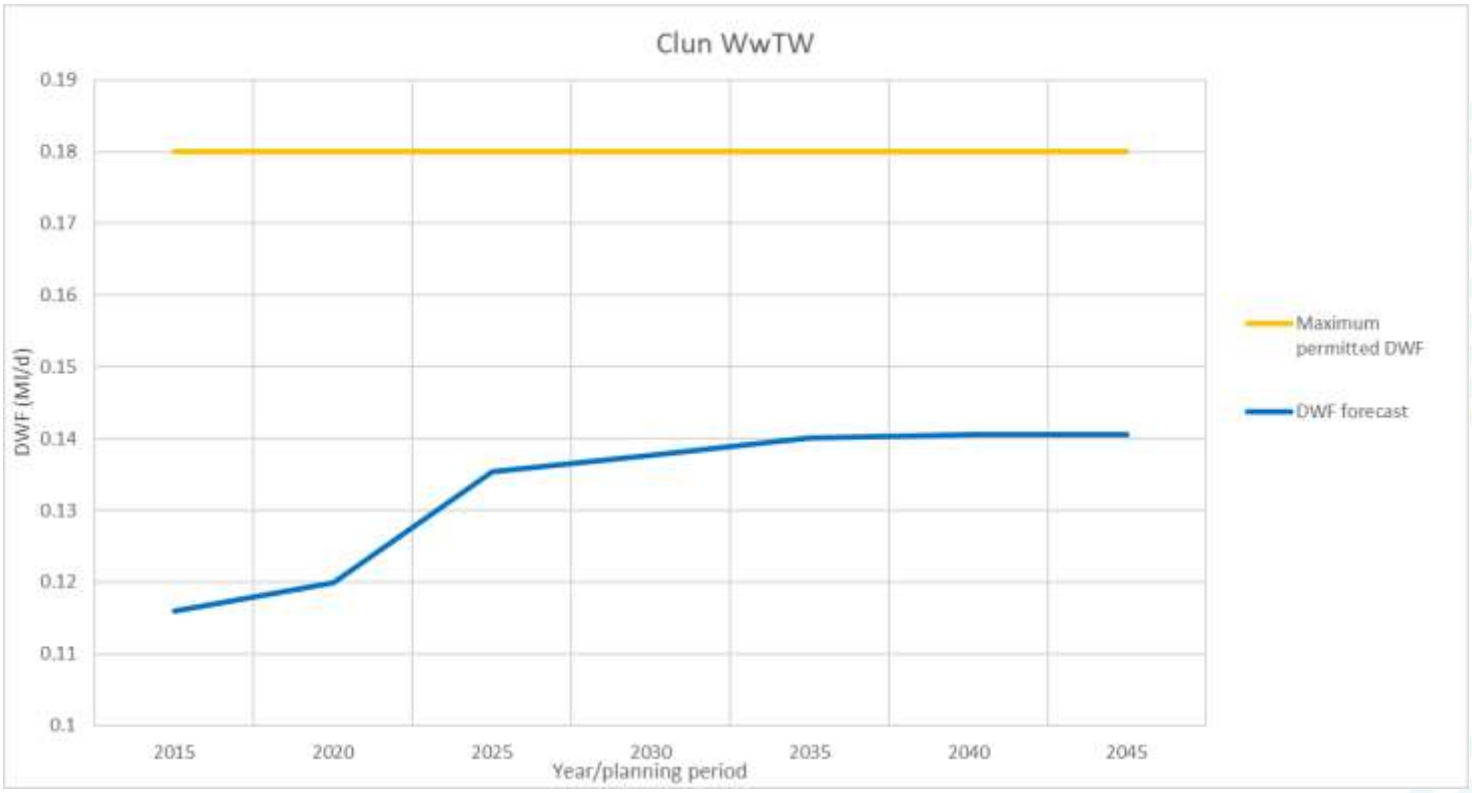

Bucknell WwTW
0.29
0.27
0.25
0.23
0.21
0.19
0.17
0.15
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

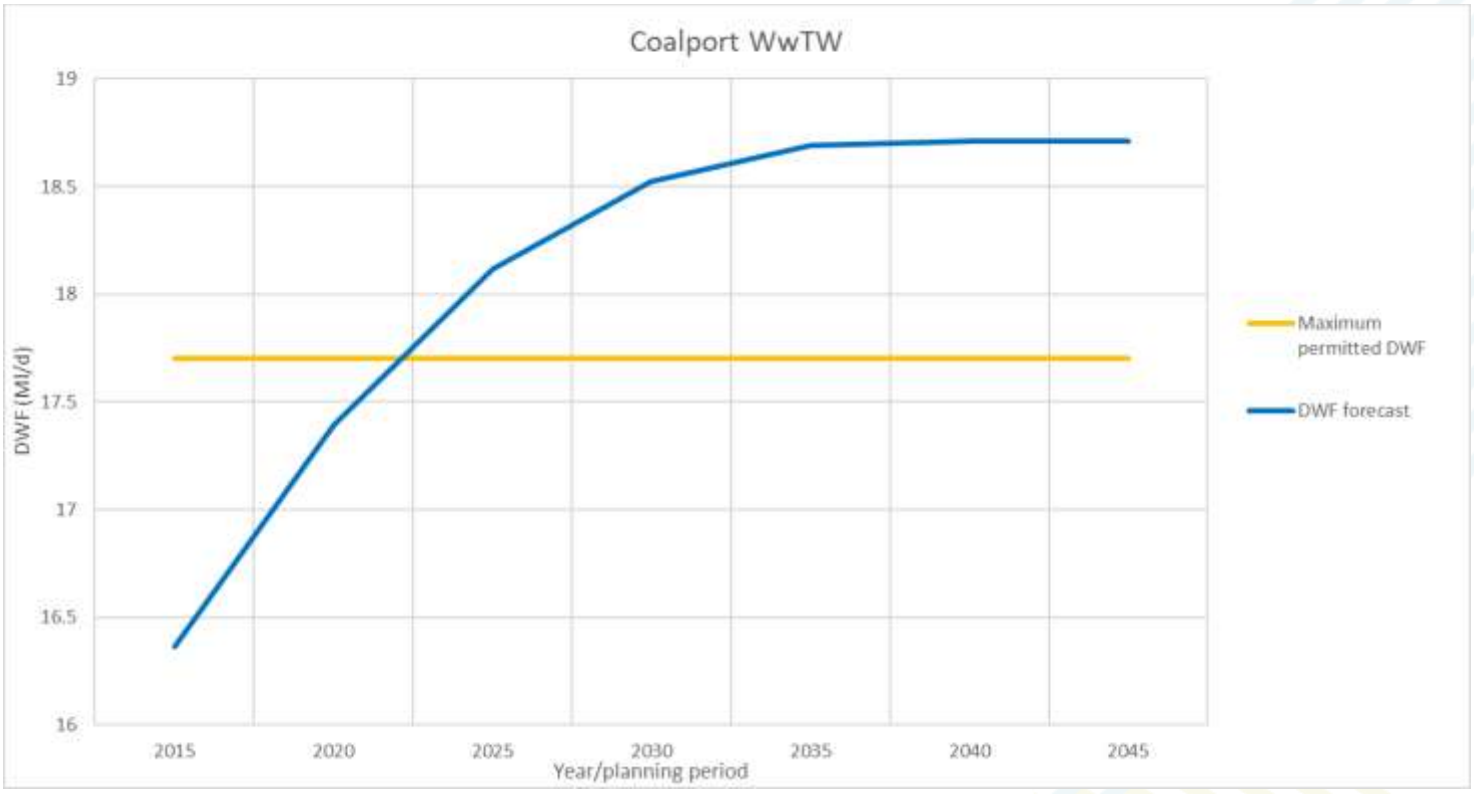

Chirbury WwTW
0.06
0.05
0.04
0.03
0.02
0.01
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

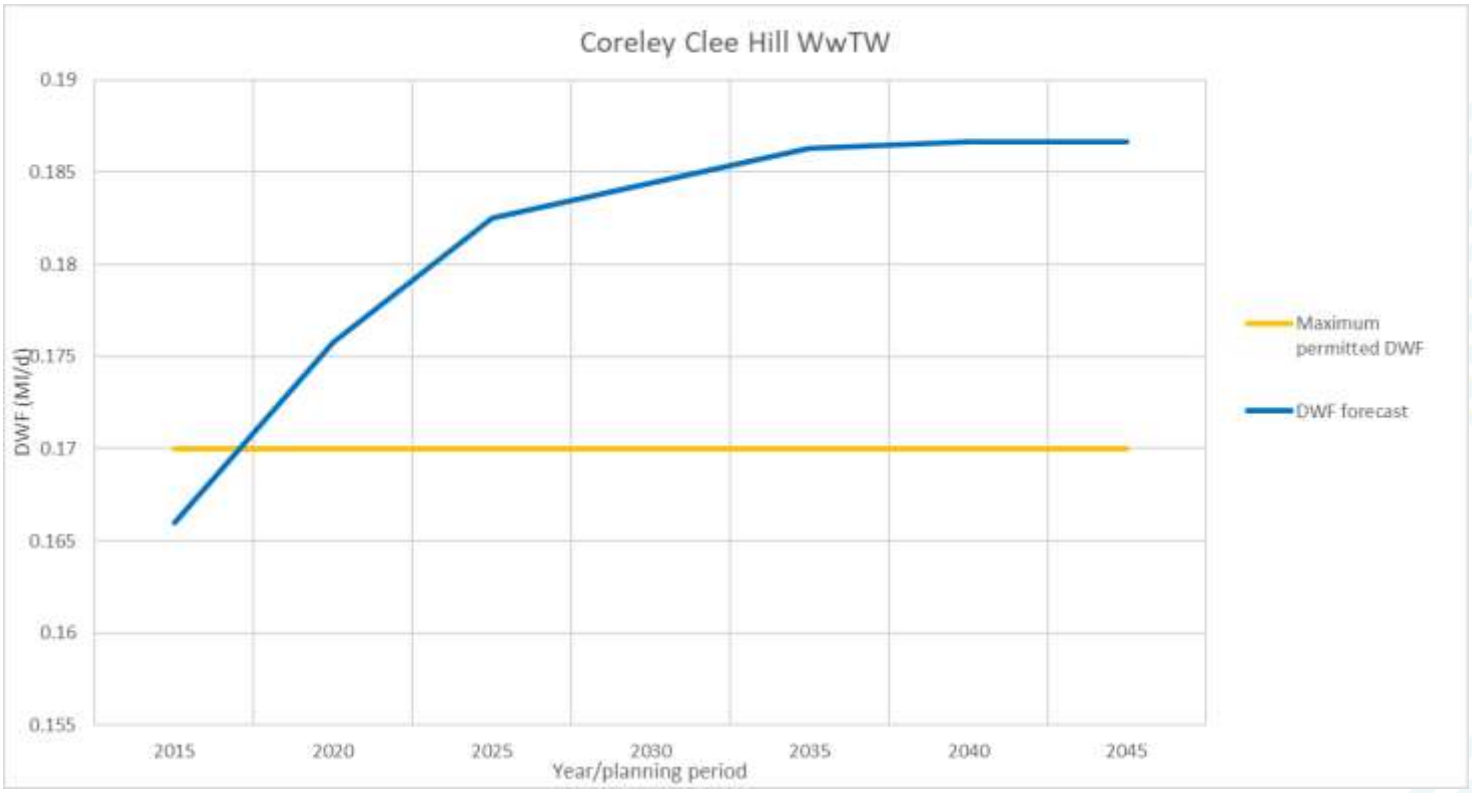

Church Stretton WwTW
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

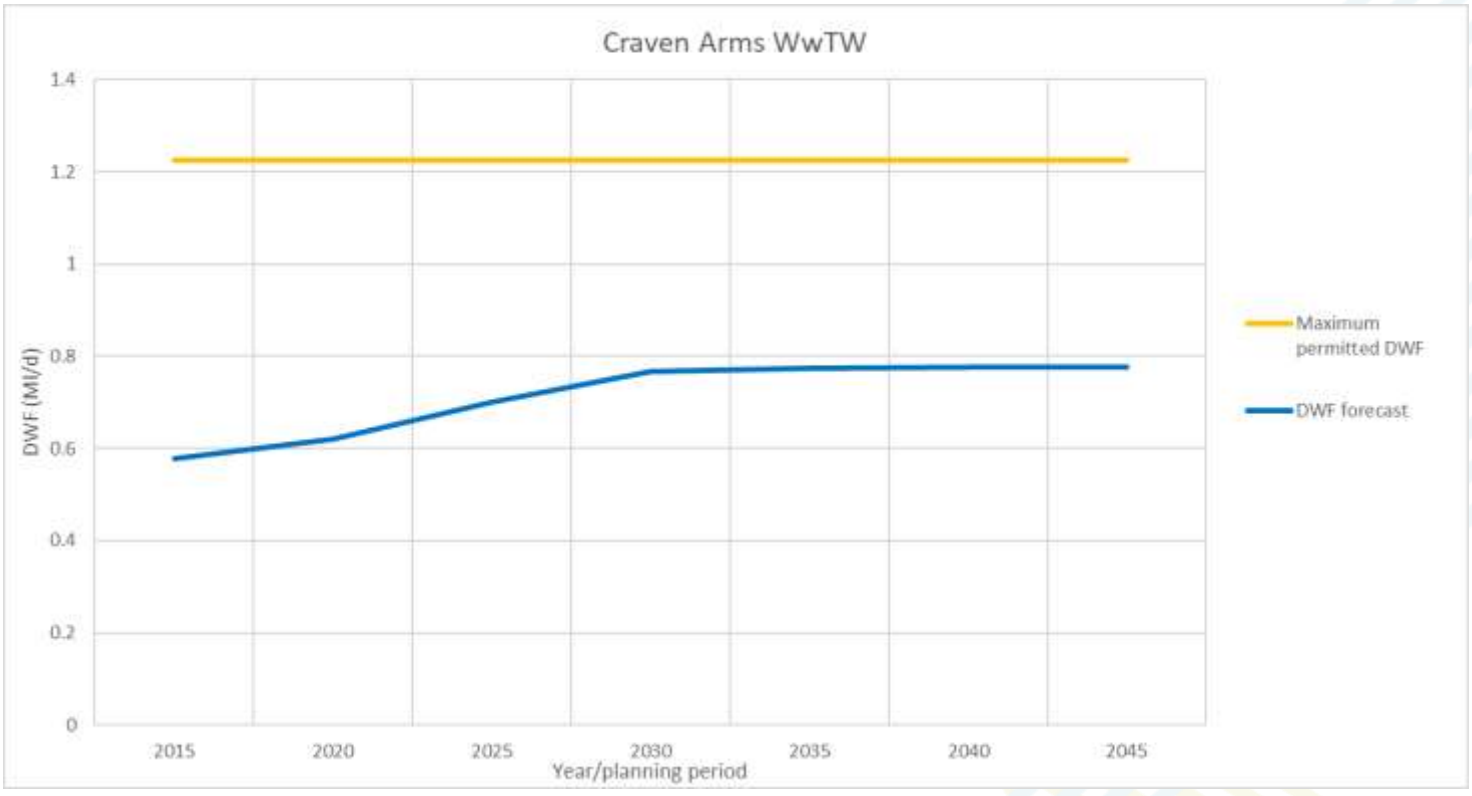

Cleobury Mortimer WwTW
0.57
0.56
0.55
0.54
0.53
0.52
0.51
0.5
0.49
0.48
0.47
0.46
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

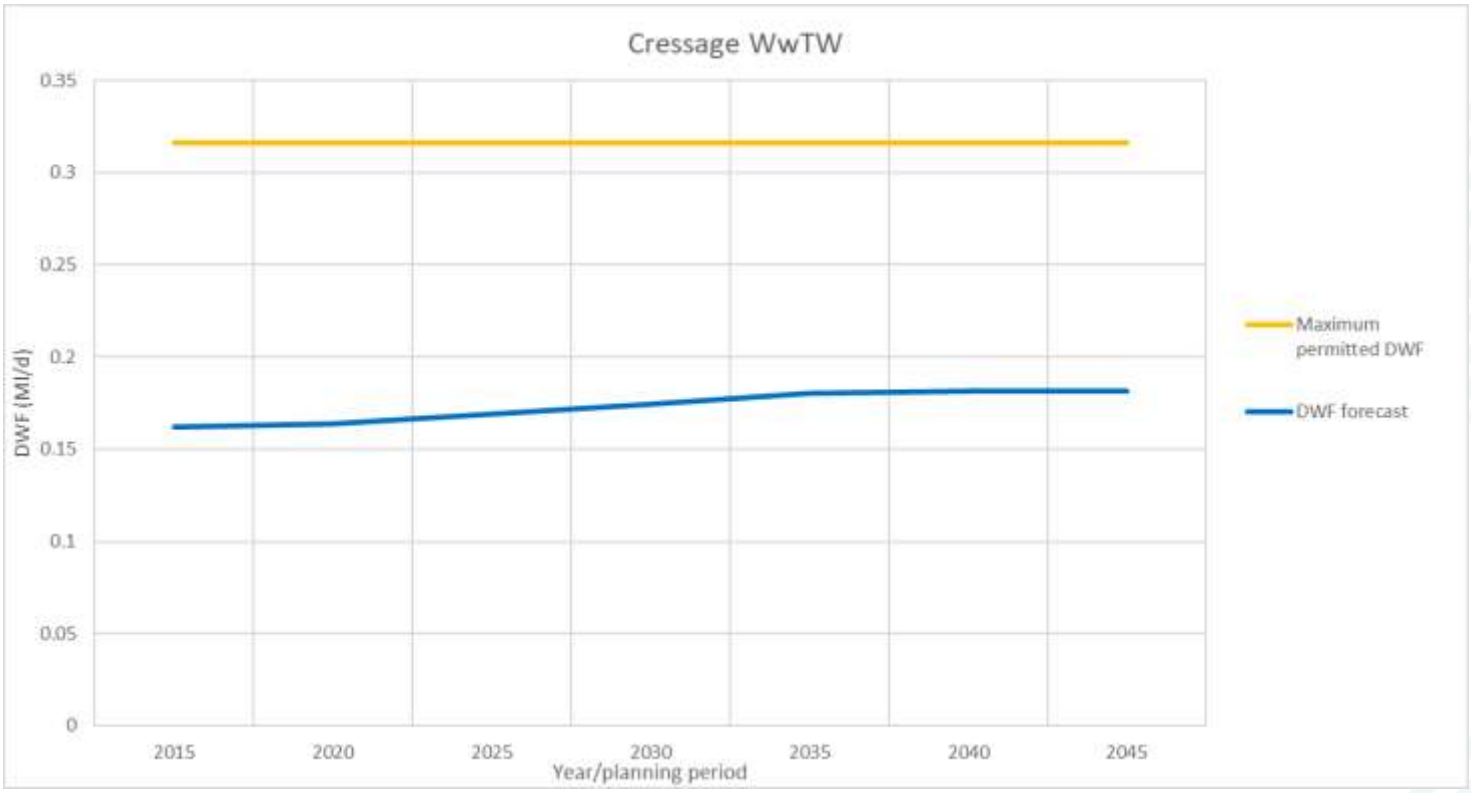

Clive WwTW
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

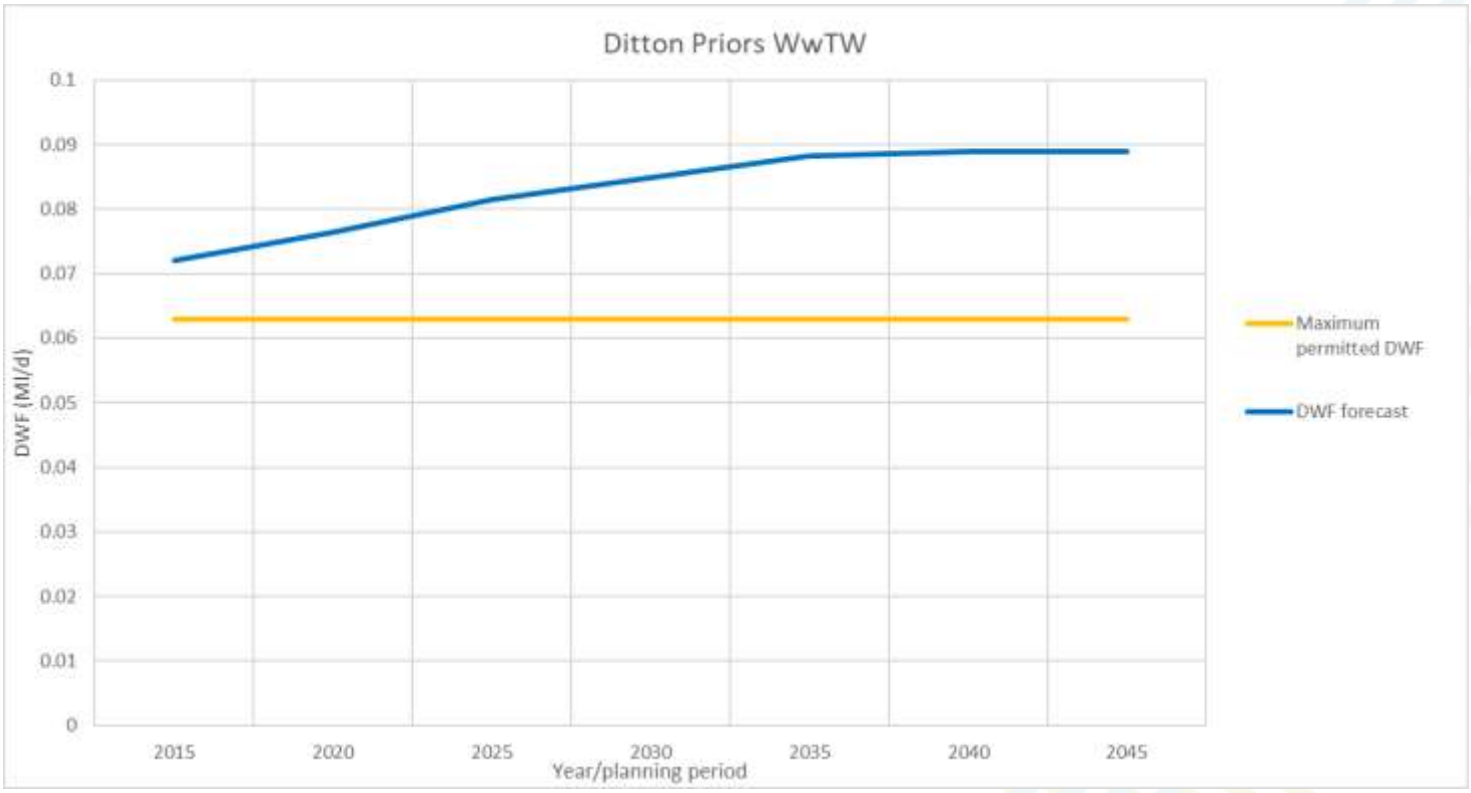

Clun WwTW
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

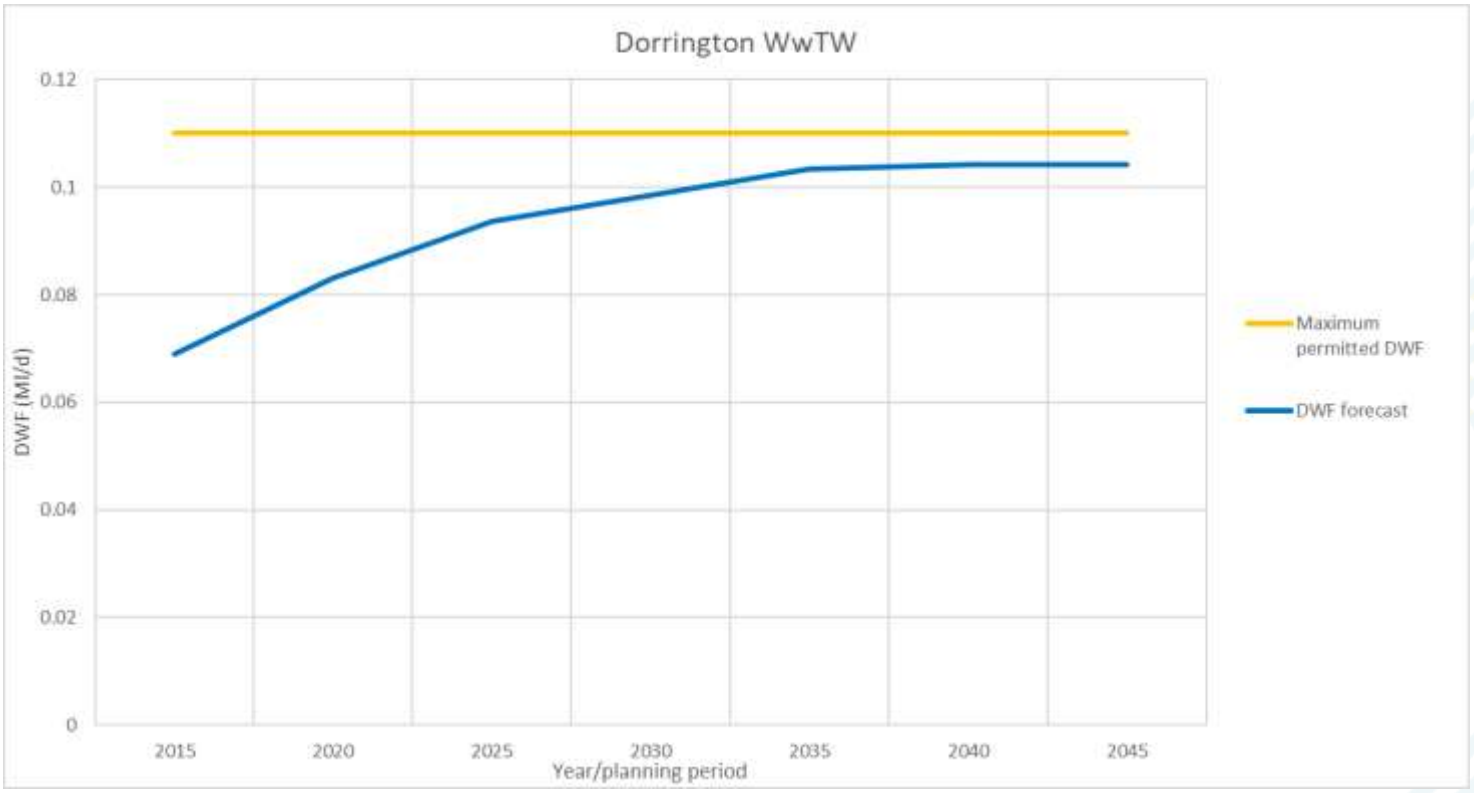

Coalport WwTW
19
18.5
18
17.5
17
16.5
16
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

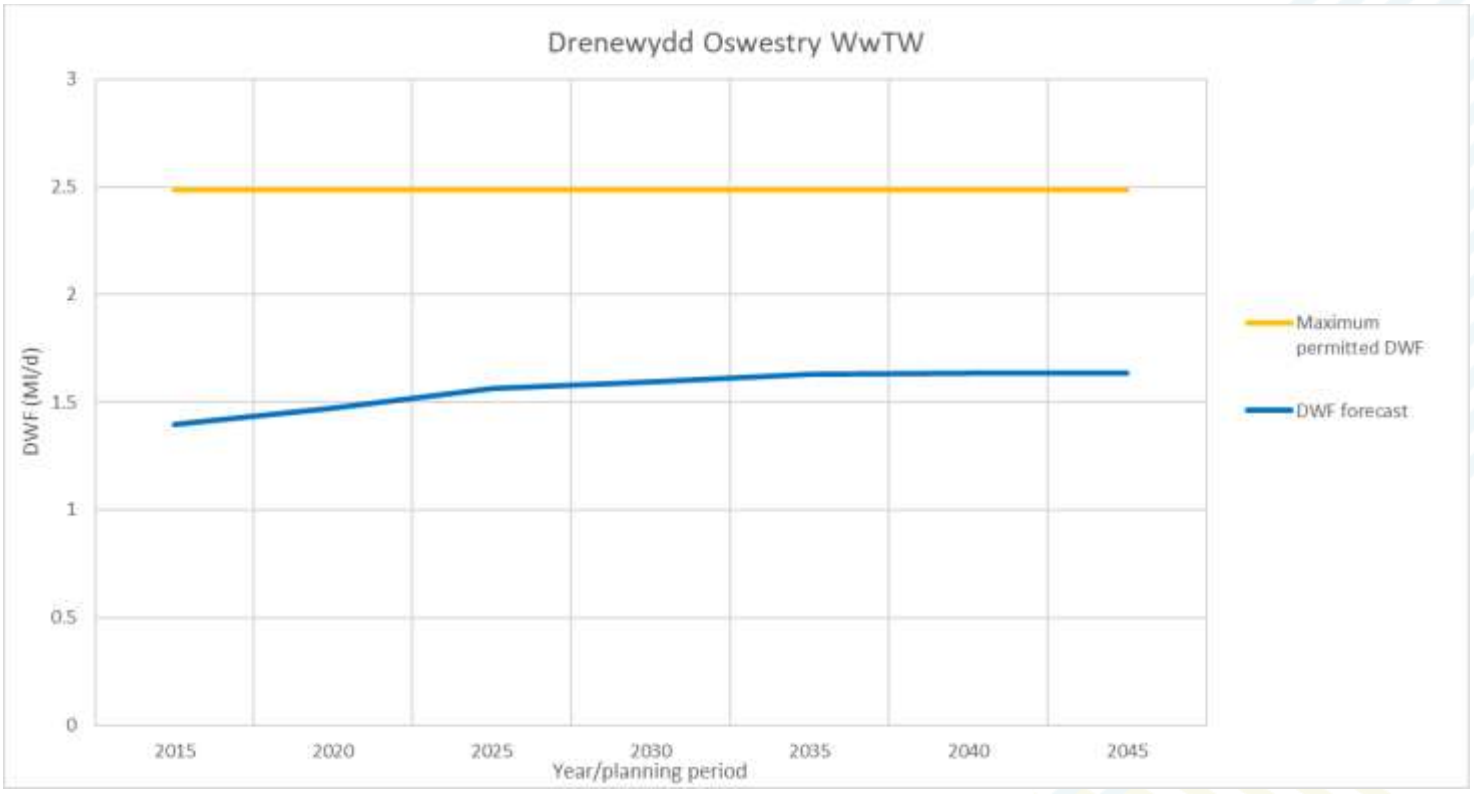

Coreley Clee Hill WwTW
0.19
0.185
0.18
0.175
0.17
0.165
0.16
0.155
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

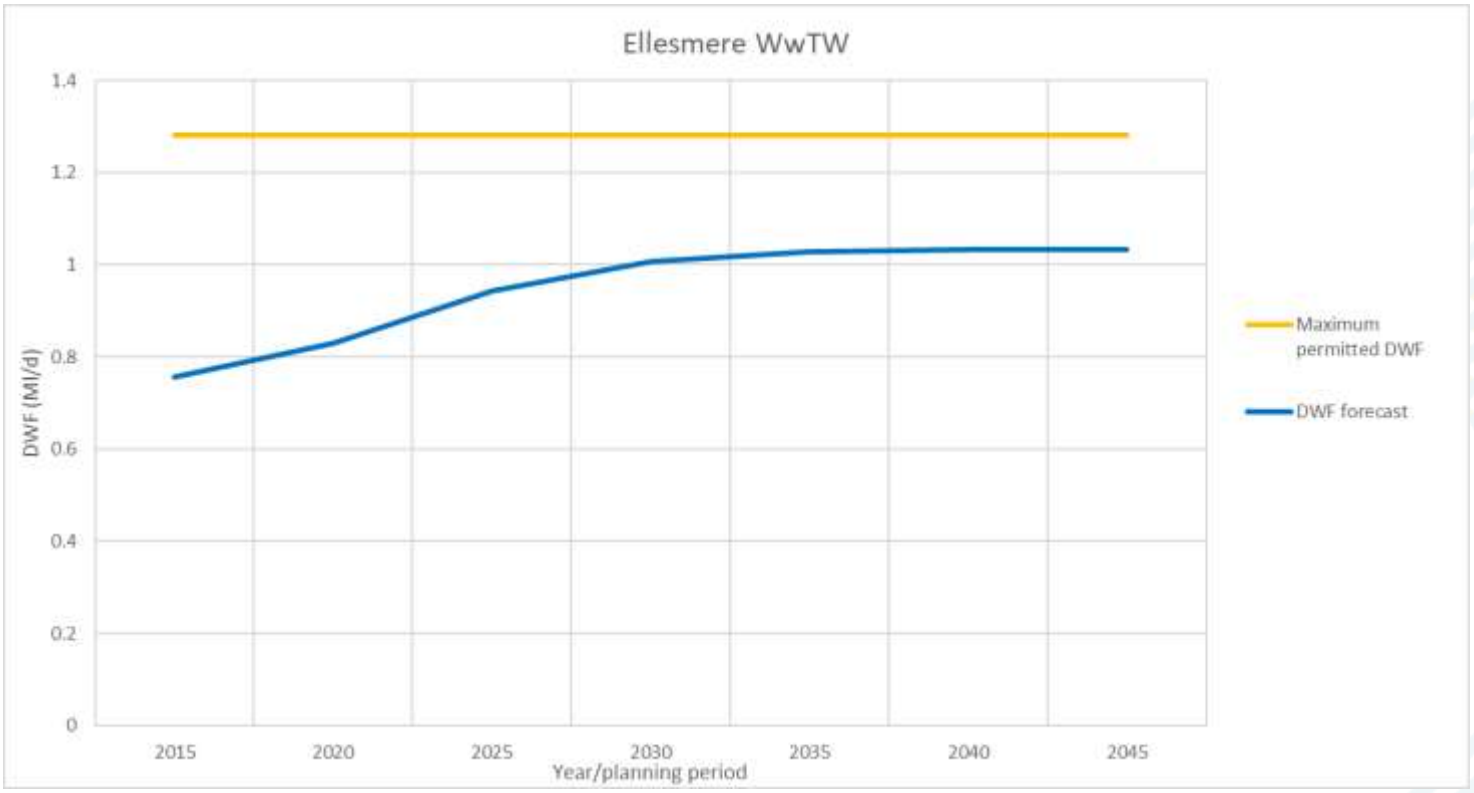

Craven Arms WwTW
1.4
1.2
1
0.8
0.6
0.4
0.2
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

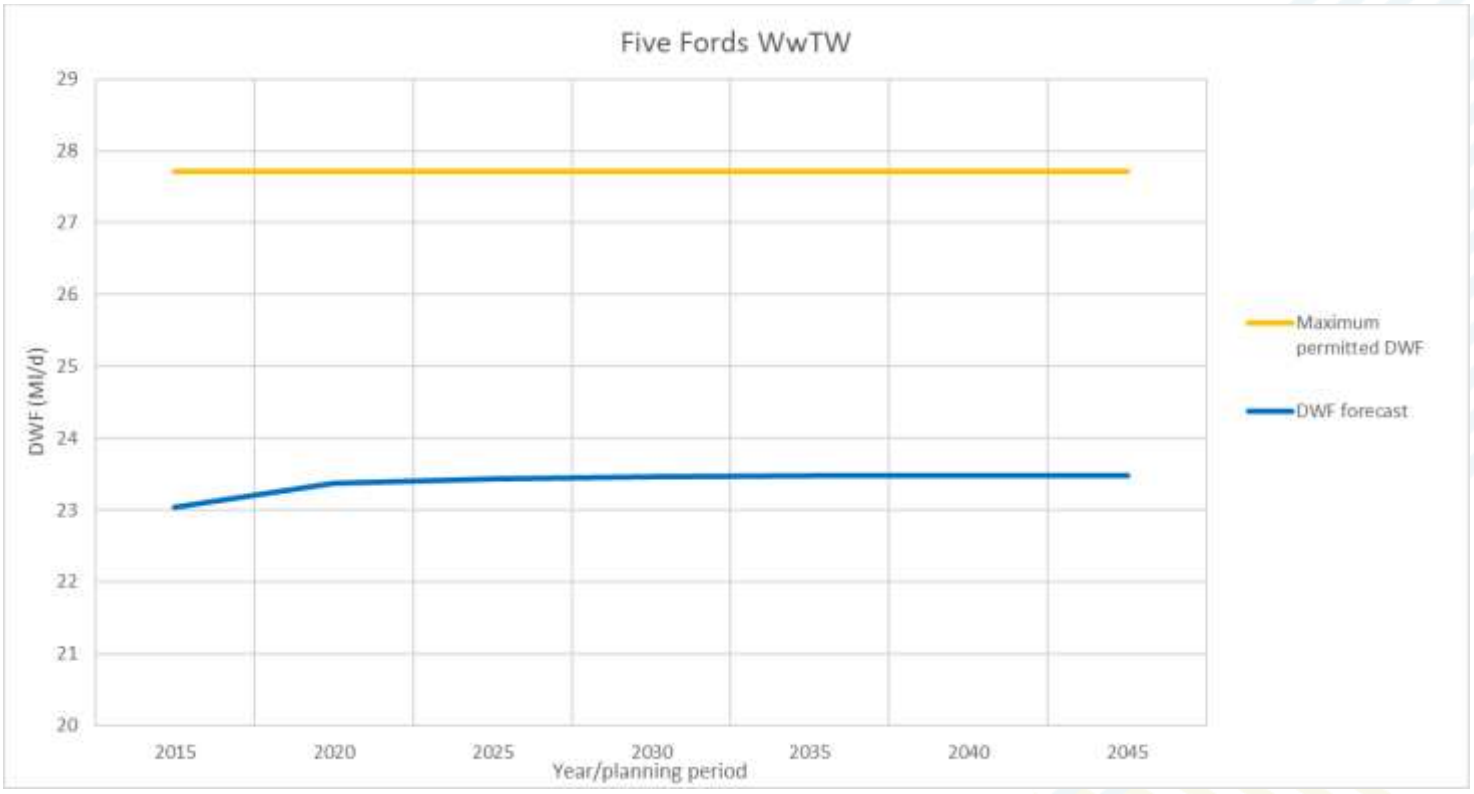

Cressage WwTW
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

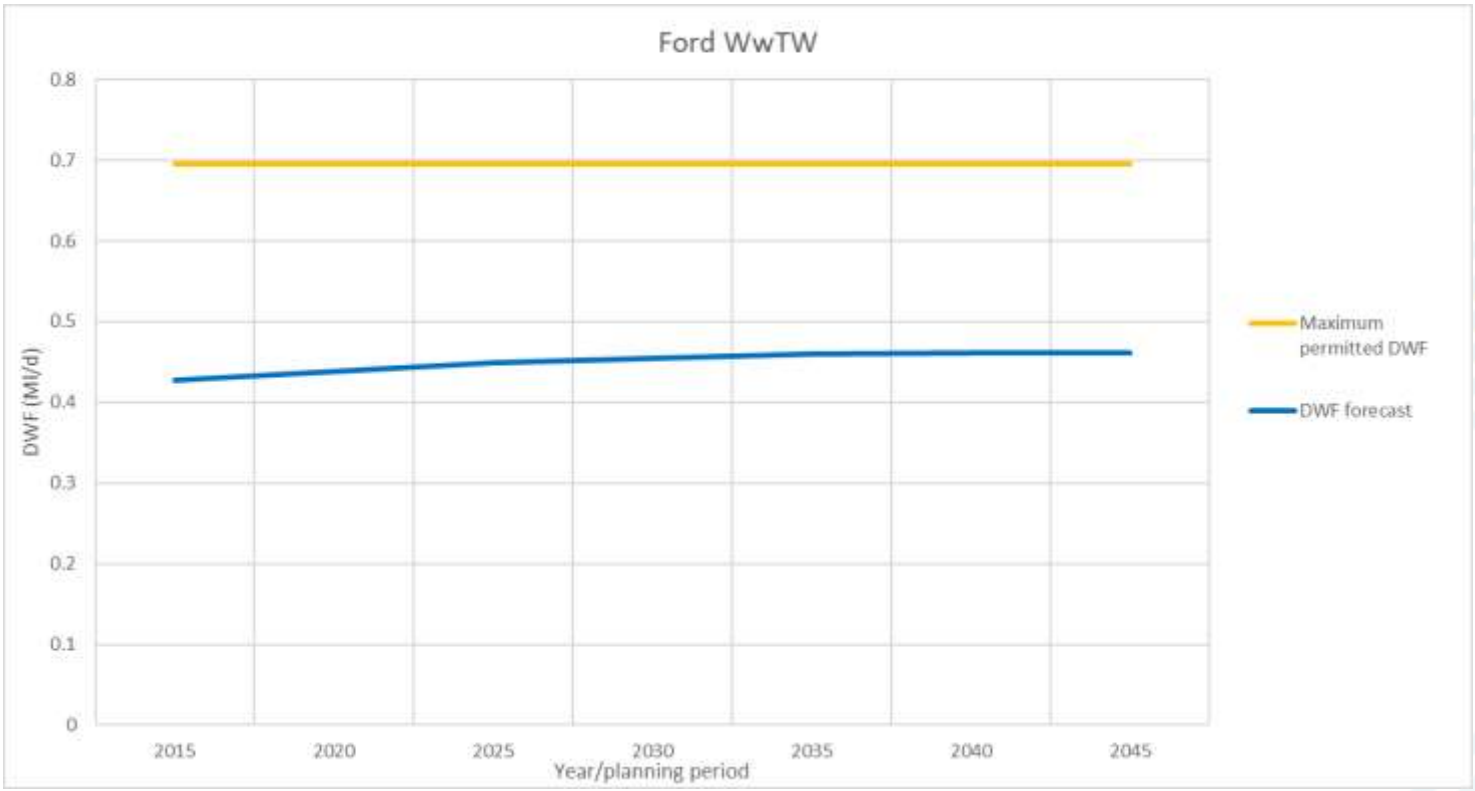

Ditton Priors WwTW
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

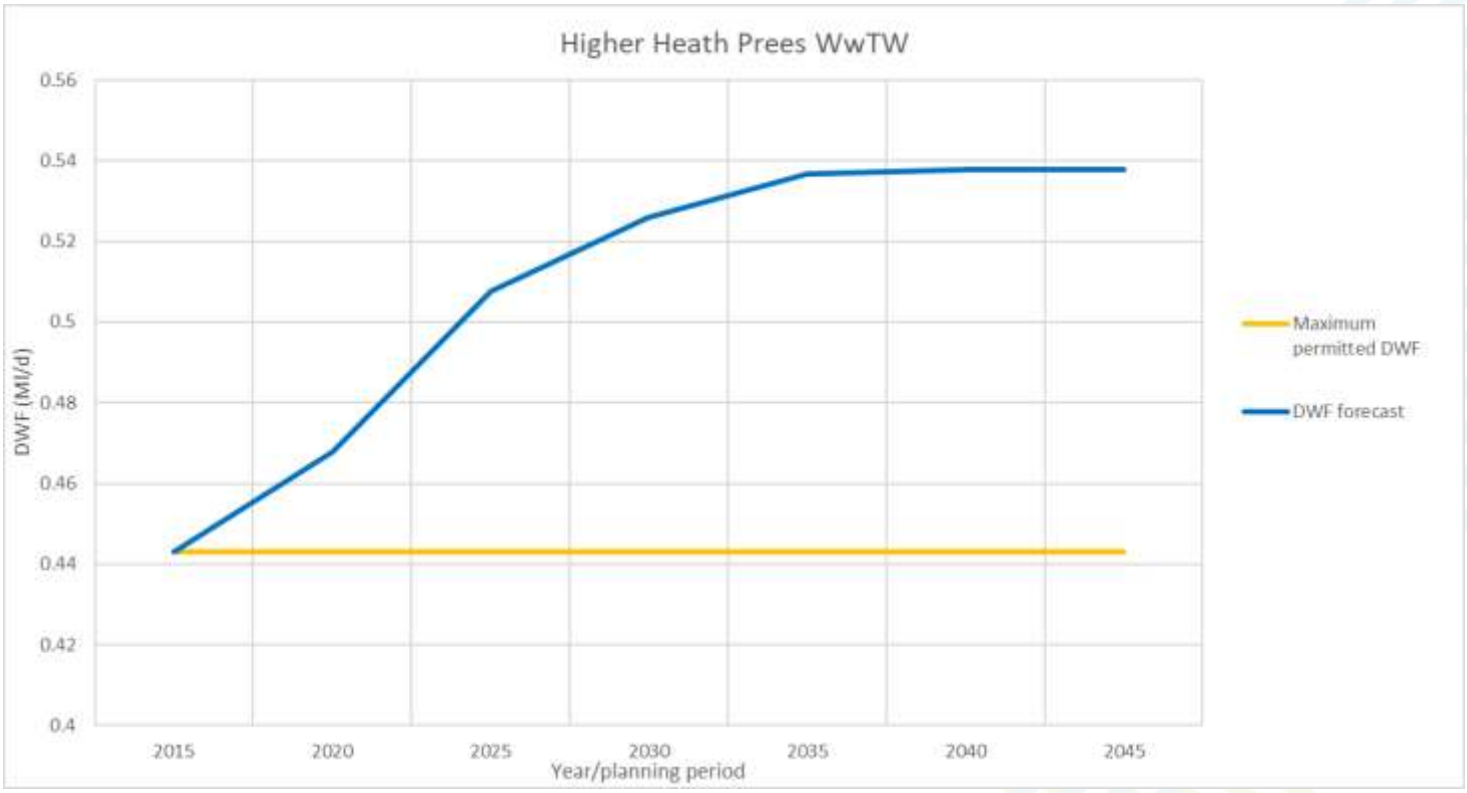

Dorrington WwTW
0.12
0.1
0.08
0.06
0.04
0.02
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

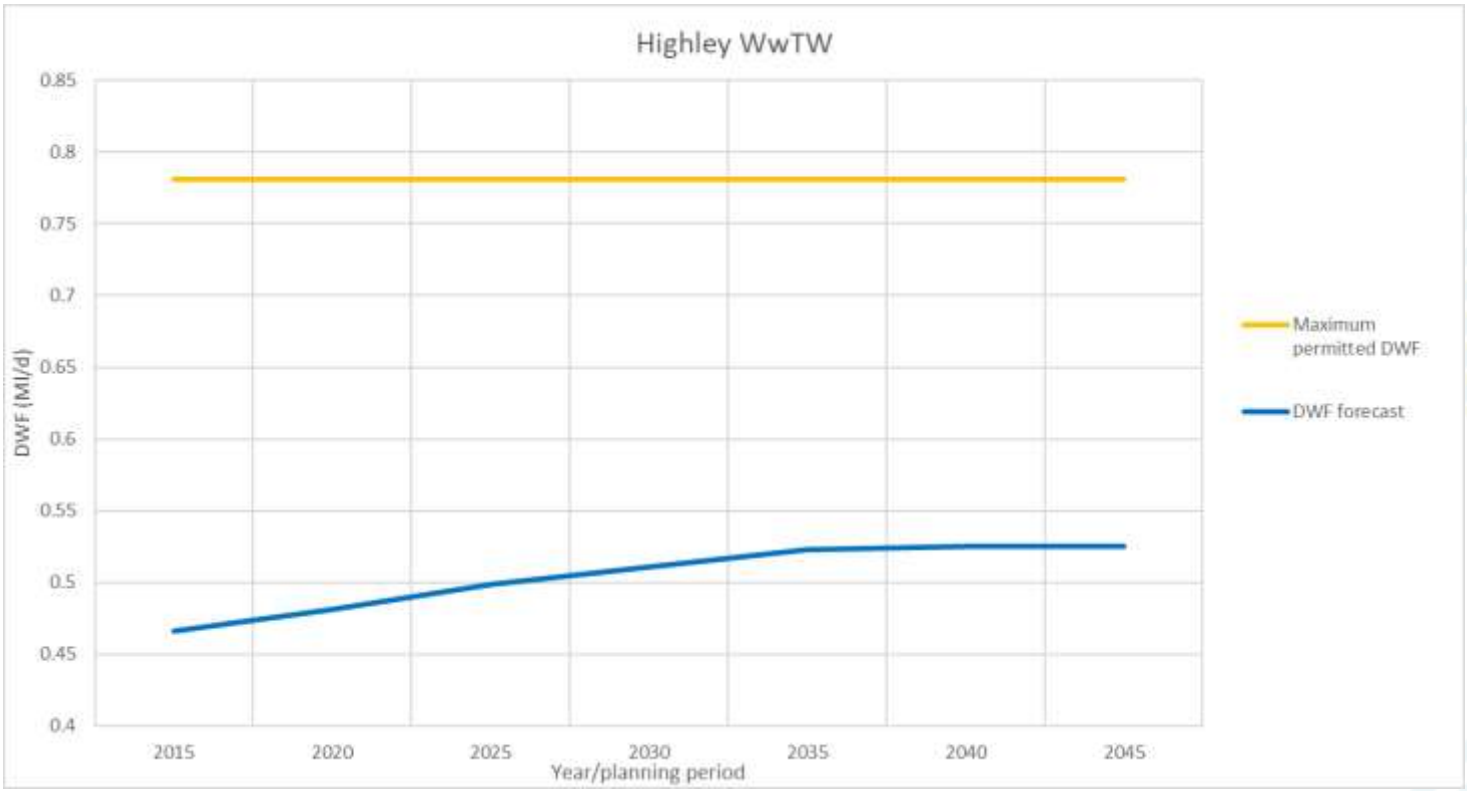

Drenewydd Oswestry WwTW
3
2.5
2
1.5
1
0.5
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

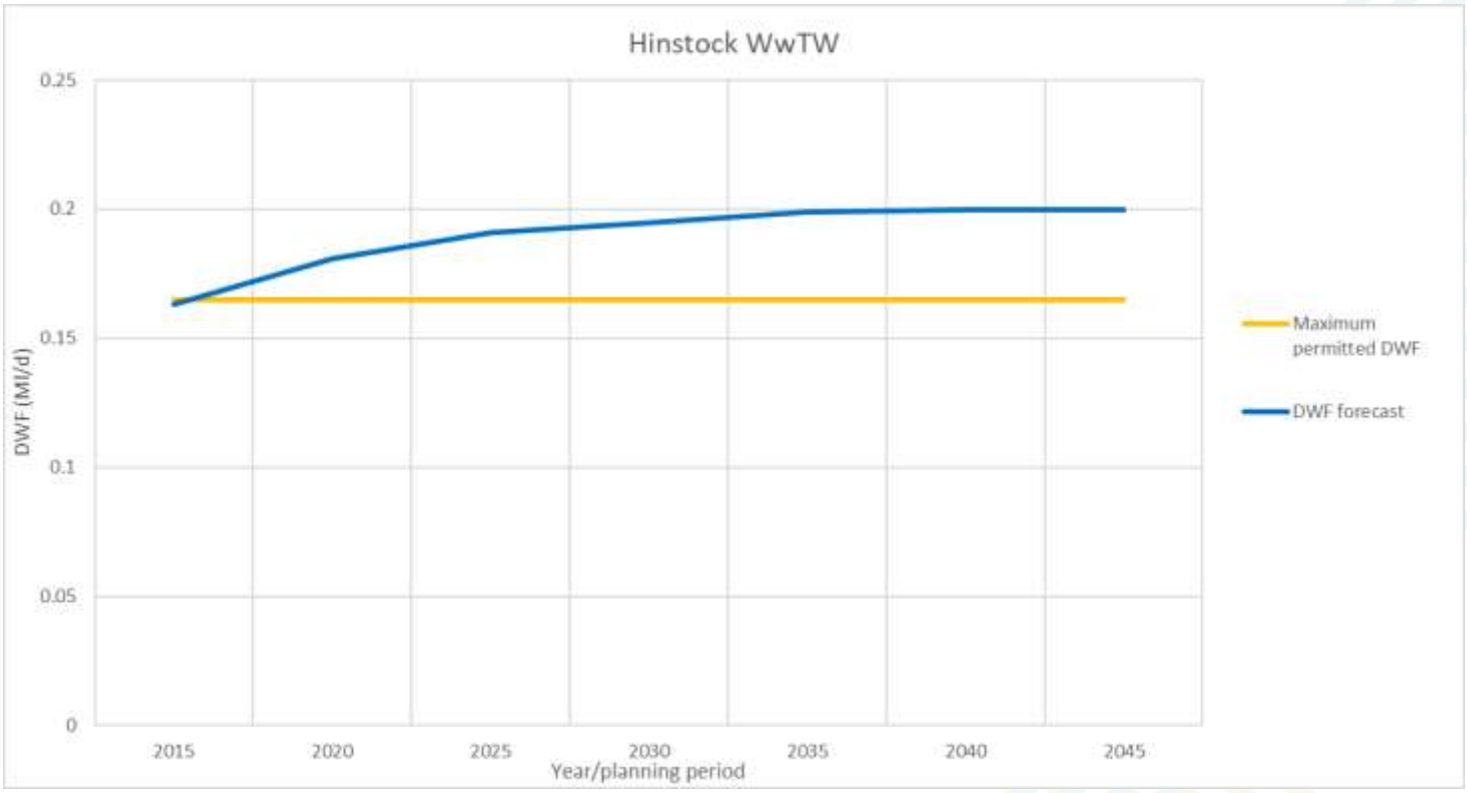

Ellesmere WwTW
1.4
1.2
1
0.8
0.6
0.4
0.2
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

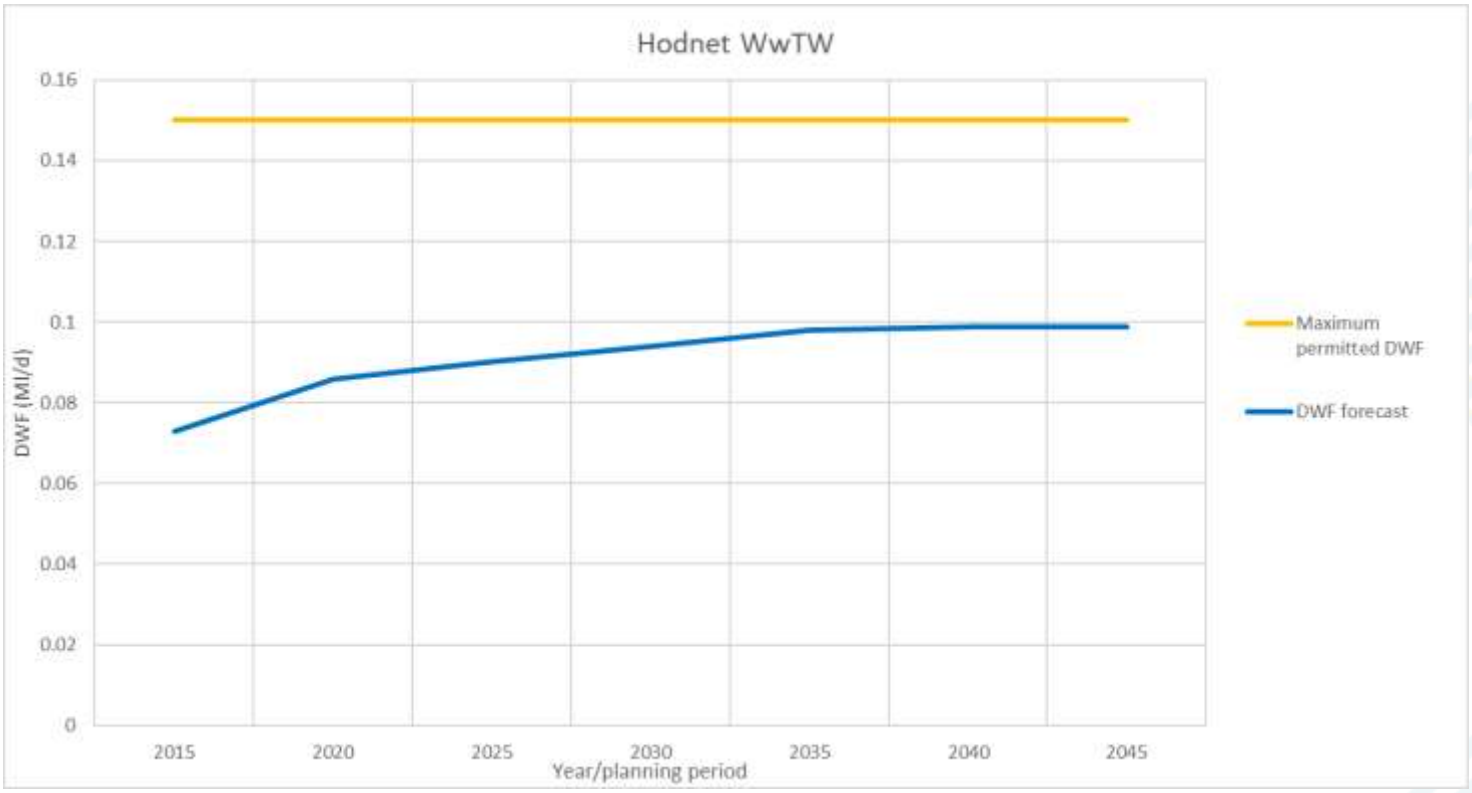

Five Fords WwTW
29
28
27
26
25
24
23
22
21
20
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

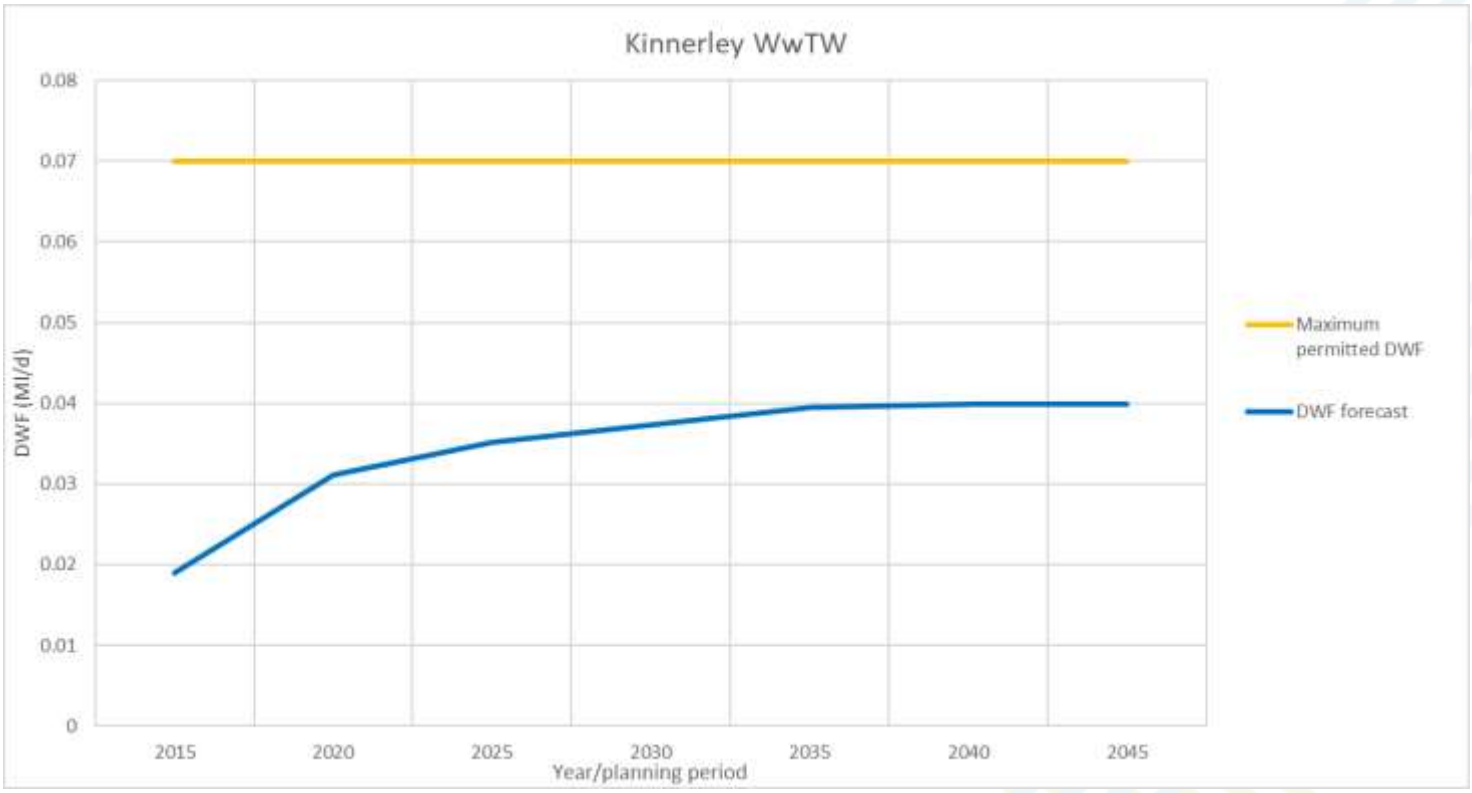

Ford WwTW
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

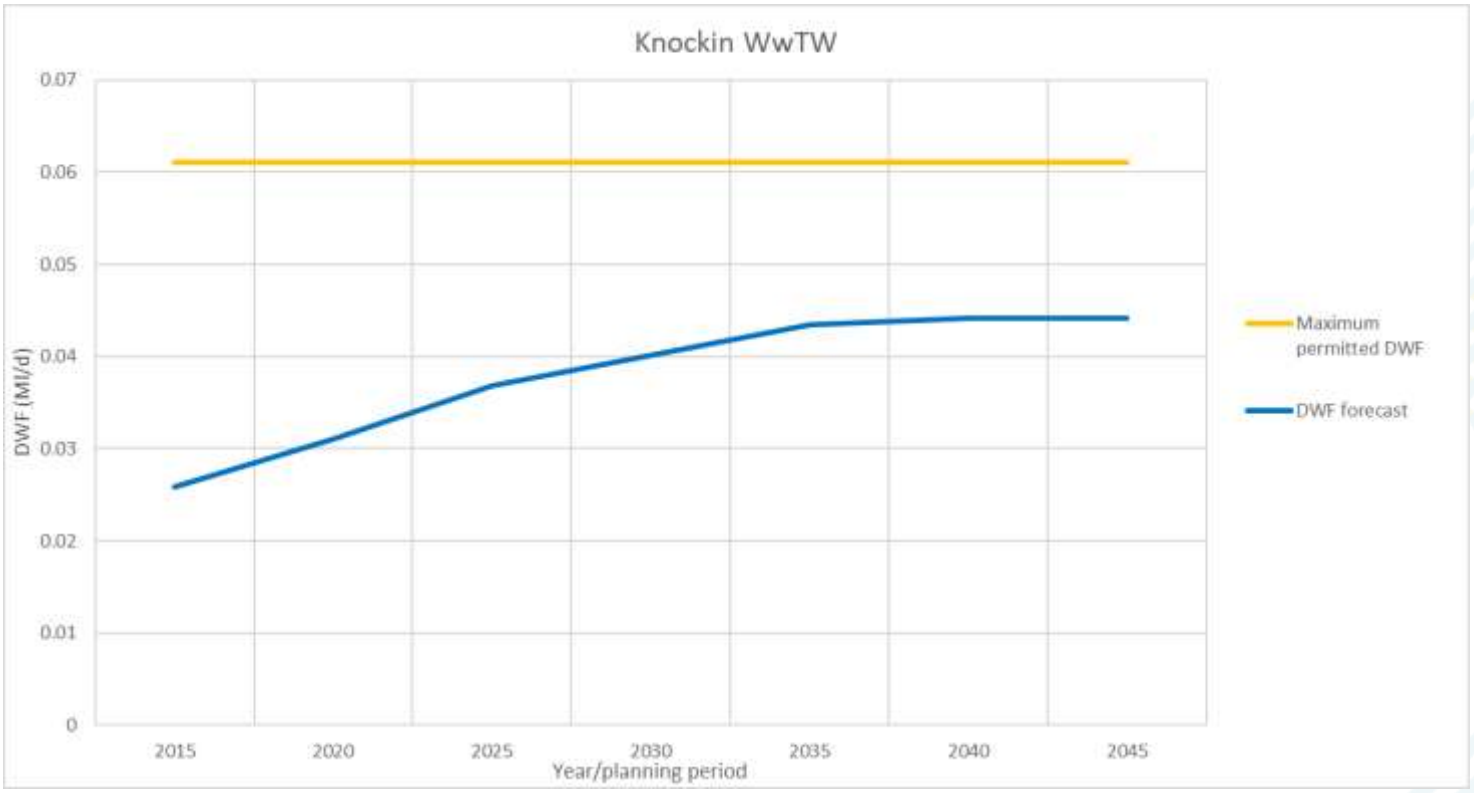

Higher Heath Prees WwTW
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

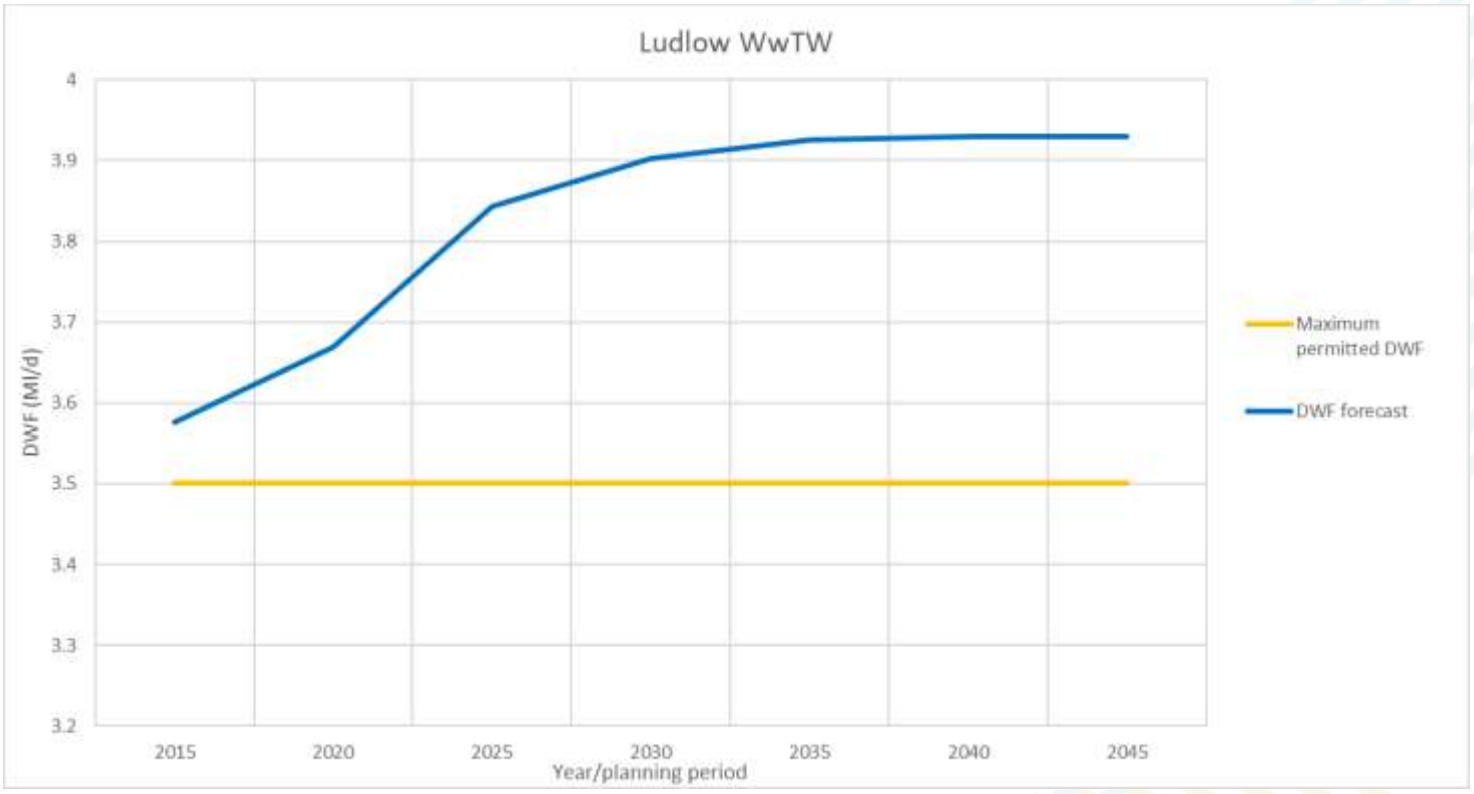

Highley WwTW
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

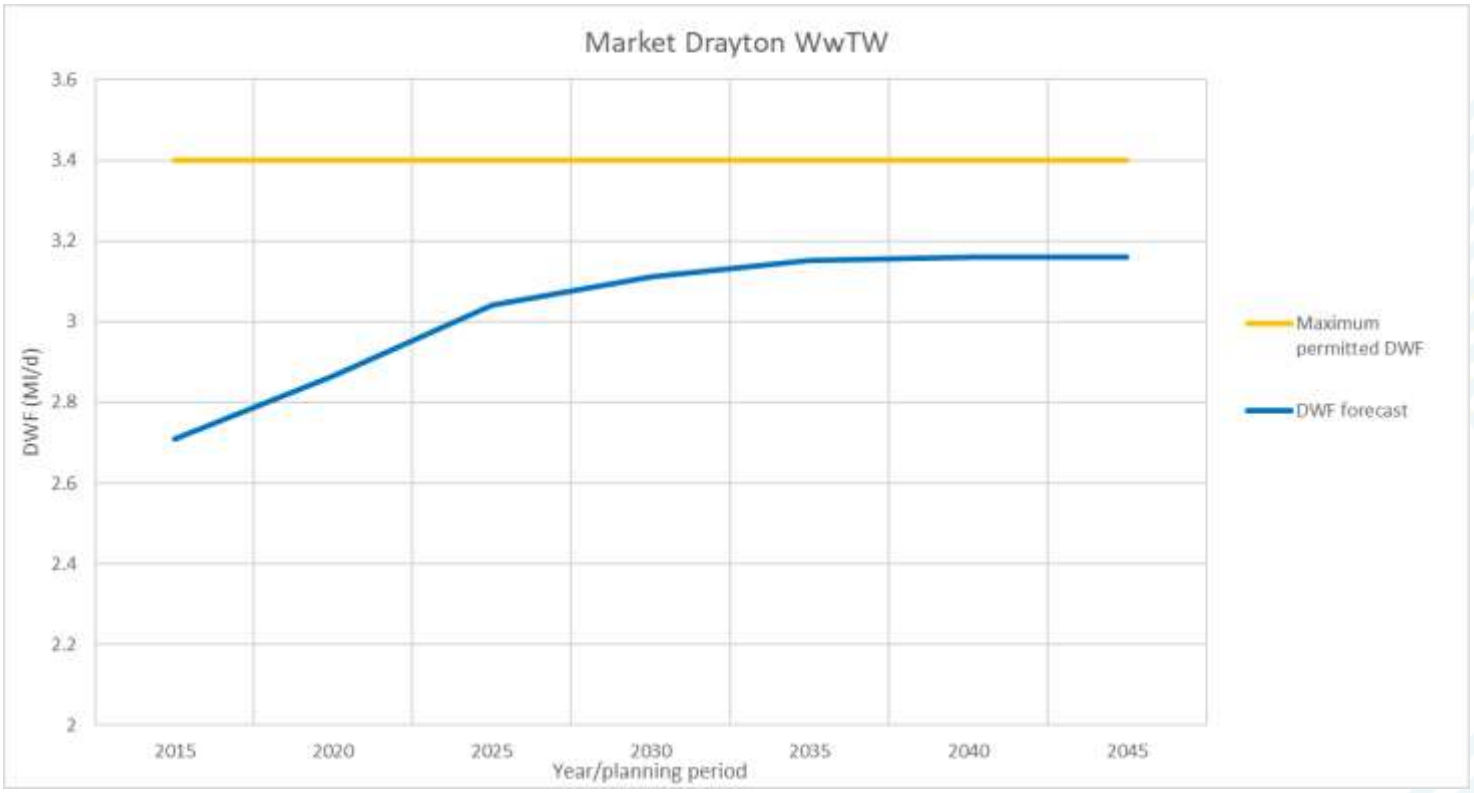

Hinstock WwTW
0.25
0.2
0.15
0.1
0.05
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

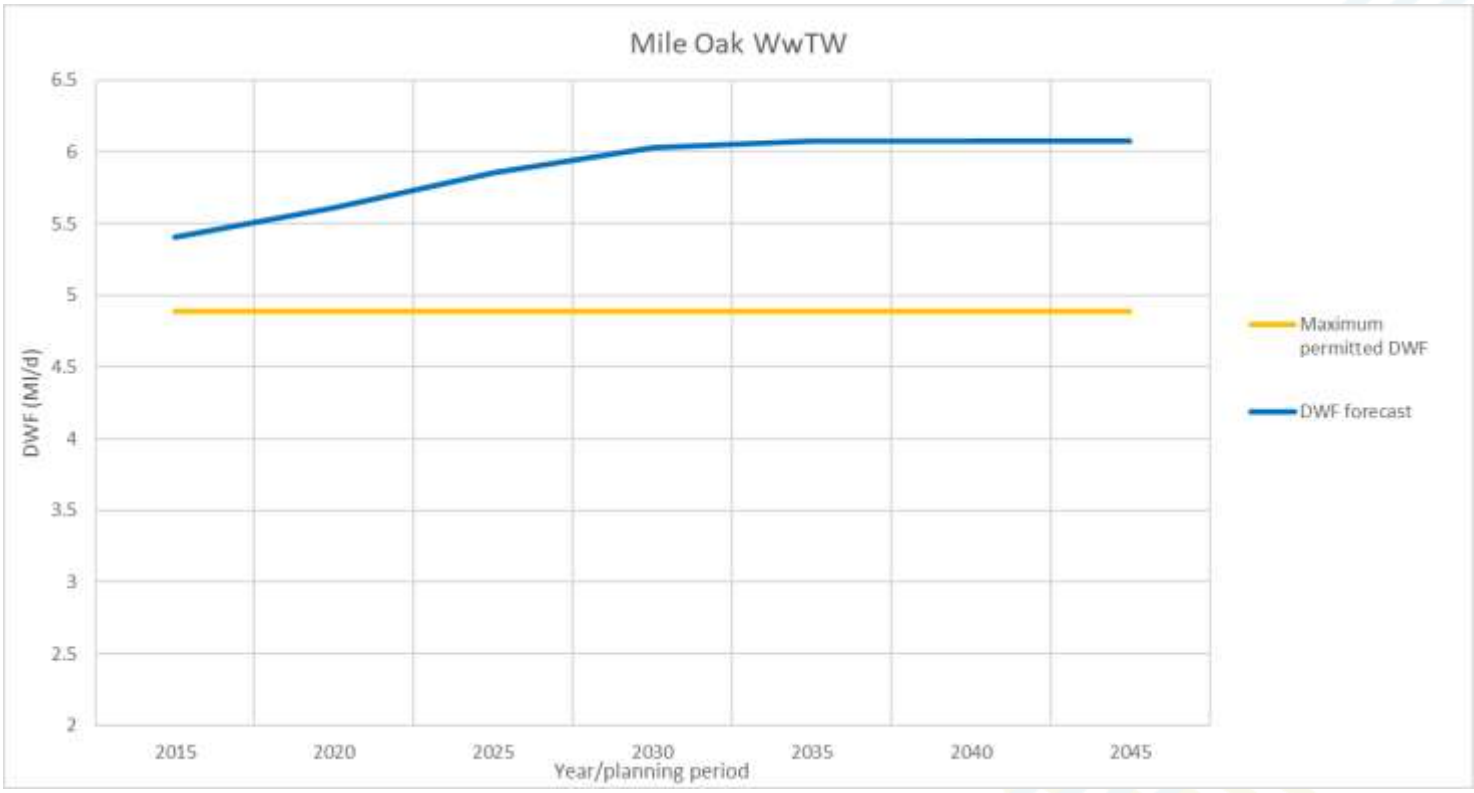

Hodnet WwTW
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

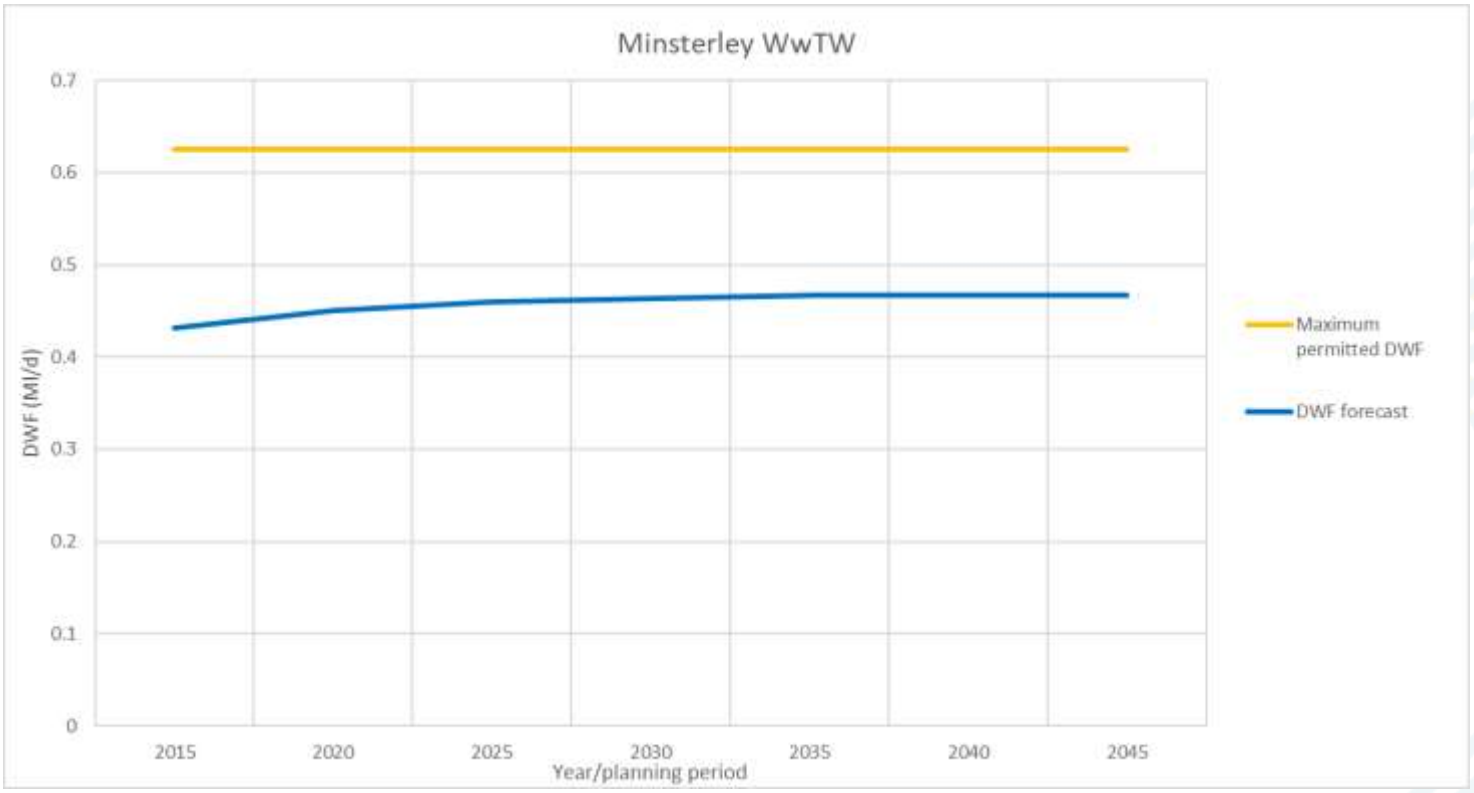

Kinnerley WwTW
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

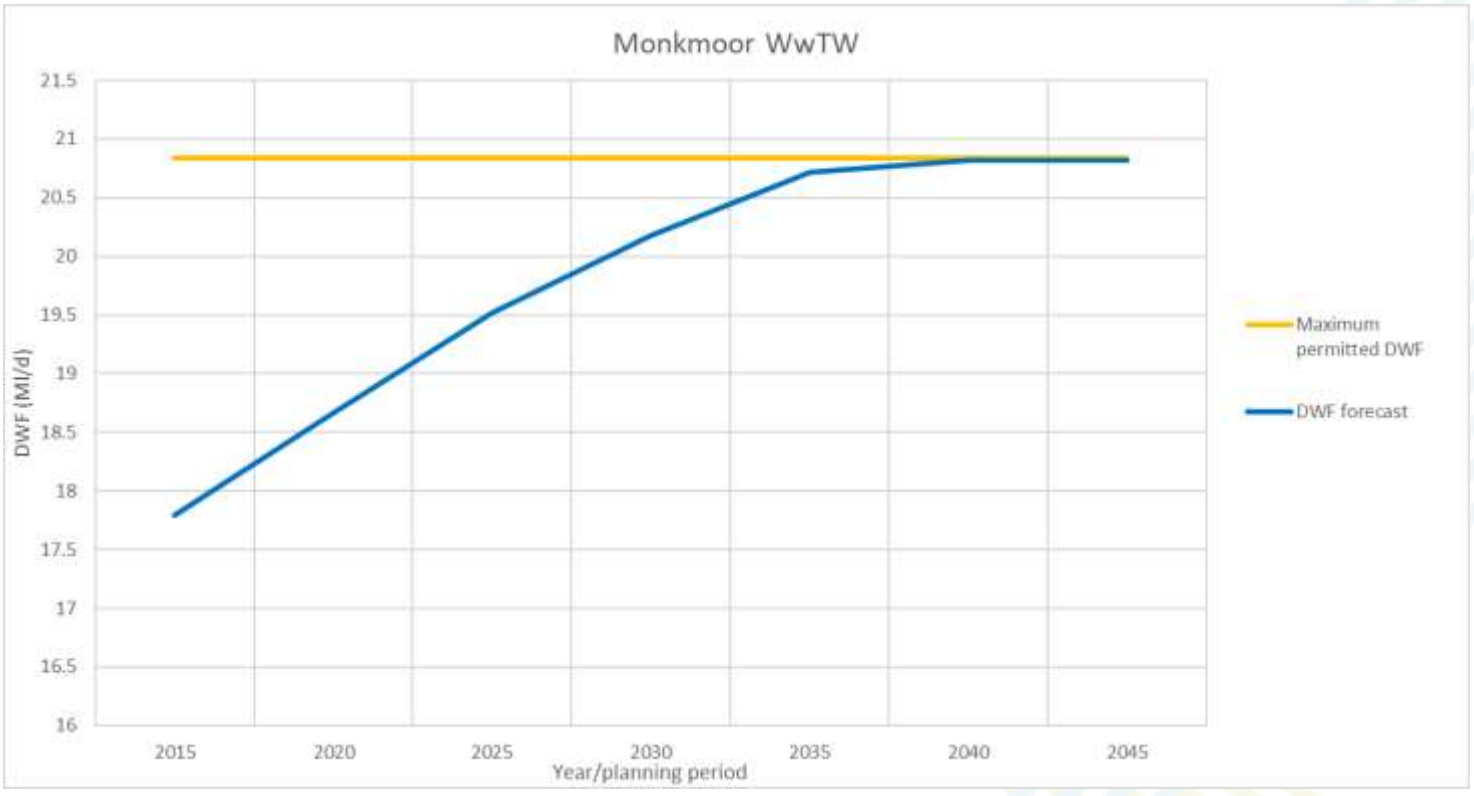

Knockin WwTW
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

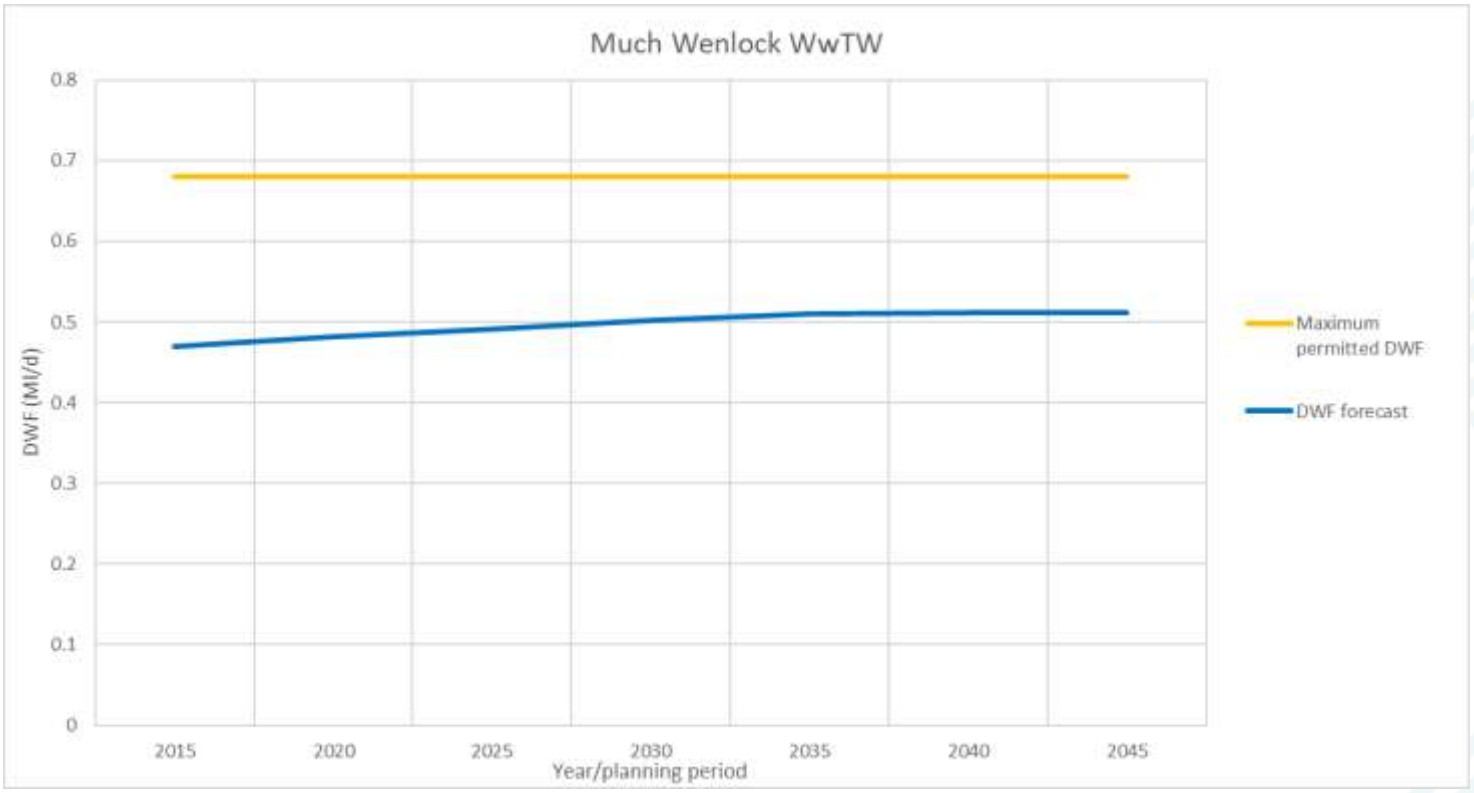

Ludlow WwTW
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

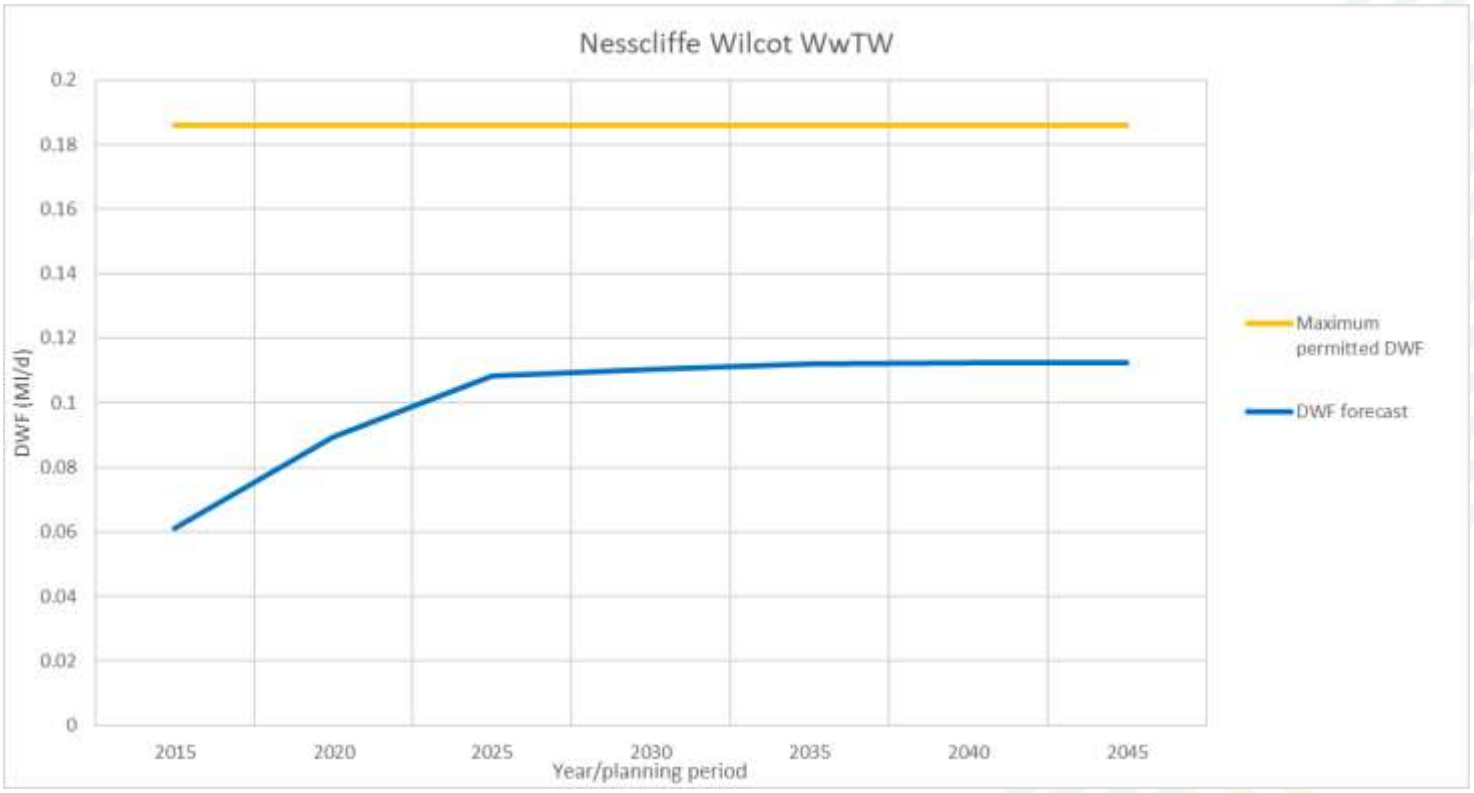

Market Drayton WwTW
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

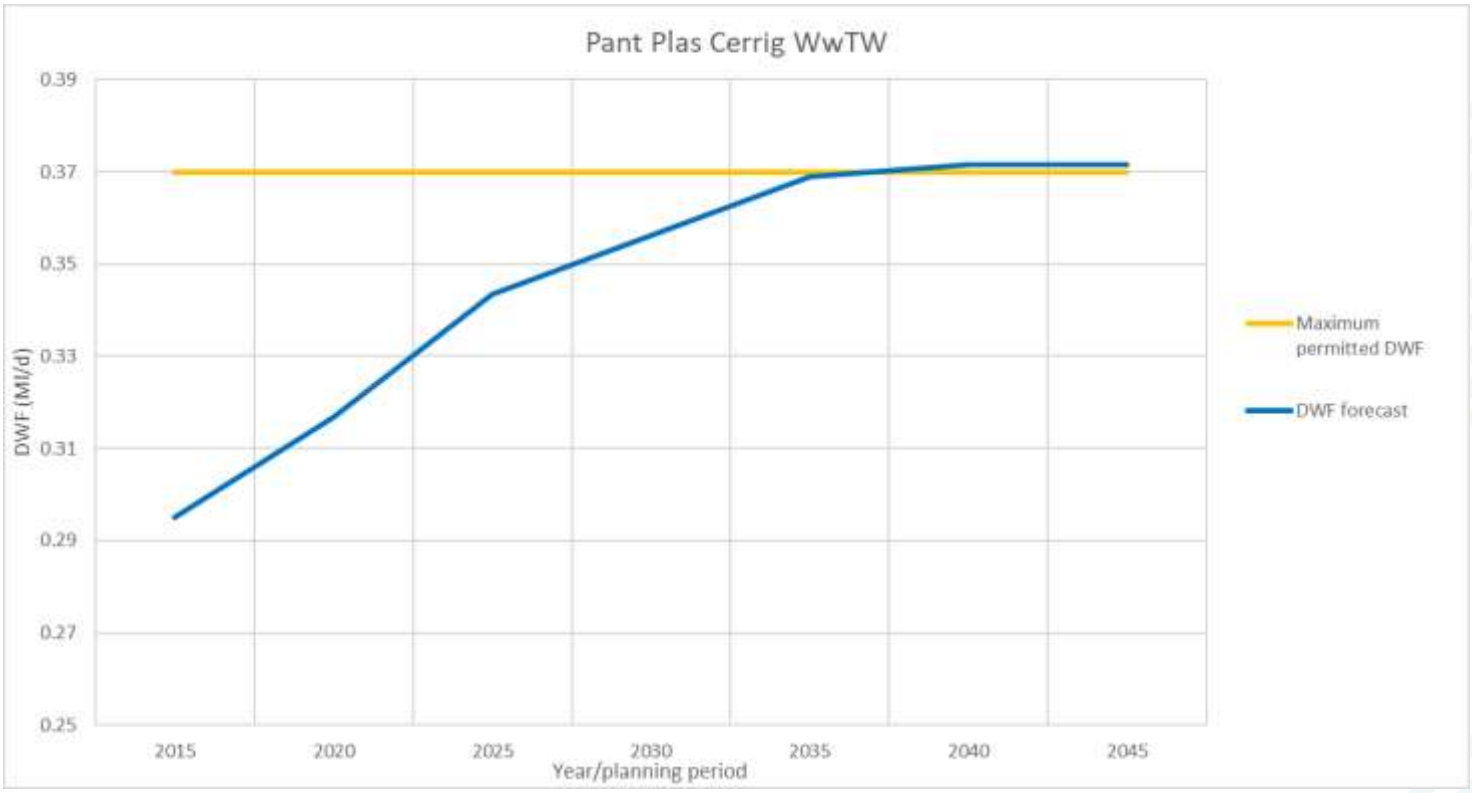

Mile Oak WwTW
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

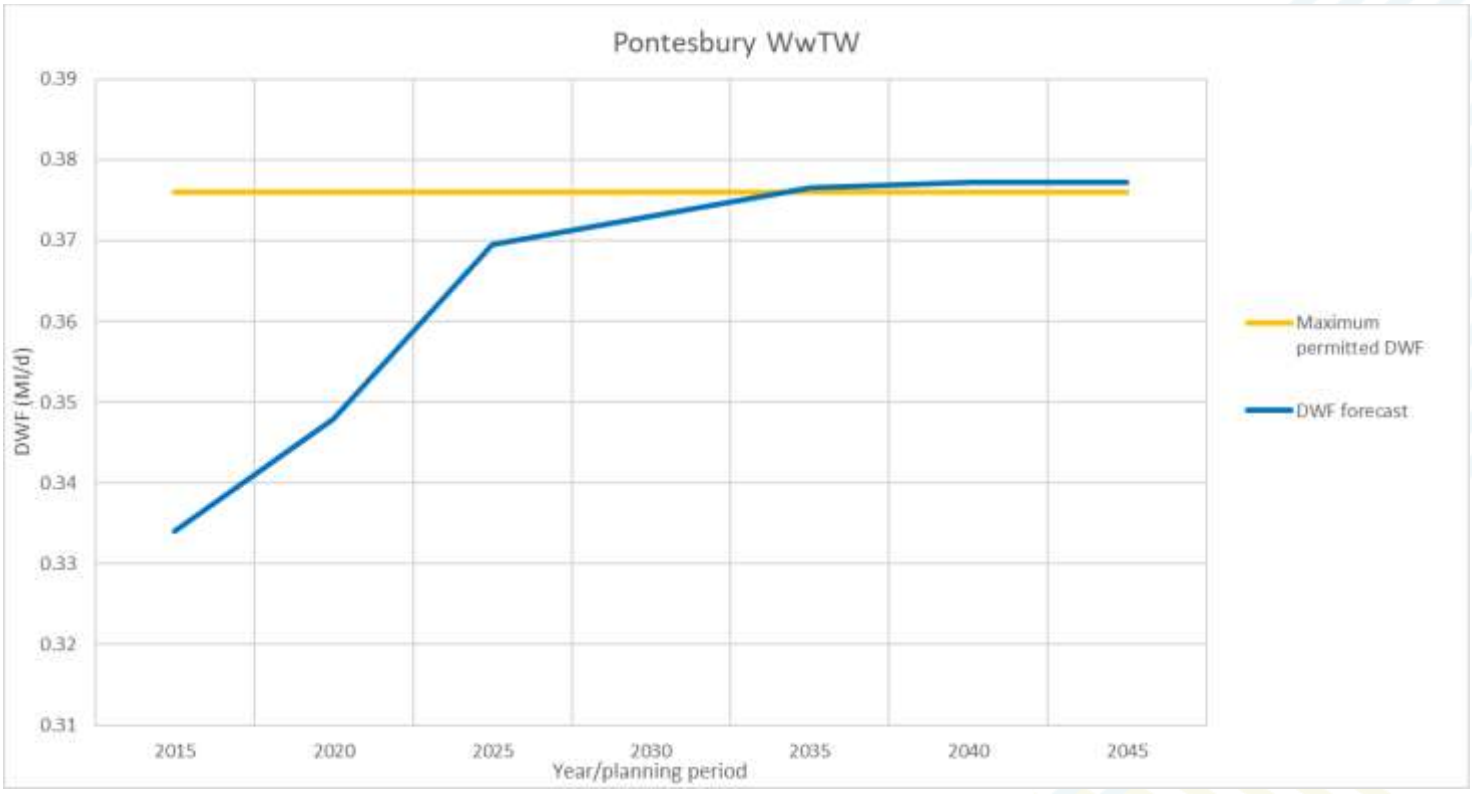

Minsterley WwTW
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

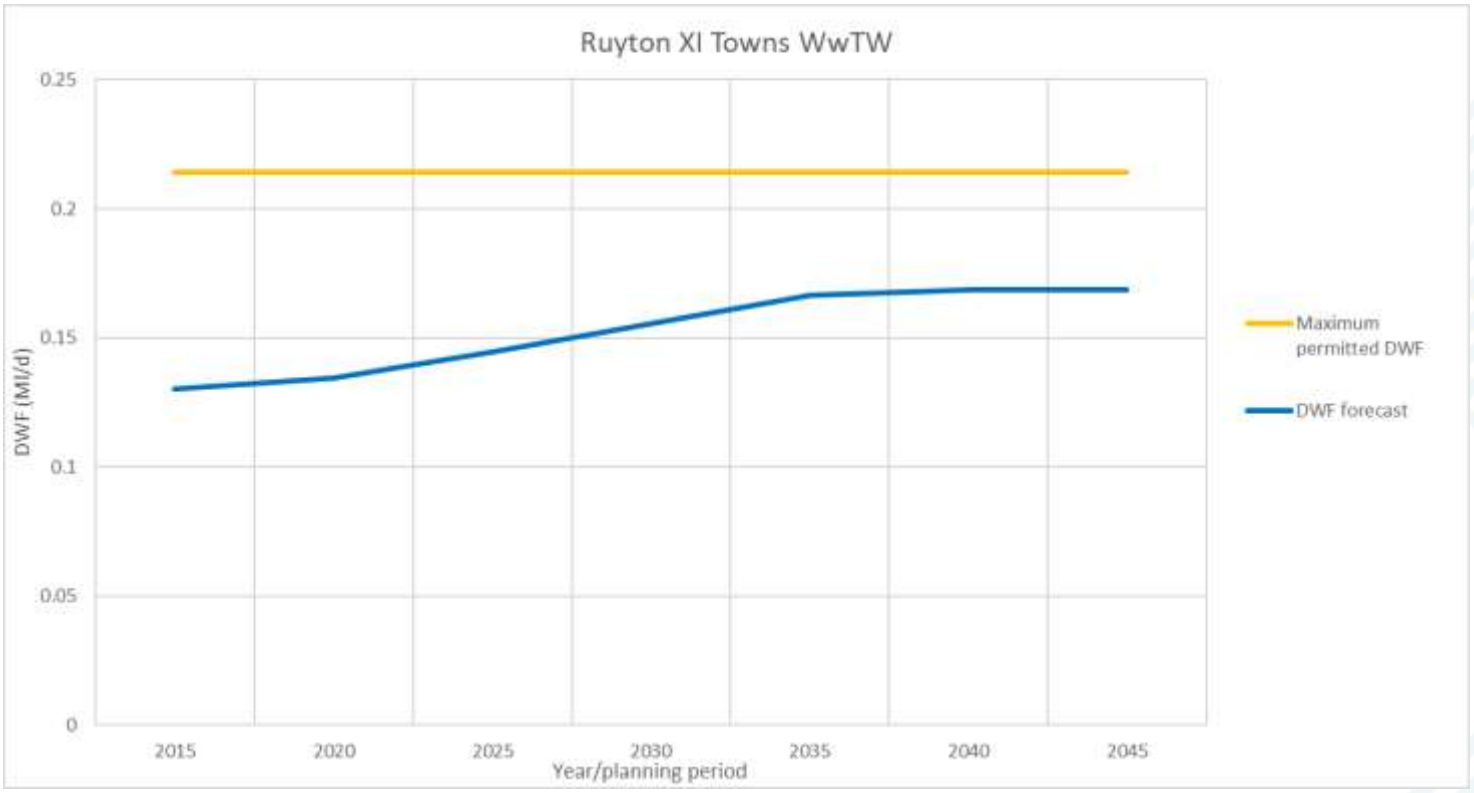

Monkmoor WwTW
21.5
21
20.5
20
19.5
19
18.5
18
17.5
17
16.5
16
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

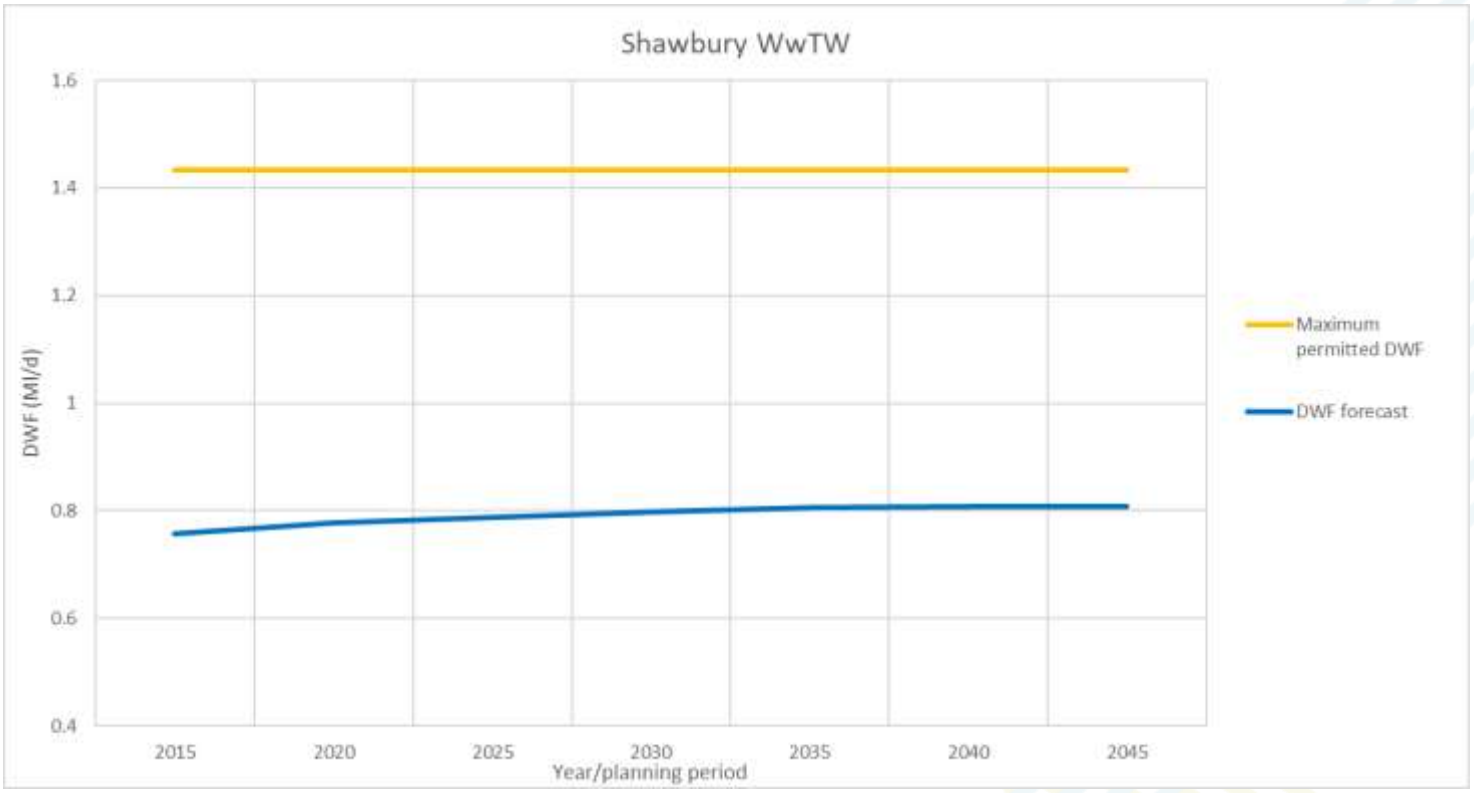

Much Wenlock WwTW
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

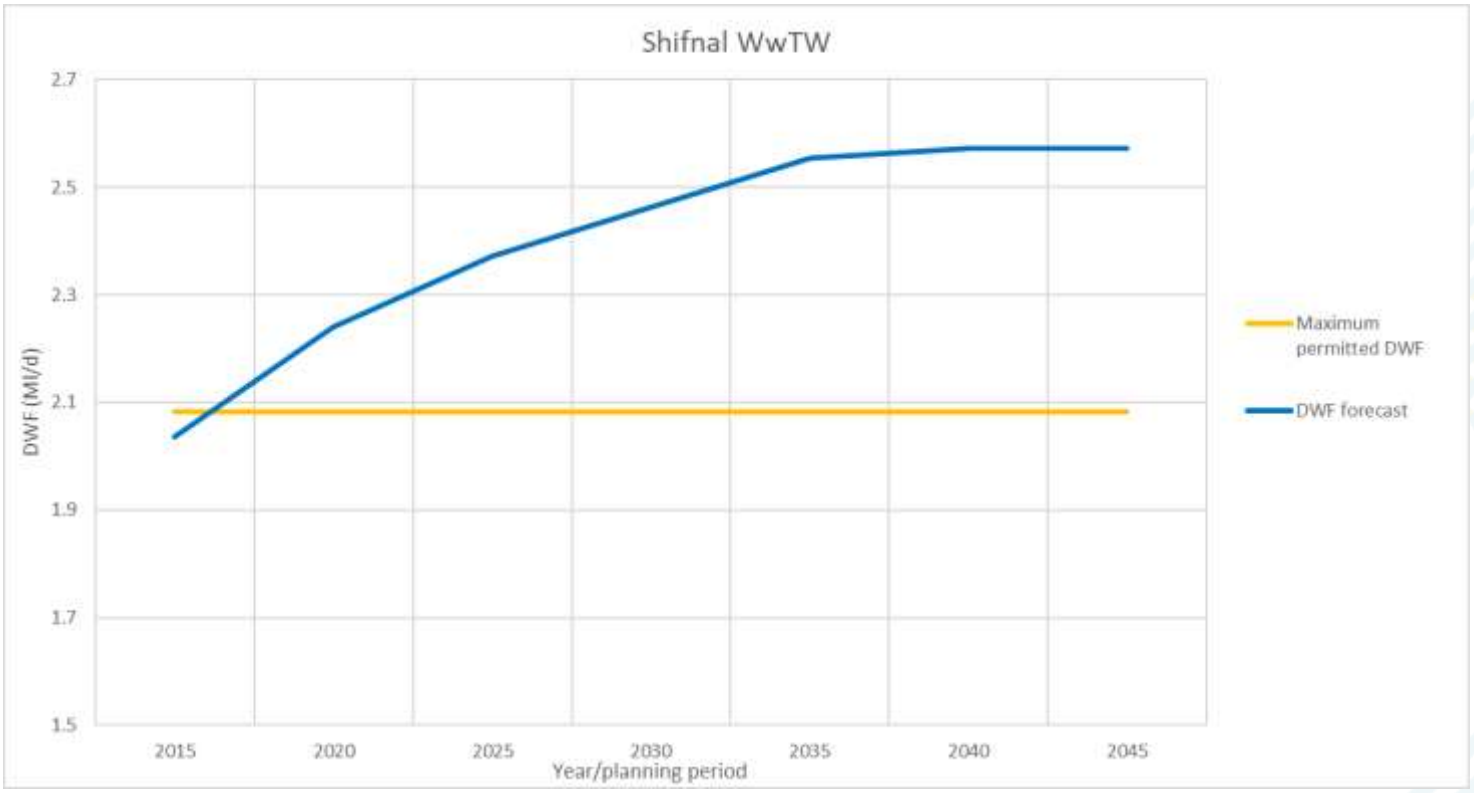

Nesscliffe Wilcot WwTW
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

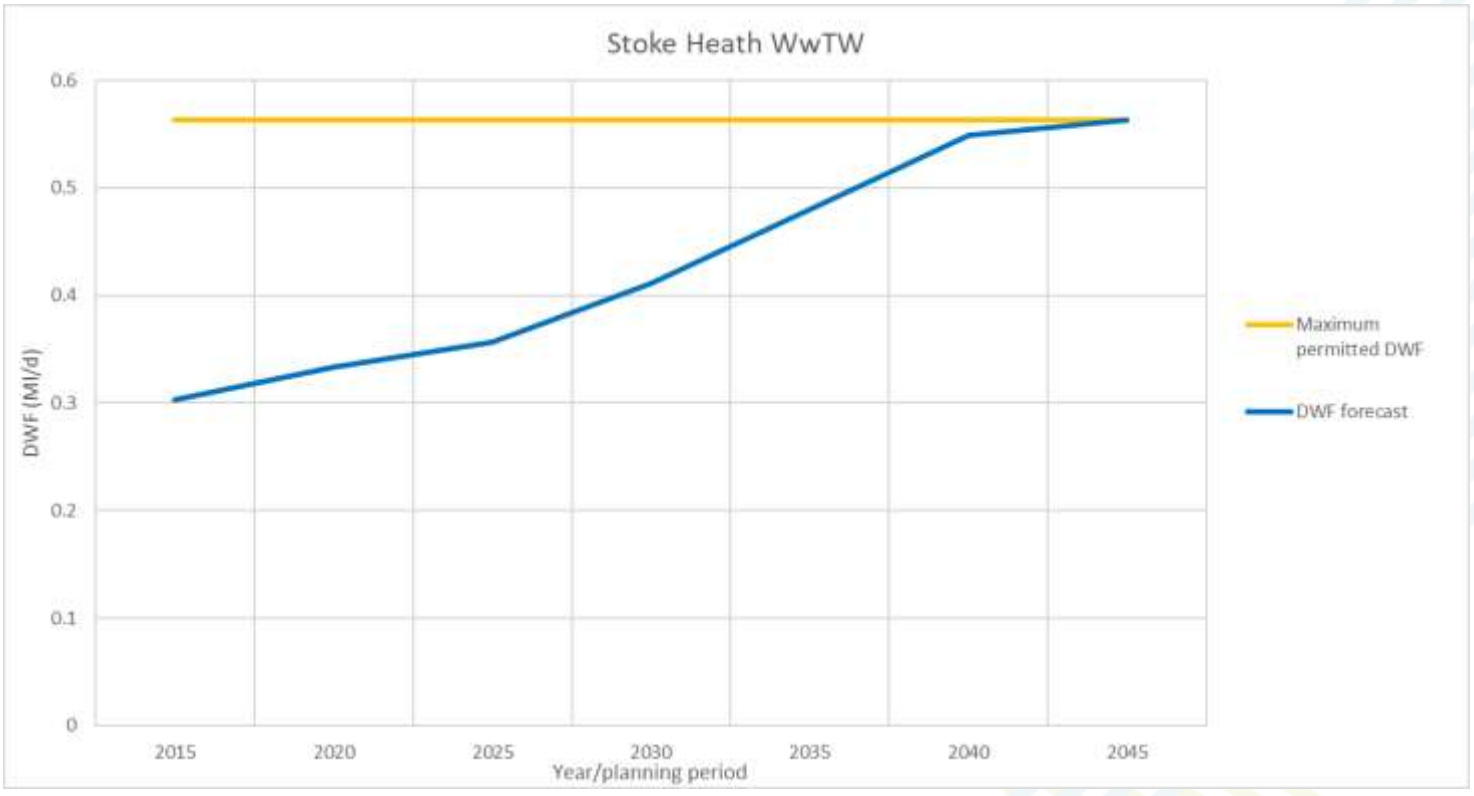

Pant Plas Cerrig WwTW
0.39
0.37
0.35
0.33
0.31
0.29
0.27
0.25
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

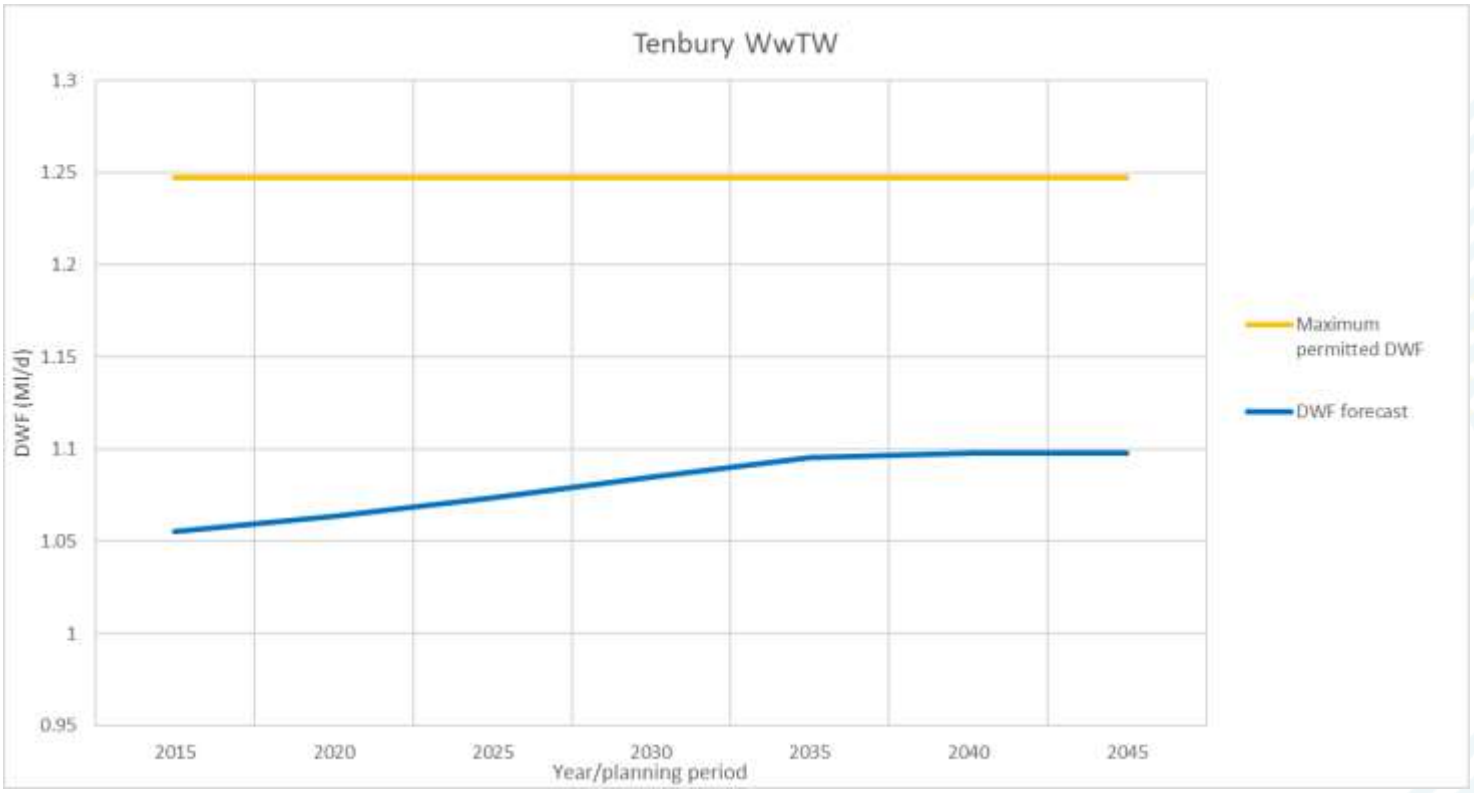

Pontesbury WwTW
0.39
0.38
0.37
0.36
0.35
0.34
0.33
0.32
0.31
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast


Ruyton XI Towns WwTW
0.25
0.2
0.15
0.1
0.05
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

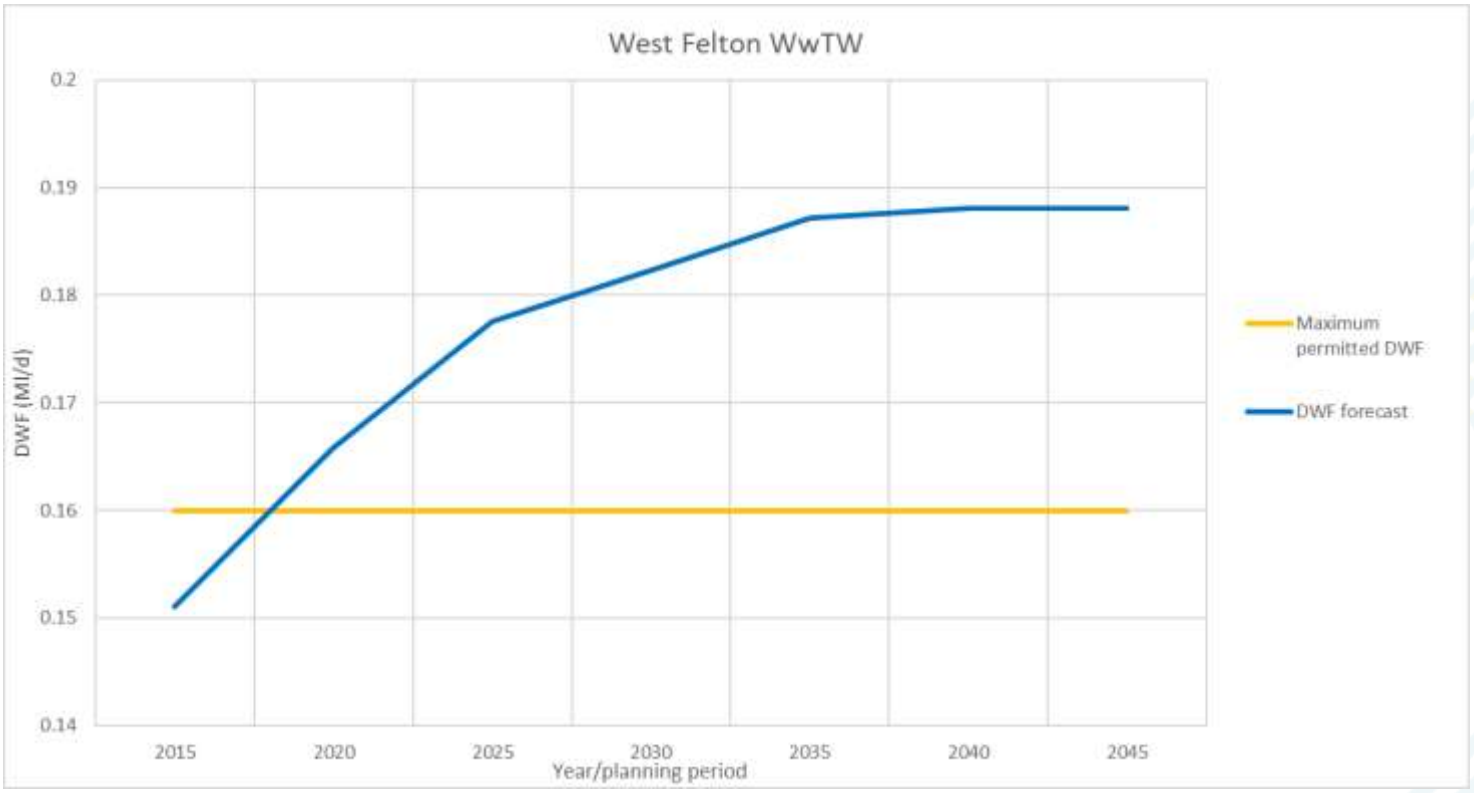

Shawbury WwTW
1.6
1.4
1.2
1
0.8
0.6
0.4
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast


Shifnal WwTW
2.7
2.5
2.3
2.1
1.9
1.7
1.5
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

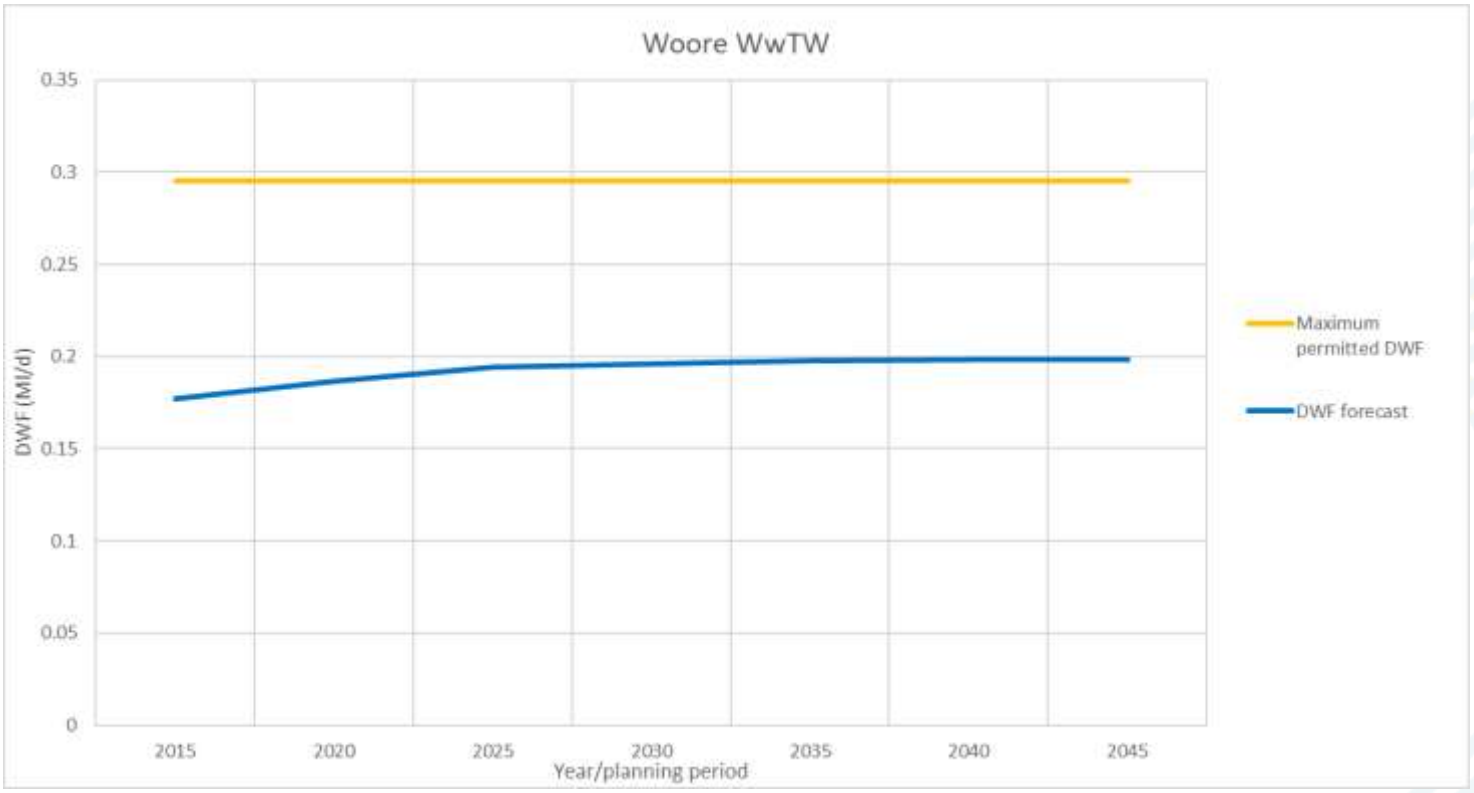

Stoke Heath WwTW
0.6
0.5
0.4
0.3
0.2
0.1
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

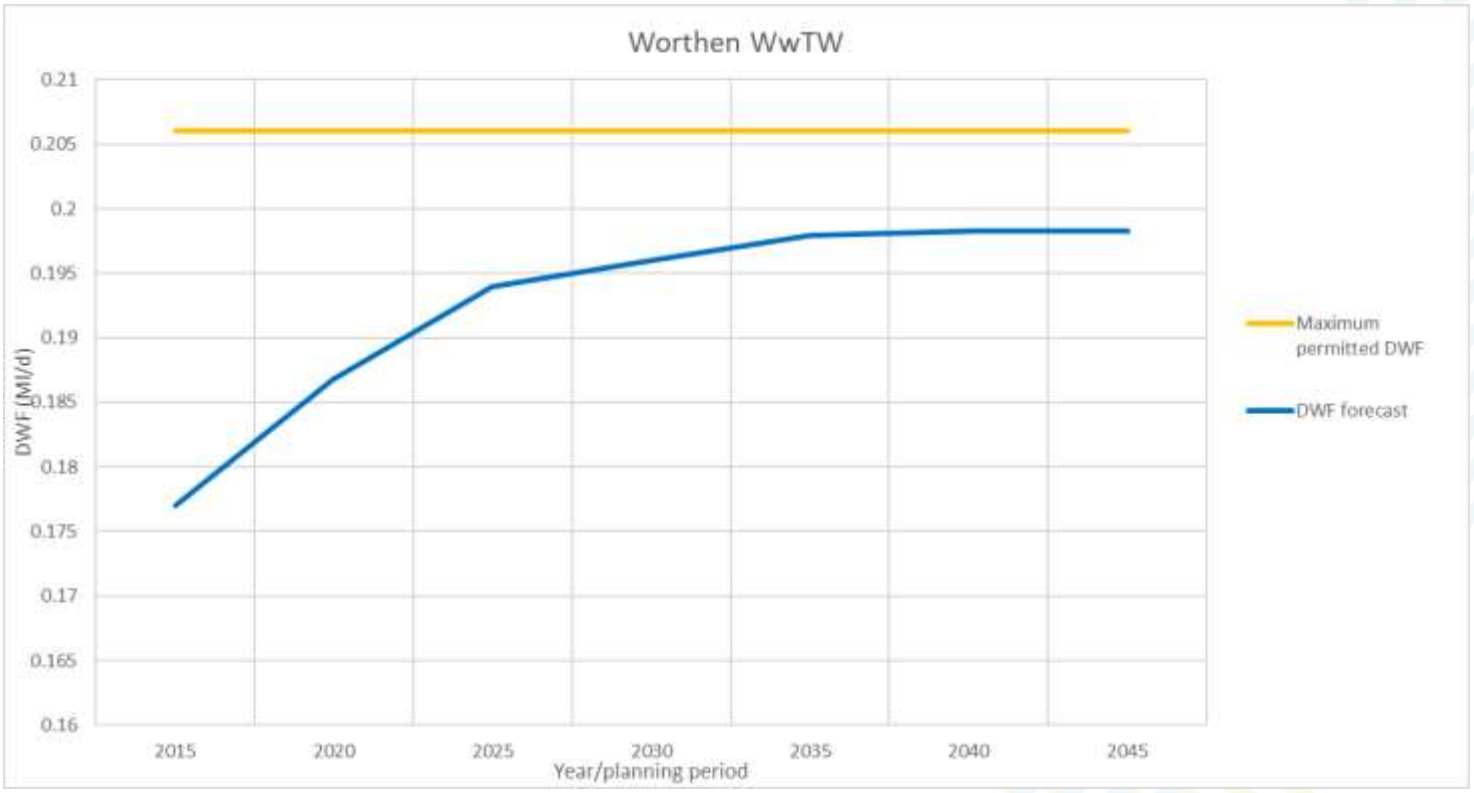

Tenbury WwTW
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast


Wem - Aston Road WwTW
1.75
1.7
1.65
1.6
1.55
1.5
1.45
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast


West Felton WwTW
0.2
0.19
0.18
0.17
0.16
0.15
0.14
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast


Whitchurch WwTW
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast


Woore WwTW
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast


Worthen WwTW
0.21
0.205
0.2
0.195
0.19
0.185
0.18
0.175
0.17
0.165
0.16
DWF (Ml/d)
2015
2020
2025
2030
2035
2040
2045
Year/planning period
Maximum permitted DWF
DWF forecast

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
Broughton
SKIPTON
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
OHSAS 18001:2007